FEDERAL RESEARCH NATURAL AREAS IN OREGON AND WASHINGTON

A Guidebook for Scientists and Educators

THIS PUBLICATION CONSTITUTES A CONTRIBUTION TO THE CONSERVATION OF ECOSYSTEMS SECTION, U.S. INTERNATIONAL BIOLOGICAL PROGRAM.

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Abstract

A guide to the use of natural scientific preserves, Research Natural Areas, on Federal lands in Oregon and Washington. Detailed descriptions of physical and biological features, maps, and photographs are provided for each of the 45 tracts presently reserved. Indices to Research Natural Areas by vegetation type and plant and mammalian species are included.

Keywords: Research Natural Areas, scientific reserves, natural ecosystems, Oregon, Washington.

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Cooperators in the Federal Research Natural Area Program in Oregon and Washington are:

U.S. DEPARTMENT OF AGRICULTURE
Forest Service

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management
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FEDERAL RESEARCH NATURAL AREAS IN OREGON AND WASHINGTON

A Guidebook for Scientists and Educators

by Jerry F. Franklin, Frederick C. Hall,
C. T. Dyrness, and Chris Maser

1972

PACIFIC NORTHWEST FOREST AND RANGE
EXPERIMENT STATION Forest Service U.S.
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Federal Research Natural Areas in Oregon and Washington
Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station,
Portland, Oregon.

ABBOTT CREEK RESEARCH NATURAL AREA [1]

Southwestern Oregon mixed conifer forest with especially fine examples of sugar pine occupying a large (1,077 ha.) mountain stream drainage.

Abbott Creek Research Natural Area was established on November 18, 1946, to exemplify the Sierra-type mixed conifer forests found in southwestern Oregon. The tract was specifically selected because of the excellent representation of sugar pine *(Pinus lambertiana)* in many of the stands. The 1,077-ha. (2,660acre) natural area is located in Douglas and Jackson Counties, Oregon, and is administered by the Prospect Ranger District (Prospect, Oregon), Rogue River National Forest. It occupies portions of sections 23, 24, 25, 26, and 36, R. 2 E., T. 30 S., and of sections 19, 30, and 31, R. 3 E., T. 30 S., Willamette meridian. The majority of the boundaries follow physiographic features (fig. AC-1): the dividing ridge between the Rogue and Umpqua Rivers on the north, the Golden Stairs trail, which essentially follows a ridgetop on the east, and the main and west branches of Abbott Creek along much of the west edge. The natural area is located at 42^{0}56' N. latitude and 122°31' W. longitude.

ACCESS AND ACCOMMODATIONS

The natural area is approached via Oregon State Highway 26. Personnel at Prospect Ranger Station can provide directions through the network of graveled forest roads which lead from the highway to the southwestern corner (Forest Road 3047) and eastern edge (Forest Road 3016) of the tract (fig. AC-1). Unimproved dirt roads also lead to Abbott Butte Lookout at the northwestern corner (Forest Road 2923) and along the west side of the main branch of Abbott Creek; the latter road is driveable for only a short distance. The unmaintained Golden Stairs trail forms the western boundary.

Cross-country toot travel provides the only access within the natural area; there are no trails or roads inside the boundaries. Because of its large size and rugged character such travel is time consuming and often difficult and hazardous.

Commercial accommodations are available at Prospect and Union Creek located approximately 16 to 24 km. (10 to 15 miles) from the natural area. There are also numerous improved forest campgrounds in the vicinity.

ENVIRONMENT

The Abbott Creek Research Natural Area is a relatively large mountainous tract which occupies the entire drainage of the main branch of Abbott Creek as well as portions of tributary drainages (fig. AC-1). Topography is generally rugged with moderate to steep slopes and numerous rock outcrops and escarpments. Small benches along Abbott Creek and more extensive benchy areas below the summit peak of Abbott Butte provide the only gentle relief. Elevations range from about 1,000 m. (3,300 ft.) to 1,869 m. (6,131 ft.) at Abbott Butte Lookout.

The natural area is located in the geologically older western Cascades and is composed entirely of volcanic materials. Bedrock at higher elevations is composed of middle and upper Miocene andesite flows, probably belonging to the Sardine formation (Peck 1961).

[1] Description prepared by Dr . .Jerry F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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At lower elevations, Oligocene and lower Miocene pyroclastic rocks occur and may include tuffs, breccias, and conglomerates. The summit area of Abbott Butte itself is mapped as basalt of Pliocene or Pleistocene age. Finally, some Eocene to Pliocene felsic intrusive rocks may occur along the west boundary.

The natural area is subject to a modified maritime climate with cool, wet winters and warm, dry summers. There are strong elevational gradients in temperature, snowfall, and snowpack accumulation. Lower part of the tract is typical of midelevational, montane forest environments in the southern Oregon Cascades while highest elevations are subalpine in character. Climatic data from the Prospect Weather Station located 19 km. (12 miles) southeast of the natural area are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	H.9°C.(4H.f)OF.)
1\1 ean January temperature	1.HoC. (35.4 of.)
Mean July temperature	l(J.O°C.(66.2°F.)
Mean ,January minimum temperature	-3.3 °C.(26.1 of.)
Mean July maximum temperature	80.0°C.(86.1°F.)
Average annual precipitation	1,05fJ mm.(41.6H in.)
June through August precipitation	62 mm.(2.43 in.)
Average annual snowfall	161.5 cm.(63.6 in.)

Conditions are wetter and cooler on the natural area, even at lower elevations within it. Isohyetal maps suggest annual precipitation varies from 1,575 to 1,725 mm. (62 to 68 in.) on the natural area (Oregon State Water Resources Board 1959).

Soils in the area have not been mapped or described. Great soil groups present include the Lithosol, Brown Podzol, and Alluvial groups and possibly the Western Brown Forest and Gray-Brown Podzol great soil groups.

BIOTA

Approximately 832 ha. (2,055 acres) of the natural area are forested and 245 ha. (605 acres) are occupied non-forested communities. In the absence of a detailed type map it is probably best to categorize all of the forested acreage as SAF forest cover type 243, Ponderosa Pine-Sugar Pine-Douglas-Fir (Society of American Foresters 1954). Although the broadly defined type definition makes this possible, it scarcely does justice to the diversity of forest conditions present on the tract; individual stands are present which fit SAF cover types 211, White Fir; 229, Pacific Douglas-Fir; and 207, Red Fir. Kuchler (1964) types represented include 5, Mixed Conifer Forest; 7, Red Fir Forest; 12, Douglas Fir Forest; and 33, Chaparral. The bulk of the natural area lies within the Mixed Conifer Zone of Franklin and Dyrness (1969) although elements of the *Abies cancolor* and *Abies magnifica shastensis* Zones are also present at higher elevations.

Major tree species in approximate order of importance are: Douglas-fir *(Pseudotsuga menziesii),* sugar pine, white fir *(Abies concolor),* incense-cedar *(Libocedrus decurrens),* Shasta red fir *(Abies magnifica* var. *shastensis),* western hemlock *(Tsuga heterophylla),* mountain hemlock *(Tsuga mertensiana),* western white pine *(Pinus monticola),* and ponderosa pine *(Pinus ponderosa).* The first four are found over almost the entire area. White fir does tend to increase in dominance in stands at higher elevations (especially above 1,450 to 1,600 m. or 4,750 to 5,250 ft.) and in stream terraces. Shasta red fir and mountain hemlock are generally confined to elevations over 1,600 m. (5,250 ft.). Western hemlock occurs mainly on terraces next to Abbott Creek which is also where western white pine are most common. Ponderosa pine is typical of the warmest, driest habitats such as steep southerly slopes at lower elevations. Minor tree species present include subalpine fir *(Abies lasiocarpa),* bigleaf maple *(Acer macrophyllum),* golden chinkapin *(Castanopsis chrysophylla),* Oregon white oak *(Quercus garryana),* and Pacific yew *(Taxus brevifolia).*

White fir appears to be the major climax tree species in most of the forest stands. Seedlings and saplings of this species are typically more common than reproduction of Douglas-fir or incense-cedar under closed forest canopies. However, most of the stands are in relatively long-lasting seral stages

many decades, or perhaps several centuries, away from climax condition even in the absence of wildfire or other disturbances. Severe environmental conditions on many sites retard successional processes, and there are numerous small openings which allow less shade-tolerant species, such as Douglas-fir, incensecedar, and sugar pine, to reproduce (fig. AC-2).

The composition of all layers of the forest communities varies markedly with moisture and temperature gradients, which are roughly correlated with soil-land form and elevation, respectively, and with stand history. Mature forests on mid and lower slopes are dominated by a mixed overstory of Douglas-fir, incense-cedar, sugar pine, and white fir. Common understory species include *Corylus cornuta* var. *californica, Pachistima myrsinites,* golden chinkapin, *Rosa gymnocarpa,* and *Vaccinium membranaceum* in the shrub layer and *Chimaphila umbellata, Achlys triphylla, Berberis nervosa, Pyrola picta, Iris chrysophylla, Trientalis latifolia,* and *Carex* sp. in the herb layer. There are many variations on this basic theme, however. For example, incensecedar and Douglas-fir increase in relative importance and ponderosa pine and a variety of hardy intolerant shrubs and herbs, including many typical of the non-forest communities discussed below, make their appearance in drier phases of this community.

Stands on stream terraces typically have more white fir and less incense-cedar in the overstory. Douglas-fir remains a major dominant. Several species are found solely or in greatest abundance in these terrace communities: western hemlock and western white pine in the tree layer; Pacific yew, vine maple *(Acer circinatum),* and Pacific dogwood *(Cornus nuttallii)* in the shrub layer; and *Asarum caudatum, Trillium ovatum, Disporum hookeri, Clintonia uniflora, Viola glabella, Linnaea borealis, Calypso bulbosa, Anemone deltoidea, Rubus nivalis,* and *Viola sempervirens* in the herb layer. These species sharply distinguish the terrace communities from those found on more xeric habitats.

Higher elevation forest stands include some dominated by white fir with relatively lush under-stories of forbs or weeds. Typical under-story plants are *Ribes viscosissimum, Mertensiana paniculata, Smilacina sessilifolia,* and a variety of other broad-leaved herbs and several grasses. Small stands dominated by Shasta red fir, either pure or in mixture with white fir or mountain hemlock, are also present. These characteristically have sparse under-stories.

The non-forested communities are also highly variable in character including several rock outcrop types and subalpine mosaics of relatively lush herbaceous stands and tree and shrub patches. Communities on rock outcrops and scree slopes reflect the extremely xeric habitat (fig. AC-2). Typical plant species include *Ceanothus prostratus, Arctostaphylos nevadensis, Senecio integerrimus* var. *exaltatus, Pellaea* sp., *Cheilanthes gracillima, Cystopteris fragilis, Stipa columbiana, Collomia heterophylla, Cynoglossum grande, Delphinium* spp., *Ribes cereum, Marah oreganus,* and *Epilobium minutum.* On some non-forested sites, as well as in open forest stands, there are larger evergreen shrubs such as *Arctostaphylos patula, Ceanothus velutinus,* and *Garrya fremonti.*

The meadows at high elevations are dominated by herbaceous species such as *Veratrum viride, Pteridium aquilinum,* and various grasses and sedges. Small perennial herbs such as *Erythronium grandiflorum* and *Claytonia lanceolata* are also common. Intermixed with the herbaceous stands are large *Sorbus* bushes and individuals and groups of young trees - incense-cedar, white fir, and Shasta red fir. There has been extensive meadow invasion by tree species during the last century.

Mammals believed to utilize the natural area as residents or transients are listed in Table AC-l. Reptiles and amphibians present probably include spiny lizards *(Sceloporus* spp.), striped skinks *(Eumeces* spp.), garter snakes *(Thamnophis* spp.), frogs *(Rana* spp.), and toads *(Hyla* spp.). A great variety of resident and transient birds utilize the tract including grouse (Phasianidae), hawks (Accipitridae), jays (Corridae), owls (Columbidae), woodpeckers (Picidae), nuthatches *(Sitta* spp.), wrens (Troglodytidae), and sparrows

332
346
586

(Fringillidae).

Streams, streamsides, and springs provide some area of aquatic and semiaquatic habitat of special interest to animal ecologists and plant taxonomists. As mentioned, there are also numerous rock outcrops and cliffs which provide specialized habitats.

HISTORY OF DISTURBANCE

The most important human disturbances to the natural area have resulted from grazing and logging; fortunately the tract is large so the overall impact has not been significant. It is estimated that approximately 12 to 16 ha. (30 to 40 acres) of the natural area has been unintentionally clear-cut due to inadequate attention to the area's boundaries; this involves a clear-cut north of the west branch of Abbott Creek in sections 25 and 26 and the western third of another in section 30. Partial cutting has also taken place along the west edge of the tract in sections 30 and 31 and salvage logging in a small area just inside the boundary in section 19. Trees were marked for salvage cutting within the natural area along the west branch of Abbott Creek but were never cut; however, there is evidence of an earlier light cutting in the same area.

Drifting cattle have grazed the meadows and open forests at higher elevations for many years and still do so every summer. The grazing appears to have significantly altered the composition of meadows and of the understory in some forest stands.

A lookout station has been maintained for many years on top of Abbott Butte but has had no significant impact on the area. The only other human use of the tract is by hikers, hunters, and tourists. This is confined to the edges and has had no influence on natural processes.

Wildfire has undoubtedly been a major influence in creating the present community mosaic. Young stands, brushfields, and fire scars provide abundant evidence for periodic wildfires prior to initiation of fire control programs about 1910. None are known to have occurred in recent years.

RESEARC H

A study of the plant communities and species with emphasis on classification and environmental relationships is presently underway.2 It has also been used as a sampling site in taxonomic studies of variation in the noble - California red fir species complex.[3]

The tract provides innumerable opportunities for research on southwestern Oregon mixed-conifer forests because of its size and the diversity of stand conditions and environments present. These could include studies of hydrologic and nutrient cycling in an essentially virgin drainage; life histories of all but the largest animals; and variations in composition, productivity, and successional development of plant communities. It is an excellent location for studies of sugar pine growing under near-optimum conditions as well as for ecological studies of many other tree species. The unintentional clear-cuts also provide opportunities to study secondary succession.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 15' Abbott Butte, Oregon quadrangle, scale 1: 62,500 issued by the U.S. Geological Survey in 1944; and *geology* - *Geologic Map of Oregon West of the 121st Meridian,* scale 1:500,000 (Peck 1961). Either the District Ranger (Prospect Ranger District) or Forest Supervisor (Rogue River National Forest, Medford, Oregon) can provide details on the most recent aerial photo coverage of the area.

r. R. Mitchell, Department of General Science, Oregon State University, Corvallis. :I Research by Dr. J. F. Franklin, U.S. Forest Service, Forestry Sciences Laboratory, Corvallis, Oregon.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. *Am.* Geogr. Soc. Spec. Publ. 36, various paging, illus.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

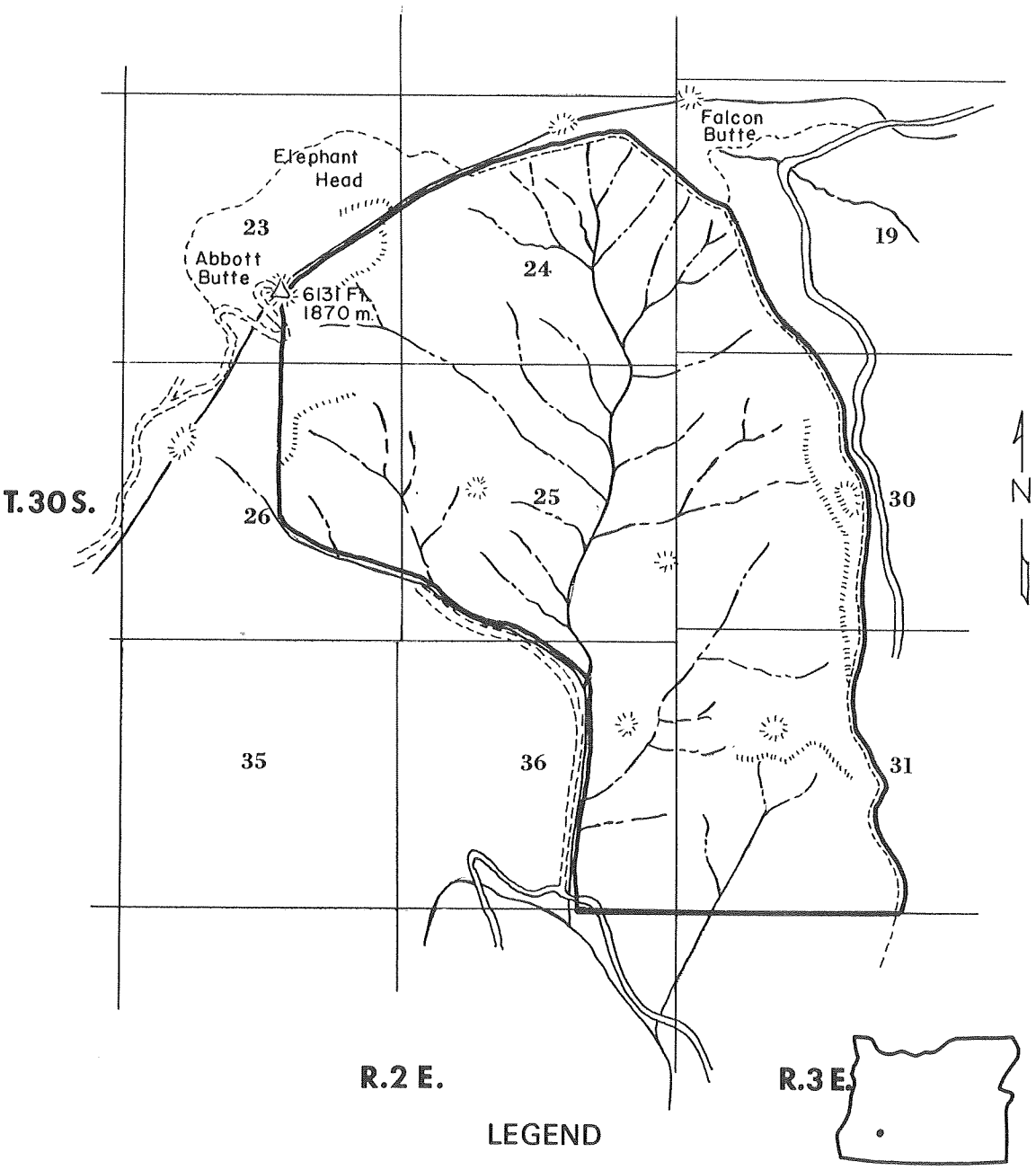
(Oregon) State Water Resources Board
1959. Rogue River Basin. 440 p., illus. Salem.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31, 96 p., illus.

Table AC-1. — Tentative list of mammals for Abbott Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex palustris	northern water shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifagus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Ochotona princeps	pika
Rodentia	*Aplodontia rufa*	mountain beaver
	Arborimus longicaudus	red tree vole
	Clethrionomys californicus	California red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus richardsoni	Richardson vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys mazama	Mazama pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Canis lupus	wolf
	Felis concolor	mountain lion or cougar
	Gulo luscus	wolverine
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Urocyon cinereoargenteus	gray fox
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	black-tailed deer



LEGEND

BOUNDARY, ABBOTT CREEK RESEARCH NATURAL AREA

SECTION LINE

STREAM

RIDGE LINE

GOOD ROAD

POOR ROAD

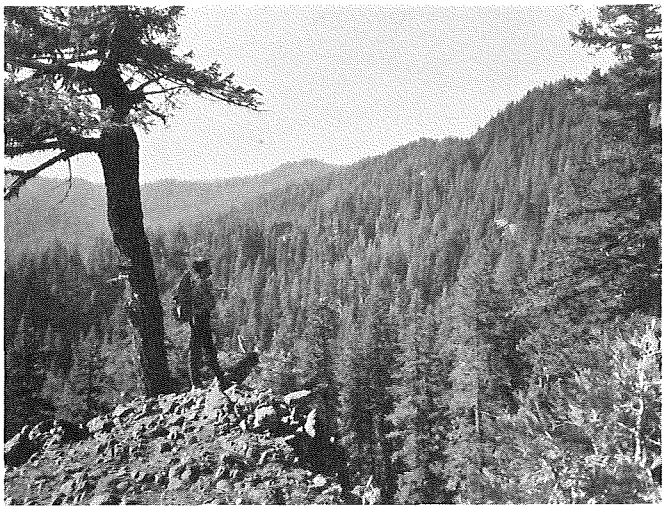
TRAIL

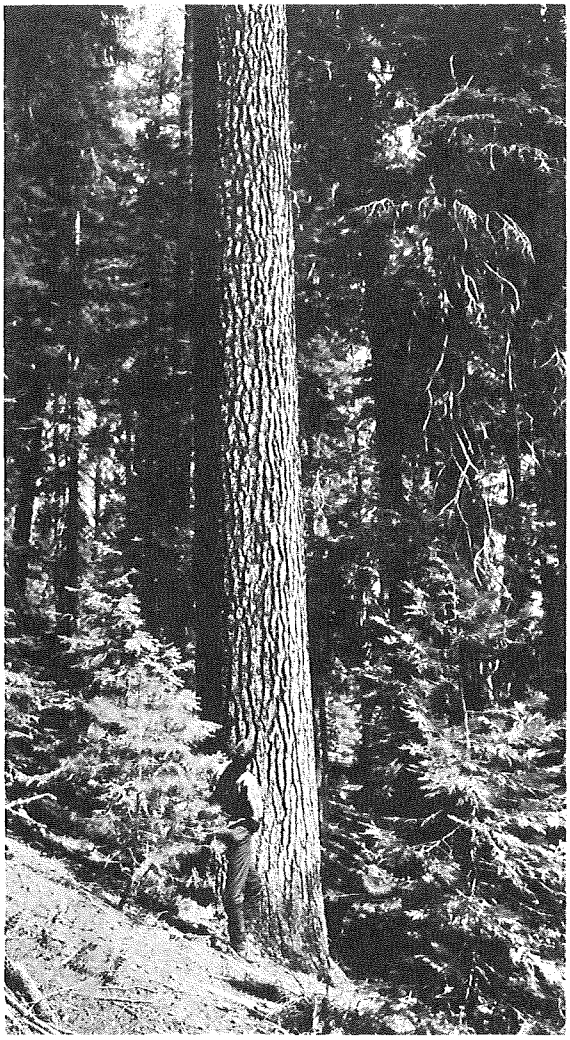
0 1/4 1/2 1 Mi.

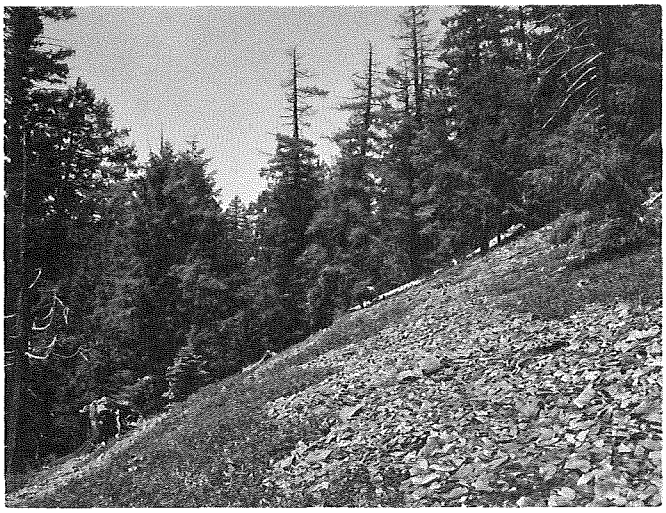
0 1/2 1 2 Km.

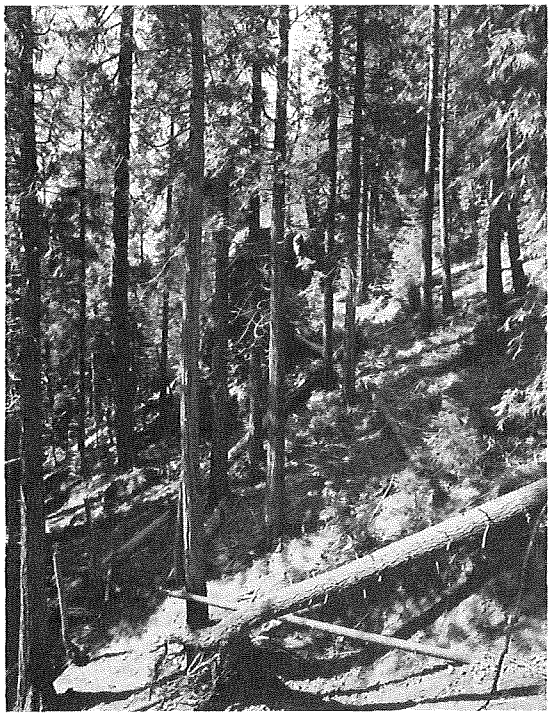
Figure AC-1.– Abbott Creek Research Natural Area, Jackson and Douglas Counties, Oregon.

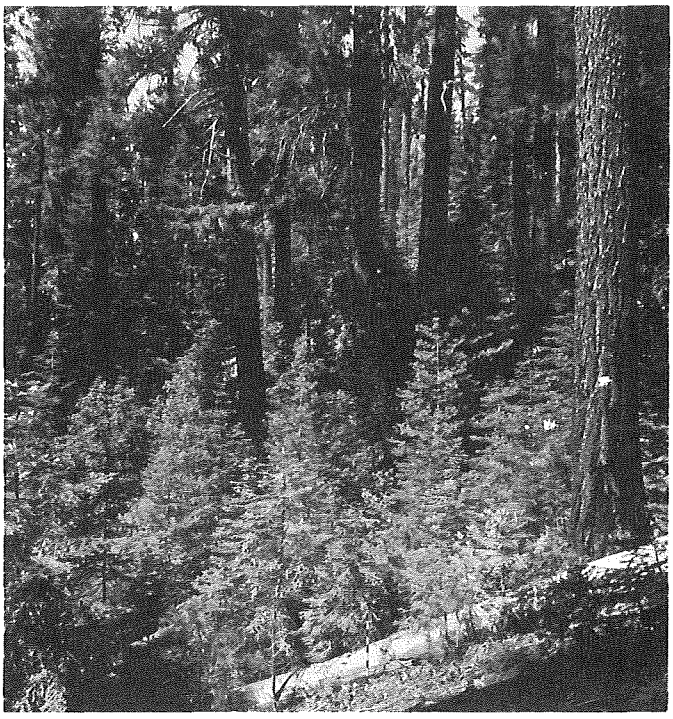
Figure AC-2.-Natural features of Abbott Creek Research Natural Area. Upper left: Looking north over the northwestern quarter of the natural area from a rocky promontory in section 31; all the area visible is within the natural area. Upper right: Typical old-growth specimen of sugar pine, a species well represented in the natural area. Center left: Community of *Arctostaphylos nevadensis* and *Ceanothus prostratus* growing on an open scree slope. Lower left: Typical south slope stand of Douglas-fir, incense-cedar, and scattered sugar pine. Lower right: Forest opening occupied by reproduction of Douglas-fir and sugar pine; frequent openings of this type provide sites for reproduction of less shade-tolerant tree species.











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Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

ASHLAND RESEARCH NATURAL AREA[1]

"Pacific" ponderosa pine and ponderosa pine-Douglas-fir forests in a steep, granitic mountain valley of southwestern Oregon's Siskiyou Mountains.

The Ashland Research Natural Area was established on May 4, 1970, to provide examples of the "Pacific" ponderosa pine *(Pinus ponderosa)* and ponderosa pine-Douglas-fir *(Pseudotsuga menziesii)* forests found west of the Cascade Range in southern Oregon. The 570-ha. (l,408-acre) tract is located in Jackson County and is administered by the Ashland Ranger District (Ashland, Oregon), Rogue River National Forest. The natural area occupies portions of sections 21, 27, 28, 33, and 34, T. 39 S., R. 1 E., and sections 3, 4, 9, and 10, T. 40 S., R. 1 E., Willamette meridian. About three-fourths of the tract is bounded by roads: Forest Roads 3963 and 3903 on the east and south and Forest Road 3903-B (a spur) on the southwest (fig. AS-I). Ridgetops form most of the remaining northeast and east boundary. The natural area lies at 42°08' N. latitude and 122°43' W. longitude.

ACCESS AND ACCOMMODATlONS

The natural area will normally be reached from Ashland, located about 5 km. (3 miles) to the north, via either Forest Road 3963 or 3903. These roads are located on the upper edge of the natural area and provide general views and access. The lower edge of the natural area can be reached via Forest Road 3925 which goes past Reeder Reservoir; however, this road is blocked by a locked gate.

There are no maintained trails within the natural area. The steep, broken topography and brush make cross-country travel somewhat arduous and hazardous. There is an old trail which crosses the northern part of the natural area from east to west (fig. AS-I).

Numerous commercial accommodations are available at Ashland.

ENVIRONMENT

The natural area occupies the slopes of a rugged mountain canyon along the East Fork of Ashland Creek. Topography is steep to very steep throughout most of the tract, with many spur ridges and subdrainages occurring at right angles to the main drainage. Areas of gentle to moderate slopes are found in southern and southwestern portions of the natural area. Elevations range from about 840 m. (2,800 ft.) at Reeder Reservoir to a maximum of about 1,400 m. (4,600 ft.).

The natural area is located on intrusive granitoid rocks of upper Jurassic and lower Cretaceous age (Wells 1956). Quartz diorite, a light- to medium-gray rock of sodic plagioclase and quartz, dominates. It may contain minor amounts of hornblende or biotite or both.

The climate is typical of inland valleys in southwestern Oregon. Summers are warm and dry, and winters are cool and moist. Extended summer drought periods are common. Some winter precipitation occurs as snow, the percentage of snow and total precipitation increasing rapidly with elevation. The following climatic data from Ashland (located at about 610-m. or 2,000-ft. elevation, 5 miles or 3 km. to the north) are reasonably representative of conditions in the lower part of the natural area (U.S. Weather Bureau 1965):

[1]Description prepared by Dr . J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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Mean annual temperature	11.3°C. (52.4°F.)
Mean January temperature	3.6°C. (37.5°F.)
Mean July temperature	20.6°C. (69.1°F.)
Mean January minimum temperature	-0.5°C. (30.1°F.)
Mean July maximum temperature	30.2°C. (86.4°F.)
Average annual precipitation	508 mm. (19.99 in.)
June through August precipitation	46 mm. (1.81 in.)
Average annual snowfall	39 cm. (15.3 in.)

Soils within the natural area are typically relatively shallow and coarse-textured. The major soil series present is probably the Siskiyou series, a type of Grey Brown Podzol, with a thin Al horizon and yellowishbrown B2.

BIOTA

Approximate areas by SAF forest cover type are as follows (Society of American Foresters 1954):

No.	*Name*	*Area*
245	Pacific Ponderosa Pine	152 ha. (375 acres)
244	Pacific Ponderosa Pine-Douglas-Fir	292 ha. (720 acres)
229	Pacific Douglas-Fir	113 ha. (280 acres)
234	Oak-Madrone	8 ha. (21 acres)
243	Ponderosa Pine-Sugar Pine-Douglar-Fir	3 ha. (12 acres)

As will be seen, assignment of many stands to these categories is necessarily somewhat arbitrary. Kuchler (1964) types represented probably include 10 (Ponderosa Shrub Forest), 5 (Mixed Conifer Forest), 12 (Douglas Fir Forest), and 29 (California Mixed Evergreen Forest). The natural area appears to lie primarily within the southwestern Oregon Mixed Conifer Zone (Franklin and Dyrness 1969), although elements of the *Abies concolor* and Interior Valley Zones are present at highest and lowest elevations, respectively.

It is important to note that the natural area is located in the eastern Siskiyou Mountains, an area impoverished in species in comparison with either the western Siskiyou Mountains or southern Cascade Range (Waring 1969). Furthermore, the natural area occupies an area where strong environmental gradients, particularly of temperature and moisture, have been demonstrated and quantified (Waring 1969). These have profound effects on community composition and make it difficult to break the mosaic into community types.

Common tree species within the natural area include ponderosa pine, Douglas-fir, sugar pine *(Pinus lmbertiana),* white fir *(Abies concolor),* and Pacific madrone *(Arbutus menziesii).* Less important species include California black oak *(Quercus kelloggii),* Oregon white oak *(Quercus garryana),* chinkapin *(Castanopsis chrysophylla),* and incensecedar *(Libocedrus decurrens).* Bigleaf maple *(Acer macrophyllum),* white alder *(Alnus rhombifolia),* Pacific yew *(Taxus brevifolia),* and vine maple *(Acer circinatum)* are found along the stream bottoms.

The major climax species appear to be Douglas-fir and white fir. Douglas-fir is probably the typical climax tree on warmer and drier sites such as are found at lower elevations and southerly-exposed slopes. Ponderosa pine is probably not climax anywhere in the natural area, even where Douglas-fir is presently absent.[2] However, successional processes are often slow on these sites due to the severe microclimate and historically open nature of the stands. White fir is clearly the major climax species at higher elevations and on moister habitats; this is certainly the case where it presently occurs and is probably so in some other stands where this fire-sensitive species does not yet occur.

The forest stands classed as "Pacific Ponderosa Pine" are generally found in the lower third of the natural area (fig. AS-2). Type maps show these are dominated by poor to medium stocking of old-growth ponderosa pine,[3] i.e., trees over 53-cm. (21-in.) d.b.h. Minor amounts of Douglas-fir are normally associated. Typical measurements for dominant conifers are 75-cm. (30-in.) d.b.h. and 22 m. (75 ft.) in height. Hardwood tree

[2]Personal communication from Dr. H. H. Waring, Forestry Research Laboratory, Corvallis, Oregon.

[3]These are stocking levels according to standard timber inventory practices. Full (100-percent) stocking is defined by "normal stocking tables" and indicates complete occupation of the site by a tree species. Poor, medium, and good stocking are equivalent to 10 to 40, 40 to 70, and 70 to 100 percent, respectively, of the theoretical full stocking.

species present in such stands are California black and Oregon white oaks and Pacific madrone. The oaks typically attain diameters of 30 cm. (12 in.) at b.h. and heights of 10 to 12 m. (30 to 40 ft.); madrones may be somewhat larger (40-cm. or 16-in. d.b.h. and 15 m. or 50 ft. in height). Douglas-fir typically dominates whatever reproduction is present with smaller amounts of ponderosa pine. Both may be essentially absent, however, when a heavy understory of shrubs is present. The shrubby understory typically includes such sclerophyllous evergreen species as *Arctostaphylos patula* and *A. viscida.* In some stands the shrubs are gradually being killed off as Douglas-fir reproduction grows through and overtops them (fig. AS-2). Other common understory species are *Ceanothus integerrimus, Lotus crassifolius, berberis nervosa, Achillea lanulosa, Solidago canadensis, Apocynum pumilum, Hieracium albiflorum, Madia madioides, Lupinus albifrons, Collomia* spp., *Agoseris retrorsa, Rhus diversiloba, Lonicera hispidula,* and grasses. These communities appear to relate most closely to Waring's (1969) "Black Oak Type"; Waring (1969) provides environmental and additional compositional data for this type.

The "Pacific Ponderosa Pine-Douglas-Fir" stands occupy the bulk of the natural area (fig. AS-2). Ponderosa pine is again conspicuous in the overstory, but it is consistently associated with medium to high stocking levels of Douglas-fir poles, second growth, and/or old growth. Conifers typically attain larger sizes - 75- to 100-cm. (30- to 40-in.) d.b.h. and 37 to 45 m. (125 to 150 ft.) tall. Douglas-fir is an important species in the tree reproduction, although reproduction of white fir is often present and may even be numerically dominant. Hardwood tree species are less common than in the Pacific ponderosa pine type. Understory shrubs include *Corylus cornuta* var. *californica,* chinkapin, *Holodiscus discolor, Symphoricarpos mollis,* and *Arctostaphylos patula. Rhus diversiloba* and *Lonicera hispidula* are generally absent. Subshrub and herbaceous species generally include those previously mentioned, but less hardy species such as *Trientalis latifolia, Adenocaulon bicolor,* and *Polystichum munitum* are also common. These communities are mostly assignable to Waring's (1969) "Mixed Conifer Type," which indicates a significantly cooler and moister habitat than the aforementioned "Black Oak Type."

The forest stands assigned to the "Pacific Douglas-Fir" cover type differ from those outlined in the previous paragraph only in the minor role of ponderosa pine. Douglas-fir dominates the overstory with medium levels of stocking, and most of the reproduction is white fir (fig. AS-2). Ground vegetation is generally reduced under these denser stands, but the composition is typical of the "Mixed Conifer Type" (Waring 1969). The single stand of "Ponderosa Pine-Sugar Pine-Douglas-Fir" type differs only in 10- to 40-percent stocking of very large, old-growth sugar pine.

Although hardwoods are scattered throughout the natural area, there is one small, nearly pure stand of Pacific madrone 12- to 25-cm. (5- to ll-in.) d.b.h. It is located on top of a spur ridge just inside the natural area boundary south of Reeder Reservoir. Douglasfir is the major conifer associate. The understory includes the relatively uncommon parasite *Boschniakia strobilacea.*

Most of the common animals of the southwestern Oregon pine-fir forest are found in the natural area. Mammals believed to utilize the tract as residents or transients are listed in table AS-I. Spiny lizards *(Sceloporus* spp.), striped skinks *(Eumeces* sp.), gopher snakes *(Pituophis melanoleucus),* and garter snakes *(Thamnophis* spp.) constitute the most common reptiles present. A great variety of bird life is represented, including species of hawks (Accipitridae), grouse (Phasianidae), quail (Tetraonidae), doves (Columbidae), owls (Tytonidae), woodpeckers (Picidae), jays (Corvidae), nuthatches *(Sitta* spp.), wrens (Troglodytidae), sparrows (Fringillidae), and the red-shafted flicker *(Coloptes cafer).*

Specialized habitats consist primarily of rock outcrops and cliffs and stream and streamside areas. There is a small ecologically interesting stand of *Cercocarpus betuloides* and *Bromus* sp. located on very shallow soil near Reeder Reservoir.

HISTORY OF DISTURBANCE

There is abundant evidence of wildfire occurrence within the natural area prior to the initiation of fire control programs about 1910. No major fires are known to have occurred within the area during recent years.

Human disturbance of the natural area is relatively minor despite its proximity to the city of Ashland. Access to the lower part of the natural area (Reeder Reservoir) is controlled, since this is the municipal water source for Ashland. Consequently, most disturbance is found along the bounding roads and extends only a short distance into the natural area. This type of marginal disturbance is expected to continue and probably increase in the future. There are some old mine workings, including buildings, within the northeastern edge of the tract.

RESEARC H

No research is presently known to be in progress on the natural area. However, numerous studies have been carried out in immediately adjacent areas on the ecology and environmental relations of the forest stands and tree species (Waring 1969, Cleary and Waring 1969, Atzet and Waring 1970). The results of these studies are directly applicable to the natural area; the work of Whittaker (1960) should be applied with considerable caution, however, as it generally does not apply to conditions in the eastern Siskiyou Mountains. The flora of Mount Ashland, including the natural area, has been surveyed by Dennis (1959).

The natural area provides a site for studying the ecology of "Pacific" ponderosa pineDouglas-fir forests over much of the range of environmental conditions in which it occurs. Studies of successional development within the variety of stand conditions and environments and their faunistic relationships are one example.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 15' Ashland, Oregon-California quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1962; and *geology* - *Geology of the Medford Quadrangle, Oregon-California,* scale 1:96,000 (Wells 1956). Either the District Ranger (Ashland Ranger District) or Forest Supervisor (Rogue River National Forest, Medford, Oregon) can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

Atzet, Thomas, and R. H. Waring
1970. Selective filtering of light by coniferous forests and minimum light energy requirements for regeneration. Can. J. Bot. 48: 2163-2167, illus.

Cleary, B. D., and R. H. Waring
1969. Temperature: Collection of data and its analysis for the interpretation of plant growth and distribution. Can. J. Bot. 47: 167-173, illus.

Dennis, La Rae June
1959. A taxonomic study of the vascular flora of Ashland Peak, Jackson County, Oregon. 114 p., iIlus. (M.A. thesis, on file at Oregon State Univ., Corvallis.)

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW - 80,216 p., illus. Pac. Northwest Forest and Range Exp. Sta., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., ilIus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-39, 96 p., ilIus.

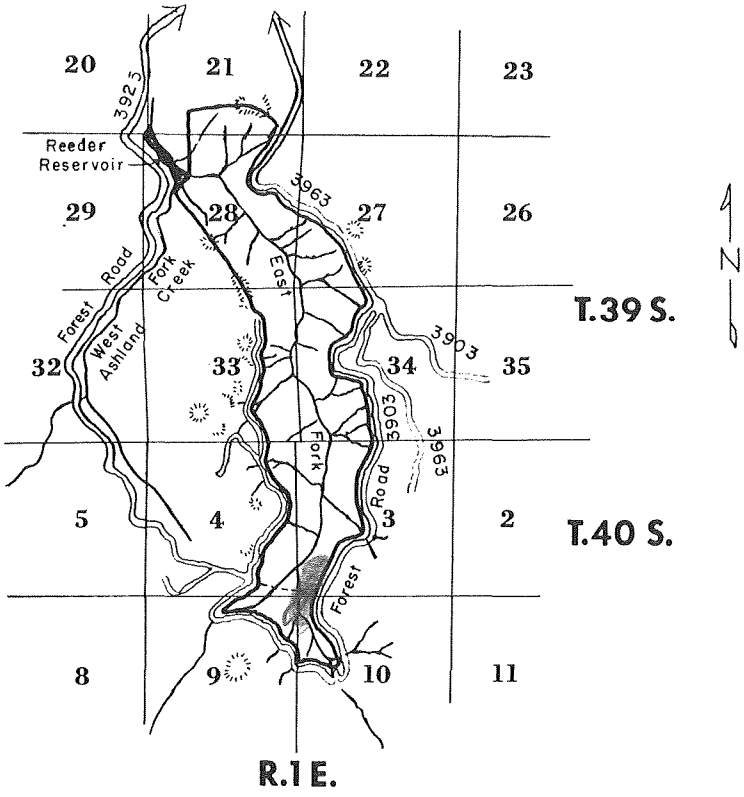
Waring, R. H.
1969. Forest plants of the eastern Siskiyous: Their environmental and vegetational distribution. Northwest Sci. 43: 1-17, illus.

Wells, Francis G.
1956. Geology of the Medford Quadrangle, Oregon-California. U.S. Geol. Surv. Geol. Quadrangle Maps of the U.S. GQ-89.

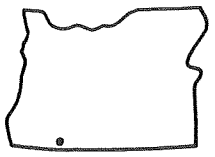
Whittaker, R. H.
1960. Vegetation of the Siskiyou Mountains, Oregon and California. Ecol. Monogr. 30: 279-338, illus.

Table AS-1. — Tentative list of mammals for Ashland Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus latimanus	broad-footed mole
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
	Tadarida brasiliensis	Brazilian free-tailed bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Lepus californicus	black-tailed jack rabbit
	Sylvilagus bachmani	brush rabbit
Rodentia	*Aplodontia rufa*	mountain beaver
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus californicus	California vole
	Neotoma fuscipes	dusky-footed wood rat
	Peromyscus maniculatus	deer mouse
	Sciurus griseus	western gray squirrel
	Spermophilus beecheyi	California ground squirrel
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys bottae	valley pocket gopher
	Thomomys mazama	Mazama pocket gopher
Carnivora	*Bassariscus astutus*	ringtail or miner's cat
	Canis latrans	coyote
	Felis concolor	mountain lion or cougar
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Spilogale putorius	spotted skunk or civet cat
	Taxidea taxus	badger
	Urocyon cinereoargenteus	gray fox
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Odocoileus h. columbianus*	black-tailed deer



LEGEND



BOUNDARY, ASHLAND RESEARCH NATURAL AREA

SECTION LINE

ROAD

STREAM

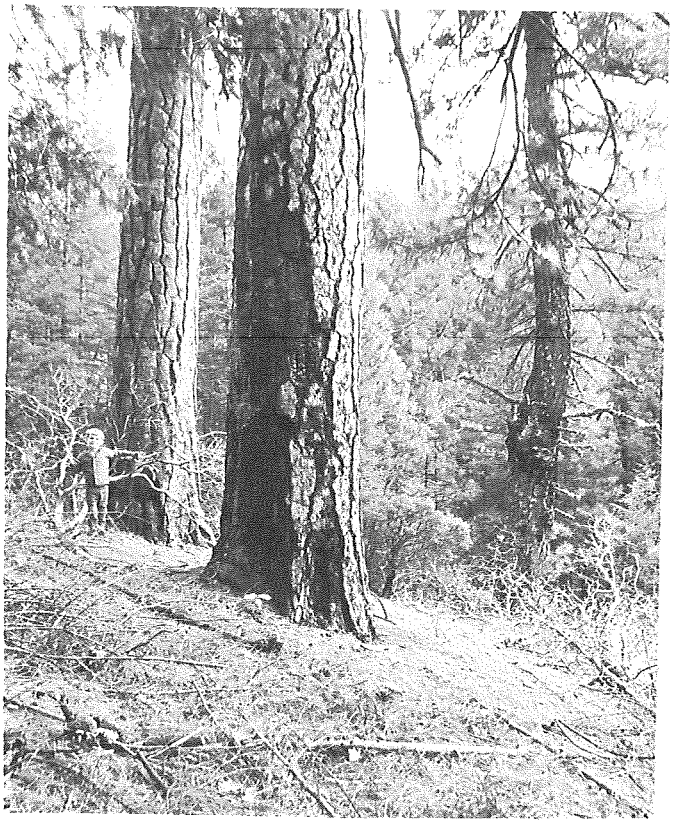
TRAIL

0 1/2 1 2 Mi.

0 1/2 1 2 Km.

Figure AS-1.– Ashland Research Natural Area, Jackson County, Oregon.

Figure AS-2.-Natural features of the Ashland Research Natural Area. Upper left: General view of mixed ponderosa pine-Douglas-fir stands in the northeastern corner of the natural area; the East Fork of Ashland Creek is located in the canyon on the right. Upper right: Shrub community of *Arctostaphylos* spp. being overtopped and gradually killed off by conifers. Lower left: White fir reproduction under a mixed stand of sugar and ponderosa pine; white fir is the climax species and reproduces aggressively on more mesic portions of the natural area. Lower right: Old-growth ponderosa pine and Douglasfir; note the severe fire scars left by past ground fires.



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BAIRD BASIN RESEARCH NATURAL AREA[1]

Typical northeastern Washington forests of ponderosa pine and Douglas-fir growing on north and south slopes and ridgetops.

The Baird Basin Research Natural Area was established in October 1959. It exemplifies typical northeastern Washington ponderosa pine *(Pinus ponderosa),* Douglas-fir *(Pseudotsuga menziesii),* and grand fir *(Abies grrandis)* forest stands as they vary with landform (ridgetop and slope) and aspect (north and south). The 65-ha. (160-acre) tract is located in Stevens County, Washington, and is owned by the Bureau of Sport Fisheries and Wildlife. The area is administered as a part of the Little Pend Oreille Game Range, by the Washington Department of Game (Route 1, Colville, Washington). The rectangular area straddles a rolling hill and is located in the northwest portion of section 10, T. 34 N., R. 41 E., Willamette meridian, at 48°30' N. latitude, 117°40' W. longitude (fig. BB-1).

ACCESS AND ACCOMMODA TIONS

The natural area is located about 49 km. (19 miles) east of Colville and is approached via State Highway 6A. An unmaintained logging road reaches the tract. Access is good during the summer, but snow creates difficulties during the winter. Public accommodations are available in Colville; there are primitive forest camps in the general area.

[1] Description prepared by Dr. F. C. Hall. U.S. Department of Agriculture. Forest Service. Region G, Portland, Oregon.

ENVIRONMENT

The Baird Basin Research Natural Area varies in elevation from 950 to 1,070 m. (3,100 to 3,500 ft.). It is located in rolling topography on a plateau glaciated during the Wisconsin period. Parent rocks appear to be granitic.

A modified continental climate prevails. Most precipitation occurs as snow during the cool, cloudy winter. Summers are warm, generally low in precipitation and largely cloudless. One to 3 months of drought are common. Climatic data from Colville, located in a valley 48 km. (19 miles) to the east are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	8.0°C. (46.5°F.)
Mean January temperature	-4.7°C. (23.6°F.)
Mean July temperature	20.4°C. (68.8°F.)
Mean January minimum temperature	-8.4°C. (16.8°F.)
Mean July maximum temperature	30.3°C. (86.7°F.)
Average annual precipitation	427 mm. (16.8 in.)
June through August precipitation	91 mm. (3.6 in.)

Soils in the area have not been mapped. Cursory examination suggests southerly slopes have colluvial soils derived from granitic material, whereas soils on gentle ridgetops and north slopes are developed in aerially deposited volcanic ash over buried profiles.

BIOTA

Estimated areas by forest cover type are:

Name	*Area*
Ponderosa pine with western larch and Douglas-fir	26 ha. (63 acres)
Douglas-fir and western larch	25 ha. (62 acres)
Lodgepole pine	14 ha. (35 acres)

The stands of ponderosa pine mixed with Douglas-fir and western larch *(Larix occidentalis)* can be assigned to SAF forest cover type 214, Ponderosa Pine-Western Larch-DouglasFir (Society of American Foresters 1954), and

This file was created by scanning the printed publication. Text errors identified by the software have been corrected; however, some errors may remain.

Kuchler's (1964) Type 12, Douglas Fir Forest. The Douglas-fir with western larch can be assigned to SAF type 212, Larch-Douglas-Fir, and Kuchler's Type 12, Douglas Fir Forest. Lodgepole pine *(Pinus contorta)* forest belongs to SAF type 218, Lodgepole Pine; Kuchler does not recognize lodgepole pine as a potential forest type. The area falls within the *Pseudotsuga menziesii* Zone (Daubenmire 1952).

Steep, southwest slopes with shallow, stony soils are generally dominated by ponderosa pine, bluebunch wheatgrass *(Agropyron spicatum.),* Idaho fescue *(Festuca idahoensis)* and *Phlox* spp., with some elk sedge *(Carex geyeri), Lupinus* spp., and *Achillea millefolium* (fig. BB-2). It relates to Daubenmire and Daubenmire's (1968) *Pinus ponderosa/Agropyron spicatum* Association.

Ridgetops and gentle south slopes and swales are often dominated by ponderosa pine with occasional Douglas-fir. Douglas-fir reproduction and poles clearly dominate the understory. Ground vegetation is characterized by low to moderate crown cover of *Physocarpus malvaceus* and dense, vigorous pinegrass *(Calamagrostis rubescens).* Other ground vegetation species are *Symphoricarpos albus, Achillea millefolium,* and, occasionally, *Spiraea lucida* and *Arctostaphylos uva-ursi.* These stands typically grow on soils of aerially deposited pumice over residual granitic materials. They probably correlate with the *Pseudotsuga menziesii/Physocarpus malvaceus* Association (Daubenmire and Daubenmire 1968).

The most important north slope community is dominated by Douglas-fir with abundant western larch and an understory of *Physocarpus malvaceous* and Douglas maple *(Acer glabrum), Vaccinium scparium,* pinegrass, *Linnaea borealis, Spirea lucida, Berberis repens,* and *Hieracium albiflorum* are also present. This may represent a mesic phase of Daubenmire and Daubenmire's (1968) *Pseudotsuga menziesii/Physocarpus malvaceus* Association. It characteristically occupies soils of aerially deposited volcanic ash over granite.

The small lodgepole pine stand averages 70 to 90 years old. Lodgepole pine dominates with ground vegetation characterized by pine-grass, *Vaccinium scoparium, Chimaphila umbellata, Linnaea borealis, Spirea lucida,* and occasional *Rosa gymnocarpa, Pachistima myrsinites,* and various forbs.

Resident and transient mammals believed to utilize the natural area are listed in table BB-I. Mule deer *(Odocoileus hemionus)* use the area as spring, summer, and fall range.

HISTORY OF DISTURBANCE

Fire scars on ponderosa pine indicate that ground fires periodically burned the area prior to initiation of fire control programs; four to eight wildfires are recorded in these scars. Dead and down trees in the lodgepole pine stand have been charred, clearly indicating a fire of conflagration proportions in that plant community.

Domestic livestock apparently grazed the tract to some extent between 1890 and 1930. There was no evidence of serious vegetational changes due to livestock use, however.

RESEARC H

No research is known on the area. It provides interesting opportunities: (1) to correlate vegetational gradients with variations in land form, slope, and aspect since the tract completely straddles a broad ridge; (2) to study development of forest stands in the absence of natural wildfires; and (3) to determine changes in biomass productivity with topography under a single macroclimate.

MAPS AND AERIAL PHOTOGRAPHS

No special topographic or geologic maps are available for the Baird Basin Research Natural Area which are sufficiently detailed to be useful. The Game Range Manager (Little Pend Oreille Game Range) can provide details on the most recent aerial photo coverage of the area.

LITERATURE CITED

Daubenmire, R.
1952. Forest vegetation of northern Idaho and adjacent Washington, and its bearing on concepts of vegetation classification. Ecol. Monogr. 22: 301-330, illus.

Daubenmire, R., and Jean B. Daubenmire
1968. Forest vegetation of eastern Washington and northern Idaho. Wash. Agric. Exp. Stn. Tech. Bull. 60, 104 p., illus.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Amer. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States-supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table BB-1. — Tentative list of mammals for the Baird Basin Research Natural Area

Order	Scientific name	Common name
Insectivora	*Microsorex hoyi*	pigmy shrew
	Sorex cinereus	masked shrew
	Sorex obscurus	dusky shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis yumanensis	Yuma myotis
Lagomorpha	*Lepus americanus*	snowshoe hare
	Sylvilagus nuttalli	mountain cottontail
Rodentia	*Clethrionomys gapperi*	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias ruficaudus	red-tailed chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Marmota flaviventris	yellow-bellied marmot
	Microtus longicaudus	long-tailed vole
	Microtus pennsylvanicus	meadow vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Spermophilus columbianus	Columbian ground squirrel
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus hudsonicus	red squirrel
	Thomomys talpoides	northern pocket gopher
	Zapus princeps	western jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx canadensis	Canadian lynx
	Lynx rufus	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Taxidea taxus	badger
	Ursus americanus	black bear
Artiodactyla	*Alces alces*	moose
	Cervus canadensis	wapiti or elk
	Odocoileus h. hemionus	mule deer
	Odocoileus virginianus	white-tailed deer

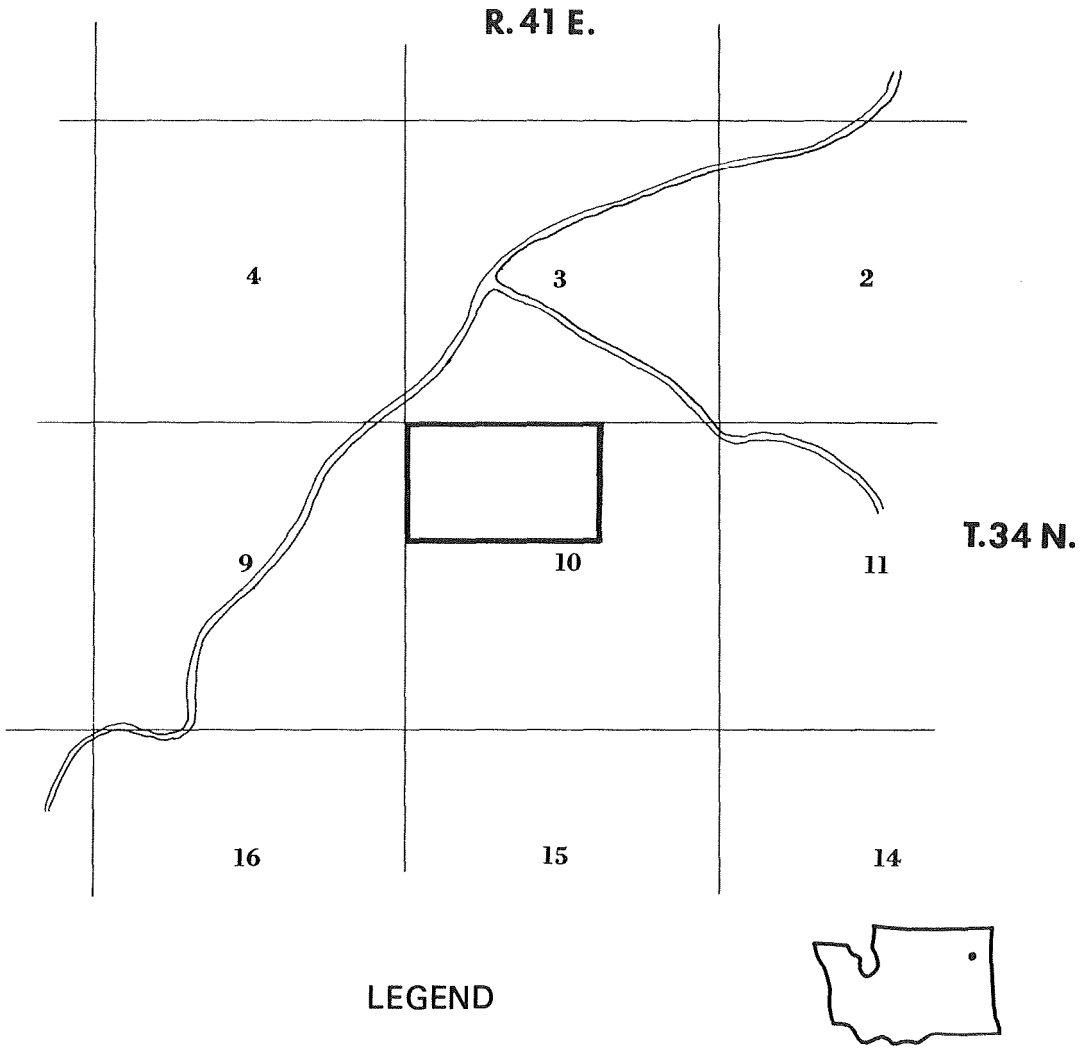

Figure BB-1.– Baird Basin Research Natural Area, Stevens County, Washington.

Figure BB-2.-Plant communities of the Baird Basin Research Natural Area. Upper left: Ponderosa pine/bluebunch wheatgrass community with Idaho fescue typical of south aspects with shallow soils. Upper right: Ponderosa pine/pinegrass community with some Douglas-fir and occasional *Physocarpus* and *Symphoricarpos* on upper south slope. Lower left: Douglas-fir-ponderosa pine/ Physocarpus/pinegrass community on south slope cove and swale. Lower right: Douglas-fir-western larch/ *Physocarpus-Vaccinium* community with some Douglas maple, pinegrass, and *Linnaea borealis.*

Federal Research Natural Areas in Oregon and Washington a Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

BLUEJAY RESEARCH NATURAL AREA[1]

Ponderosa pine/bitterbrush and lodgepole pine/bitterbrush communities located near the center of the Mount Mazama pumice deposits of south-central Oregon.

The Bluejay Research Natural Area was established March 1971 to exemplify ponderosa pine/bitterbrush/needlegrass *(Pinus ponderosa/ Purshia tridentata/Stipa occidentallis)* and lodgepole pinelbitterbrush/needlegrass *(Pinus contorta/Purshia tridentata/Stipa occidentalllis)* communities characteristic of the central portion of the pumicite deposits resulting from the eruption of Mount Mazama (Crater Lake). The 85-ha, (210-acre) tract is located in Klamath County, Oregon, and is administered by the Chiloquin Ranger District (Chiloquin, Oregon), Winema National Forest (Klamath Falls, Oregon). The slightly rectangular area is located in the E *1/2* of section 33, T. 30 S., R. 10 E., Willamette meridian, at 42°55' N. latitude and 121 °30' E. longitude (fig. BJ -1).

ACCESS AND ACCOMMODATlONS

The natural area is located approximately 58 km. (36 miles) northeast of Chiloquin and is reached via U.S. Highway 97 and a gravel road. Access is good during summer but becomes difficult during the winter due to snow. Public accommodations are available in Chiloquin and Chemult; a primitive campground at Bluejay Springs is adjacent to the tract.

[1]Description prepared by Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

ENVIRONMENT

The Bluejay Research Natural Area varies in elevation from 1,380 to 1,430 m. (4,540 to 4,700 ft.). Topography is flat to undulating with occasional slopes of 20 percent. The tract is located on a large plateau area over which dacite type pumice (bulk density of 0.6 to 0.8) was aerially deposited following the eruption of Mount Mazama (Baldwin 1964). All rocks and soil existing prior to the eruption have been covered with 2 to 25 dm. (1 to 10 ft.) of this pumice.

A modified continental climate prevails. Most precipitation occurs as snow during the cool, cloudy winter. Summers are warm, generally low in precipitation and largely cloudless. One to 3 months of drought are common. Climatic data from Chemult, Oregon, located 40 km. (25 miles) northwest are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	5.3°C. (41.5°F.)
Mean January temperature	-3.9°C. (25.0°F.)
Mean July temperature	15.3°C. (59.6°F.)
Mean January minimum temperature	-11.0°C. (12.1°F.)
Mean July maximum temperature	28.1°C. (82.7°F.)
Average annual precipitation	676 mm. (26.6 in.)
June through August precipitation	66 mm. (2.6 in.)
Average annual snowfall	417 cm. (164.0 in.)

Soils on the area have been mapped at a reconnaissance level. The Lapine loamy coarse sand, moderately deep phase, and a representative of the Wickiup series are present (U .S. Bureau of Indian Affairs 1958). A soil description obtained on the site, probably belonging to the Lapine series, is described below (see also fig. BJ-2). Pumice particles vary in size from coarse sand (I-mm. diameter) to pea gravel (5- to 10-mm. diameter) (fig. BJ-2). This soil is characteristic of the ponderosa pine/bitterbrush/needlegrass com-munity:

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01		Locally absent, pumice gravels on the surface, pine needles and shrub leaves under tree and shrub canopies.
A1	0 to 44 cm.	Dark brown when moist (10 YR3/2) loamy coarse sand; not plastic or sticky with very fine weak granular structure; pH 6.2; no stones.
AC	4 to 30 cm.	Dark brown (10 YR 4/3 moist, 10 YR 7/3 dry) fine gravelly loamy coarse sand; not plastic or sticky, very weak subangular blocky structure; pH 6.4; no stones.
C1	23 to 74 cm.	Light yellowish brown (10 YR 7/6 moist, 10 YR 8/3 dry) very gravelly coarse sand; not plastic or stocky, single grained; pH 6.4; no stones.
C2	74 to 109 cm.	Light yellowish brown (10 YR 7/4 moist) fine gravelly coarse sand; not plastic or sticky, single grained; pH 6.6; no stones.
C3	109 to 117 cm.	Fine gravelly coarse sand and fine loamy sand; a mixed horizon of slightly plastic and sticky to non-plastic or -sticky with variable structure from moderate subangular blocky to single grained; pH 6.4; no stones.
IIBb	117 cm.+	Buried soil; brown (7.5 YR 4/4 moist) loamy sand; slightly plastic and slightly sticky with moderate subangular blocky structure; pH 6.6; 20 to 40 percent stones.

A Wickiup type soil occurs in swale topography at the west edge of the tract and currently supports lodgepole pine/bitterbrush/ needlegrass.

BIOTA

Estimated areas by plant community are:

Name	*Area*
Ponderosa pine/bitterbrush/ needlegrass	65 ha. (160 acres)
Lodgepole pine/bitterbrush/ needlegrass	20 ha. (50 acres)

The ponderosa pine/bitterbrush/needlegrass stands can be assigned to SAF forest cover type 237, Interior Ponderosa Pine (Society of American Foresters 1954), and Kuchler's (1964) Type 10, Ponderosa Pine Shrub. Lodgepole pine/bitterbrush/needlegrass communities belong to SAF forest cover type 218, Lodgepole Pine; Kuchler does not recognize lodgepole pine as a type. The natural area falls within the *Pinus ponderosa* Zone (Franklin and Dyrness 1969).

The communities of ponderosa pine/bitterbrush/needlegrass fit the habitat type descriptions of Dyrness and Youngberg (1966) and Volland (1963) who worked in this general area. The plant community is dominated by ponderosa pine *(Pinus ponderosa),* bitterbrush *(Purshia tridentata),* and needlegrass *(Stipa occidentalis)* associated with *Carex rossii, Erigonum nudum, Viola purpurea* var. *purpurea,* and bottlebrush squirreltail *(Sitanion hystrix).* Ponderosa pine crown cover varies from 10 to 30 percent. Site index for ponderosa pine is 70 according to Meyer (1961); ponderosa pine basal area averages 16 sq. m. per hectare (70 sq. ft. per acre). All pines are growing slowly, suggesting near maximum stocking for the site (fig. BJ -2).

The lodgepole pine/bitterbrush/needlegrass community occurs in a swale topographic position on the tract's west edge. Lodgepole pine *(Pinus contorta)* dominates with bitterbrush, needlegrass, and some *Arctostaphylos uva-ursi.* It represents only moderate productivity according to Youngberg and Dahms (1970).

Resident and transient mammals believed to frequent the natural area are listed in table BJ -1. Mule deer *(Odocoileus hemionus)* utilize the area for spring, summer, and fall range.

HISTORY OF DISTURBANCE

Fire scars on ponderosa pine indicate ground fires periodically burned the area prior to initiation to fire control programs in 1910. According to these fire scars, the last wildfire occurrence was about 1916. Age classes of bitterbrush and ponderosa pine saplings suggest that both were established after the last ground fire.

Domestic sheep occasionally grazed the area in early spring. Ranger District records suggest sheep use never exceeded moderate levels and usually was light so domestic

animals have apparently not seriously affected the vegetation.

RESEARCH

Vegetation, soil description, and environmental notes for the pine/bitterbrush/needlegrass community are available.[2] No other research on the tract is known. However, relevant research in the general vicinity has been conducted by Dyrness and Youngberg (1966), Volland (1963), and Youngberg and Dahms (1970).

The Bluejay Research Natural Area provides interesting research opportunities: (1) to evaluate soils and vegetation in relation to the Mount Mazama pumice deposits in conjunction with Goodlow Mountain Research Natural Area on the southwestern edge of Mazama deposit and the Metolius Research Natural Area located near the northern edge of aerially deposited pumice; (2) to compare microsite relations and biomass productivity of ponderosa pine and lodgepole pine; and (3) as a reference stand for undisturbed vegetation in the center of aerially deposited Mount Mazama pumice.

[2]Research by L. A. Volland; available from the Division of Range and Wildlife Management, U.S. Forest Service, P.O. Box 3623, Portland, Oregon 97208.

MAPS AND AERIAL PHOTOGRAPHS

No special topographic or geologic maps are available for the natural area which are sufficiently detailed to be useful. Either the District Ranger (Chiloquin Ranger District) or Forest Supervisor (Winema National Forest, Klamath Falls, Oregon) can provide details of the most recent aerial photo coverage of the area.

LITERATURE CITED

Baldwin, Ewart M.
1964. Geology of Oregon. Ed. 2, 165 p., illus. Eugene: Univ. Oreg. Coop Bookstore.

Dyrness, C. T., and C. T. Youngberg
1966. Soil-vegetation relationships within the ponderosa pine type in the central Oregon pumice region. Ecology 47: 122-138, illus.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Serv. Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Meyer, Walter H.
1961. Yield of even-aged stands of ponderosa pine. U.S. Dep. Agric. Tech. Bull. 630, 59 p., illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Bureau of Indian Affairs
1958. Soils of the Klamath Indian Reservation (interim report). 297 p. (Soil Conserv. Servo & Oreg. State Coll. cooperating.)

U.S. Weather Bureau
1965. Climatic summary of the United States supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31,96 p., illus.

Volland, Leonard Allen
1963. Phytosociology of the ponderosa pine type on pumice soils in the Upper Williamson River Basin, Klamath County, Oregon. 166 p., illus. (M.S. thesis, on file at Oreg. State Univ., Corvallis.)

Youngberg, C. T., and W. G. Dahms
1970. Productivity indices for lodgepole pine on pumice soils. J. For. 68: 90-94, illus.

Table BJ-1. — Tentative list of mammals for the Bluejay Research Natural Area

Order	Scientific	Common name
Insectivora	*Scapanus latimanus*	broad-footed mole
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus californicus*	black-tailed jack rabbit
	Sylvilagus nuttalli	mountain cottontail
Rodentia	*Erethizon dorsatum*	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Sciurus griseus	western gray squirrel
	Spermophilus beldingi	Belding ground squirrel
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys mazama	Mazama pocket gopher
Carnivora	*Canis latrans*	coyote
	Felix concolor	mountain lion or cougar
	Lynx rufus	bobcat
	Martes americana	marten
	Mephitis mephitis	striped skunk
	Mustela frenata	long-tailed weasel
	Spilogale putorius	spotted skunk or civet cat
	Taxidea taxus	badger
	Urocyon cinereoargenteus	gray fox
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Odocoileus h. hemionus*	mule deer

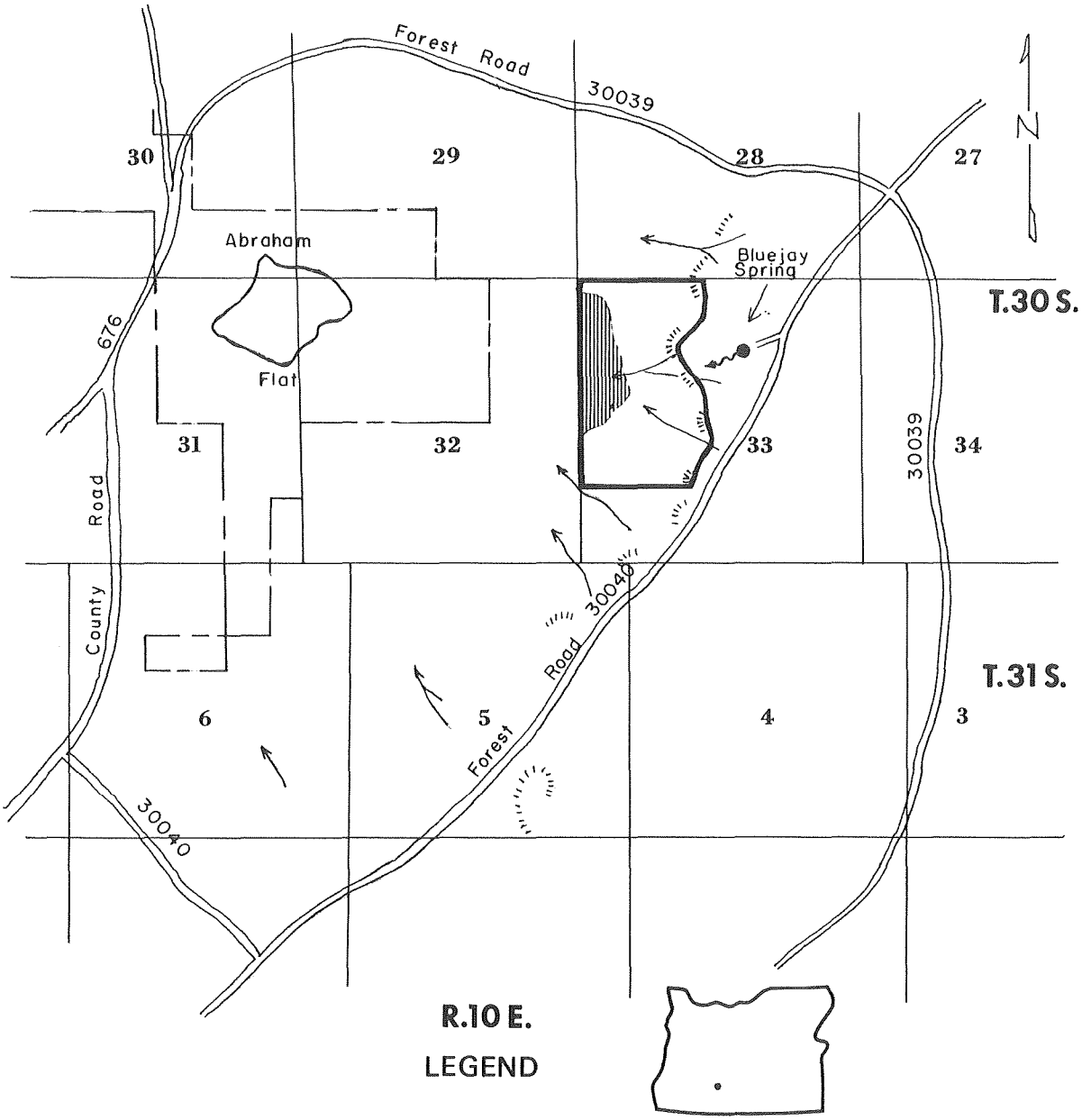
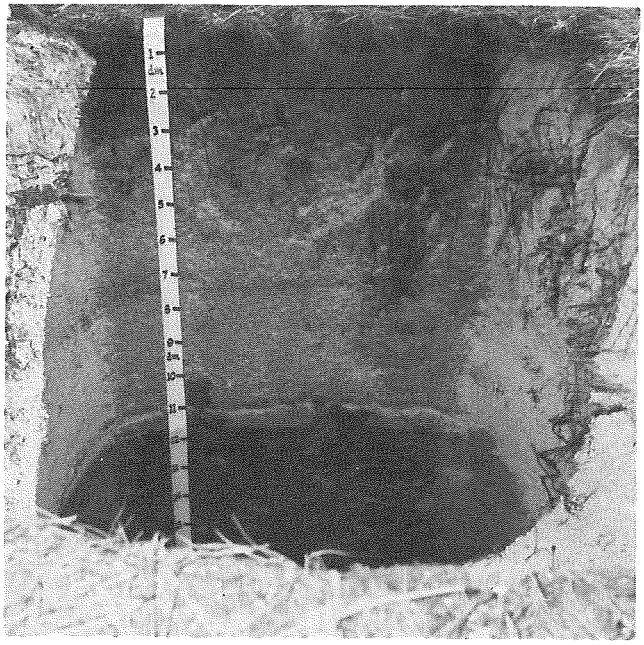


Figure BJ-1.– Bluejay Research Natural Area, Klamath County, Oregon.

Figure BJ-2.-Natural features of the Bluejay Research Natural Area. Upper left: A ponderosa pine/bitterbrush/ needlegrass community typical of those occupying the bulk of the area. Upper right: Ground vegetation showing charred shrub stump and absence of herbaceous plants, a typical condition on soils from Mount Mazama pumice. Bottom: Soil profile showing the 11-dm.(44-in.-) thick layer of aerially deposited pumice over a buried soil.



Federal Research Natural Areas in Oregon and Washington a Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

BREWER SPRUCE RESEARCH NATURAL AREA[1]

A mixed conifer type with abundant Brewer spruce and associated brush-fields on a rugged ridgetop in the Siskiyou Mountains.

The Brewer Spruce Research Natural Area was established on January 29,1965. It exemplifies a high-elevation, mixed conifer type containing large amounts of Brewer spruce *(Picea breweriana)* and associated brushfields as they occur on mountain ridgetops in southwestern Oregon's Siskiyou Mountains. The 85-ha. (210-acre) area is located in Josephine County, Oregon, and is administered by the Medford District (Medford, Oregon), Bureau of Land Management (BLM). Administratively, it lies within the Deer Creek planning unit of the Applegate Resource Management Area. The tract occupies the N1/2 NW1/4 SW1/4 and SW1/4 NW1/4 SW1/4 of section 5, and the NE1/4 SE1/4, SW1/4 SW1/4, S1/2 NW1/4 SE1/4, SE1/4 NE1/4 SW1/4, SE1/4 SW1/4, and S1/2 of lot 7 in section 6, T. 39 S., R. 6 W., Willamette meridian. It lies at 42° 12' N. latitude and 123 ° 28' W. longitude.

ACCESS AND ACCOMMODA TIONS

The area is accessible from the west (D .S. Highway 199 to the Illinois River Valley) via BLM's Deer Creek Access Road (No. 38-7-13); it can also be approached from the east via Williams and BLM's Cedar Flat Road (No. 39-5-6). These roads join at the intersection with the BLM's Rabbit Lake Road (No. 39-6-9), which passes within 91 m. (300 ft.) of the northern boundary of the natural area (fig. BP-l). Although an abandoned trail crosses the southwestern portion of the area, it is now very difficult to follow and foot travel through the area is slow and tedious.

The closest commercial accommodations are located in Cave Junction, about 16 km. (10 miles) to the southwest. Numerous and varied accommodations are also available in Grants Pass, situated about 49 km. (30 miles) to the north.

ENVI RONMENT

The Brewer Spruce Research Natural Area occupies the summit of a small mountain peak (Little Grayback Peak, elevation 1,861 m, or 5,445 ft.) and the crest of a downward-trending ridge extending in a northeasterly direction (fig. BP-2). With the exception of two small saddles located near the east and west boundaries, the area is extremely rugged, with steep slopes and numerous rock outcrops. Most of the steeply sloping portion has a northerly aspect. Elevations range from about 1,250 to 1,645 m. (4,100 to 5,400 ft.). A small cirque-like basin contains a small, shallow pond named Rabbit Lake.

The entire area is underlain by metavolcanic rocks of the Applegate Group (Wells, Hotz, and Cater 1949). These rocks were laid down during the Triassic period. In the natural area they are apparently largely metamorphosed andesites and basalts.

The climate is warm-temperate with hot, dry summers and cool, moist winters. Much of the winter precipitation occurs as snow. Cumulative winter snowpacks may exceed 3 m. (10 ft.) and they are not completely melted until midsummer. The following climatic data are from the Williams weather station, which is about 14 km. (9 miles) east

[1] Description prepared by Dr. C. T. Dyrness, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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of and 915 m. (3,000 ft.) below the natural area (Whittaker 1960, U.S. Weather Bureau 1965) :

Mean annual temperature	11.1°C.	(52.0°F.)
Mean January temperature	3.7°C.	(38.7°F.)
Mean July temperature	19.4°C.	(66.9°F.)
Extreme minimum temperature	-16.0°C.	(3.0°F.)
Extreme maximum temperature	42.0°C.	(108.0°F.)
Average annual precipitation	957 mm.	(37.69 in.)
June through August precipitation	32 mm.	(1.24 in.)

Temperatures are undoubtedly considerably lower and precipitation somewhat higher on the natural area.

Very little is known about the soils of the area. Steepness of the terrain and high frequency of rock outcrops indicate most soils are undoubtedly shallow and immature with high stone contents. A profile examination near the southwestern corner of the area disclosed a regosolic soil containing about 60 percent stones, with a dark brown, silt loam surface horizon.

BIOTA

It is difficult to place the Brewer Spruce Research Natural Area within a single vegetation zone. In fact, it contains elements of three vegetation zones defined by Franklin and Dyrness (1969) for southwestern Oregon: the Mixed Conifer, *Abies concolor,* and *Abies maagnifica shastensis* Zones. The area includes Kuchler's (1964) Types 5, Mixed Conifer Forest *(Abies-Pinus-Pseudotsuga),* and 34, Montane Chaparral *(Arctostaphylos-Castanopsis-Ceanothus).* The forest stands appear to be a mixture of SAF cover types 207 (Red Fir) and 211 (White Fir) with possibly some areas classifiable as cover type 243 (Ponderosa Pine-Sugar Pine-Fir) (Society of American Foresters 1954).

At least 10 different coniferous tree species grow in the natural area. The most common of these are: Douglas-fir *(Pseudotsuga menziesii),* white fir *(Abies concolor),* Brewer spruce (fig. BP-2), Shasta red fir *(Abies magnifica* var. *shastensis),* western white pine *(Pinus monitcola),* Pacific yew *(Taxus brevifolia),* and Port-Orford-cedar *(Chamaecyparis lawsoniana).* Coniferous tree species more limited in distribution include sugar pine *(Pinus lambertiana),* knobcone pine *(Pinus attenuata),* and incense-cedar *(Libocedrus decurrens).* Another outstanding feature of the area is the rather extensive brushfields. The Bureau of Land Management estimates that only about 60 percent of the area is forested, 25 percent is brushfield, and the remaining 15 percent is made up of bare rock outcrops and talus.

Most of the older (200- to 300-year-old or more) forest stands in the area are very open with a total overstory coverage of only 25 to 30 percent (fig. BP-2). Brewer spruce and Douglas-fir are generally codominant in the overstory; minor amounts of western white pine may also be present. Tree regeneration in some locations is dominated by Port-Orford-Cedar saplings which have a stunted appearance, probably due to heavy snow loads. In most areas, however, both Shasta red fir and Brewer spruce appear to be reproducing successfully, each with about 5-percent reproduction coverage in a typical stand. Western white pine and Douglas-fir are also scattered individually through the understory. The most abundant understory shrub is *Vaccinium membranaceum.* Other more scattered shrubs include *Amelanchier pallida, Arctostaphylos patula* and *A. nevadensis, Ceanothus prostratus, Castanopsis chrysophylla, Berberis nervosa, Rosa gymnocarpa,* and Pacific yew. Typical herbaceous species in these open timber stands include *Achlys triphylla, Chimaphila umbellata, Pedicularis racemosa, Hieracium allbiflorum, Xerophyllum tenax, Senecio triangularis,* and *Pyrola secunda.*

The Brewer spruce-Shasta fir stand just southeast of and above Rabbit Lake probably contains the best specimens of Brewer spruce in the area. Scattered large individuals range up to about I-m. (3-ft.) d.b.h. The understory is dominated by thickets of sapling-sized Port-Orford-cedar, although both Brewer spruce and Shasta fir are apparently reproducing successfully.

An area of young, dense white fir occurs near the western boundary. Although the stand is dominantly 90- to 100-year-old white

fir, significant amounts of Shasta red fir and western white pine are also present in the overstory. Tree regeneration consists of scattered white fir and western white pine. The shrub layer has about 15-percent *Berberis nervosa* cover, with lesser amounts of Pacific yew, C*astanopsis chrysophylla, Amelanchier pallida, Holodiscus discolor,* and *Rosa gymnocarpa.* The herb layer has low coverage; some of the principal species are several grasses, C*himaphila umbellata, Arenaria macrophylla, Trientalis latifolia, Osmorhiza chilensis, Synthyris reniformis, Arnica latifolia, Disporum hookeri, Trillium ovatum, Dicentra formosa, Anemone deltoidea,* and *Polystichum munitum.*

Extensive tracts of extremely dense, tall (3-m. or 10-ft.) shrubs with only very scattered tree cover occur on steep north and northwest facing slopes adjacent to rock outcrops. The hardy, isolated trees dotting these shrub communities are usually white fir, Shasta red fir, Brewer spruce, and, occasionally, western white pine. The dominant shrub species is generally Pacific yew, which sometimes forms almost impenetrable thickets. Other shrubs which may be important components of the stand include *Acer glabrum* var. *torreyi, Holodiscus discolor, Corylus Cornuta* var. *californica, Quercus vaccinifolia, Amelanchier pallida,* and *Rubus parviflorus.* On similar sites, which perhaps have been more recently disturbed by fire, are scattered young trees with *Vaccinium membranaceum* and *Xerophyllum tenax* as the principal understory.

Low (about 1-m. or 3-ft.) brushfields are rather extensive in southeastern and southwestern portions of the natural area in section 6 (fig. BP-2). The most important contributions to the dense shrub cover are *Arctostaphylos patula* and *Quercus vaccinifolia.* Other shrub species of more scattered occurrence include *Ceanothus velutinus, Holodiscus discolor, Corylus Cornuta* var. *calfornica, Quercus garryana* var. *breweri,* and *Quercus chrysolepis.*

The 1/4-ha. (0.5-acre) Rabbit Lake constitutes an interesting aquatic habitat in the natural area (fig. BP-2). Snowmelt apparently supplies the water for this shallow pond. Outflow occurs only during the spring and by late summer the shoreline has receded considerably. Although the pond is too shallow to support fish, it undoubtedly serves as a habitat for amphibians. The area near the shoreline supported the following plant species which were not observed elsewhere: *Veratrum californicum, Ribes lacustre, Salix* sp., *Clintonia unifoliata, Tiarella unifoliata,* and *Linnaea borealis* ssp. *longiflora.*

Resident and transient mammals believed to utilize the natural area are listed in table BP-l.

HISTORY OF DISTURBANCE

There is no evidence of recent fires within the Brewer Spruce Research Natural Area. However, the area has probably been repeatedly burned in the more distant past.

Human disturbances chiefly involve several clear-cut areas logged in 1964. These extend into the natural area in two locations along the northern boundary. The total clear-cut area within the boundaries of the natural area is estimated to be less than 4 ha. (10 acres).

Some of the developments planned for the area may result in some additional disturbance. The Bureau of Land Management plans to reconstruct approximately 0.8 km. (0.5 mile) of foot trail within the natural area. This trail will be a segment of a 15-km. (9-mile) scenic trail. A spur trail, lying outside the natural area, is proposed from the end of the Rabbit Lake Road in section 6 to an intersection with the main scenic trail in the SW1/4 of section 6. Plans also call for installation of plant identification signs for 30 to 40 of the most common species within the natural area.

RESEARCH

No research is presently being conducted within the natural area. Although both Whittaker (1960) and Waring (1969) studied forest ecology in nearby areas, neither is known to have included the Brewer Spruce Research Natural Area in his investigations.

MAPS AND AERIAL PHOTOGRAPHS

Maps applicable to the natural area are: *Topography* - 15' Oregon Caves, Oregon quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1954; and *geology* - *Preliminary Geologic Map of Southwestern Oregon,* scale 1:500,000 (Wells 1955) and *Geologic Map of Oregon. West of the 121st Meridian,* scale 1:500,000 (Peck 1961).

The District Manager (Medford District), Bureau of Land Management, can provide details on the most recent aerial photo coverage and any forest type maps which may be available for the area.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW - 80,216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, *D.C.*

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31, 96 p. illus.

Waring, R. H.
1969. Forest plants of the eastern Siskiyous: their environmental and vegetation distribution. Northwest Sci. 43: 1-17, illus.

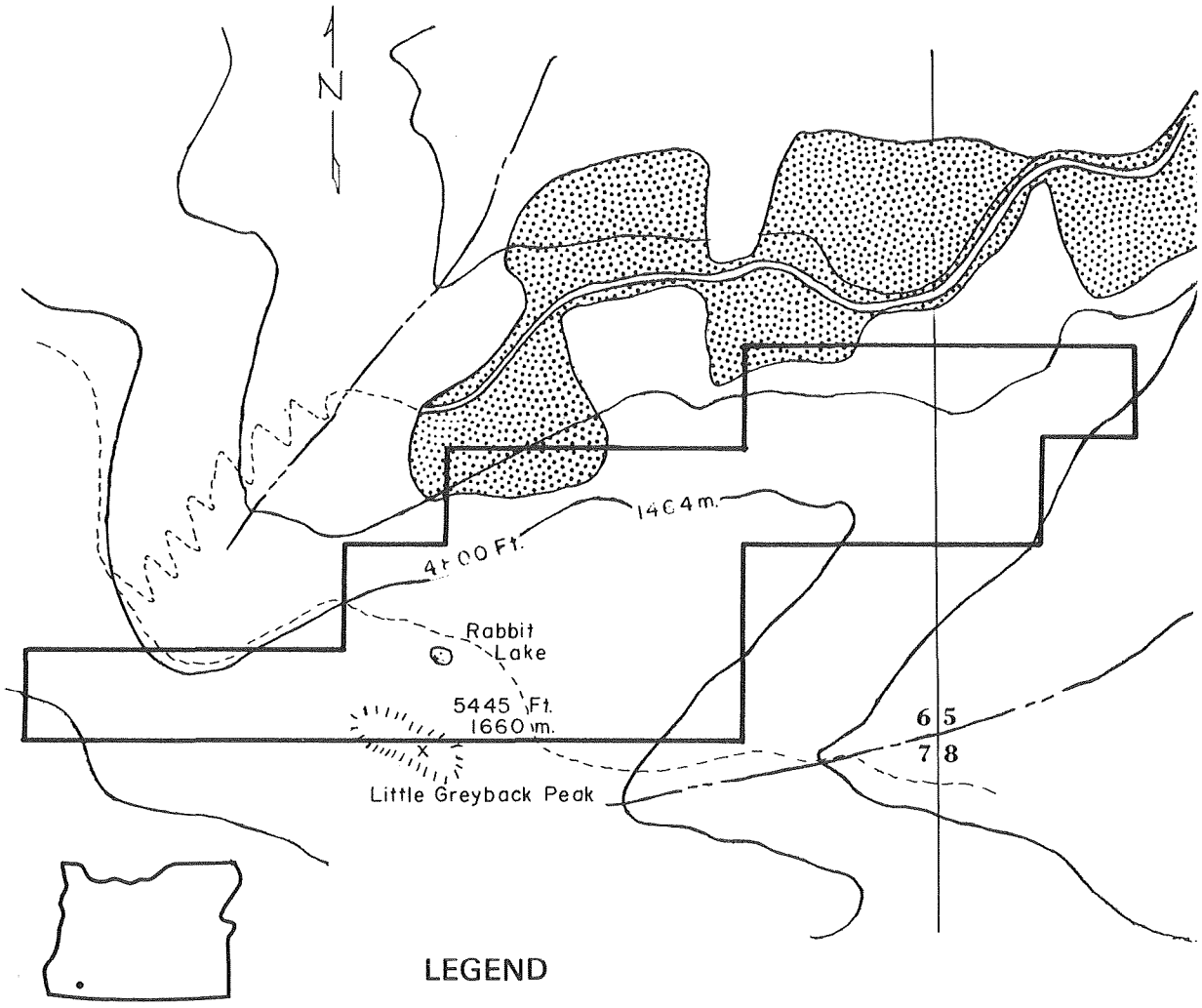
Wells, Francis G.
1955. Preliminary geologic map of southwestern Oregon west of meridian 122^0 west and south of parallel 43^0 north. U.S. Geol. Surv. Miner. Invest. Field Stud. Map MF38.

___ Preston E. Hotz, and Fred W. Cater, Jr.
1949. Preliminary description of the geology of the Kerby quadrangle, Oregon. Oreg. Dep. Geol. & Miner. Ind., Bull. 40,23 p.

Whittaker, R. H.
1960. Vegetation of the Siskiyou Mountains, Oregon and California. Ecol. Monogr. 30: 279-338, illus.

Table BP-1. — Tentative list of mammals for the Brewer Spruce Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus latimanus	broad-footed mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Arborimus longicaudus	red tree vole
	Clethrionomys californicus	California red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys mazama	Mazama pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Bassariscus astutus*	ringtail or miner's cat
	Canis latrans	coyote
	Canis lupus	wolf
	Felis concolor	mountain lion or cougar
	Gulo luscus	wolverine
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mustela erminea	short tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. columbianus	black-tailed deer



LEGEND

BOUNDARY, BREWER SPRUCE RESEARCH NATURAL AREA
SECTION LINE
STREAM
TRAIL
ROAD
CLEARCUT
X BENCH MARK

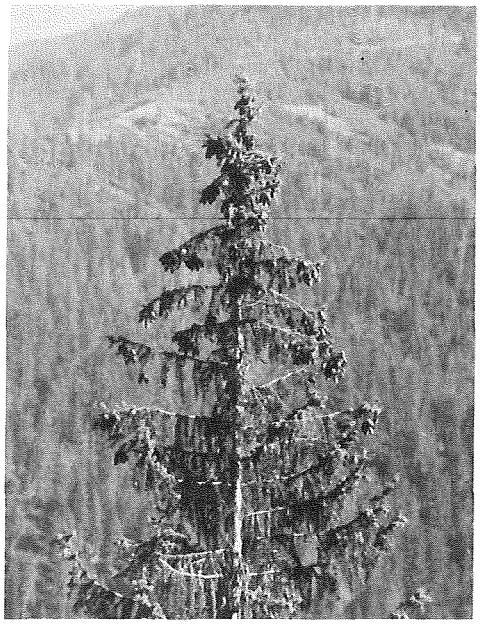
T.39 S., R.6 W., W.M.

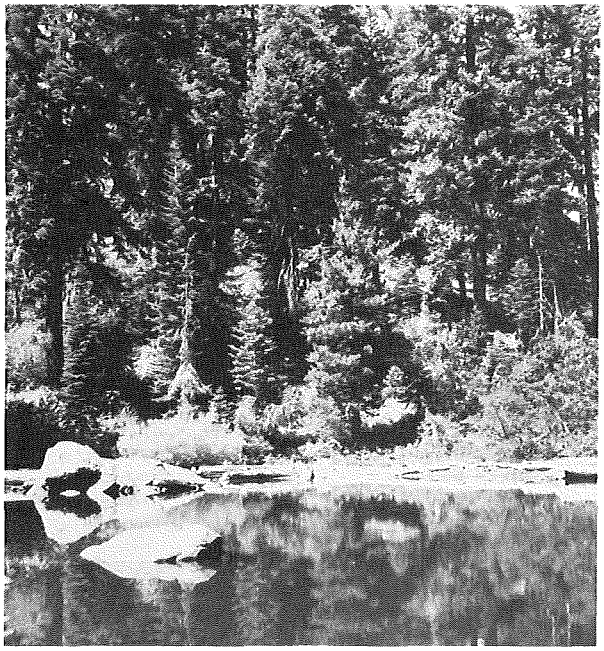
0 500 1000 2000 Ft.

0 152 305 610 m.

Figure BP-1.– Brewer Spruce Research Natural Area, Josephine County, Oregon.

Figure BP-2.-Communities in the Brewer Spruce Research Natural Area. Upper left: Rugged slopes of Little Grayback Peak viewed from the southwestern corner of the natural area. Upper right: Typical Brewer spruce crown. Lower left: Rabbit Lake in late summer. Lower right:
Scattered Brewer spruce, white fir, Shasta red fir, and western white pine with a typical brushfield in the background.





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Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

BULL RUN RESEARCH NATURAL AREA[1]

Mixed stands of noble fir, Pacific silver fir, western hemlock and Douglas-fir on the slopes of a cirque in the Oregon Cascade Range.

The Bull Run Research Natural Area was established on April 8, 1966. It exemplifies the mixed true fir *(Abies* spp.), hemlock *(Tsuga* spp.), and Douglas-fir *(Pseudotsuga menziesii)* forests found at middle elevations in central portions of the Cascade Range. The 146-ha. (361-acre) tract is located in Clackamas County, Oregon, and is administered by the Columbia Gorge Ranger District (Springdale, Oregon), Mount Hood National Forest. The natural area lies immediately west of the Cascade Range divide at the head of the Bull Run drainage and on the eastern slope of Sentinel Peak and northern slope of Hiyu Mountain (fig. BR-l). It occupies portions of sections 27 and 34, T. 1 S., R. 8 E., Willamette meridian. Major bounding features are an old firebreak along the northeast and east, the 1,000-m. (3,280-ft.) contour on the west, and a rockslide on the northwest (fig. BR-l). The natural area lies at 45°26' N. latitude and 121 °49' W. longitude.

ACCESS AND ACCOMMODA TIONS

Since this natural area lies within the Bull Run watershed, the municipal water supply for Portland, access is strictly controlled. It is necessary to obtain an entry permit and, possibly, a key from the Ranger District before entering the watershed, regardless of the approach route. This is in addition to obtaining permission to conduct research on the natural area itself.

Access to this natural area is either by foot or by boat. The simplest approach is probably by about 0.4 km. (0.25 mile) of unmaintained trail from the top of Hiyu Mountain. This trail drops about 180 m. (600 ft.) down the old firebreak on the north slope of the mountain before reaching the natural area. The summit of Hiyu Mountain is best reached via Forest Roads N12 (Lolo Pass road) and S10 from Zigzag on U.S. Highway 26, a distance of about 25 km. (16 miles). The other approach is by boat from the lower (western) end of Bull Run Lake. This can be reached either from the Sandy area via Forest Road S10 or from Zigzag via Forest Roads N12 and S10. If repeated visits are planned, heavy research equipment is involved, or the lower or northern portions of the natural area are of most interest, the lake approach is recommended. Boat rentals are not available.

The nearest commercial accommodations are at Rhododendron and along adjacent portions of U.S. Highway 26. Developed forest campgrounds are also found in this area and along the Lolo Pass road (Forest Road NI2).

ENVIRONMENT

The Bull Run Research Natural Area is located on mountain slopes in a cirque adjacent to the crest of the Cascade Range (fig. BR-3). Topography is generally steep, with slopes commonly 30 to 60 percent in the southern half and in excess of 60 percent in the northern half of the area. Relatively gentle slopes and benches occupy limited area. Springs are common in middle and lower portions of the natural area, and streams have cut sharp, steep-walled canyons in several locations. Limited areas of rock slides (talus) are present (fig. BR-3). Elevations range from 1,000 to 1,370 m. (3,280 to 4,500 ft.).

[1]Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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Vulcanism and glaciation have been the primary geologic processes within the natural area. Bedrock is composed primarily of basalts and andesites belonging to the Cascade Andesite formation[2] and Pliocene-Pleistocene in age (Peck 1961). Pleistocene glaciation affected almost the entire Bull Run drainage, and at least two glacial advances are evident. Bull Run Lake itself lies behind a classical example of a terminal moraine. Compacted glacial till is present in several locations.

The climate of the natural area is cool and wet. Total precipitation, measured nearby at the outlet of Bull Run Lake, averaged 3,125 mm. (123 in.) between 1961 and 1967[3]. Summers are relatively dry (about 200 mm. or 8 in.) in July through September. The bulk of the precipitation occurs during the winter months, and much of this accumulates in snowpacks which probably attain maximum depths of 2 to 3 m. (6 to 9 ft.) on the average. Temperature data are not available for the area, and the nearest climatic station (U .S. Weather Bureau 1965) is at low elevation in the foothills about 29 km. (18 miles) to the west at the Portland Water Bureau's Headworks.

Soils in the natural area have been mapped (fig. BR-2) and described as part of a general soil survey of the Bull Run drainage.[4] They are Podzols developed in glacial till and are classified into two tentative soil series Jackpot and Last Chance. The Jackpot soil is the more productive and usually contains an indurated till layer. A generalized profile description is as follows:

01 and 02	4 to 0 cm.	Organic matter.
A2	0 to 4 cm.	Black (moist color) silt loam with very fine granular structure, pH 4.6.
A31	4 to 15 cm.	Very dark brown gravelly silt loam with weak, fine, subangular blocky structure, pH 4.6.
A32	15 to 32 cm.	Very dark brown gravelly silt loam with weak, fine and medium subangular blocky structure, pH 4.8.
B2	32 to 53 cm.	Dark brown, stony, gravelly light clay loam with weak, fine subangular blocky structure, 50 percent stone volume, pH 5.0.

A typical Last Chance profile is generally more strongly podzolized:

01 and 02	5 to 0 cm.	Organic matter.
A2	0 to 4 cm.	Gray and dark gray (moist color) sandy loam with weak, coarse platy to massive structure, pH 4.2.
B2ir	4 to 15 cm.	Dark brown and dark reddish brown, stony, gravelly loam, massive to very weak, fine su bangular blocky structure, 30 percent stones and 45 percent gravel, pH 4.4.
B3	15 to 25 cm.	Brown to dark brown, stony, gravelly loam, massive, 30 percent stones and 45 percent gravel, pH 4.6.
C	25 to 70 cm.	Brown, stony gravelly loam, pH 4.8.
D	70 to 160 cm.	Brown, stony gravelly loam, pH 5.0.

The D horizon mayor may not be present, and A2 horizons vary from 1 to 8 cm. in thickness. Bedrock may lie 1 to 65 m. or more below the morainal deposits in the case of either soil series.

BIOTA

All 146 ha. (361 acres) of the Bull Run Research Natural Area are classified as SAF cover type 226, Pacific Silver Fir-Hemlock (Society of American Foresters 1954). The area falls within Kuchler's (1964) Types 3 or 4 (Silver Fir-Douglas Fir or Fir-Hemlock Forest) and the *Abies amabilis* Zone of Franklin and Dyrness (1969).

Forest stands in the natural area are a mixture of noble fir *(Abies procera),* Pacific silver fir *(Abies amabilis),* western hemlock *(Tsuga heterophylla),* and Douglas-fir. The first three

[2]Information from "Interim Soil Survey Report of the Bull Run Watershed Portion of the Bull Run Sandy Soil Survey Area," by F. R. Stephens. lfJ62. Typewritten inservice report, 65 p., illus. USDA Forest Service, Region 6, Portland, Oregon.

[3]Unpublished data provided by J. Rothacher, U.S. Forest Service, Forestry Sciences Laboratory, Corvallis,Oregon.

[4]See footnote 2.

species are common throughout the entire natural area, while Douglas-fir tends to be only a minor component or absent in the stands above 1,100 m. (3,600 ft.). Mountain hemlock *(Tsuga mertensiana)* occurs at higher elevations. The forests in the area are all old growth with an estimated age in excess of 250 years. The largest trees in the stand are generally noble fir (fig. BR-3) and Douglasfir, followed by western hemlock and Pacific silver fir, in that order. Mensurational data are not available, but dominant trees on better sites are often 90- to 130-cm. (35- to 50-in.) d.b.h. and over 45 m. (150 ft.) tall.

Size and age class distributions indicate Pacific silver fir is the major climax species throughout the natural area. Pacific silver fir seedlings, saplings, and poles are by far the most numerous in the stands. Western hemlock appears to be either intermediate successionally or a minor climax species on some sites. Douglas-fir and noble fir are clearly pioneer species and are gradually being eliminated by mortality.

Two major plant communities are common within the natural area[5] which probably belong to the *Abies amabilis/Streptopus curvipes* and *Abies amabilis/Vaccinium alaskaense* Associations (Franklin 1966). The *Abies amabilis/Streptopus curvipes* Association typifies the more productive sites and Jackpot soil series. The dense, herbaceous understory includes *Vancouveria hexandra, Streptopus curvipes, Achlys triphylla, Asarum caudatum,* and *Oplopanax horridum.* The *Abies amabilis/Vaccinium alaskaense* Association is found on poorer sites and Last Chance soils. *Vaccinium alaskaense, V. membranaceum, Menziesia ferruginea, Cornus canadensis, Xerophyllum tenax,* and *Gaultheria ovatifolia* are common understory plants. The presence of *Rhododendron macrophyllum* contrasts with its absence in similar *Abies amabilis/ Vaccinium alaskaense* communities north of the Columbia River in the Washington Cascade Range.

Mammals believed to occur as either residents or transients within the natural area are listed in table BR-I. The ruffed grouse *(Bonasa umbellus)* is an important resident gamebird.

Specialized habitats within the natural area include spring and seep areas, the several permanent streams, and open talus or rock slides (fig. BR-3).

HISTORY OF DISTURBANCE

The natural area is essentially free of any human disturbance. Minor disturbances due to transient fishermen, hunters, hikers, etc. are, and will continue to be, absent due to the strict control over access to the Bull Run drainage. The bounding firebreak has regenerated with young trees, and any minor edge effects it has caused should decline rapidly in the future.

The natural area also appears to have been free of significant natural disturbances, such as wildfire in recent decades.

RESEARC H

There is no history of research in Bull Run Research Natural Area except in connection with the general soil survey.

The natural area is particularly valuable as a site for studies of the mixed stands typical of the transition zone between temperate and subalpine forests. Two contrasting soil and community types can be compared within the tract. Specialized areas available for study include the aquatic and semiaquatic habitats and rock slides; these may be of special interest for zoological studies.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 7.5' Bull Run Lake, Oregon quadrangle, scale 1 :24,000, issued by the U.S. Geological Survey in 1962; and *geology - Geologic Map of Oregon West of the 121st Meridian,* scale 1:500,000 (Peck 1961). Either the District Ranger (Columbia Gorge Ranger District) or Forest Supervisor (Mount Hood National Forest, Portland, Oregon) can provide details on the most recent aerial photo coverage and forest type maps for the area.

[5]See footnote 2.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Franklin, Jerry Forest
1966. Vegetation and soils in the subalpine forests of the southern Washington Cascade Range. 132 p., illus. (Ph.D. thesis, on file at Wash. State Univ., Pullman.)

Ktlchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Pub1. 36, various paging, illus.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geo1. Surv. Misc. Geo1. Invest. Map 1-325.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31, 96 p., illus.

Table BR-1. — Tentative list of mammals for the Bull Run Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex palustris	northern water shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	Yaquina shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Ochotona princeps	pika
Rodentia	*Aplodontia rufa*	mountain beaver
	Arborimus albipes	white-footed vole
	Arborimus longicaudus	red tree vole
	Clethrionomys californicus	California red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus richardsoni	Richardson vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Tamiasciurus douglasi	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Canis lupus	wolf
	Felis concolor	mountain lion or cougar
	Gulo luscus	wolverine
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer

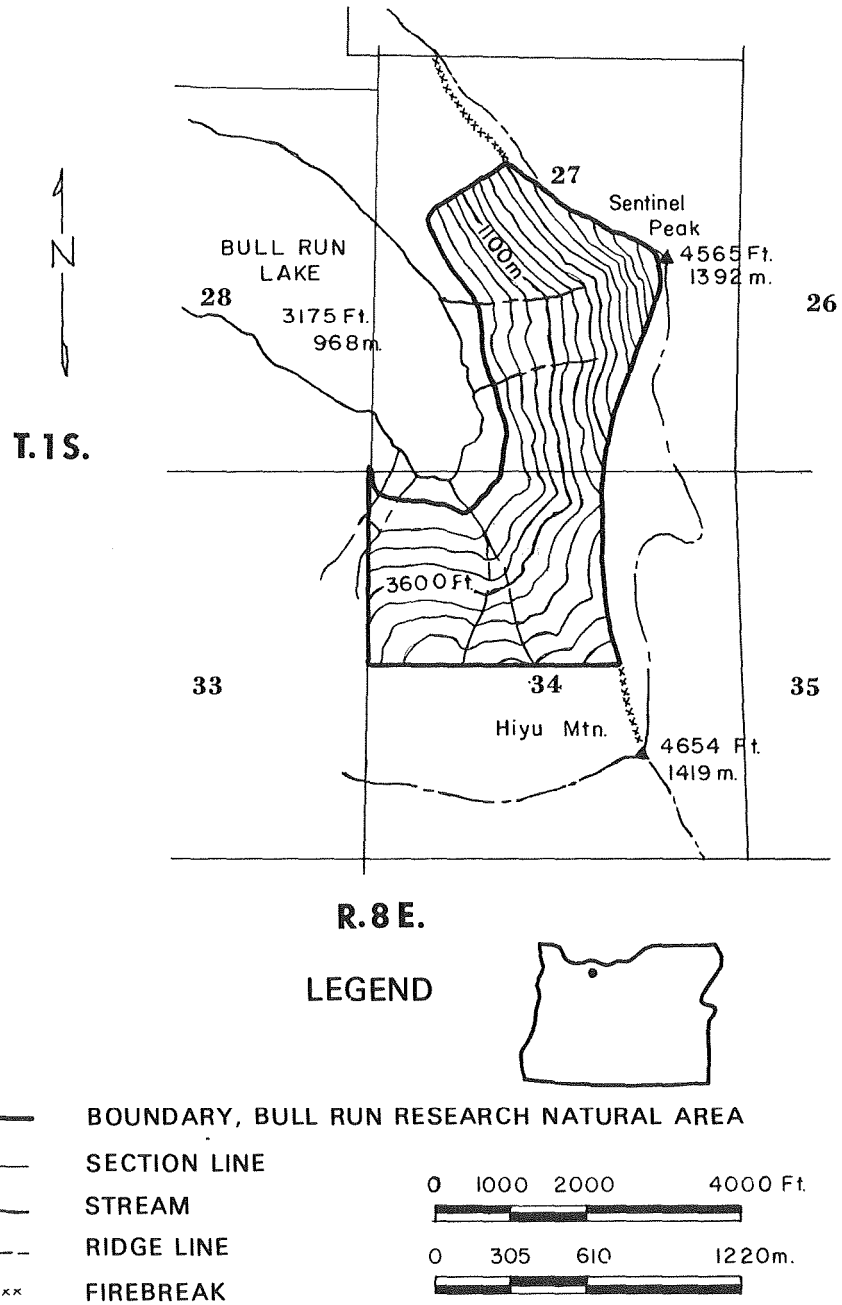
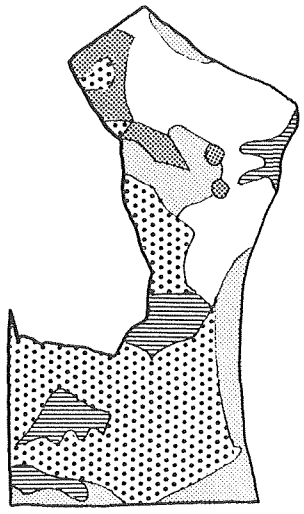
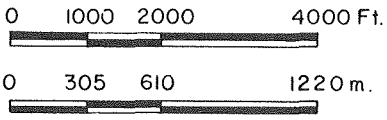


Figure BR-1.– **Bull Run Research Natural Area, Clackamas County, Oregon.**





LEGEND

LAST CHANCE SOIL SERIES
PODZOLS FORMED IN GLACIAL DEPOSITS ON 0-TO 60-PERCENT SLOPES

LAST CHANCE SOIL SERIES
PODZOLS FORMED IN GLACIAL DEPOSITS ON SLOPES OVER 60 PERCENT, INCLUSIONS OF SENTINEL (BROWN PODZOLS) SOIL SERIES LIKELY

JACKPOT SOIL SERIES
WEAKLY DEVELOPED PODZOLS FORMED IN MORAINAL DEPOSITS

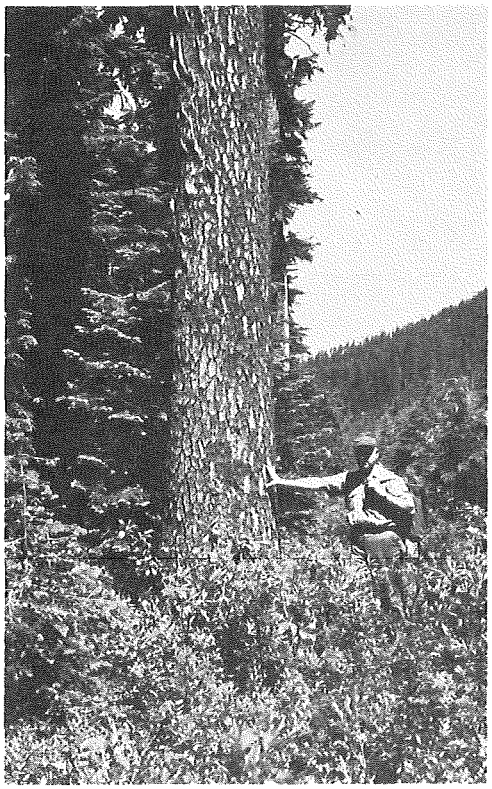
ROCK RUBBLE LAND
TALUS AND BOULDERY MORAINAL MATERIAL DEVOID OF SOIL

GLACIAL PLUCKED LAND
ROCK OUTCROPS AND TALUS, SOME WITH SMALL AMOUNTS OF SOIL BUT LACKING MORAINAL DEPOSITS

Figure BR-2.– Soil type map for Bull Run Research Natural Area.

Figure BR-3.-Views of the Bull Run Research Natural Area.

Upper left: Mixed forest of true firs, Douglas-fir, and western hemlock in the center of the natural area viewed across a small rock slide. Upper right: Old firebreak and forest at the edge of the natural area (right) looking south to the summit of the Hiyu Mountain. Lower left: Natural area and environs as seen from the summit of Hiyu Mountain; the firebreak on the right forms the eastern boundary and the rock slide near the center of the picture the northern boundary. Lower right: Typical specimen of old-growth noble fir about 1 DO-em. (40-in.) d.b.h. growing in the natural area.



Federal Research Natural Areas in Oregon and Washington a Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

BUTTER CREEK RESEARCH NATURAL AREA[1]

A subalpine mosaic of forest, shrub, and meadow communities in a rugged 2,OOO-acre drainage in the Washington Cascade Range near Mount Rainier.

Butter Creek Research Natural Area exemplifies an entire mosaic of subalpine communities including closed forest, parkland, shrubfields, and meadows. The 810-ha. (2,000acre) tract is located in Lewis County, Washington, and administered by Mount Rainier National Park (Longmire, Washington). The natural area includes all of Butter Creek drainage within the park; consequently, boundaries follow natural topographic features (ridge and mountain summits) except along the southern edge (fig. BU -1). It lies at 46^0 45' N.latitude and $121^0$44' W.longitude.

ACCESS AND ACCOMMODA TIONS

The natural area occupies a rugged drainage lacking trails and roads; consequently access is by cross-country travel which is frequently difficult and requires care. The upper end of the natural area is reached via the Pinnacle Peak trail which terminates at the edge of the tract in the saddle between Pinnacle and Plummer Peaks. Most of the meadow areas can be reached from this point by easy to moderately difficult cross-country travel. A Forest Service logging road up Butter Creek terminates in a clearcut about 0.8 km. (0.5 mile) south of the park boundary; the lower part of the natural area is reached in this way with Butter Creek itself providing the easiest cross-country route from the roadhead into the tract.

Commercial accommodations are located nearby at Longmire and Paradise Valley in the National Park and at Ashford and Packwood. There are numerous improved campgrounds in adjacent portions of Mount Rainier National Park and the Gifford Pinchot National Forest.

ENVI RONMENT

The natural area occupies the entire upper drainage of Butter Creek, including two major branches which are effectively divided for most of their length by a large downward trending ridge (fig. BU -1). This is one of the major drainage basins on the south slopes of the Tatoosh Range, an intruded mountain massif of east-west orientation. Various mountain peaks and ridges of this range, such as Wahpenayo, Lane, Pinnacle, Plummer, Unicorn, and Boundary Peaks, form a semicircular rim for the northerly boundaries of the tract (fig. BU-3). The natural area spans a wide range in elevations varying from about 1,040 m. (3,400 ft.) along Butter Creek to 2,116 m. (6,939 ft.) at the summit of Unicorn Peak. It also incorporates a variety of mountain landforms from precipitous rock outcrops to nearly level valley bottom. Gentle topography is confined to the valley bottoms along the lower reaches of Butter Creek and to occasional benches at higher elevations. Most of the natural area consists of moderate to steep (30- to 90-percent) mountain slopes, some of which are continuous over nearly the entire elevational span (fig. BU -3). Precipitous topography is most common along the bounding ridges and at intermediate elevations along the west branch of Butter Creek.

[1] Description prepared by Dr. C. T. Dyrness and Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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The natural area incorporates several miles of perennial stream. In addition, there are at least four ponds or lakes within the natural area, all located in the subalpine parkland. Three of these are located at about 1,555 m. (5,100 ft.) in the northwestern corner of the natural area on the slopes below Lane Peak. Cliff Lake, the largest, covers about 2.2 ha. (5.5 acres) and has a maximum depth of 9 m. (30 ft.) (Wolcott 1961). An unnamed lake (about 0.4 ha. or 1 acre in size and shallow) and a smaller pond are located about 300 m. (1,000 ft.) southwest of Cliff Lake. No fish inhabit either of the lakes (Wolcott 1961). The fourth pond is located just inside the northeastern corner of the natural area in the saddle between Pinnacle and Unicorn Peaks.

The geology of the Butter Creek Research Natural Area is probably better known than any other aspect of its natural history (Crandell 1969a, 1969b; Fiske, Hopson, and Waters 1963). The bulk of the natural area is located on Miocene-Pliocene intrusive igneous rocks (Fiske, Hopson, and Waters 1963) (fig. BU-2). These are the granodiorites and quartz monzonites of the Tatoosh pluton; included are subordinate amounts of quartz diorite, contact breccia, and fine-grained border rocks. Oligocene-Miocene volcanic rocks belonging to the Stevens Ridge formation dominate the western third of the natural area and occur along the bounding ridges elsewhere. These consist of rhyodacite ash flows with subordinate amounts of volcanic breccia and sandstones and siltstones of epiclastic and pyroclastic origin. The oldest volcanic rock formation, the Ohanapecosh, occupies a small area in the lower reaches of Butter Creek. The volcanic breccias and associated epiclastic and pyroclastic sandstones and siltstones of this formation are of Eocene age. Finally, small areas of dioritic rocks and of basaltic and andesitic rocks belonging to the Fifes Peak formation occur in alternating layers near the summit of Unicorn Peak.

Existing landforms and surficial geology are primarily the result of stream erosion and glaciation. Glaciers have occupied the drainage periodically (Crandell 1969b) and are responsible for the alplike appearance of the upper ridge and the U -shaped valley of the west branch of Butter Creek. The surficial geology of most of the tract appears to be relatively simple, undifferentiated bedrock types (Crandell 1969a). However, blockfield deposits are identified on the slopes below Pinnacle Peak and the ridgetop along the east boundary. In addition, taluses occur mainly on the slopes below the northwest boundary ridgetop from Wahpenayo to Lane Peaks (fig. BU-2).[2] Recent aeolian deposits of volcanic ejecta also blanket much of the natural area. These deposits are largely made up of pumice and volcanic ash of varying age. Ash layers W and Y from Mount St. Helens, which are about 450 and 3,250 to 4,000 years old, respectively, are known to occur on the tract (Crandell 1969b).

A wet, cool maritime climate prevails. Annual precipitation is heavy, with maxima in December and January and minima in July and August. Summers are generally cool with frequent cloudy days, but only about 10 percent of the precipitation occurs from June through August. A winter snowpack develops over the entire natural area, but its depth and total annual snowfall increase rapidly with elevation. The range of climatic conditions encountered on the natural area are approximated by the following data from the Longmire and Paradise Valley weather stations, 5 and 3 km. (3 and 2 miles) west and north of the natural area, respectively (U.S. Weather Bureau 1965):

	Longmire	*Paradise Valley*
Elevation	842 m. (2,762 ft.)	1,821 m. (5,550 ft.)
Mean annual temperature	7.3°C. (45.1°F.)	3.4°C. (38.2°F.)

[2] Blockfield deposits consist of angular rock fragments pried from underlying formations by freeze-thaw cycles of moisture in cracks. Taluses are loose accumulations of coarse and typically fresh and angular rock fragments with steeply sloping surfaces. Taluses can be differentiated from blockfield deposits by their location beneath cliffs and the wide range in rock fragment size from pieces a few centimeters across to blocks 10 m. or more in maximum diameter (Crandell 1969a).

	Longmire	*Paradise Valley*
Mean January temperature	-0.9°C. (30.3°F.)	-3.4°F. (25.8°F.)
Mean July temperature	16.2°C. (61.2°F.)	11.6°C. (52.8°F.)
Mean January minimum temperature	-4.1°C. (24.5°F.)	-7.0°C. (19.4°F.)
Mean July maximum temperature	23.8°C. (74.9°F.)	17.4°C. (63.3°F.)
Average annual precipitation	2,094 mm. (82.43 in.)	2,635 mm. (103.73 in.)
June through August precipitation	171 mm. (6.73 in.)	226 mm. (8.91 in.)
Average annual snowfall	474 cm. (186.5 in.)	1,362 cm. (587.4 in.)

Soils in the forested lower end of the natural area are largely Podzols and Regosols with limited areas of Alluvial soil in terrace positions along Butter Creek. The podzolic soils are formed primarily in layers of pumice and volcanic ash which have been aerially deposited over the surface of the bedrock. A typical soil on relatively gentle terrain just north of the confluence of the two major branches of Butter Creek exhibited the following horizons:

01 and 02 7 to 0 cm. Forest floor material of varying stages of decomposition.
A2 0 to 2 cm. Light gray sand-size pumice.
B2 2 to 20 cm. Dark brown loam with high pumice content and some pockets of fresh pumice.
IIAb 20 to 25 cm. Very dark grayish brown loamy sand.
IICb 25 to 32 cm. White un-weathered pumice sand with brownish yellow pockets caused by iron staining.
IIIB2b 32 to 45 cm. Brown pumiceous silt loam over bedrock (granodiorite).

Some gravels and cobbles are typically intermixed with the volcanic ash and pumice, especially in the buried horizons. Regosolic soils on steeper slopes are intimate mixtures of pumiceous materials and rock fragments showing little evidence of profile development.

Much of the upper, nonforested portion of the natural area consists of steep slopes characterized by talus and blockfield deposits. However, on more gentle terrain at high elevations are tracts of Alpine Turf and Alpine Meadow soils. These soils are characterized by black, generally thick A horizons underlain by a stony substratum.

BIOTA

There are at least four major categories of subalpine plant communities found within the Butter Creek Research Natural Area: (1) forests of Pacific silver fir *(Abies amabilis),* western hemlock *(Tsuga heterophylla),* and noble fir *(Abies procera)* typical of middle elevations in the Cascade Range; (2) subalpine forests typified by mountain hemlock *(Tsuga mertensiana)* and Pacific silver fir which ranged from a continuous closed canopy to isolated, patchy tree groups found near timberline; (3) shrub communities, generally dominated by Sitka alder *(Alnus sinvata),* or Alaska-cedar *(Chamaecyparis nootkatensis),* and vine maple *(Acer circinatum);* and (4) subalpine meadows of widely variable composition and structure. Each of these categories covers a significant area although no quantitative breakdown is available. SAF cover types represented include 226, Pacific Silver Fir-Western Hemlock, and 205, Mountain Hemlock-Subalpine Fir (Society of American Foresters 1954). Kuchler's (1964) Types 3, Silver Fir-Douglas Fir Forest; 4, Fir-Hemlock Forest; and 52, Alpine Meadows and Barren, are present. Lower elevations fall within the *Abies amabilis* Zone (Franklin and Dyrness 1969) and higher elevations cover both the closed forest and parkland (forest-meadow mosaic) subzones of the *Tsuga mertensiana* Zone (Franklin and Bishop 1969). True alpine vegetation is probably not present; precipitous slopes preclude vegetational development at the highest elevations (over about 6,300 ft. or 1,900 m.) where it might be expected.

Reconnaissance of the natural area was unusually limited in view of its large size and complexity. On-the-ground examination has been restricted to subalpine meadow areas near the northern boundary and several

forested sites adjacent to Butter Creek at the southern boundary. Sites occupied by shrubs and young trees which cover much of the central portion of the tract received only limited attention.

Forest communities in the southern portion of the natural area *(Abies amabilis* Zone) include seral stages of the *Abies amabilis/Vaccinium alaskense, Abies amabilis/Streptopus curvipes,* and *Abies amabilis/Oplopanax horridum* Associations described by Franklin (1966). Near the southern boundary stream, terraces adjacent to Butter Creek are occupied by an open, seral phase of the *Abies/Vaccinium* Association. Tree overstory is very scattered and made up of about equal amounts of noble fir and Pacific silver fir. Although both silver fir and western hemlock are also present, tree regeneration is generally dominantly noble fir. The dense shrub layer, dominated by *Vaccinium alaskense,* also includes vine maple, *Rubus spectabilis,* and *Sambucus racemosa.* The most important herbs are *Clintonia uniflora* and *Pteridium aquilinum,* with smaller amounts of *Anaphalis margaritaceae, Achlys triphylla, Tiarella unifoliata, Veratrmviride,* and *Smilacinastellata.*

An open, seral phase of the *Abies amabilis/ Streptopus curvipes* Association occupies rather extensive areas on moderate to steep slopes above Butter Creek. The overstory is made up of scattered, often very large noble fir (fig. BU-3) along with smaller Pacific silver fir. A thicket-like understory of vine maple makes travel through the area very difficult. Other species of some importance in these stands include *Pachistima myrsinites, Achlys triphylla, Clintonia uniflora, Streptopus Curvipes, Pteridium aquilinum, Galium triflorum, Polystichum munitum,* and *Rubus lasiococcus.* In wetter areas this community gives way to the *Abies amabilis/Oplopanax horridum.*

The *Abies/Streptopus* Association is also found with a dense tree overstory but only at scattered locations at low elevations. Dominant trees are old-growth Douglas-fir *(Pseudotsuga menziesii)* and western hemlock, with Pacific silver fir the most abundant species in the understory. The shrub layer is scattered, comprised of such species as *Acer circinatum, Vaccinium alaskense,* and *Rubus spectabilis.* The herb layer is well developed and typically includes *Achlys triphylla, Gymnocarpium dryopteris, Tiarella unifoliata, Streptopus curvipes, Rubus pedatus, R. lasiococcus, Viola sempervirens, Chimaphila menziesii, Pyrola asarifolia,* and *Trillium ovatum.*

The forests occupying the *Tsuga mertensSiana* Zone were examined to only a minor extent. Tree species present include mountain hemlock, Pacific silver fir, subalpine fir *(Abies lasiocarpa),* and whitebark pine *(Pinus albicaulis).* As mentioned, conditions vary widely from closed stands of both young and old age to small tree groups surrounded by meadows (fig. BU-3). In general, Pacific silver fir is less common in the parkland subzone above the line of continuous forest, and whitebark pine is uncommon in the lower elevation, closed forest. Community types probably include the *Abies amabilis-Tsuga mertensiana/Vaccinium membranaceum* and *Abies amabilis/Menziesia ferruginea* Associations described by Franklin (1966) as well as others,

Shrub communities are of several types, Stands dominated by 3- to 5-m. (9- to 15-ft.) tall Sitka alder, vine maple, or Alaska-cedar are believed to be topographic or topoedaphic climax types. They probably owe origin and maintenance to special environmental conditions, such as an extremely stony substrate and recurring snow avalanches. The effects of heavy snowloads are evident in the strong bowing of Sitka alder stems, and the resilience of the stems allows them to bend under avalanching rather than break. The avalanche communities are especially common on the slopes above the west branch of Butter Creek (fig. BU-3). In general, vine maple apparently dominates brushfields on drier sites and Sitka alder and Alaska-cedar on moister sites. An earlier description of the area (Anonymous 1942) mentions brushfields with *Rhododendron albiflorum* and *Srbus occidentalis* as major components. These have not been seen and may be misidentifications of the maple, alder, or Alaska-cedar communities.

Subalpine meadow vegetation begins at about 1,585-m. (5,200-ft.) elevation, although

most occurs between 1,675 and 1,830 m. (5,500 to 6,000 ft.). The extensive steeply sloping portion of this headwaters area is south-facing with very shallow soils (fig. BU -3). As a result, the habitat is relatively warm and dry during the growing season and supports two closely related subalpine meadow types characteristic of such habitats. These have tentatively been named the *Festuca viridula/Lupinus latifolius* and *Festuca viridula/Aster ledophyllus* types.[3] The *Festuca/Aster* community occurs on the driest portion of the slopes and includes as dominants the following species: *Festuca viridula, Aster ledophyllus, Carex spectabilis, Castilleja/miniatta, Erigeron salsuginosus, Agoseris alpestris, Lupinus latifolius, Polygonum bistortoides,* and *Phlox diffusa.* The most important species in the *Festuca/Lupinus* community are: *Festuca viridula, Lupinus latifolius, Carex spectabilis, Polygonum bistortoides, Castilleja oreopola, Pedicularis bracteosa, Ligusticum/ purpureum, Anemone occidentalis, Erigeron salsuginosus,* and *Potentilla ftabellifolia.* Localized seep areas on these otherwise dry slopes support such species as *Phyllodoce empetriformis, Veratrum viridum,* and *Valeriana sitchensis.*

Two closely related heather communities occupy the moister and cooler sites, such as ridgetops and protected east-facing slopes. These are the *Phyllodoce empetriformis/Lupinus latifolius,* and *Phyllodoce empetriformis/Vaccinium deliciosum* communities. Some of the dominant species in the *Phyllodoce/Lupinus* type are *Phyllodoce empetriformis, Cassiope mertensiana, Lupinus latifolius, Carex spectabilis,* and *Lycopodium* sp. Species characteristic of the *Phyllodoce/ Vaccinium* type include *Phyllodoce empetriformis, Cassiope mertensiana, Vaccinium deliciosum, Lupinus latifolius,* and *Antennaria lanata.*

Snowbed communities are found at highest elevations in those localized areas where snowbanks persist until late in the growing season. Generally these sites are easily recognized by the overwhelming dominance of *Carex nigricans.*

In general, *Phyllodoce* and related cooler, moister subalpine community types are most common at the head of the west branch of Butter Creek (e.g., around Cliff Lake) and least common at the head of the east branch below Pinnacle Peak. The *Festuca-types* are distributed in a reverse fashion, being most abundant on the slopes below Pinnacle Peak and extending toward Unicorn Peak.

Meadow-associated or timberline tree species have already been mentioned. None are known to invade the *Festuca-dominated* communities to any extent. However, both subalpine fir and mountain hemlock have invaded the *Phyllodoce* communities, a phenomenon commonly encountered in the Cascade Range and believed related to climatic fluctuations (Franklin et al. 1971).

A tentative list of mammals believed to inhabit the natural area as residents or transients is provided in table BU -1. Important resident birds include blue grouse *(Dendragapus obscurus),* Franklin's grouse *(Canachites canadensis),* white-tailed ptarmigan *(Lagopus leucurus),* gray jays *(Perisoreus canadensis),* and Clark's nutcrackers *(Nucifraga columbiana),* the last named an important vector for the distribution of whitebark pine seeds. A bird checklist and a mammalogical guidebook (Potts and Grater 1949) for Mount Rainier National Park are available at the Park headquarters.

HISTORY OF DISTURBANCE

Human disturbance in the tract is essentially absent except in a very small area near the terminus of the Pinnacle Peak trail. South of the saddle where it terminates, visitors have produced numerous trails, campfire spots, and patches of trampled vegetation.

Perhaps the most important natural disturbances are the avalanches which repeatedly plunge down some of the more precipitous slopes and the over-steepened headwater channels of Butter Creek (fig. BU -3). There is abundant evidence that avalanching is probably the single most impor-

[3] Data on subalpine meadows were in personal communication from Mr. Jan Henderson, Department of Botany, Oregon State University, Corvallis.

tant factor in controlling forest composition and age in the natural area.

RESEARCH

The Butter Creek Research Natural Area is currently being used as a sampling site in a study of alpine and subalpine meadow vegetation of Mount Rainier National Park.[4]

The natural area offers innumerable opportunities for ecological research on the communities, plants, and animals of subalpine regions in the Cascade Range. Its size makes it suitable for many types of research activities not possible in smaller tracts, such as studies of larger-sized animals. Furthermore, it provides a complete mosaic of subalpine communities rather than an isolated representation of only one. The great range in elevation makes it possible to study relationships over broad environmental and community gradients, from old-growth true fir-western hemlock stands to snowbed communities situated 760 m. (2,500 ft.) above. In addition, it offers an unparalleled opportunity to study succession following avalanching because of the wide range in age and abundance of avalanche tracks which are present. Finally, the western and eastern parts of the natural area have sharply contrasting bedrock, making possible comparative studies of communities on intrusive and extrusive igneous rock types.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - special 15' x 25' Mount Rainier National Park, Washington quadrangle, scale 1:62,500, issued by the U.S. Geological Survey in 1955 and, for the southern third of the area, the 15' Packwood, Washington quadrangle, scale 1: 62,500, issued in 1962; and *geology* - *Geologic Map and Sections of Mount Rainier National Park, Washington,* scale 1: 62,500 (Fiske, Hopson, and Waters 1963), *Surficial Geology of Mount Rainier National Park, Washington,* scale 1:48,000 (Crandell 1969a), and *Geologic Mop of Washington,* scale 1: 500,000 (Huntting et al. 1961). The Superintendent (Mount Rainier National Park, Longmire, Washington) can provide details on the most recent aerial photograph and type map coverage for the area.

[4] Research by Mr. Jan Henderson, Department of Botany, Oregon State University, Corvallis.

LITERATURE CI D

Anonymous
1942. Research areas in the national parks. Ecology 23: 236-238.

Crandell, Dwight R.
1969a. Surficial geology of Mount Rainier National Park Washington. U.S. Geol. Surv. Bull. 1288, 41 p., illus.

1969b. The geologic story of Mount Rainier. U.S. Geol. Surv. Bull. 1292, 43 p., illus.

Fiske, Richard S., Clifford A. Hopson, and Aaron C. Waters
1963. Geology of Mount Rainier National Park Washington. U.S. Geol. Surv. Prof. Pap. 444, 93 p., illus.

Franklin, Jerry Forest
1966. Vegetation and soils in the subalpine forests of the southern Washington Cascade Range. 132 p., illus. (Ph.D. thesis, on file at Wash. State Univ., Pullman.)

Franklin, Jerry F., and Norman A. Bishop
1969. Notes on the natural history of Mount Rainier National Park. 24 p., illus. Longmire, Wash.: Mt. Rainier Nat. Hist. Assoc.

_____ and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

_____ William H. Moir, George W. Douglas, and Curt Wiberg
1971. Invasion of subalpine meadows by trees in the Cascade Range. Arctic & Alpine Res. 3: 215-224, illus.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kiichler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Potts, Merlin K., and Russell K. Grater
1949. Mammals of Mount Rainier National Park. 87 p., illus. Longmire, Wash.: Mt. Rainier Nat. Hist. Assoc.

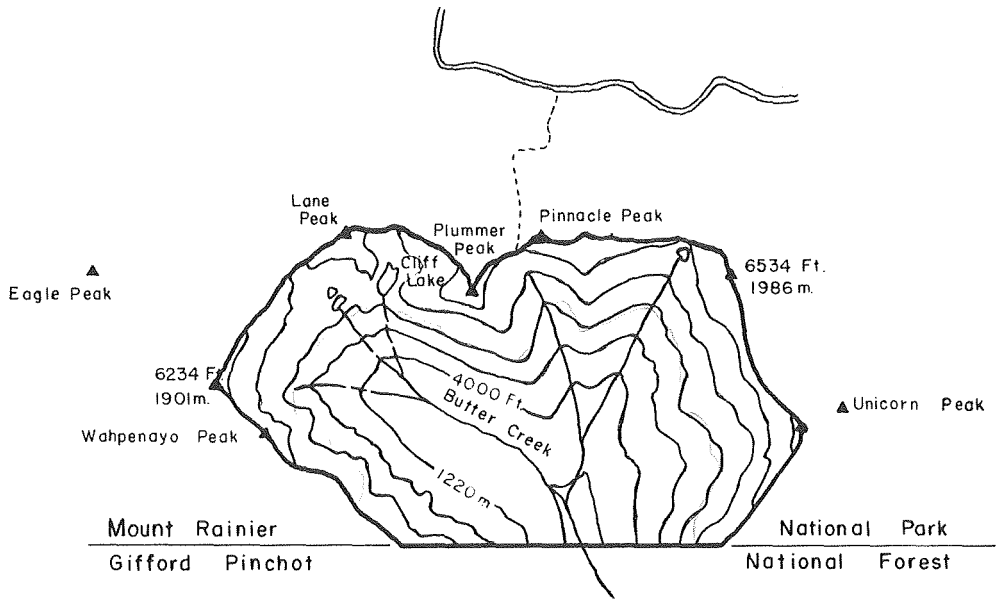
Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

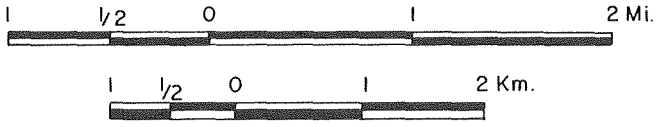
U .S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Wolcott, Ernest E.
1961. Lakes of Washington. Vol. 1, Western Washington. Wash. State Dep. Conservo Div. Water Resour. Water Supply Bull. 14,619 p., illus.

Table BU-1. — Tentative list of mammals for Butter Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex cinereus	masked shrew
	Sorex obscurus	dusky shrew
	Sorex palustris	northern water shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
Lagomorpha	*Lepus americanus*	snowshoe hare
	Ochotona princeps	pika
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Marmota caligata	hoary marmot
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus richardsoni	Richardson vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Spermophilus saturatus	Cascades mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys talpoides	northern pocket gopher
	Zapus princeps	western jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. columbianus	black-tailed deer
	Oreamnos americanus	mountain goat





LEGEND

BOUNDARY, BUTTER CREEK RESEARCH NATURAL AREA

NATIONAL PARK BOUNDARY

ROAD

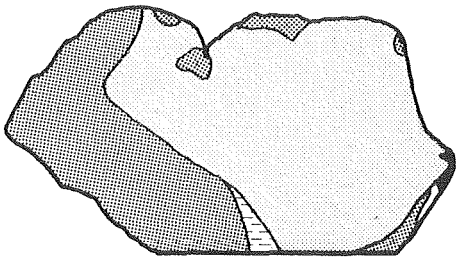
TRAIL

STREAM

PEAKS

CONTOUR LINE

Figure BU-1.– Butter Creek Research Natural Area, Lewis County, Washington.



TATOOSH PLUTON AND ASSOCIATED INTRUSIVES

GRANODIORITE AND QUARTZ MONZONITE

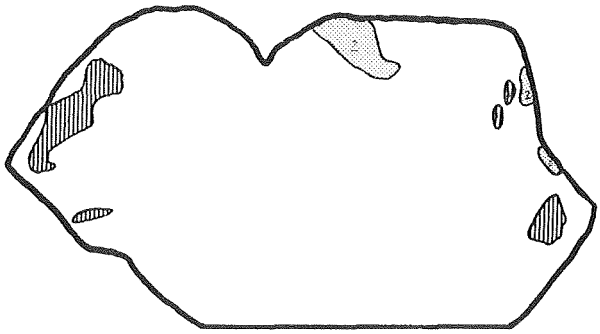
DIORITE, QUARTZ DIORITE, GRANODIORITE AND QUARTZ MONZONITE PORPHYRIES

EXTRUSIVE IGNEOUS ROCKS

RHYODACITIC ASH FLOWS OF STEVENS RIDGE FORMATION

VOLCANIC BRECCIA, SANDSTONE AND SILTSTONE OF OHANAPECOSH FORMATION

BASALT BASALTICANDESITE AND ANDESITE FLOWS OF FIFES PEAK FORMATION



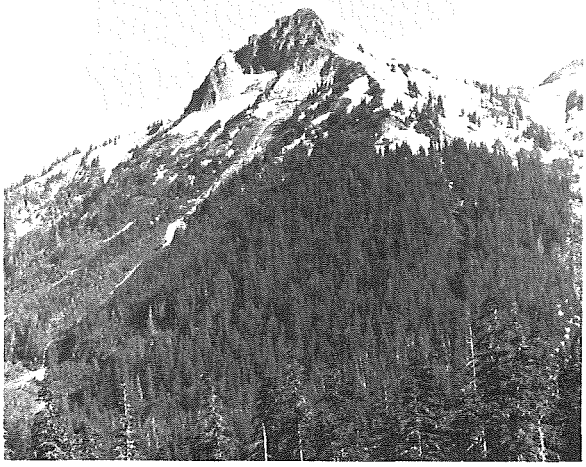
TALUSES (EXCEPT DENSELY FORESTED TALUSES)

BLOCK - FIELD DEPOSITS

Figure BU-2.– Geology of Butter Creek Research Natural Area showing bedrock (upper) and surficial (lower) features (after Fiske, Hopson, and Waters 1963, and Crandell 1969a).

Figure BU-3.-Natural features of Butter Creek Research Natural Area. A: South slope of Plummer Peak; note the extensive avalanche tracks on the left and mixed forests of true firs, Douglas-fir, and western hemlock in the center and on the right (mid-July 1971). B: South slopes of Pinnacle Peak (center) and The Castle (right); note extensive avalanche tracks in the center of the picture (mid-July 1971). C: Mosaic of subalpine meadows and tree groups in the parkland subzone of the *Tsuga mertensiana* Zone on the south slopes of Pinnacle Peak (left) and The Castle (right) (August 1969). D: Shrub communities dominated by Sitka alder and vine maple along the west branch of Butter Creek (August 1969). E: Forest-meadow mosaic at the head of the west branch of Butter Creek; two small ponds are located on the bench near the center of the picture (August 1969). F: Basin at head of the east branch of Butter Creek; a small pond is located near the saddle at the left of the picture (mid-July 1971).

A



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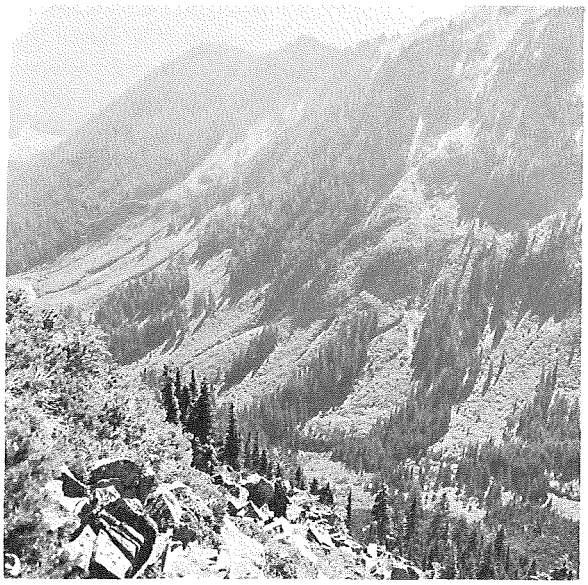

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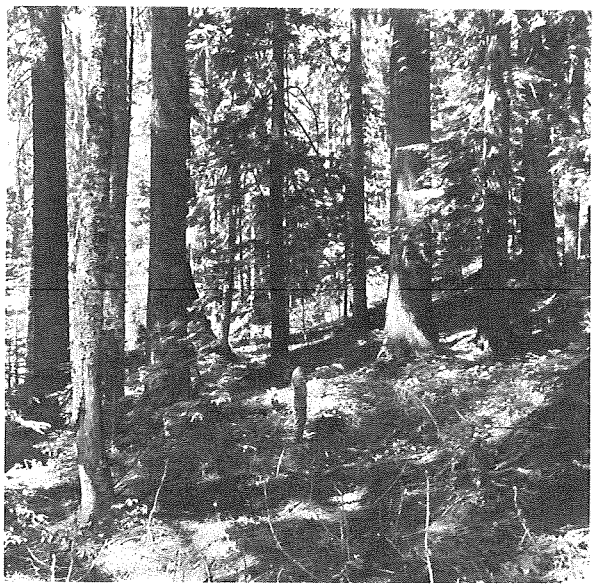
Figure BU-3.-Natural features of Butter Creek Research Natural Area (continued). G: Typical old-growth noble fir, Pacific silver fir, and western hemlock stand at the confluence of the west and east branches of Butter Creek. H: Typical specimen of old-growth noble fir in the lower part of the natural area. I: Avalanche track communities of Sitka alder (center) and mountain hemlock (upper right) emerging from the winter snowpack (mid-July 1971). J: Alaska-cedar-dominated avalanche track communities on the south slope of Plummer Peak (mid-July 1971). K: Butter Creek, Sitka alder communities, and noble fir forest at the southern boundary of the natural area; Plummer Peak in distance (mid-July 1971). L: View from Plummer Peak to the confluence of the east and west branches of Butter Creek (hidden in trees), showing the best developed forest stands in the natural area; note the younger, even-aged true fir stand in the center of the picture which has developed on an old avalanche track (mid-July 1971).



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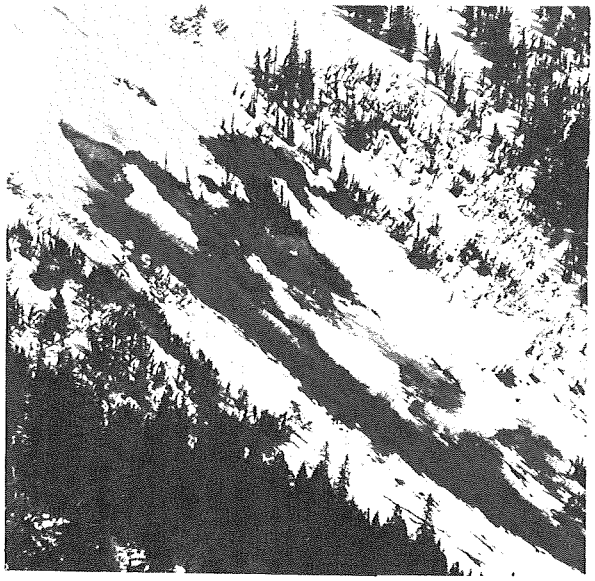

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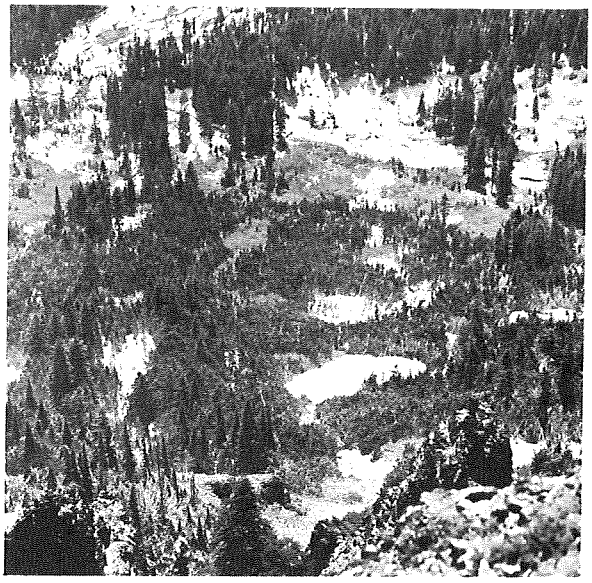

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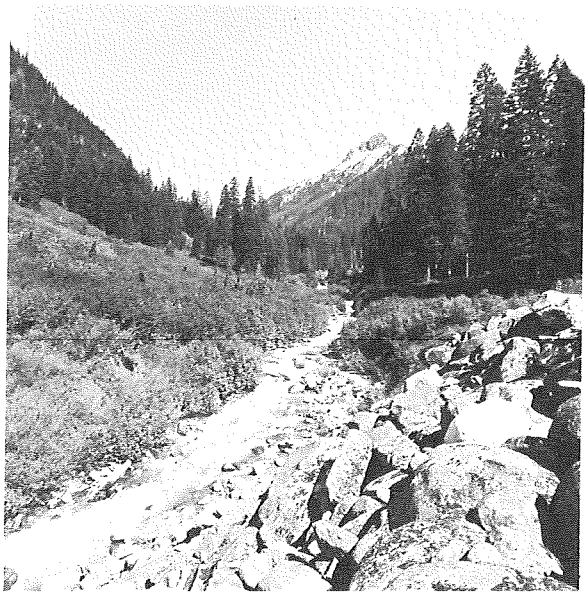

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L

Federal Research Natural Areas in Oregon and Washington a Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

CANYON CREEK RESEARCH NATURAL AREA[1]

Virgin ponderosa pine/pinegrass stands in the Blue Mountains of northeastern Oregon.

The Canyon Creek Research Natural Area was established August 2, 1960, as an example of virgin ponderosa pine *(Pinus ponderosa)* stands which are important in the Blue Mountains of central and northeastern Oregon. The 284-ha. (700-acre) tract is located in Grant County, Oregon, and is administered by the Bear Valley Ranger District (John Day, Oregon), Malheur National Forest. Unfenced, topographic boundaries give it an irregular shape (fig. CC-1). It occupies portions of sections 3, 4, 9, and 10, T. 15 S., R. 32 E., Willamette meridian. It lies at 44 ° 17' N. latitude and 119°52' W. longitude.

ACCESS AND ACCOMMODA TIONS

Access is rather difficult because the nearest road terminates approximately 2.5 km. (1.5 miles) from the tract at a privately owned ranch. Directions should be obtained from the Bear Valley District Ranger together with a letter of introduction to the ranch owner. The rancher is most helpful when he knows a person has business on National Forest land, and he can give specific directions for following the correct jeep trail across his property. Public accommodations are available in Canyon City, 19 km. (12 miles) north on U.S. Highway 395 or at Wickiup Camp 10 km. (6 miles) south. Primitive camps are located along Canyon Creek adjacent to the natural area; however, all stream water on livestock range is a potential source of typhoid fever and should be boiled.

[1]Description prepared by Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

ENVIRONMENT

The Canyon Creek Research Natural Area varies from 1,433- to 1,798-m. (4,700- to 5,900-ft.) elevation. It occupies a topographically gentle, southerly facing enclosed basin which rises from Canyon Creek to moderately steep ridges on the northern and western edges. Slope aspects are east, south, and west.

The natural area contains both granitic and andesitic parent rocks and some volcanic ash deposits on its upper slopes. It apparently straddles the contact between Strawberry Mountain granitics and serpentines and some of the many andesitic and basaltic flows characteristic of the Blue Mountains.

A modified continental climate prevails with cool, moist, partly cloudy winters and warm, dry, cloudless summers. Precipitation is moderate and seasonal, usually occurring as snow. Climatic data from Seneca, 16 km. (10 miles) southwest in a rain shadow valley, is as follows (U.S. Weather Bureau 1965):

Mean annual temperature	4.7°C. (40.5°F.)
Mean January temperature	-4.7°C. (23.6°F.)
Mean July temperature	15.8°C. (60.4°F.)
Mean January minimum temperature	-13.9°C. (7.0°F.)
Mean July maximum temperature	28.8°C. (83.9°F.)
Average annual precipitation	304 mm. (11.95 in.)
June through August precipitation	40 mm. (1.59 in.)
Average annual snowfall	177 cm. (69.8 in.)

Soils are variable. At lower elevations, residual and colluvial soils from granite are present in small areas. Generally, the upper slopes are covered by volcanic ash soils with buried residual profiles from andesite or granite. They may be broadly classed as Gray Wooded under forest cover and Regosols under juniper and bunchgrasses.

This file was created by scanning the printed publication. Text errors identified by the software have been corrected; however, some errors may remain.

BIOTA

All forested stands in the area are dominated by ponderosa pine and are classed as SAF cover type 237, Interior Ponderosa Pine (Society of American Foresters 1954). They apparently fit either Kuchler's (1964) Types 10 or 11, Ponderosa Shrub Forest or Western Ponderosa Forest. Area and volume by forest composition (based on volume) are as follows:

	Volume/unit area		*Area*	
Stand composition	*Cu. m./ha.*	*Bd. ft./ acre*	*Ha.*	*Acres*
Ponderosa pine	196	14,000	158	390
Ponderosa pine (80%), western larch (10%), Douglas-fir (5%), grand fir (5%)	70	5,000	71	175
Ponderosa pine (90%), Douglas-fir (5%), grand fir (5%)	168	12,000	30	75
Ponderosa pine	42	3,000	4	10
Total Forested Area			264	650

There are, in addition, 20 ha. (50 acres) of nonforested communities covered by grass and brush.

Ponderosa pine clearly dominates the forest. With increasing elevation Douglas-fir *(Pseudotsuga menziesii)* and grand fir *(Abies grandis)* both increasingly dominate the understory as reproduction, suggesting pine is not climax over the entire area (fig. *CC-2).* Hall (1967) has suggested that the *Pinus ponderosa/Calamagrostis rubescens* community is generally successional to a grand firdominated community. Since grand fir seed sources are located at higher elevations and west of the tract, distribution of fir reproduction may be associated more with seed source than elevation.

Ground vegetation is dominated by pinegrass *(Calamagrostis rubescens)* with such associated species as elk sedge *(Carex geyeri), Fragaria* spp., *Lupinus caudatus, Hieracium scouleri, Arnica cordifolia, Ceanothus velutinus,* and *Vaccinium scoparium* (fig. *CC-2).* To a large extent, *Ceanothus velutinus* is decadent and dead. It seems to have deteriorated due to natural causes in the absence of conditions suitable for natural seed germination, such as ground fire.

This *Pinus/Calamagrostis* community is the most important grazing type in the Blue Mountains, occupying more area than all other range types combined. Palatable species are pinegrass and elk sedge. Forage production averages 272 kg. per hectare (600 lb. per acre) under 40- to 50-percent tree cover. As fir reproduction increases, forage production decreases and species composition changes. With overgrazing, palatable plants tend to decrease and unpalatable forbs and annual grasses increase; such conditions are moderately common where livestock obtain water along Canyon Creek.

A few nonforest communities are present in the natural area. Most common is the *Juniperus occidentalis/ Agropyron Spicatum* Association on shallow soils. Other species commonly present are *Cercocarpus ledifolius,* Sandberg bluegrass *(Poa secunda),* cheatgrass brome *(Bromus tectorum),* elk sedge, *Crepis acuminata, Achillea millefolium, Berberis repens, Danthonia unispicata,* and *koeleria cristata.* Some rock outcrops are occupied by *Ceanothus velutinus* associated with *Prunus emarginata, Salix scouleriana,* elk sedge, and *Poa pratensis.* A rather dense forest of Douglas-fir, western larch *(Larix occidentalis),* and *Vaccinium scoparium.* is present along the dry creek and the east slope at the tract's western edge. Associated species are ponderosa pine, grand fir, *Osmorhiza chilensis, Salix scouleriana,* elk sedge, *Hieracium albiflorum,* and pinegrass. Tree cover approaches 90 percent.

Resident and transient mammals believed to occur on the natural area are listed in table CC-l. Mule deer *(Odocoileus hemionus hemionus)* commonly browse in the area. Rocky Mountain elk *(Cervus canadensis)* occasionally winter in and near the tract.

H I STORY OF DI STU RBANC E

Fire scars are common on ponderosa pine. They indicate a long history of ground fires which occurred at 15- to 20-year intervals until 1910 when a fire control program was initiated. Presumably, these fires tended to maintain ponderosa pine and *Ceanothus velu-*

tinus and discourage reproduction of Douglasfir and grand fir.

Sheep grazing was common in the area until 1946 when it was terminated. Current game use is moderate to high, resulting in moderate to severe hedging of palatable browse plants. This condition is expected to continue.

No other disturbance has been recorded since establishment.

RESEARCH

No research activities in the tract are known. Special research opportunities in the area include: (1) long-term study of natural forest succession since fire control; (2) evaluation of seed source in relation to distribution of fir reproduction; (3) effect of various soils and topography on biomass production under a rather homogeneous macroclimate; and (4) evaluation of game use on subordinate vegetation.

MAPS AND AERIAL PHOTOGRAPHS

The U.S. Geological Survey topographic map for the 15' John Day, Oregon quadrangle, scale 1:62,500, issued in 1939, covers the natural area. Either the District Ranger (Bear Valley Ranger District) or Forest Supervisor (Malheur National Forest, John Day, Oregon) can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

Hall, Frederick Columbus
1967. Vegetation-soil relations as a basis for resource management on the Ochoco National Forest of Central Oregon. 207 p., illus. (Ph.D. thesis, on file at Oreg. State Univ., Corvallis.)

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, *D.C.*

U.S. Weather Bureau
1965. Climatic summary of the United States-supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31,96 p., illus.

Table CC-1. — Tentative list of mammals for the Canyon Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Scapanus orarius*	coast mole
	Sorex palustris	northern water shrew
	Sorex preblei	Preble shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis subulatus	small-footed myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Pipistrellus hesperus	western pipistrel
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Castor canadensis*	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Marmota flaviventris	yellow-bellied marmot
	Microtus longicaudus	long-tailed vole
	Microtus montanus	mountain vole
	Microtus richardsoni	Richardson vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Spermophilus beldingi	Belding ground squirrel
	Spermophilus columbianus	Columbian ground squirrel
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus hudsonicus	red squirrel
	Thomomys talpoides	northern pocket gopher
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx canadensis	Canadian lynx
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Taxidea taxus	badger
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer

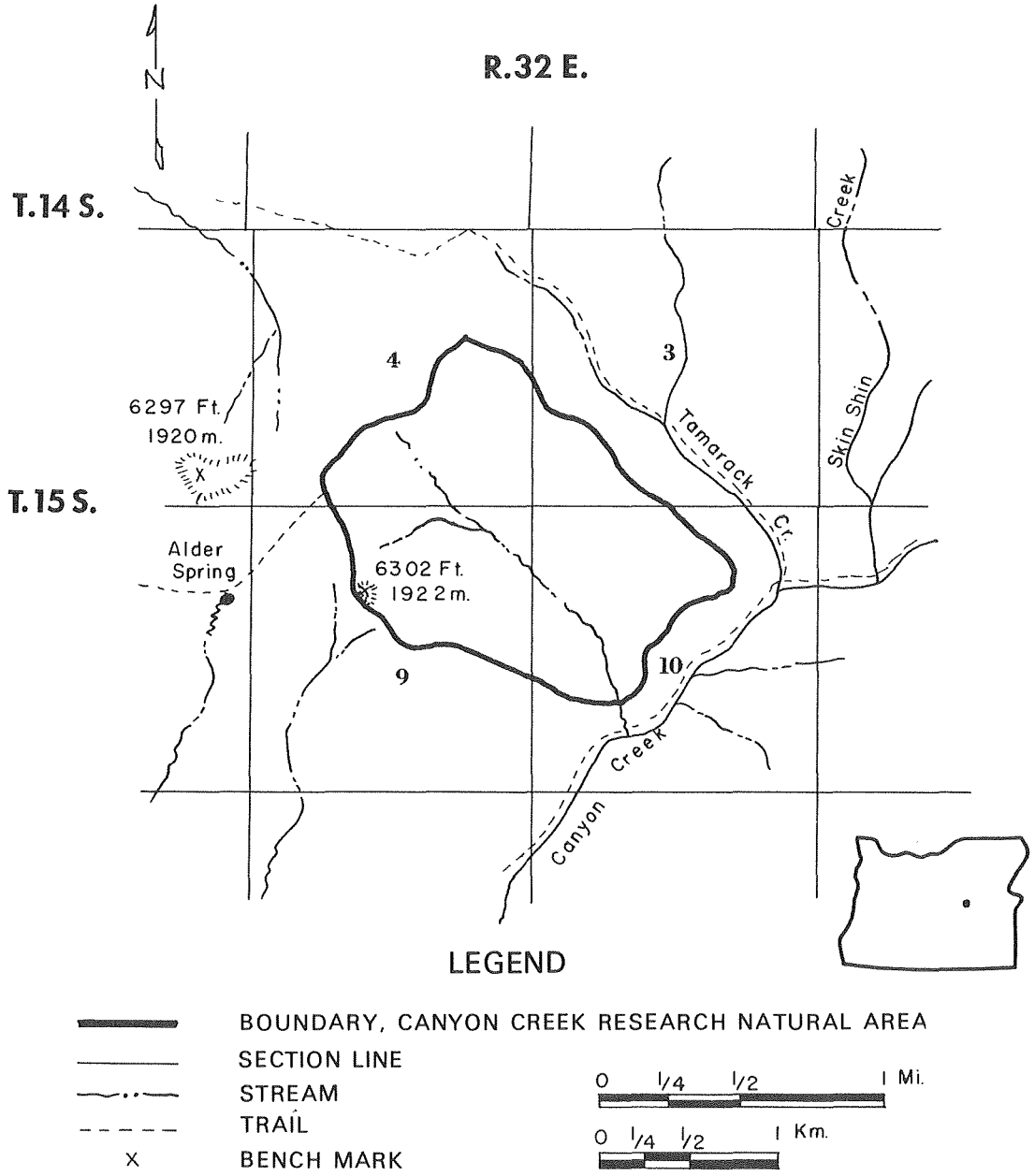
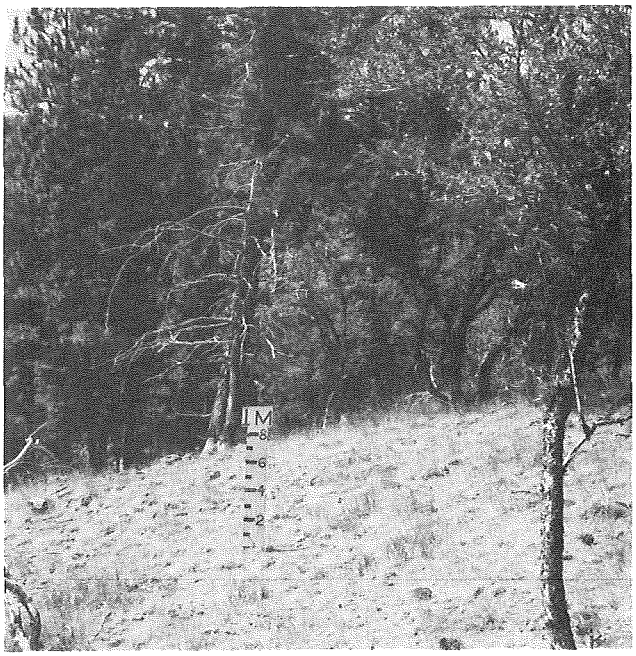
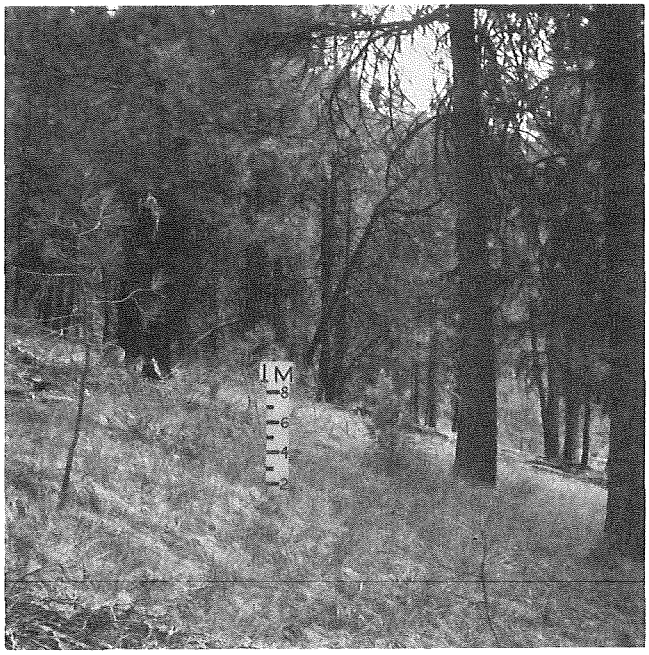


Figure CC-1.– Canyon Creek Research Natural Area, Grant County, Oregon.

Figure CC-2.-Natural features of the Canyon Creek Research Natural Area. Upper left: *Juniperus occidentalis/ Agropyron spicatum* community on shallow soil in a forest opening. Upper right: *Pinus ponderosa/Calamagrostis rubescens* community found on residual soils on the lower, south-exposed slopes. Lower left: *Pinus/Pteridium aquilinum/Calamagrostis* community with seedlings, saplings, and poles of Douglas-fir which is found on the upper-slope volcanic ash soils. Lower right: General view of east-facing slope at the west edge of the natural area showing ponderosa pine overstory, Douglas-fir reproduction, and shrub-dominated opening.





Federal Research Natural Areas in Oregon and Washington a Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

CEDAR FLATS RESEARCH NATURAL AREA[1]

Old-growth stands of western red-cedar and Douglas-fir growing on valley bottom benches in the southwestern Washington Cascade Range.

Cedar Flats Research Natural Area was established on March 14, 1946, to exemplify the western red-cedar *(Thuja plicata)* stands found on valley bottom habitats in the Washington Cascade Range. The 275-ha. (680-acre) tract is located in Skamania County, Washington, and is administered by the Lewis River Ranger District (Cougar, Washington), Gifford Pinchot National Forest. The tract occupies portions of sections 11, 12, and 13, T. 7 N., R. 6 E., Willamette meridian. Legal lines form the boundaries on the north, west, and south and the Muddy River forms the boundary on the east (fig. CF -1). It lies at at 45 °06' N . latitude and 122°01' W.longitude.

ACCESS AND ACCOMMODATlONS

The natural area is located approximately 5 km. (3 miles) north of the Lewis River Ranger Station on Forest Road 125. The Lewis River Ranger Station is easiest to reach from the west via Woodland and Cougar, which are approximately 73 km. (46 miles) and 27 km. (17 miles) away on State Highway 503 and Forest Road N90. Forest Road 125 cuts through the northwestern part of the natural area providing easy access (fig. CF-1). An old trail traverses the area from north to south along the western edge of section 12 and can be utilized for portions of its length. The southwestern quarter of the research natural area is presently least accessible.

The nearest commercial accommodations are in Woodland, Washington, or can sometimes be arranged in Cougar. There are several improved forest camps in the vicinity of the natural area along the Muddy River.

ENVIRONMENT

Most of the Cedar Flats Research Natural Area occupies a gently undulating series of benches along the Muddy River. The northwestern corner of the natural area (west of Forest Road 125) is located on moderately steep slopes at the foot of some mountain ridges. Elevations range from about 366 to 640 m. (1,200 to 2,000 ft.).

Bedrock in the natural area is composed of Oligocene-Miocene volcanic rocks such as andesite flow breccias and andesite (Huntting et al. 1961). The benches are, of course, composed mainly of deposited materials. The exact nature of these materials and their mode of origin is unknown, but alluvium, glacial outwash, and mudflows are probably included. There are also surficial deposits of various Pleistocene and/or Recent volcanic ash or pumice falls, some of the ejecta forming distinct layers. Samples collected from surfaces of a nearby mudflow suggest that materials from at least the St. Helens "W" and Mount Rainier ″C″ ash deposits are present (Crandell 1969).[2]

The climate is wet and cool. Precipitation is seasonal, peaking during winter months and reaching low levels during the summer period. There are no nearby weather stations for which published data are available; how-

[1] Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. Forestry Sciences Laboratory, Corvallis, Oregon.

[2] Personal communication from Dr. H. W. Smith, Agronomy Department, Washington State University. Pullman.

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ever, unpublished records for the Lewis River Ranger Station, located approximately 5 km. (3 miles) south of the natural area, are on file there.

Soils within the natural area have not been carefully examined. Soil types belonging to the Brown Podzolic, Sols Bruns Acides, Alluvial, and Humic Gley great soils groups were encountered during the reconnaissance. Organic soils are associated with some of the swamp and marsh land habitat. Soil profiles within the natural area typically exhibit several primary or secondary depositions of Pleistocene and/or Recent volcanic ejecta.

BIOTA

Approximately 255 ha. (630 acres) of the natural area are occupied by forest and 20 ha. (50 acres) by non-forested communities. Areas by SAF cover types are as follows (Society of American Foresters 1954):

No.	*Nome*	*Area*
230	Douglas-Fir-Western Hemlock[3]	162 ha. (400 acres)
228	Western Redcedar	8H ha. (220 acres)
221	Red Alder	4 ha. (10 acres)

The area would include Kuchler's (1964) Types 2, Cedar-Hemlock-Douglas Fir Forest; and 25, Alder-Ash Forest. The area falls within the *Tsuga heterophylla* Zone of Franklin and Dyrness (1969).

The most abundant tree species within the natural area are western red-cedar and Douglas-fir *(Pseudotsuga menziesii).* Other coniferous tree species present in lesser numbers are western hemlock *(Tsuga heterophylla),* Pacific silver fir *(Abies amabilis),* grand fir *(Abies grandis),* and western white pine *(Pinus monticola).* Hardwoods commonly encountered are red alder *(Alnus rubra),* bigleaf maple *(Acer macrophyllum),* and black cottonwood *(Populus trichocarpa).*

Stands of old-growth western red-cedar and associated swamps and marshes are the key features of the natural area (fig. CF-2). These are located on higher benches in the center of the tract near Forest Road 125 (fig. CF -1). The western red cedar range from 90- to 300cm. (36- to 120-in.) d.b.h. (fig. CF-2) and reach heights in excess of 60 m. (200 ft.). Some individual areas of dense western red-cedar trees, which were cruised at the time of the natural area establishment, contain timber volumes exceeding 2,800 cu. m. per ha. (200,000 bd. ft. per acre).

Acer circinatum and *Polystichum munitum* dominate the shrub and herb layers of most western red-cedar stands (fig. CF -2). *Cornus nuttallii,* Pacific yew, *(Taxus brevifolia),* and bigleaf maple complete the list of common tall shrubs and small trees. *Oplopanax horridum* and *Berberis nervosa* are typical low shrubs. There is a rich selection of herbs such as *Achlys triphylla, Tiarella unifoliata, Blechnum spicant, Vancouveria hexandra,* and *Gymnocarpium dryopteris.*

A variety of swamp and marsh communities are associated with seasonally or continuously wet sites. They provide habitat for a rich collection of aquatic and semiaquatic plant species. Large areas of this type tend to be a mosaic of shrub- and herb-dominated stands with scattered stunted red alder and, perhaps, conifers on hummocks (fig. CF-2). The more common shrubs are *Salix* spp., *Spiraea* sp., *Rubus spectabilis, Cornus stolonifera, Pyrus rivularis, Prunus emarginata,* and *Acer circinatum.* Herb dominants include *Athyrium filix-femina, Carex obnupta, Scirpus microcarpus,* and *Lysichitum americanum.*

Stands dominated by Douglas-fir occupy the bulk of the natural area. These include both old-growth and second-growth age classes, the former surrounding the western red-cedar type and blending with it at its edges. In these Douglas-fir-dominated stands, western hemlock and Pacific silver fir appear to be the climax species. Successional processes are particularly evident in the stands on the west and south where the Douglas-fir overstory is rapidly breaking up.

The Douglas-fir-dominated stands appear to occupy a wide range of environmental conditions judging by variations in understory composition. In the southwestern corner

[3] A portion of this area, particularly that occupied by younger stands, might be classified as SAF type 22H, Pacific Douglas-Fir.

of the natural area, *Gaultheria shallon, Acer circinatum, Berberis nervosa,* and *Achlys triphylla* are typical understory dominants. On other sites an herbaceous-dominated understory (e.g., *Polystichum munitum* and *Vancouveria hexandra)* suggest much more mesic and fertile conditions.

Wildlife make significant use of the natural area. It provides late fall and winter range for a herd of Roosevelt elk *(Cervus canadensis roosevelti)* and for deer *(Odocoileus hemionus columbianus).* In fact, these animals may be encountered in the area at almost any time of year and their grazing undoubtedly has a significant impact on the character of the plant communities. Black bear *(Ursus americanus)* also forage the swampy areas during the spring, and some may possibly hibernate on the natural area. Predators such as coyote *(Canis latrans),* cougar *(Felis concolor),* and bobcat *(Lynx rufus)* are occasional visitors, probably following the deer and elk. Other animals such as mink *(Lutreola lutreola),* river otter *(Lutra canadensis pacifica),* and beaver *(Castor canadensis)* inhabit areas along the Muddy River. A complete list of mammals believed to utilize the natural area is provided in table CF-l.

The variety of semi aquatic and terrestrial, forested and open areas, undoubtedly provide habitat for a variety of birds, reptiles, and amphibians.

RESEARCH

No research is presently known to be in progress on the natural area. Short-term studies would be extremely timely since a large portion of the natural area will be flooded if work proceeds on a proposed and licensed power dam on the Muddy River. Research opportunities include studies of: (1) the ecology of western red-cedar and associated conifers; (2) patterns in community composition and structure in relation to environmental conditions; (3) effects of Roosevelt elk on plant communities; and (4) relationships between small animal populations and plant communities over a range of terrestrial and semiaquatic habitats.

HISTORY OF DISTURBANCE

The only recent natural disturbances are those associated with the activity of the Muddy River along the eastern boundary. There is no evidence of recent wildfires within the natural area. The fire which gave rise to the second-growth Douglas-fir stands occurred at least 130 years ago.

Human disturbances are confined to roadsides and the margins of the natural area. Unfortunately, the forest stand on private land adjacent to the southern boundary of the natural area was clearcut about 1967; this has produced, and will continue to produce, some edge effects, exposing this boundary to windfall damage. Forest Road 125 has altered natural conditions in the northwestern corner of the natural area to an unknown degree, but it is located at the extreme western edges of the benches.

As mentioned, the area does lie partially within the reservoir area of Pacific Power and Light Company's Muddy River Dam project. It is not known whether the dam will be built or, if so, when.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* –15' Mount St. Helens, Washington quadrangle, scale 1:62,500, issued by the U.S. Geological Survey in 1956; and *geology* - *Geologic Maps of Washington,* scale 1:500,000 (Huntting et al. 1961). The District Ranger (Lewis River Ranger District) or Forest Supervisor (Gifford Pinchot National Forest, Vancouver, Washington) can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERA TU RE C I TED

Crandell, Dwight R.
1969. The geologic story of Mount Rainier. U.S. Geol. Surv. Bull. 1292, 43 p., illus.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

Table CF-1. — Tentative list of mammals for Cedar Flats Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Sorex bendirii	marsh shrew
	Sorex obscurus	dusky shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Tamiasciurus douglasi	chickaree
	Zapus princeps	western jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Odocoileus h. columbianus*	black-tailed deer
	Cervus canadensis roosevelti	Roosevelt elk

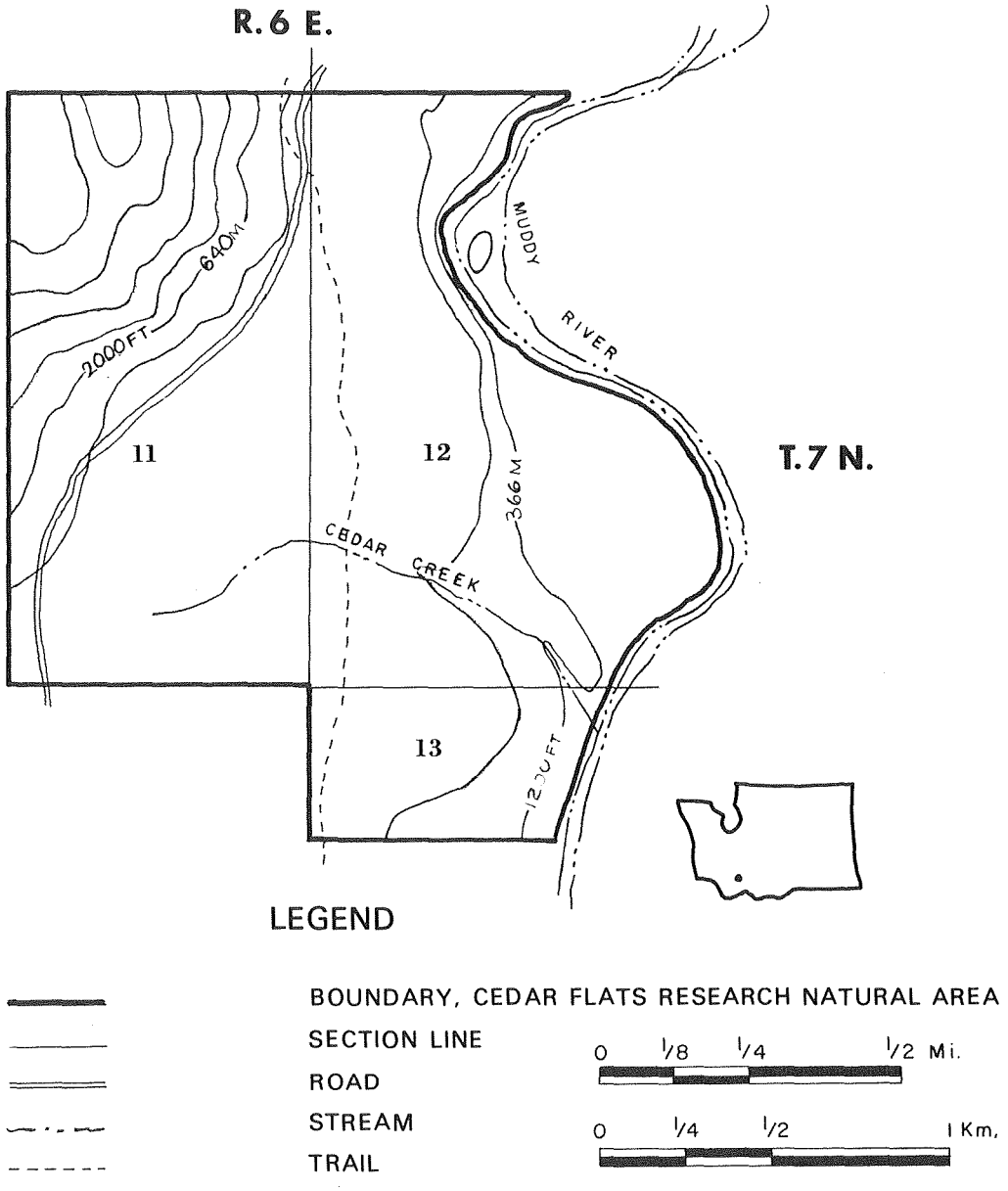
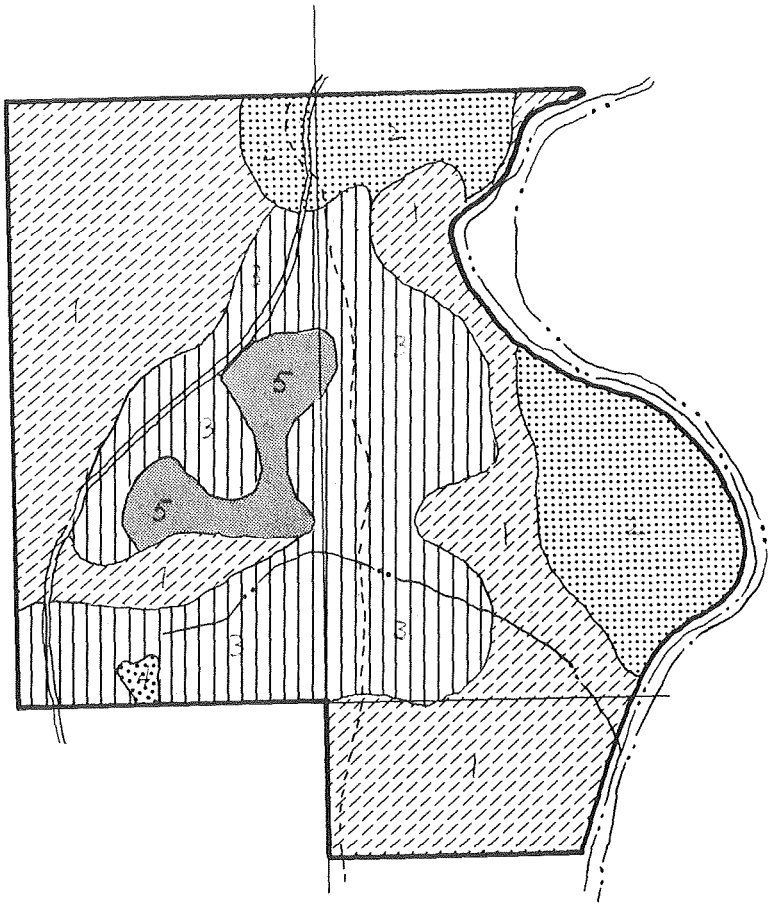


Figure CF-1.– Cedar Flats Research Natural Area, Skamania County, Washington.



LEGEND

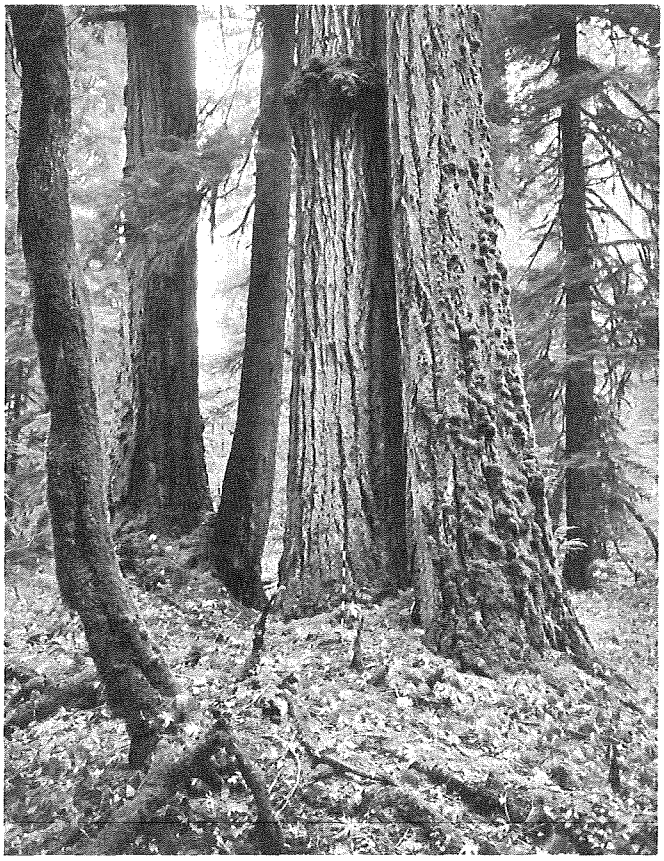
OLD-GROWTH DOUGLAS-FIR
SECOND-GROWTH DOUGLAS-FIR
WESTERN REDCEDAR
HARDWOODS
SWAMP

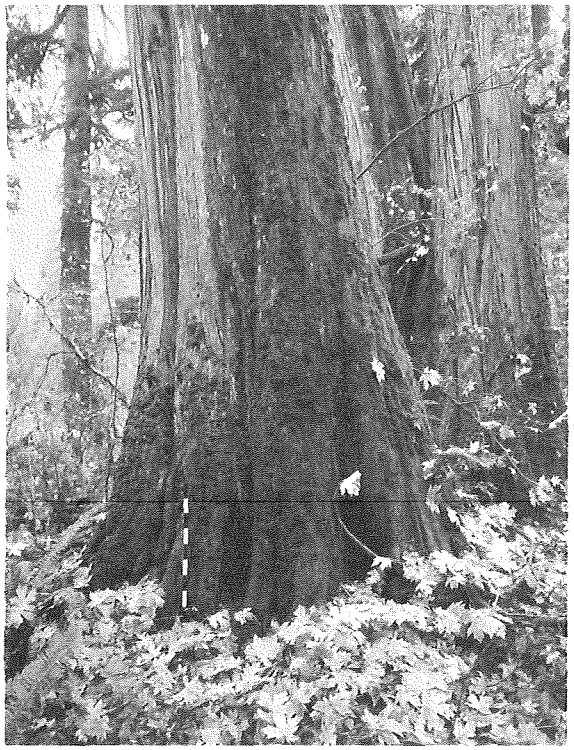
0 1/8 1/4 1/2 Mi.

0 1/4 1/2 1 Km.

Figure CF-2.– Vegetation types in the Cedar Flats Research Natural Area.

Figure CF-3.-Communities of the Cedar Flats Research Natural Area. Upper left: Old-growth Douglas-fir and smaller associated western hemlock dominate a large portion of the natural area; bigleaf maple (left foreground) are scattered through both the upland and swamp habitats. Upper right: Grove of old-growth western red-cedar showing typical understory dominants-*Acer circinatum* and *Polystichum munitum.* Lower left: Hardwoods, particularly red alder, are scattered through swampy areas, such as this one dominated by Cyperaceae. Lower right: Old-growth specimens of western red-cedar attain diameters in excess of 250-cm. (100-in.) b.h.





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CHERRY CREEK RESEARCH NATURAL AREA[1]

Old-growth Douglas-fir and western hemlock stands growing on slopes and ridgetops in the southwestern Oregon Coast Ranges.

The Cherry Creek Research Natural Area was established on February 4, 1965. It typifies virgin, old-growth Douglas-fir *(Pseudotsuga menziesii)*-western hemlock *(Tsuga heterophylla.)* stands as they occur on sedimentary materials in the southwestern Oregon Coast Ranges. The 239-ha. (590-acre) tract is located in Coos County, Oregon, and is administered by the Coos Bay District (Coos Bay, Oregon), Bureau of Land Management (BLM). The natural area occupies portions of sections 17, 18, 19, and 20, T. 27 S., R. 10 W., Willamette meridian (fig. CH-l). It lies at 45°13' N. latitude and 123°56' W. longitude.

ACCESS AND ACCOMMODATIONS

The normal approach to the natural area is from Coquille, to the south. Just west of the Coquille High School, turn north from State Highway 42 onto the Fairview-McKinley Road. At Fairview, 14.5 km. (9 miles) to the north, turn southeast (right) onto the Coos Bay Wagon Road. Follow this road to Cherry Creek Park (about 11 km. or 7 miles) and turn left on Cherry Creek County Road which later changes to the B.L.M. Cherry Creek Access Road (27-11-27.0). Follow it for 9.5 km. (6 miles) to the Big Tree Recreational Site at the edge of the natural area. The vicinity of the natural area can also be reached via the BLM Middle Creek Access Road (2711-29.0) and Burnt Mountain Road (27-1112.0). To approach the north side of the natural area in this way, turn onto the Middle Creek Access Road about 6 km. (4 miles) east of Fairview.

There are no roads or trails within the main body of the natural area. Access is by cross-country travel.

The nearest commercial accommodations are in Coquille and Coos Bay, approximately 35 km. (22 miles) and 50 km. (31 miles) away, respectively. There are several improved forest camps in the vicinity, the most convenient being located on Middle Creek.

ENVIRONMENT

The Cherry Creek Research Natural Area occupies complex ridge and valley topography bounding a portion of Cherry Creek. Slopes are generally moderate to steep on the middle and lower slopes and gentle to moderate along the ridgetops (fig. CH-l). Elevations range from about 207 m. (680 ft.) along Cherry Creek to 451 m. (1,480 ft.) in the northwestern corner of the natural area. The topography is very complex and dissected.

Sedimentary bedrock underlies the entire natural area. These sand and siltstones belong to the Tyee formation of Middle Eocene Age (Pech 1961).

The climate is wet and mild. Precipitation is seasonal, with a peak in January and December and a minimum in July and August. The summer drought period is more pronounced than in northern Oregon and Washington coastal mountains. The following climatic data are from the closest weather station at Sitkum located about 5 km. (3 miles) to the southeast (U.S. Weather Bureau 1965):

[1] Description prepared by Dr. J. F. Franklin. U.S. Department of Agriculture. Forest Service, Pacific Northwest Forest and Range Experiment Station. Forestry Sciences Laboratory, Corvallis, Oregon.

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Mean annual temperature	11.1°C. (52.0°F.)
Mean January temperature	4.2°C. (40.6°F.)
Mean July temperature	17.2°C. (63.0°F.)
Mean January minimum temperature	0.8°C. (33.5°F.)
Mean July maximum temperature	25.1°C. (77.2°F.)
Average annual precipitation	2,035 mm. (80.11 in.)
June through August precipitation	82 mm. (3.21 in.)

A soil survey for the area is not available, but most soils tend toward relatively deep, Reddish-Brown Lateritics developed in colluvium and residuum from silt and sandstones. Surface (A1) horizons are typically dark brown in color and the B2 horizon has a clay-loam texture and fine to very fine, sub-angular, blocky structure. Depth to bedrock (R horizon) is typically from 100 to over 150 cm. (40 to 60 in.). A horizons typically average about 20 cm. (8 in.) in thickness and B horizons 75 to 90 cm. (30 to 35 in.).

BIOTA

All 239 ha. (590 acres) of the Cherry Creek Research Natural Area are classified as SAF cover type 230, Douglas-Fir - Western Hemlock (Society of American Foresters 1954). The area falls within Kuchler's (1964) Type 2 (Cedar-Hemlock-Douglas Fir Forest) and the *Tsuga heterophylla* Zone of Franklin and Dyrness (1969).

Douglas-fir and western hemlock dominate the natural area. The average age of the Douglas-fir is not known, but it is believed to be in excess of 300 years. Old-growth Douglas-firs average 125- to 175-cm. (50- to 70-in.) d.b.h. The maximum recorded size is 294-cm. (116-in.) d.b.h. and 86.9 m. (285 ft.) high at over 600 years of age. Western hemlock typically average 75- to 100-cm. (30to 40-in.) d.b.h. and are somewhat younger in age than associated Douglas-fir. Other tree species present on the natural area include western red-cedar *(Thuja plicata)* and tanoak *(Lithocarpus densiflora),* with bigleaf maple *(Acer macrophyllum)* and California-laurel *(Umbellularia californica)* common in streamside areas (fig. CH-2).

The climax tree species on the natural area clearly appears to be western hemlock. Hemlock seedlings and saplings are more abundant than those of any other coniferous species. In some areas sprout and seedling reproduction of tan oak is also common, suggesting it may also be a climax species. Very little reproduction of Douglas-fir or western red-cedar is present anywhere on the natural area.

Most of the forest communities on the natural area are assignable to one of the associations recognized by Bailey (1966) in a study of nearby old-growth forests. The communities on middle and lower slopes and on broad mesic ridgetops appear to belong to the *Tsuga heterophylla/Polystichum munitum - Oxalis oregana* Association. The understory is dominated by a dense cover of *Polystichum munitum,* with many other associated herbs such as *Oxalis oregana, Tiarella trifoliata, Adiantum pedatum, Athyrium filix-femina, Blechnum spicant, Montia sibirica,* and *Galium triflorum* (fig. CH-2). The shrubby layer is poorly developed, being confined to *Berberis nervosa* and scattered cover of vine maple *(Acer circinatum), Vaccinium parvifolium, V. ovatum,* and *Rhododendron macrophyllum.* A community related to Bailey's (1966) *Tsuga heterophylla – Pseudotsuga menziesii/Rhododendron macrophyllum/Berberis nervosa* Association occurs on some upper side slopes and narrow ridgetops, particularly those with a southerly or westerly aspect. Shrubs such as *Rhododendron macrophyllum* and *Berberis nervosa* and small hardwoods such as tanoak and golden chinkapin *(Castanopsis chrysophylla.)* are much more conspicuous in communities of this type. Conversely, the herbaceous layer is much more poorly developed.

Resident and transient mammals believed to occur within the natural area are listed in table CH-l. The most important mammal, the Roosevelt elk *(Cervus canadensis roosevelti),* utilizes the area and its surroundings heavily. Browsing and trampling by elk is undoubtedly a major influence upon the character of the understory communities within the forest stands and helps account for their relatively open nature. Elk trails provide some of the easiest means for travel through

the area. Heaviest elk use appears to be the broad ridge tops in the center and southern half of the natural area.

There are several miles of live stream course within the natural area. These streams and the streamside areas provide specialized habitats for a variety of flora and fauna. A few minor tributaries of Cherry Creek are located entirely within the natural area and support both steelhead *(Salmo gairdneri)* and sea-run cutthroat trout *(Salmo clarki).*

HISTORY OF DISTURBANCE

Major human influences upon the area are related to the road construction and clear-cut logging operations adjacent to the natural area boundaries. Burnt Mountain Road (2711-12.0), which is located along the northern edge of the natural area, is probably most important in this regard. Construction and maintenance of this road has influenced the slopes below, which are within the natural area. A picnic site and short nature trail have been developed along the western edge of the natural area (Big Tree Site). There is relatively little visitor use of the natural area core because of the lack of trails.

There is no evidence that wildfires have occurred within the natural area for at least 190 years. Nor is there evidence of recent catastrophic damage by windthrow or bark beetles.

RESEARCH

No research studies are presently known to be in progress on the Cherry Creek Research Natural Area. Some data on community structure and limited plant collections have been obtained by Forest Service personnel. The natural area provides an excellent site for studying the old-growth coniferous forest that once typified a large portion of Oregon's Coast Ranges and for studying the effect of Roosevelt elk upon the structure and composition of such communities.

MAPS AND AERIAL PHOTOGRAPHS

Maps applicable to the natural area include:

Topography - 15' Sitkum, Oregon quadrangle, scale 1:62,500, issued by the U.S. Geological Survey in 1955; and *geology Geologic Map of Oregon West of the 121st Meridian,* scale 1:500,000 (Peck 1961). The District Manager (Coos Bay District, Bureau of Land Management, Coos Bay, Oregon) can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

Bailey, Arthur Wesley
1966. Forest associations and secondary plant succession in the southern Oregon Coast Range. 164 p., illus. (Ph.D. thesis, on file at Oreg. State Univ., Corvallis. Abst. published in Diss. Abstr., Sect. B27(8): 2605B-2606B. 1967.)

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31, 96 p., illus.

Table CH-1. — Tentative list of mammals for Cherry Creek Research Natural Area[1]

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	**Scapanus orarius*	coast mole
	Sorex bendirii	marsh shrew
	Sorex pacificus	Pacific shrew
	**Sorex trowbridgii*	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Sylvilagus bachmani	brush rabbit
Rodentia	*Aplodontia rufa*	mountain beaver
	Arborimus albipes	white-footed vole
	Arborimus longicaudus	red tree vole
	**Castor canadensis*	beaver
	Clethrionomys californicus	California red-backed vole
	Erethizon dorsatum	porcupine
	**Eutamias townsendi*	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Neotoma fuscipes	dusky-footed wood rat
	**Peromyscus maniculatus*	deer mouse
	Spermophilus beecheyi	California ground squirrel
	**Tamiasciurus douglasi*	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Bassariscus astutus*	ringtail or miner's cat
	Canis latrans	coyote
	Felis concolor	mountain lion or cougar
	Lynx rufus	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	**Procyon lotor*	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	**Cervus canadensis*	wapiti or elk
	**Odocoileus h. columbianus*	black-tailed deer

[1] Asterisk (*) indicates habitation verified by sign, sighting, or collection.

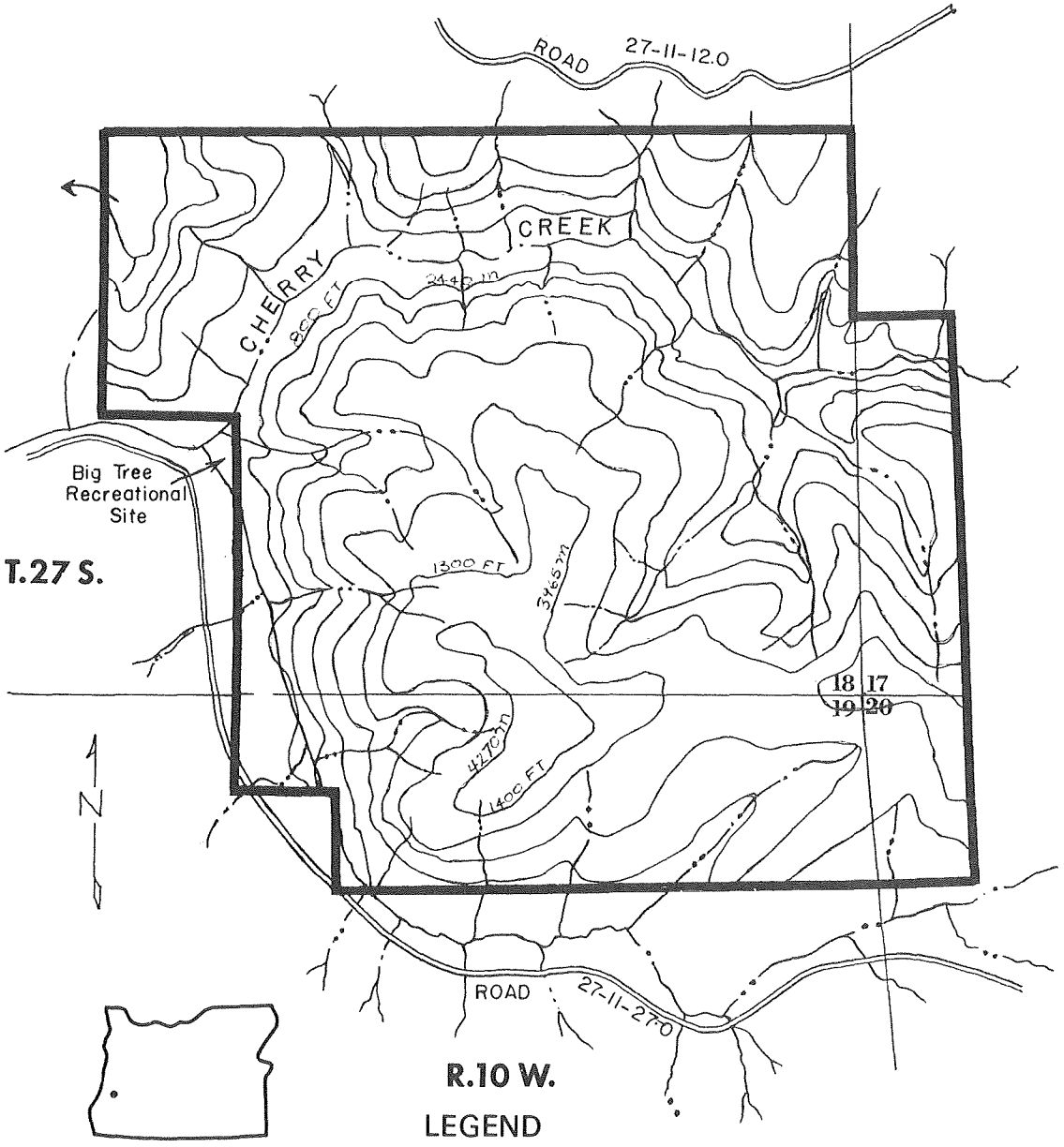
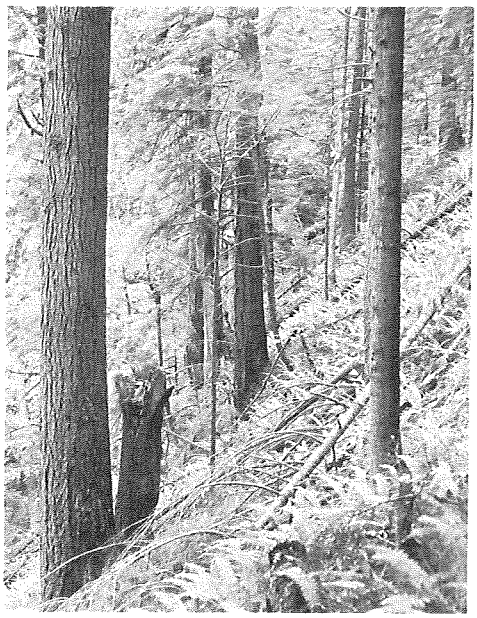


Figure CH-1.– Cherry Creek Research Natural Area, Coos County, Oregon.

Figure CH-2.-Natural features of Cherry Creek Research Natural Area. Upper left: Stand of western hemlock with dense *Polystichum munitum* understory located on a ridgetop bench. Upper right: Mixed stand of Douglas-fir (left) and western hemlock (right) on steep canyon sideslope. Center: Typical understory species including *Polystichum munitum*, *Oxalis oregana*, *Vaccinium ovatum*, V. *parvifolium*, and *Rhododendron macrophyllum*. Lower left: Open, lower-slope stand of western red-cedar, big leaf maple, and California-laurel. Lower right: Main branch of Cherry Creek near its exit from the natural area.



Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

COQUILLE RIVER FALLS RESEARCH NATURAL AREA[1]

Port-Orford-cedar and Douglas-fir growing in a rugged mountain canyon in the southwestern Oregon Coast Ranges.

The Coquille River Falls Research Natural Area was established on January 31, 1945, to provide examples of virgin old-growth Port-Orford-cedar *(Chamaecyparis lawsoniana)* stands. The 202-ha. (500-acre) tract is located in Coos County, Oregon, and is administered by the Powers Ranger District, Powers, Oregon (Siskiyou National Forest). The natural area occupies portions of sections 16, 17, 18, 20, and 21, T. 33 S., R. 11 W., Willamette meridian. The natural area is bounded by Forest Road 333 on the northwest, by Forest Road 321 on the west, south, and east, and by the center line of sections 16 and 17 on the north (fig. CO-I). It lies at 42°44' N. latitude and 124 °03' W. longitude.

ACCESS AND ACCOMMODATIONS

Primary access is via State Highway 242 and Powers, which lies 29 km. (18 miles) south of State Highway 42 and about 34 and 48 km. (21 and 30 miles) from Myrtle Point and Coquille, respectively. To reach the natural area, travel south from Powers on Forest Road 333 for about 33 km. (20 miles) to the bridge across the South Fork of the Coquille River. This bridge is located on the northwest boundary of the tract. For the next several kilometers Roads 333 and 321 bound the natural area.

Generally, cross-country travel is necessary within the natural area. Immediately east of Squaw Creek an unmarked trail leads from Road 321 down to Coquille River Falls. The upper- and mid-slopes of the natural area on the south side of the river are reasonably accessible from the road. Access to the lower slopes and area of the river is difficult, however. The best way to reach the latter is from the northwestern corner of the natural area entering just north of the bridge where Road 333 crosses the South Fork of the Coquille River.

The nearest commercial accommodations are in Powers, Myrtle Point, Coquille, and Gold Beach; however, there are several improved forest camps along Forest Road 333 in the vicinity of the natural area: Daphne Grove, Myrtle Grove, and Boundary.

ENVIRONMENT

The Coquille River Falls Research Natural Area occupies a topographically rugged canyon area. Except for a few benches along Road 321, slopes are moderate to very steep. Cliffs and rock outcrops are occasionally encountered and are very common along the river itself (fig. *CO-2).* The South Fork of the Coquille River and numerous other streams such as Squaw and Drowned Out Creek flow through the southern part of the natural area. Spring and seep areas are also common. Elevations within the natural area range from 305 to 760 m. (1,000 to 2,500 ft.).

The natural area is relatively simple geol-ogically (Diller 1903, Wells 1955, and Peck 1961). Bedrock is composed of sedimentary materials, primarily sand and siltstones, be-longing to the Tyee formation of Eocene age.

The climate is wet and mild. Precipitation

[1] Description prepared by Dr. J. F. Franklin and Dr. C. T. Dyrness, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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is seasonal, with a peak in January and December and a minimum in July and August. The summer drought period is more pronounced than in the northern Oregon and Washington coastal mountains. The following climatic data are from the closest weather station at Powers (U.S. Weather Bureau 1965) :

Mean annual temperature	12.0°C. (53.6°F.)
Mean January temperature	6.6°C. (43.8°F.)
Mean July temperature	17.6°C. (63.6°F.)
Mean January minimum temperature	1.6°C. (34.8°F.)
Mean July maximum temperature	25.0°C. (77.0°F.)
Average annual precipitation	1,535 mm. (60.44 in.)
June through August precipitation	56 mm. (2.19 in.)

Since Powers is about 150 m. (500 ft.) lower in elevation, temperatures are lower and precipitation higher on the natural area; isohyetal maps (Oregon State Water Resources Board 1959) indicate 2,500 to 2,800 mm. (100 to 110 in.) annual precipitation.

Soils vary greatly in depth throughout the area. The profiles typically are not strongly developed. On better sites, soils tend toward Reddish-Brown Lateritics with 5- to 10-cm. (2- to 4- in.) thick Al horizons. These profiles are typically developed in relatively deep colluvial deposits. Soils are generally much shallower on the slopes north of the Coquille River, where either Brown Podzolic or Lithosolic types may be encountered.

BIOTA

All of the natural area is classed as SAF cover type 231, Port-Orford-Cedar-Douglas-Fir (Society of American Foresters 1954). The area falls within Kuchler's (1964) Type 2, Cedar-Hemlock-Douglas Fir Forest, and the *Tsuga heterophylla* Zone of Franklin and Dyrness (1969).

Port-Orford-cedar and Douglas-fir *(Pseudotsuga menziesii)* are the most important tree species within the natural area composing approximately 22 percent and 69 percent of the total timber volume (fig. CO-2). There are particularly fine specimens of Port-Orford-cedar on the benches along Forest Road 321 (fig. CO-2); these trees attain diameters in excess of 130 em. (50 in.) b.h. and heights in excess of 60 m. (200 ft.) Western hemlock *(Tsuga heterophylla),* grand fir *(Abies grandis),* sugar pine *(Pinus lambertiana),* and Pacific yew *(Taxus brevifolia)* are other coniferous tree species found within the tract. Hardwoods are well represented though not necessary in the highest canopy levels. These include red alder *(Alnus rubra),* tanoak *(Lithocarpus densiflorus),* golden chinkapin *(Castanopsis chrysophylla),* and Pacific madrone *(Arbutus menziesii).*

General successional trends are toward replacement of Douglas-fir and Port-Orford-cedar by western hemlock. Hemlock seedlings and saplings are the most abundant in mature forest stands, while those of grand fir and Port-Orford-cedar are relatively uncommon or absent. However, sprout and seedling reproduction of tan oak is as abundant as or more so than that of western hemlock in some stands, suggesting it may also be a major climax species.

There are a variety of distinctive forest communities found within the natural area. Most conspicuous are the old-growth coniferous stands dominated by Port-Orford-cedar and Douglas-fir which are concentrated south of the Coquille River. *Polystichum munitum* dominates the understory on moist benches as well as on well watered slopes or in seep areas. Typical associated species are *Oxalis oregana, Berberis nervosa, Galium triflorum, Viola sempervirens, Hierchloe occidentallis,* and *Trillium ovatum.* Shrubs commonly encountered on such sites are *Vaccinium ovatum,* tanoak, and *Gaultheria shallon.*

Other old-growth stands, e.g., those found on drier sites, may have a dense understory of shrubs and small trees such as *Rhododendron macrophyllum, Vaccinium parvifolium, P. ovatum,* tanoak, golden chinkapin, *Gaultheria shallon,* and *Berberis nervosa.* Herbaceous species include many of those found on moister sites (e.g., *Polystichum munitum),* but coverage of the herbaceous layer is typically much lower.

Younger, second-growth stands growing on relatively poor sites typify the natural area north of the Coquille River. Douglas-fir

and Port-Orford-cedar are the most important coniferous tree species present, but sugar pine is also found in these stands. Hardwoods, such as golden chinkapin, tanoak, and Pacific madrone, are much more important than in the older stands, and the understory is dominated by shrubs such as *Rhododendron macrophyllum, Gaultheria shallon,* and *Berberis nervosa.*

There are some small areas of *Alnus rubra/ Polystichum munitum* communities scattered through the southern half of the natural area (fig. CO-2). There is relatively little evidence of successional direction in these stands; reproduction is lacking in almost all species.

Mammals believed to reside or occur as transients within the natural area are listed in table CO-I. A variety of amphibians, such as frogs and salamanders, are associated with the streams and seep areas. Ensatina *(Ensatina eschscholtzi),* Pacific giant salamander *(Dicamptodon ensatus),* and clouded salamanders *(Aneides ferreus)* have been collected within the natural area.

Specialized habitats within the Coquille River Falls Research Natural Area include the stream and stream side areas and the rock cliffs found along the South Fork of the Coquille River (fig. CO-2).

HISTORY OF DISTURBANCE

The most serious disruptive influence has been the recent invasion of an exotic root pathogen, *Phytopthora lateralis,* which is invariably fatal to Port-Orford-cedar. In 1966 the pathogen was not known to be present in the natural area and there were no cedar dying at that time. By 1968 dying Port-Orford-cedar were common along Road 321 and extended down the drainages north of this road. This follows the typical pattern of invasion for this pathogen. In 1970 nearly half (47 percent) of the Port-Orford-cedar volume was in snags and down trees in contrast to 16 percent in the nearby, but not yet infested, Port Orford Cedar Research Natural Area.[2] It is expected that most of the stands on the south side of the South Fork of the Coquille River will eventually become infected.

Severe fire scars are present on the old Port-Orford-cedar and Douglas-fir (fig. CO-2). These scars and the scattering of youthful red alder stands are evidence of periodic wildfires in the area prior to the establishment of fire control programs. None appear to have occurred in recent years.

Human disturbance of the area is confined to the road and trail side areas and to the vicinity of Coquille River Falls which receives moderate visitor use.

RESEARCH

There are no research studies in progress on the Coquille River Falls Research Natural Area. Some data on community structure and limited plant collections have been obtained by Forest Service personnel.

This natural area compliments the larger Port Orford Cedar Research Natural Area located about 5 km. (2 miles) to the northwest. Research opportunities include studies of: (1) variation in forest composition, structure, and dynamics under contrasting environmental and stand conditions; and (2) fauna and flora associated with rock outcrops and cliffs found in a major river canyon. The recent and rapidly progressing invasion of the area by *Phytopthora lateralis* makes studies of the communities and the ecological impacts of the pathogen upon them especially timely.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 15' Agness, Oregon quadrangle, scale 1:62,500, issued by the U.S. Geological Survey in 1954; and *geology* - *Description of the Port Orford Quadrangle,* scale 1:250,000 (Diller 1903), *Preliminary Geologic Map of Southwestern Oregon ... ,* scale 1:250,000 (Wells 1955), and *Geologic Map of Oregon West of the 121st Meridian,* scale 1:500,000 (Peck 1961). Either the District Ranger (Powers Ranger District) or

[2] Unpublished cruise data on file at Powers Ranger Station, Siskiyou National Forest, Powers, Oregon.

Forest Supervisor (Siskiyou National Forest, Grants Pass, Oregon) can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

Diller, J. S.
1903. Description of the Port Orford quadrangle. U.S. Geol. Surv. Geol. Atlas of U.S., Folio 89.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

(Oregon) State Water Resources Board
1959. Rogue River Basin. 440 p., illus. Salem.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-39, 96 p., illus.

Wells, Francis G.
1955. Preliminary geologic map of southwestern Oregon west of meridian 122^0 west and south of parallel 43° north. U.S. Geol. Surv. Miner. Invest. Field Stud. Map MF38.

Table CO-1. — Tentative list of mammals for Coquille River Falls Research Natural Area[1]

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	**Scapanus orarius*	coast mole
	Sorex bendirii	marsh shrew
	Sorex pacificus	Pacific shrew
	**Sorex trowbridgii*	Trowbridge shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Arborimus albipes	white-footed vole
	**Arborimus longicaudus*	red tree vole
	Castor canadensis	beaver
	Clethrionomys californicus	California red-backed vole
	Erethizon dorsatum	porcupine
	**Eutamias townsendi*	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus oregoni	Oregon or creeping vole
	**Peromyscus maniculatus*	deer mouse
	**Tamiasciurus douglasi*	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Bassariscus astutus*	ringtail or miner's cat
	Canis latrans	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	**Cervus canadensis roosevelti*	Roosevelt elk
	**Odocoileus h. columbianus*	black-tailed deer

[1] Asterisk (*) indicates habitation verified by sign, sighting, or collection.

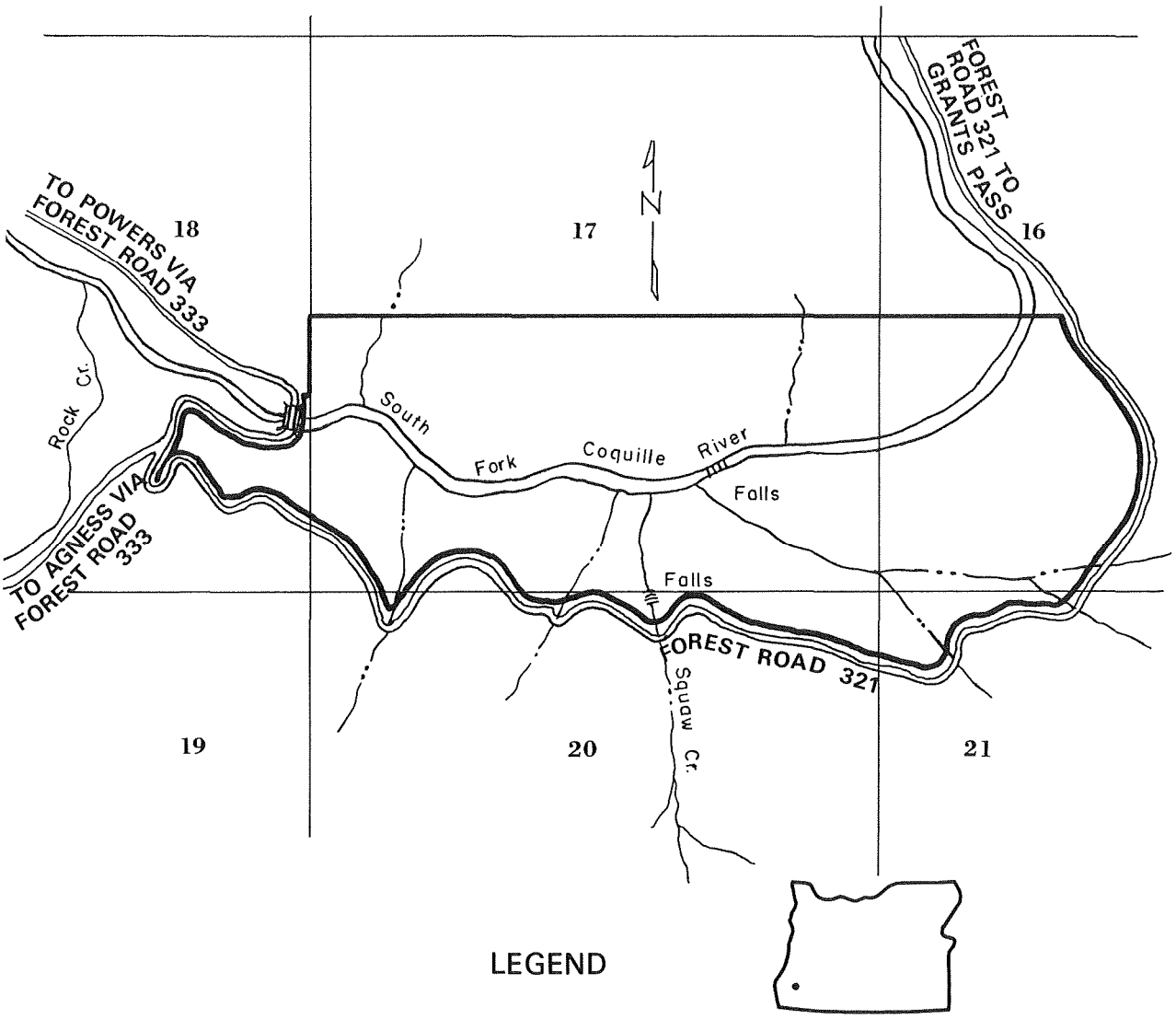
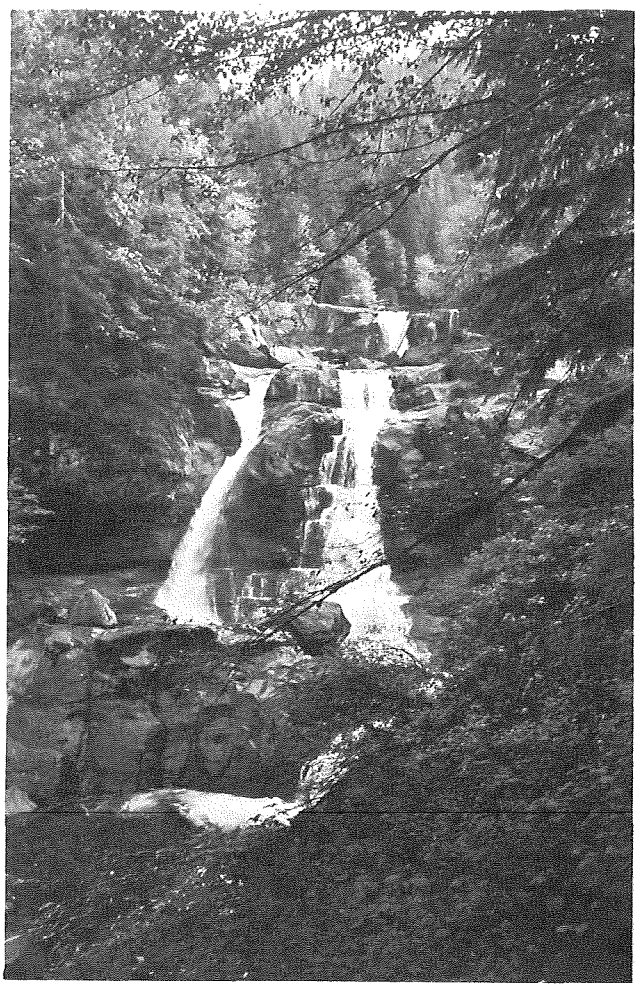


Figure CO-1.– Coquille River Falls Research Natural Area, Coos County, Oregon.

Figure CO-2.-Natural features of the Coquille River Falls Research Natural Area. A: Coquille River Falls near the center of the natural area. B: Fire scar on otherwise vigorous specimen of Port-Orford-cedar; scars are common on old-growth cedars and Douglas-fir within the natural area. C: Grove of old-growth Port-Orford-cedar on a bench near the southern edge of the natural area.

A



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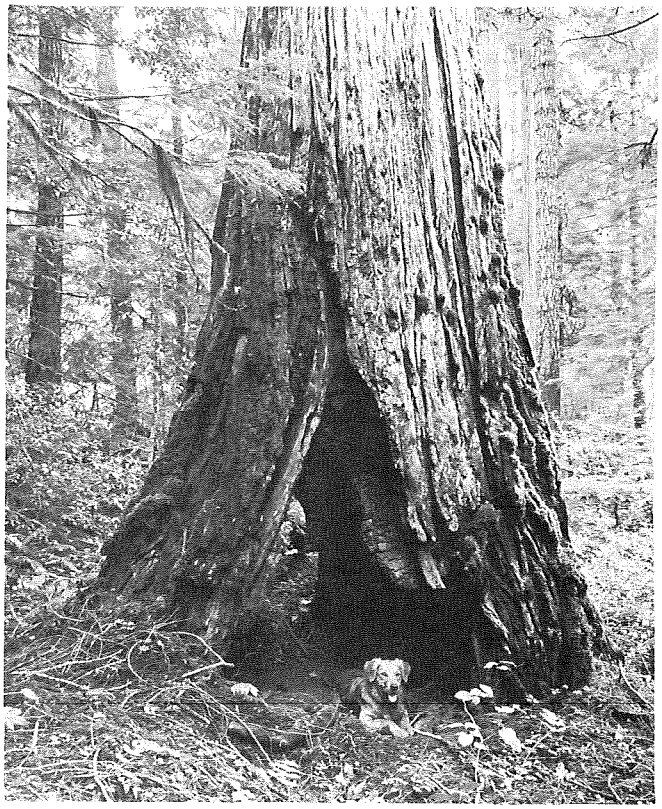
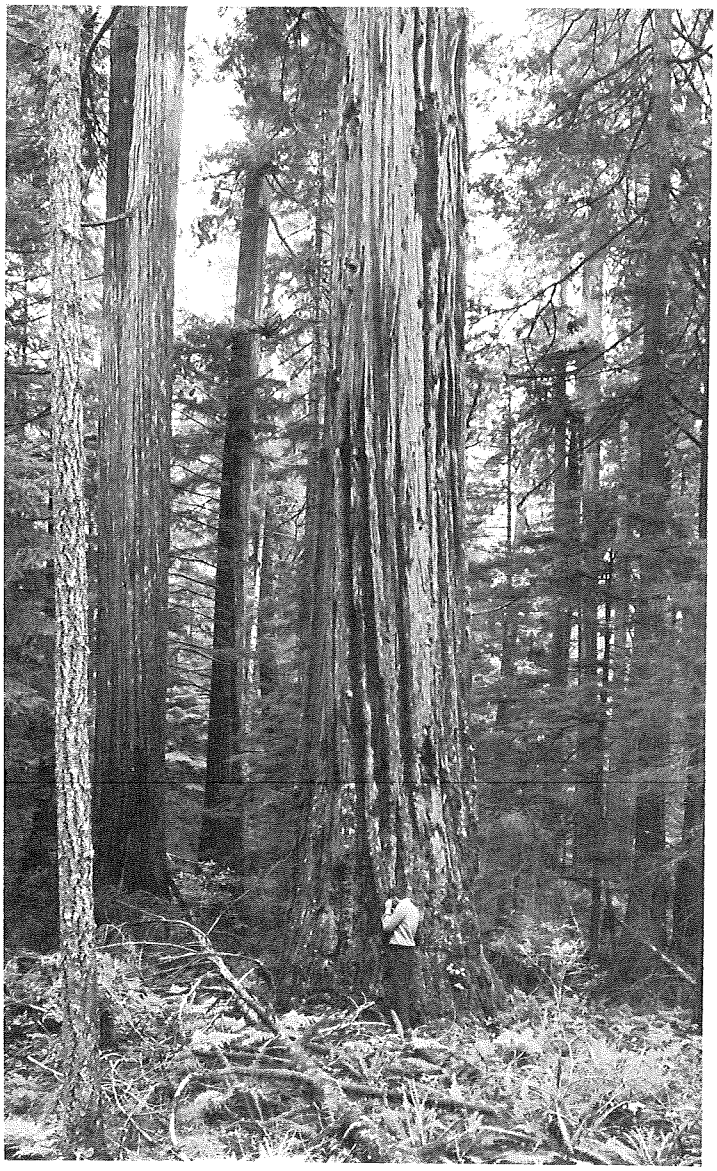


C

Figure CO-2.-Natural features of the Coquille River Falls Research Natural Area (continued). D: Mixed forest of Douglas-fir (left and center background), tanoak (right), and Port-Orford-cedar (center background); note the dense understory of *Polystichum munitum*. E: Typical example of the *Alnus rubra/Polystichum munitum* communities scattered through the southern half of the natural area. F: Typical mature specimen of Port-Orford-cedar.

D

E



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Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

DIAMOND POINT RESEARCH NATURAL AREA[1]

Second-growth western hemlock, Sitka spruce, and red alder growing on an island in a coastal estuary in southwestern Washington.

The Diamond Point Research Natural Area was established as an example of second-growth Sitka spruce *(Picea sitchensis)* - western hemlock *(Tsuga heterophylla)* forest growing on a peninsula in a coastal estuary. The 36-ha. (88-acre) tract is located in Pacific County, Washington, and is administered by the Bureau of Sport Fisheries and Wildlife. It is located at the northern tip of Long Island in Willapa Bay and is part of Willapa National Wildlife Refuge (Ilwaco, Washington). The natural area occupies a portion of the northern half of section 25, T.12 N., R. 11 W., Willamette meridian (fig. DP-1). It lies at 46°29' N. latitude and 123 °59' W. longitude.

ACCESS AND ACCOMMODATlONS

Access to the vicinity is via u.s. Highway 101 to headquarters of the Willapa National Wildlife Refuge, located approximately 21 km. (13 miles) north of Ilwaco, Washington. The headquarters site is opposite the southern end of Long Island, and the Bureau maintains a boat and docking facilities for the 0.5-km. (0.3-mile) trip to the island. On the island there is a limited logging road system which comes within 0.8 km. (0.5 mile) of the southern boundary of the natural area. The sole means of transportation on Long Island is a jeep maintained by the Bureau of Sport Fisheries and Wildlife. An alternative approach is by boat, going from the headquarters dock directly to the natural area - a trip of perhaps 10 to 14 km. (6 to 8 miles). There are no trails in the natural area, so access is by cross-country hiking or walking along the shoreline at low tide.

A wide range of commercial accommodations are available at Ilwaco, Seaview, and Long Beach, about 19 to 22 km. (12 to 14 miles) south of Willapa National Wildlife Refuge headquarters. There are seven public campgrounds on Long Island, all of them reached by boat. One of them - Diamond Point Campground - is actually located within the boundaries of the natural area.

ENVIRONMENT

Topography on the Diamond Point Research Natural Area is, for the most part, composed of moderate slopes along several broad ridges which are interrupted by short drainage channels. There are small areas of steeper slopes, notably along the northwest-facing shore where slopes plunge abruptly to the bay. Elevations range from sea level to just over 30 m. (100 ft.). The natural area is bounded on the east, north, and west by approximately 1.2 km. (3/4 mile) of shoreline.

Geologically the Diamond Point Research Natural Area is made up of marine terraces of Pliocene to Pleistocene age (Huntting et al. 1961). These terraces are characterized by alternating beds of unconsolidated to partly consolidated silt, clay, and sand.

The area has a pronounced cool and wet marine climate. Although a large proportion of the total annual precipitation occurs during the winter, there is sufficient rainfall and foggy weather during the summer to maintain relatively high levels of soil moisture. Not only does fog reduce potential evapo-

[1] Description prepared by Dr. C. T. Dyrness, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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transpiration, it also results in moisture accretion by "fog drip" from tree crowns. Temperature range throughout the year is minimal; winter temperatures are relatively mild and summers tend to be cool. The following climatic data are from the Willapa Harbor Climatic Station (D .S. Weather Bureau 1965):

Mean annual temperature…… 10.6°C. (51.1°F.)
Mean January temperature …… 4.6°C. (40.3°F.)
Mean July temperature ……..... 16.3°C. (61.4°F.)
Mean January minimum temperature …… …….1.2°C. (34.1°F.)
Mean July maximum temperature .. ……..22.0^{0}C. (71.5°F.)
Average annual precipitation ... ……2,156 mm. (84.87 in.)
June through August precipitation.……14H mm. (5.87 in.)

Even though the Willapa Harbor Climatic Station is located about 26 km. (16 miles) northeast of the natural area, climatic conditions should be roughly the same at both locations.

Soils information for the area is from a limited number of observations. Apparently most soils are Sols Bruns Acides with textural profiles largely inherited directly from the stratified parent material. Forest floor layers (01 and 02 horizons) are generally thick, ranging from 13 to 25 cm. (6 to 10 in.) in depth. These layers often contain a large proportion of the total root mass. The surface mineral horizon, averaging about 8 cm. (3 in.) in thickness, consists of very dark brown to black silt loam and obviously contains a large amount of incorporated organic matter. This is underlain by a dark brown, silt loam to silty clay loam horizon which ranges from 13 to 25 cm. (6 to 10 in.) in thickness. The subsoil material may vary from a partially indurated sand to a sticky clay, depending on parent material stratigraphy. In some locations the subsoil shows pronounced mottling, indicating impeded internal drainage.

BIOTA

Estimated areas by SAF cover types (Society of American Foresters 1954) are:

No.	*Name*	*Area*
225	Sitka Spruce - Western Hemlock	18 ha. (45 acres)
224	Western Hemlock	10ha.(25acres)
221	Red Alder	7ha.(18 acres)

The area falls within Kuchler's (1964) Type 1, Spruce-Cedar-Hemlock Forest, and the *Picea sitchensis* Zone of Franklin and Dyrness (1969).

There are only three tree species of any importance in the natural area: red alder *(Alnus rubra)* , Sitka spruce, and western hemlock. Most of the stands appear to be approximately 70 to 80 years old, having resulted from logging of the area some time near the turn of the century. Composition of coniferous stands ranges from Sitka spruce, with minor amounts of hemlock on north and west facing slopes, to pure stands of western hemlock on ridge-tops and south slopes. Tree regeneration under spruce-hemlock stands usually consists of scattered stems of both spruce and hemlock. Red alder also occasionally occurs in small openings. In stands where hemlock is the dominant tree in the over-story, regeneration is dominantly western hemlock with very few Sitka spruce. Pure, even-aged stands of red alder occur in drainage-ways and in low areas along the shoreline.

Tree over-story coverage in coniferous stands varies from about 60 to 75 percent. In the denser alder stands it averages 90 to 100 percent. Typical western hemlock and Sitka spruce trees are from 30- to 46-cm. (12- to 18-in.) d.b.h., with the largest specimens ranging up to 91-cm. (36-in.) d.b.h.

There are two main understory community types in coniferous stands within the natural area: (1) the *Polystichum munitum* type found in moist areas where Sitka spruce is the dominant tree species, and (2) a *Gaultheria shallon* type generally associated with hemlock-dominated timber stands. The *Polystichum* community is characterized by only scattered shrub cover contributed mainly by *Vaccinium parvifolium, V. ovatum, Rhamnus purshiana, Sambucus melanocarpa, and Rubus spectabil1is. Gaultheria shallon,* if present, is often restricted to rotten logs and stumps. The herb layer is dominated by a luxurious growth of *Polystichum munitum* which may cover as much as 80 percent of the ground surface. Other common herbaceous species include *Blechnum spicant, Athyrium filix-femina, Galium triflorum, Pyrola uni-*

flora, Luzula parviflora, Maianthemum bifolium var. *kamtschaticum, Lysichitum americanum, Dryopteris dilatata, Oxalis oregana, Tiarella trifoliata, Trillium ovatum,* and *Monotropa hypopitys.* A heavy growth of moss covers the ground in all coniferous stands. Average moss cover is generally 80 to 90 percent, with *Eurynchium oreganum* probably the most common species.

The *Gaultheria* community is dominated by large amounts of *Gaultheria shallon,* some of it up to 2 m. (6 ft.) in height. Other common shrubs are *Vaccinium parvifolium, V. ovatum, Rhamnus purshiana,* and *Menziesia ferruginea.* The herb layer is scattered and made up of species such as *Polystichum munitum, Blechnum spicant, Dryopteris dilatata, Polypodium scouleri* (both on the ground and as an epiphyte), *Galium triflorum, Luzula parviflora,* and *Osmorhiza nuda.*

The vegetation under pure stands of red alder in drainages and swampy swales is made up of the above mentioned ferns, *Lysichitum americanum, Montia sibirica, Carex* spp., *Cardamine* sp., *Melissa officinalis, Equisetum* sp., and a variety of other moisture-loving species. Several low-lying alder stands adjacent to the bay have an almost pure *Carex* understory which is unusually lush and dense (fig. DP-2).

Mammals believed to utilize the area as either residents or transient visitors are listed in table DP-l. Birds frequenting the area include band-tailed pigeons *(Columba fasciata),* bluegrouse *(Dendragapus obscurus),* and ruffed grouse *(Bonasa umbellus).*

HISTORY OF DISTURBANCE

As previously mentioned, the area was logged some 70 to 80 years ago. Since then, there appears to have been very little additional disturbance by man. There is a small, primitive campground (Diamond Point Campground) reached only by water near the northwestern corner of the area, but so far the user-related disturbances do not extend very far inland. All of Long Island is a big-game, bow-hunting area, and hunters undoubtedly pass through the area, but effects of this use appear negligible. There is, however, considerable evidence of heavy browsing of shrubs and ferns by deer and elk in some of the more open stands.

In 1966 a clear-cut logging operation came close to the southern boundary of the natural area. Because of the lack of natural area boundary markers, it is difficult to tell exactly how much of a buffer, if any, remains between the clear-cut and the natural area.

RESEARCH

No research is currently being conducted in the area and, so far as is known, none has been conducted in the past. The natural area offers a good opportunity for studying the development of young second-growth stands of western hemlock, Sitka spruce, and red alder.

MAPS AND AERIAL PHOTOGRAPHS

Maps covering the natural area are: *Topography* - 15' Fort Columbia, Washington quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1938; 7 1/2' Long Island, Washington quadrangle, scale 1: 31,250, issued by the U.S. Geological Survey in 1949; *geology* - *Geologic Map of Washington,* scale 1:500,000 (Huntting et al. 1961). The Refuge Manager of the Willapa National Wildlife Refuge (Ilwaco, Washington) can provide information on recent aerial photographs and maps.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table DP-1. — Tentative list of mammals for Diamond Point Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex obscurus	dusky shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Ondatra zibethicus	muskrat
	Peromyscus maniculatus	deer mouse
	Tamiasciurus douglasi	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Felis concolor*	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. columbianus	black-tailed deer

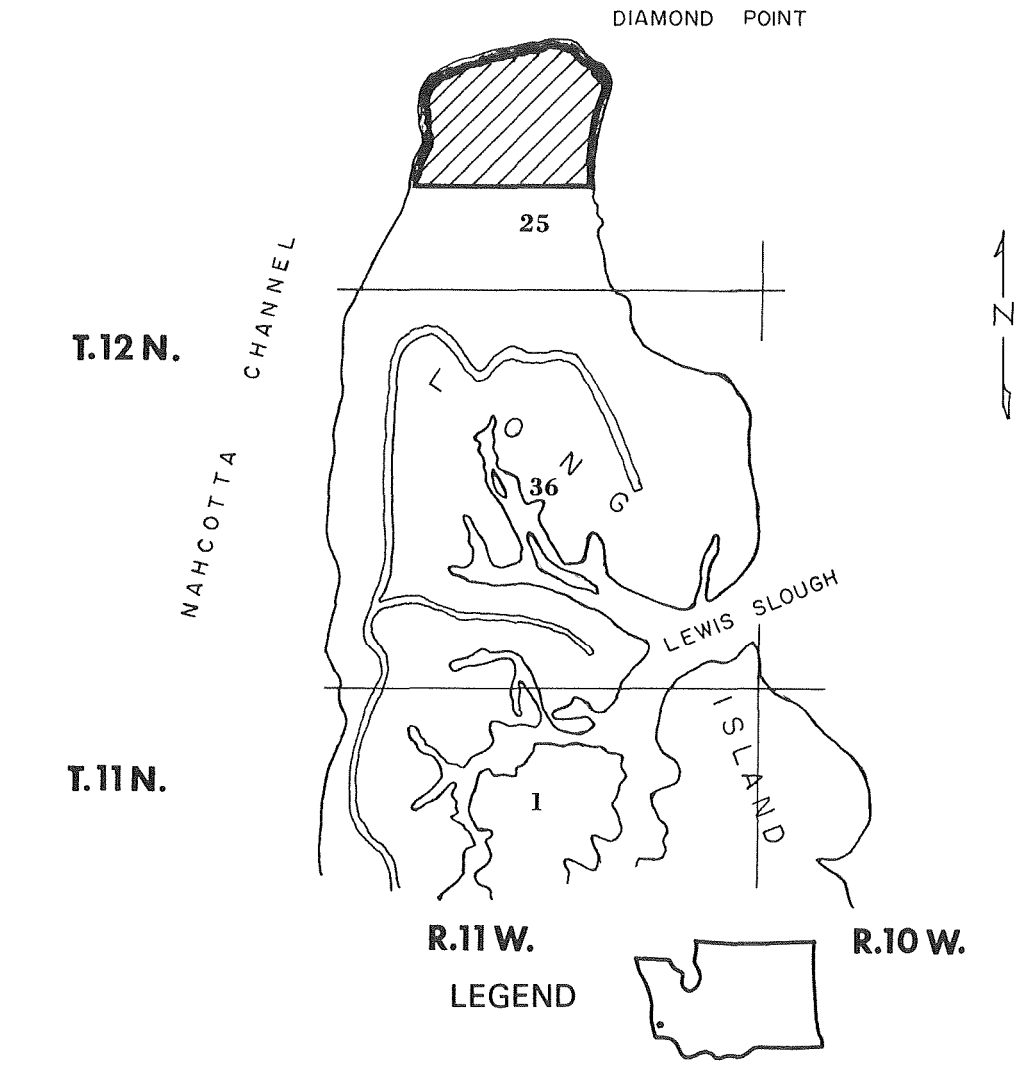

Figure DP-1.– Diamond Point Research Natural Area, Pacific County, Washington.

Figure DP-2.-Communities of the Diamond Point Research Natural Area. Upper left: Shoreline of the natural area near Diamond Point Campground. Upper right: A red alder stand with a dense *Carex* understory. Lower left: Sitka spruce-western hemlock with a *Polystichum munitum* understory in the foreground, grading into a *Tsuga heterophylla/Gaultheria shallon* community in the background. Lower right: *Tsuga heterophylla/Gaultheria shallon* community on a ridge-top.

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

GOLD LAKE BOG RESEARCH NATURAL AREA[1]

Subalpine bog communities and flora and surrounding forest lands near the crest of the Oregon Cascade Range.

The Gold Lake Bog Research Natural Area was established August 10, 1965, to preserve some prime subalpine bogs and several species of rare bog plants. The 188-ha. (463-acre) tract is located in Lane County, Oregon, and is administered by the Oak Ridge Ranger District (Oak Ridge, Oregon), Willamette National Forest. The natural area occupies most of the Sl/2 S1/2 section 20 and N1/2 section 29, T. 22 S., R. 6 E., Willamette meridian. Legal lines provide most of the boundary except for the southeastern quarter, where the boundary follows Skyline Creek and Forest Trail 3681 (Maiden Peak Trail) for a portion of its length (fig. GL-1). The natural area lies at 43^{0}39' N. latitude and 120°01' W. longitude.

ACC ESS AND ACCOMMODATIONS

The natural area lies a short distance north of Willamette Summit on Oregon State Highway 58. There are several easy access routes into the tract. The Waldo Lake Road (Forest Road 204) bounds the northwestern corner of the natural area. The northwestern and southeastern. corners of the tract can be reached by easy hikes from the end of the Gold Lake Road (Forest Road 223), via Forest Trails 3677 or 3681, respectively. The southwestern corner of the tract can also be reached by boat travel across Gold Lake from the Gold Lake Forest Camp. Wet areas, ponds, and stream courses do make cross-country travel through the boggy portions of the natural area somewhat difficult at times.

The nearest commercial accommodations are found at Odell and Crescent Lake, along Oregon State Highway 58 east of Willamette Summit. There are numerous improved forest camps in the vicinity, including one at the outlet of Gold Lake, less than a mile from the natural area.

ENVIRONMENT

The bulk of the research natural area is located in a basin between two mountain slopes at the head of Gold Lake. The topography is essentially flat, except in the northwestern and southeastern corners, where lower mountain slopes have been incorporated within the tract. Three small ponds located within the bog are estimated to total about 1.5 ha. (4 acres). Three major streams (Ray, Salt, and Skyline Creeks) converge and flow through the tract. Elevations range from 1,463 to 1,646 m. (4,800 to 5,400 ft.).

Gold Lake Bog Research Natural Area is located in the volcanic High Cascades. Bedrock is composed of Pleocene-Pleistocene olivine basalt and basaltic andesite (Williams 1957). It is covered by aeolian deposits of volcanic ash and dacitic pumice, much of which came from the Mount Mazama eruption 6,600 years ago.

A cool, wet climate prevails. Most precipitation occurs during the winter months, and much of this accumulates in snow packs which probably attain maximum depths of 2 to 3 m. (6 to 9 ft.) on the average. Summers are relatively dry, and drought periods of 1 to 2 months are not uncommon. Climatic data from a weather station located about

1 Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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8 km. (5 miles) southeast of the natural area at 1,459-m. (4,788-ft.) elevation (Odell Lake Land Pan in U.S. Weather Bureau 1965) are as follows:

Mean annual temperature	4.8°C. (40.6°F.)
Mean January temperature	-3.6°C. (25.6°F.)
Mean July temperature	14.6°C. (58.3°F.)
Mean January minimum temperature	-7.5°C. (18.5°F.)
Mean July maximum temperature	23.7°C. (74.6°F.)
Mean annual precipitation	1,533 mm. (60.37 in.)
June through August precipitation	86 mm. (3.39 in.)
Average annual snowfall	834 cm. (329.00 in.)

Temperatures are somewhat cooler and precipitation higher on the natural area itself; isohyetel maps indicate 1,800 to 2,000 mm. (70 to 80 in.) of precipitation are to be expected on the tract.

Soils within the natural area have not been mapped or described. In upland areas they appear to be nondescript, Brown Podzolic forest soils developed in volcanic ash. Most of the ash is probably from the eruption of Mount Mazama 6,600 years ago. Organic soil profiles are encountered in the low-lying boggy areas.

BIOTA

Approximately 75.7 ha. (187 acres) of the Gold Lake Bog Research Natural Area are occupied by bogs and marshes, 1.6 ha. (4 acres) by ponds, and 117.2 ha. (272 acres) by subalpine forest. The forested acreage can arbitrarily be divided into 58.6 ha. (136 acres) of SAF cover type 206, Engelmann Spruce Subalpine Fir, and 58.6 ha. (136 acres) of type 205, Mountain Hemlock-Subalpine Fir (Society of American Foresters 1954). The Engelmann spruce *(Picea engelmannii)* subalpine fir *(Abies lasiocarpa)* forests tend to occur around the periphery of the bogs and marshes, and the mountain hemlock *(Tsuga mertensiana)* - subalpine fir forests are found in upland portions of the tract. Kuchler (1964) types represented would probably include Fir-Hemlock Forest (4) and Western Spruce Fir Forest (15). The natural area is at the boundary of the *Abies amabilis* and *Tsuga mertensiana* Zones described by Franklin and Dyrness (1969).

The key features of the natural area are the bogs and marshes, but complete descriptions of these communities are not available. Most of the common bog plants occur, including sphagnum moss, *Eriophorum* spp., *Menyanthes trifoliata,* and *Kalmia polifolia.* Five species of carnivorous plants occur within the natural area: *Drosera longifolia, Drosera rotundifolia, Utricularia intermedia, Utricularia minor,* and *Utricularia vulgaris.* Another relatively rare plant, *Scheuchzeria palustris,* is also found in the bogs. The area is believed to incorporate several of the best examples of the sphagnum bogs found in the central Oregon Cascade Range.

The timbered area includes Engelmann spruce, subalpine fir, mountain hemlock, Pacific silver fir *(Abies amabilis),* Shasta red fir *(Abies magnifica* var. *shastensis),* lodgepole pine *(Pinus contorta),* western white pine *(Pinus monticola),* and Douglas-fir *(Pseudotsuga menziesii)* as constituent species. As mentioned, there appear to be two major forest types present. Low-lying forests bordering marshes and bogs are typically dominated by Engelmann spruce and subalpine fir. Reproduction is composed primarily of mountain hemlock and subalpine fir. Engelmann spruce attains diameters of 110 em. (45 in.) b.h. and heights of 50 m. (160 ft.). However, many of the stands have suffered recent mortality, with wind-throw being the most common agent killing the spruce and insects, the subalpine fir. Common understory species are *Viola sempervirens, Chimaphila umbellata, Pyrola secunda, Xerophyllum tenax, Clintonia uniflora, Rubus lasiococcus,* and *Tiarella unifoliata.*

The drier upland forests are very mixed in composition with mountain hemlock, Shasta red fir, Douglas-fir, and western white pine typically most conspicuous. The Shasta red fir and western white pine are usually largest, occasional specimens exceeding 100-cm. (40-in.) d.b.h. and 52 m. (175 ft.) in height. Mountain hemlock and Pacific silver fir often dominate the reproduction. The understory is typically sparse with species such as *Vaccinium membranaceum., V. scoparium,* and *Xerophyllum tenax* present.

Beaver *(Castor canadensis)* are probably the most important animals influencing natural processes within the natural area. They have developed dams and runways in some marshy areas (fig. GL-2). The natural area is used as summer range by elk *(Cervus canadensis),* blacktail deer *(Odocoileus hemionus columbianus),* and mule deer *(Odocoileus hemionus).* Badger *(Taxidea taxus neglecta)* have also been observed within the tract; their occurrence west of the summit of the Cascade Range is unusual. A complete list of mammals believed to utilize the natural area is provided in table GL-l. Birds commonly found within the natural area include blue grouse *(Dendragapus Obscurus),* mountain quail *(Oreortyx pictus),* mourning doves, *(Zenaidura macroura),* band-tailed pigeons *(Columbia fasciata),* mallard ducks *(Anas platyrhyncos),* and wood ducks *(Aix sponsa).* Gold Lake is stocked with rainbow trout which have moved up into the ponds and streams within the natural area.

Several species of amphibians are known to inhabit Gold Lake Bog. The Cascade frog *(Rana cascadae)* is found near the exterior of the bog, and the western spotted frog *(Rana pretrosa)* inhabits the interior of the bog. These two closely related species are probably genetically compatible in their ability to hybridize. The northwestern tree toad *(Hyla regilla)* is also found within the area.

HISTORY OF DISTURBANCE

The major human disturbance to the natural area has been the removal of beaver dams from the main stream channel by the Oregon State Game Commission to provide access for spawning rainbow trout from Gold Lake. Since the dams appear to be of major importance in maintaining high water levels in the marshes and bogs, this practice has been discontinued since establishment of the natural area. Beaver populations have reportedly decreased considerably in the last few years, a possible consequence of trapping which is not yet prohibited on the tract. Recreationists have caused some minor disturbances; these are confined primarily to trailside areas.

Open grasslands above the bog have been used as a base camp for hunters in the late fall, however. Such use is now prohibited, and public recreational use of the bogs and marshes is discouraged.

Wildfires have undoubtedly occurred over the natural area in past centuries; however, there is no evidence of recent wildfires.

RESEARCH

Some research on plant communities[2] and amphibian fauna[3] have been carried out within the natural area.

The natural area is, of course, particularly valuable as a site for the study of the ecology of bog and marsh communities and the fauna associated with them. It provides a refugium for the protection of six uncommon species of bog plants and a site for studying the environmental (habitat) and breeding relationships of two species of frogs. The natural area is also well suited to studies of variation in composition, structure, and productivity of forest communities along an environmental gradient extending from wet, low-lying to dry, upland areas.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* 15' Waldo Lake, Oregon quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1956; and *geology - Geologic Map of Oregon West of the 121st Meridian,* scale 1: 500,000 (Peck 1961), and *Geolog1ic Map of the Central Part of the High Cascade Range, Oregon* (Williams 1957), Either the District Ranger (Oak Ridge Ranger District) or Forest Supervisor (Willamette National Forest, Eugene, Oregon) can provide details on the most recent aerial coverage and forest type maps for the area.

[2] Research by Dr. John Rumley, Montana State University, Bozeman.

[3] Research by Dr. James Kezar, Department of Biology, University of Oregon, Eugene.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., mus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31, 96 p., illus.

Williams, Howel
1957. A geologic map of the Bend quadrangle, Oregon and a reconnaissance geologic map of the central portion of the High Cascade Mountains. Oreg. State Dep. Geol. & Min. Ind.

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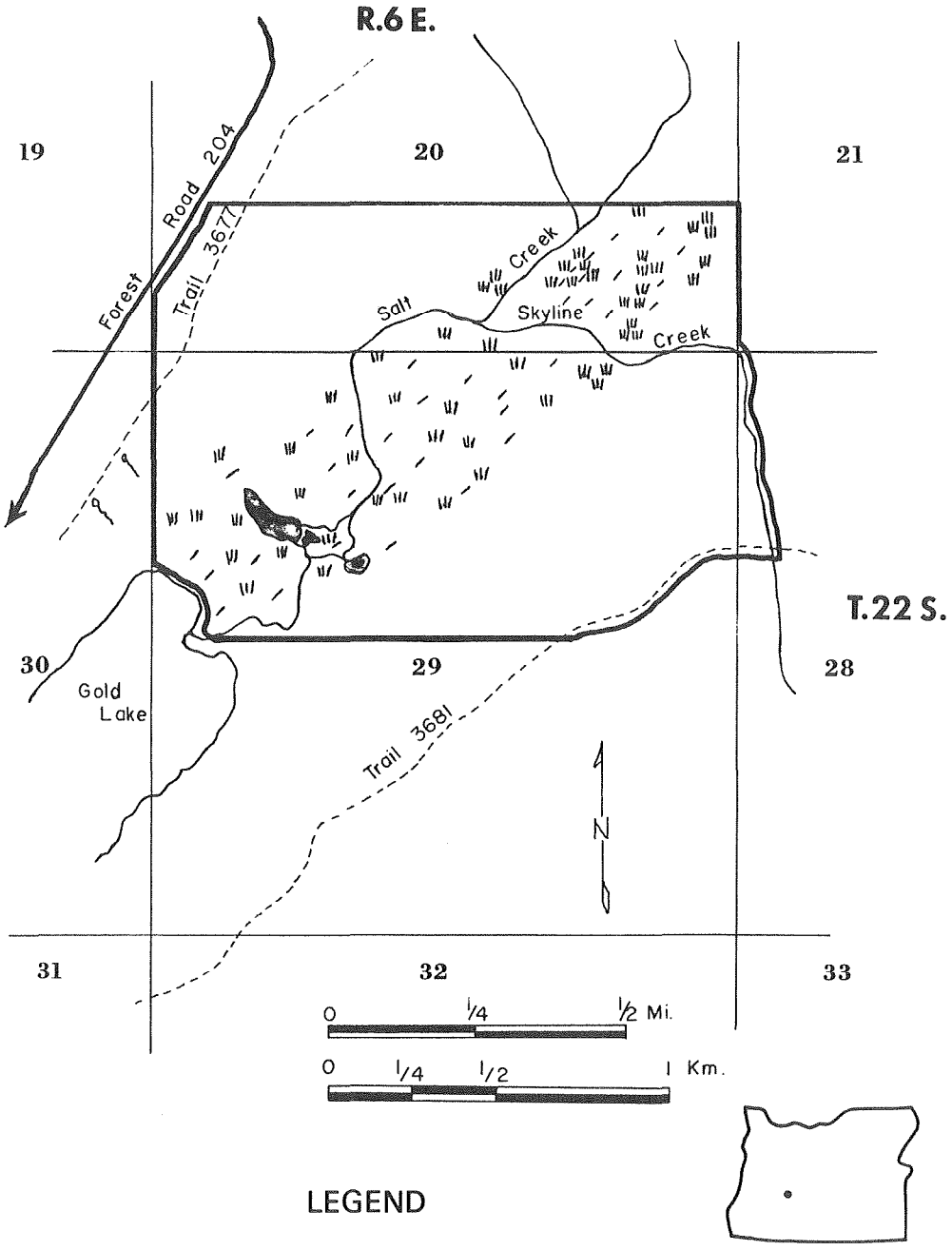
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Arborimus longicaudus	white-footed vole
	Castor canadensis	beaver
	Clethrionomys californicus	California red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus richardsoni	Richardson vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys mazama	Mazama pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Canis lupus	wolf
	Felis concolor	mountain lion or cougar
	Gulo luscus	wolverine
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Taxidea taxus	badger
	Urocyon cinereoargenteus	gray fox
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer
	Odocoileus h. columbianus	blacktail deer

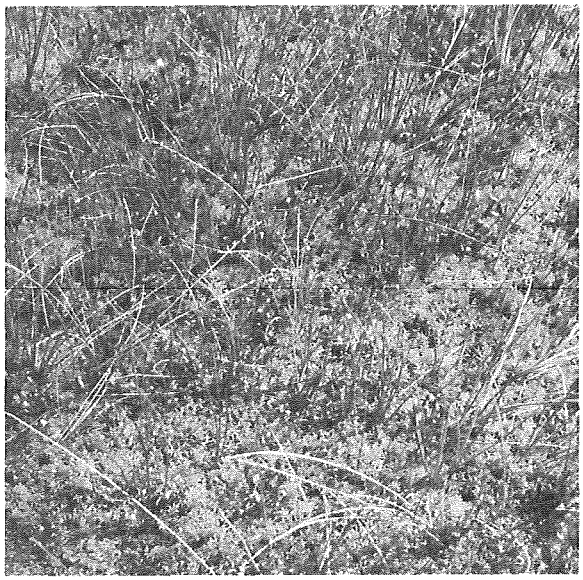


LEGEND

- BOUNDARY, GOLD LAKE BOG RESEARCH NATURAL AREA
- SECTION LINE
- STREAM
- MARSH AND GRASSLAND
- ROAD
- TRAIL

Figure GL-1.– Gold Lake Bog Research Natural Area, Lane County, Oregon.

Figure GL-2. -Natural features of Gold Lake Bog Research Natural Area. Upper left: Typical bog community in which two species of *Drosera* and three of *Utricularia* are found. Upper right: Open forest association of Engelmann spruce and lodgepole pine typical of areas in and around the bogs and ponds. Center left and right:
Ponds within the natural area showing typical subalpine mixed-conifer forests on surrounding slopes; note abundant water lilies. Lower left: Beaver dam within the Gold Lake Natural Area; the Oregon State Game Commission no longer removes such dams. Lower right:
Beaver runways are common in some marshy areas.



Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

GOODLOW MOUNTAIN RESEARCH NATURAL AREA[1]

A tract spanning the transition from sagebrush steppe through open ponderosa pine savanna to ponderosa pine - white fir forest characteristic of south-central Oregon.

The Goodlow Mountain Research Natural Area was established May 1942 to exemplify the transition from sagebrush *(Artemisia* spp.) steppe through open ponderosa pine *(Pinus ponderosa)* savanna to ponderosa pine - white fir *(Abies concolor)* forest along an east-west elevational gradient. The 510-ha. (1,260-acre) tract is located in Klamath County, Oregon, and is administered by the Bly Ranger District (Bly, Oregon), Fremont National Forest. Its rectangular shape is oriented east and west (fig. GM-1) encompassing part of section 4, all of section 5, and part of section 6, T. 39 S., R. 13 E., Willamette meridian, at 45° 10' N. latitude and 121°15' W. longitude.

ACCESS AND ACCOMMODATIONS

The natural area is located about 71 km. (43 miles) east of Klamath Falls, Oregon. It is reached most readily by following State Highway 140 for 43.5 km. (27 miles) to Bonanza Junction at the foot of Bly Mountain; thence south for 3 km. (2 miles) on State Highway 70 to its junction with Forest Road 3726; thence east on Road 3726 for 11 km. (7 miles) to its junction with Forest Road 384; and south on Road 384 for 11 km. (7 miles) to the natural area. Although the tract can be reached from Bly, Oregon, the road is in very poor condition and should be avoided if possible.

1 Description prepared by Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

ENVIRONMENT

The Goodlow Mountain Research Natural Area varies in elevation from 1,490 to 1,620 m. (4,900 to 5,300 ft.). Topography is gently rolling to rolling with slopes of 10 to 20 percent. Goodlow Mountain is a low butte at the edge of the sagebrush steppe. The natural area extends from the summit of Goodlow Mountain to the forest edge. The butte is igneous rock of volcanic origin.

A continental climate prevails. Most precipitation occurs as snow during the cool, partly cloudy winter. Summers are warm, generally low in precipitation, and largely cloudless. One to 3 months of drought are common. Climatic data from Round Grove located 29 km. (18 miles) east-northeast of the natural area are as follows (U .S. Weather Bureau 1965):

Mean annual temperature	6.4°C. (43.5°F.)
Mean January temperature	-2.8°C. (27.0°F.)
Mean July temperature	16.8°C. (62.3°F.)
Mean January minimum temperature	-8.8°C. (16.1°F.)
Mean July maximum temperature	27.4°C. (83.1°F.)
Average annual precipitation	419 mm. (16.5 in.)
June through August precipitation	56 mm. (2.2 in.)
Average annual snowfall	119 cm. (47.0 in.)

Soils in the area have not been mapped. Reconnaissance notes suggest that, under forested stands, upper horizons contain aerially deposited pumice presumably from the Mount Mazama (now Crater Lake) eruption (Baldwin 1964). They tend to have minimum profile development and are not podzolized. Soils under juniper and sagebrush-grass appear to be derived from igneous rock.

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BIOTA

Estimated areas by plant community are as follows:

Community	*Area*
Pinus ponderosa/ Purshia tridentata savanna	89 ha. (220 acres)
Pinus ponderosa/ Arctostaphylos parryana	218 ha. (540 acres)
Pinus ponderosa-Abies concolor/ Carex rossii	130 ha. (320 acres)
Juniperus occidentalis/ Artemisia tridentata	40 ha. (100 acres)
Artemisia arbuscula/ Poa sandbergii	32 ha. (79 acres)

Pinus/Purshia and *Pinus/Arctostaphylos* stands are probably assignable to SAF forest cover type 237, Interior Ponderosa Pine (Society of American Foresters 1954), and Kuchler's (1964) Type 10, Ponderosa Pine Shrub Forest. The *Pinus-Abies/Carex* stands are possibly assignable to SAF type 214, Ponderosa Pine - Western Larch - Douglas Fir, and to Kuchler's Type 14, Grand Fir Douglas-Fir Forest, even though Douglas-fir is not present in this part of Oregon. *Juniperus/Artemisia* stands are assignable to SAF type 238, Western Juniper, and Kuchler's Type 24, Juniper Steppe Woodland. The *Artemisia/Poa* stands are assignable to Kuchler's Type 55, Sagebrush Steppe. The natural area spans upper elevation edges of sagebrush steppe, the ponderosa pine zone, and the lower edge of the white fir zone.

At lower elevations (1,490 m. or 4,900 ft.), *Juniperus/Artemisia* stands occur. These plant communities are dominated by western juniper *(Juniperus occidentalis),* big sagebrush *(Artemisia tridentata),* and Idaho fescue *(Festuca idahoensis).* The *Artemisia/Poa* stands occur on shallow to very shallow soils and reflect these edaphic restraints. They are dominated by low sagebrush *(Artemisia arbuscula)* and Sandberg bluegrass *(Poa sandbergii).* Soil conditions are inimical to both juniper and ponderosa establishment (fig. GM-2). Where soils are deeper, Idaho fescue tends to dominate.

A small meadow complex, about 1 ha. (2 acres) in size, occurs at the eastern edge of the natural area. It is unique in that a moist meadow is located topographically above a dry meadow.

The *Pinus/Purshia* stands are characteristic of the lowest forested elevations and represent savanna transitional to sagebrush steppe. They are dominated by ponderosa pine with a crown cover of 20 to 40 percent. Ground vegetation is generally dominated by bitterbrush *(Purshia tridentata)* and Ross's sedge *(Carex rossii)* with curlleaf mountain-mahogany *(Cercocarpus ledifolius)* and a variety of Compositae spp. as associates (fig. GM-2). Mid-elevations are characterized by ponderosa pine of 30- to 50-percent crown cover with Parry manzanita *(Arctostaphylos parryana)* and occasional bitterbrush with sedge (fig. GM-2). Upper elevations are characterized by old-growth ponderosa pine with seedlings, saplings, and poles, and occasionally mature trees of white fir. Tree crown cover ranges from 40 to 70 percent. Ground vegetation is dominated by Ross's sedge with minor amounts of Parry manzanita (fig. GM-2).

Mammals which frequent the natural area either as residents or transients are listed in table GM-l.

HISTORY OF DISTURBANCE

Fire scars on ponderosa pine (fig. GM-2) indicate ground fires periodically burned the area prior to initiation of fire control programs in 1910. Ranger District records document a ground fire between 1920 and 1930. In addition, a severe fire in 1918 (known as the Goodlow Mountain Burn) burned over 16 ha. (41 acres) of the southwestern corner of the natural area and killed 100 percent of the timber. A very dense stand of pine reproduction is now present in this area.

Prior to establishment of the natural area, an 800-ewe band of sheep grazed the tract periodically from the middle of June to the end of August. Ranger District records indicate this livestock use was light to moderate and should not have materially affected vegetation. Sheep use is now terminated.

RESEARCH

The Bureau of Entomology and Plant Quarantine has been studying bark beetle activity in section 5 since 1922. Between 1938 and 1940, two 10-acre plots were established in which all trees of 10-inch and larger d.b.h. were tagged, recorded, and fully described. These permanent plots are still under observation.

The Goodlow Mountain Research Natural Area provides interesting research opportunities on: (1) comparison of undisturbed vegetation across the geographic range of the aerially deposited Mount Mazama pumice in conjunction with Bluejay and Pringle Falls Research Natural Areas in the center and at the northern edge of the pumice deposit, respectively; (2) evaluation of environmental and plant community relationships from sagebrush steppe to mixed coniferous forest; (3) biomass productivity in relation to the environmental gradient; and (4) study of forest succession under fire prevention.

MAPS AND AERIAL PHOTOGRAPHS

No special topographic or geologic maps are available for the natural area which are sufficiently detailed to be useful. Either the District Ranger (Bly Ranger District) or Forest Supervisor (Fremont National Forest, Lakeview, Oregon) can provide details on the most recent aerial photo coverage of the area.

LITERATURE CITED

Baldwin, Ewart M.
1964. Geology of Oregon. Ed. 2, 165 p., illus. Eugene: Univ. Oreg. Coop. Bookstore.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Pub I. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31, 96 p., illus.

Table GM-1. — Tentative list of mammals for Goodlow Mountain Research Natural Area

Order	Scientific name	Common name
Insectivora	*Scapanus latimanus*	broad-footed mole
	Sorex merriami	Merriam shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus californicus*	black-tailed jack rabbit
	Sylvilagus nuttalli	mountain cottontail
Rodentia	*Erethizon dorsatum*	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Lagurus curtatus	sage vole
	Microtus montanus	mountain vole
	Neotoma cinerea	bushy-tailed wood rat
	Neotoma fuscipes	dusky-footed wood rat
	Peromyscus maniculatus	deer mouse
	Sciurus griseus	western gray squirrel
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus douglasi	chickaree
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx rufus	bobcat
	Martes americana	marten
	Mephitis mephitis	striped skunk
	Mustela frenata	long-tailed weasel
	Spilogale putorius	spotted skunk or civet cat
	Taxidea taxus	badger
	Urocyon cinereoargenteus	gray fox
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Odocoileus h. hemionus*	mule deer

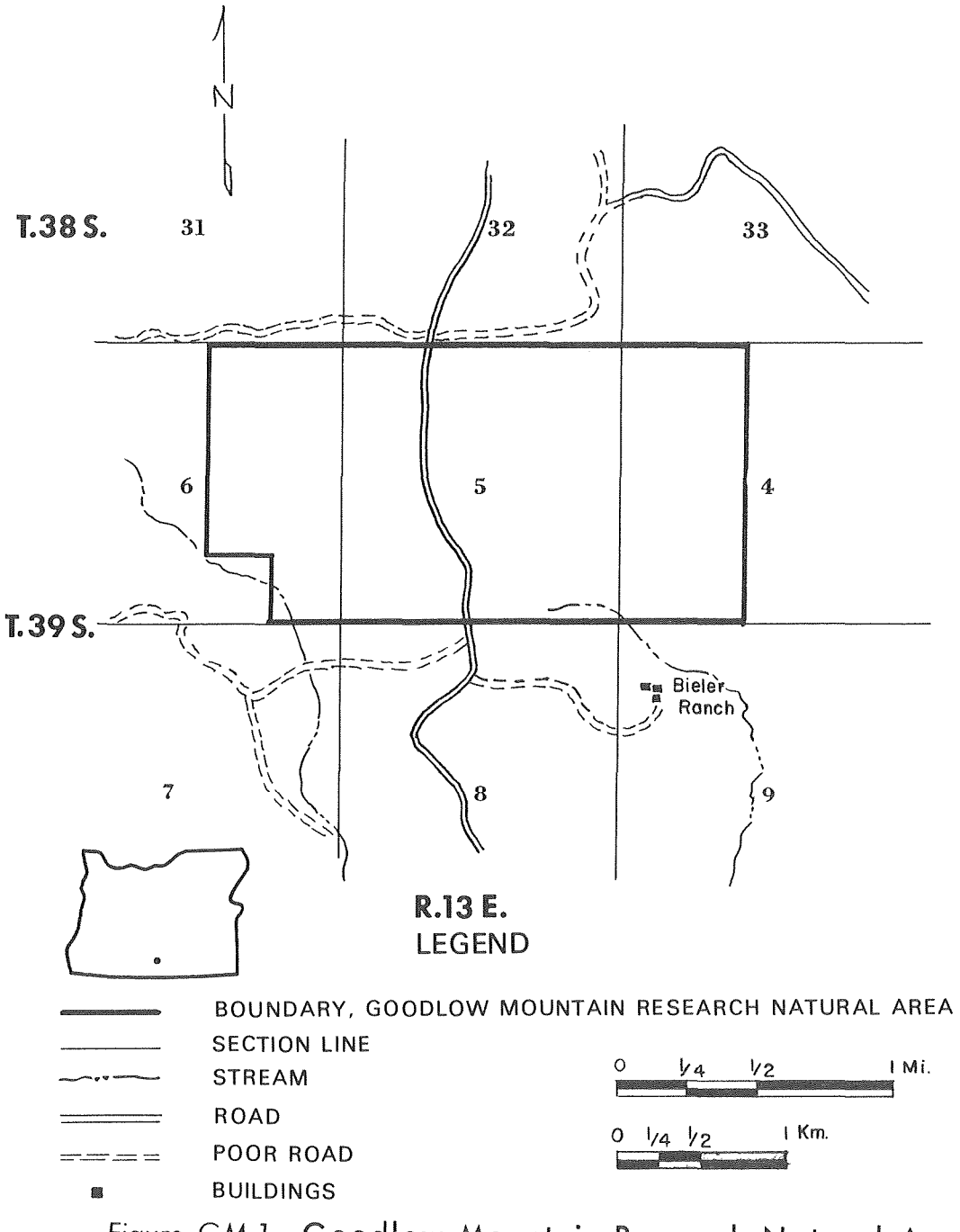

Figure GM-1.– Goodlow Mountain Research Natural Area, Klamath County, Oregon.

Figure GM-2.-Communities of the Goodlow Mountain Research Natural Area. Upper left: *Artemisia arbuscula/Poa Sandbergii* community with some Idaho fescue on shallow soil. Upper right: The *Pinus ponderosa/Purshia tridentata* community with some curl leaf mountain-mahogany is typical of lower elevations. Lower left: A *Pinus ponderosa/Arctostaphylos parryana* community typical of middle elevations. Lower right: *Pinus ponderosa-Abies concolor/Carex rossii* community characteristic of upper elevations; note fire scar on the tree left of the meter board.

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

HADES CREEK RESEARCH NATURAL AREA[1]

Pacific silver fir-western hemlock stands located at low elevations on the northwestern edge of the Olympic Peninsula.

The Hades Creek Research Natural Area was established to exemplify Pacific silver fir *(Abies amabilis)* - western hemlock *(Tsuga heterophylla)* forest as it occurs at lower elevations in the Olympic Mountains. The 227-ha. (560-acre) tract is located in Jefferson County, Washington, and is administered by Olympic National Park (Port Angeles, Washington). The natural area occupies the S 1/2 and S 1/2 NW1/4 of section 5 and N1/2 N1/2 of section 8, T. 27 N., R. 11 W., Willamette meridian. It lies at 47°52' N. latitude and 124°09' W. longitude.

ACCESS AND ACCOMMODATIONS

The natural area is reached via the Bogachiel River Road (which leaves U.S. Highway 101 about 10 km. or 6 miles south of Forks) and the Bogachiel River Trail. The tract is located about 10 km. (6 miles) from the end of the road near the Bogachiel Shelter; it is necessary to ford the river about 1/4 mile above the shelter since it is on the north side of the river and the natural area is on the south. The natural area is located on slopes west of Hades Creek (fig. HA-l). An abandoned trail extends from the river to the summit of Spruce Mountain and traverses a large part of the natural area.

Commercial accommodations are, of course, quite remote, the nearest being located in the vicinity of Forks, which is several hours away by trail and road. There are numerous good camp spots along the Bogachiel River in the vicinity of the natural area. When camping in undeveloped areas, one must obtain a fire permit from the Park Service.

ENVIRONMENT

Hades Creek Research Natural Area occupies the top and slopes of a spur ridge on the lower slopes of Spruce Mountain and extends down to the benches along the Bogachiel River. Moderately steep slopes are typical except along the southern edge of the natural area, where the topography drops steeply into the drainage of Hades Creek. The gentlest slopes are found on the benches just above the Bogachiel River. Elevations in the natural area range from about 145 to 582 m. (475 to 1,910 ft.) .

The natural area is located on upper Cretaceous - lower Tertiary sedimentary rocks belonging to the Soleduck formation (Huntting et al. 1961). This formation developed from marine sediments which were intensely folded and faulted and slightly metamorphosed (Danner 1955). The dominant, dark gray, massive to poorly bedded graywackes and sandstones are commonly interbedded with slate, argillite, and volcanic rock. The natural area was glaciated at least three times during the Wisconsin epoch and at least once even earlier (Crandell 1964).

A maritime climate, wet with muted temperature extremes, prevails. Winters are mild, and summers are cool with frequent cloudy days. Precipitation is heavy but highly seasonal, with January and December the peak months. Less than 10 percent of the annual

1 Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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precipitation falls during June, July, and August, and some years a drought period of a month or more occurs. The following climatic data are from Forks, located about 19 km. (12 miles) to the northwest; temperatures are somewhat cooler and precipitation slightly higher on the natural area itself (U .S. Weather Bureau 1965):

Mean annual temperature	9.55°C. (49.2°F.)
Mean January temperature	3.72°C. (38.7°F.)
Mean July temperature	15.39°C. (59.7°F.)
Mean January minimum temperature	0.17°C. (32.3°F.)
Mean July maximum temperature	21.55°C. (70.8°F.)
Average annual precipitation	2,974 mm. (117.10 in.)
June through August precipitation	214 mm. (8.44 in.)
Average annual snowfall	34 cm. (13.7 in.)

The soils on the area have not been mapped or described. At least a portion would probably be classed as Sols Bruns Acides.

BIOTA

All 227 ha. (560 acres) of the natural area can be classified as SAF cover type 226, Pacific Silver Fir - Western Hemlock (Society of American Foresters 1954). The area would probably fall within Kuchler's (1964) Type 3, Silver Fir - Douglas-fir Forest, and the *Tsuga heterophylla* Zone as defined by Franklin and Dyrness (1969). A zonal assignment is difficult for this area since it is occupied by forests which are more typically found at much higher elevations.

Pacific silver fir and western hemlock dominate the Hades Creek Research Natural Area. The relative proportion of the tree species varies considerably throughout the tract. For example, silver fir composes about 80 percent of the stand volume on the ridge-top but only 20 percent near Hades Creek on the south side of the area and on the north end. The bulk of the area varies from about a 60-40 to a 50-50 mixture of Pacific silver fir and western hemlock, respectively. Pacific silver fir within the natural area averages 75- to 90-cm. (30- to 35-in.) d.b.h. and 46 to 53 m. (150 to 175 ft.) in height. The largest known Pacific silver fir specimen, which is 56.7 m. (186 ft.) in height and about 208- cm. (82-in.) d.b.h. is located within the natural area (Pomeroy and Dixon 1966) (fig. HA-2). Occasional large, old-growth Douglas-fir *(Pseudotsuga menziesii* and western red-cedar *(Thuja plicata)* are also found throughout the natural area.

The major climax tree species within the natural area appears to be western hemlock. Seedlings and saplings of this species are typically much more common than those of Pacific silver fir, especially on drier sites. This is, of course, in direct contrast with the successional relationship between these species at middle and high elevations in the Olympic and Cascade Mountains (Fonda and Bliss 1969, Franklin and Dyrness 1969). Pacific silver fir is probably at least a minor climax species, as at least some reproduction of this species is present in most locations.

At least two major community types occur within the natural area: the *Tsuga heterophylla - Abies amabilislGaultheria shallon Vaccinium parvifolium/Hylocomium splendens* and *Abies amabilis/Tsuga heterophylla/Maianthemum bifolium* communities. The *Tsuga/Gaultheria/Hylocomium* community is typical of lower elevations and drier slopes within the natural area. Understory plant species include: *Gaultheria shallon, Viola sempervirens, Acer circinatum, Blechnum spicant, Vaccinium parvifolium,* and *Eurhynchium Oreganum.* The *AbieslTsuga/Maianthemum* community appears to be typical of moister habitats within the natural area. The understory is dominated by herbaceous species such as *Maianthemum bifolium* var. *kamschaticum, Rubus pedatus, Oxalis oregana, Polystichum munitum, Disporum* sp., *Blechnum spicant, Tiarella trifoliata,* and *Trillium ovatum.*

Mammals believed to utilize the natural area either as residents or transients are listed in table HA-l.

Streams and streamsides are the only specialized habitats known to occur within the natural area.

HISTORY OF DISTURBANCE

There is no evidence of any unusual natural disturbance of the area during recent cen-

turies. Natural mortality such as that caused by wind-throw is scattered throughout the tract.

Human disturbances to the natural area are very minor. An abandoned trail was constructed and used during World War II to supply an air-warning station on Spruce Mountain.

RESEARC H

Ten Pacific silver fir "trend plots" were established on the natural area in 1954 to observe annual mortality of Pacific silver fir and western hemlock, particularly that associated with the silver fir beetle *(Pseudohylesinus* Spp.).[2] At the time of the first remeasurement in 1958, mortality of Pacific silver fir had been negligible (Buckhorn and Orr 1959).

The natural area provides interesting opportunities to study the ecology of low-elevation Pacific silver fir - western hemlock stands, e.g., the successional relationships between these tree species including variations associated with different types of microhabitats.

[2] "Silver fir beetles" is a local name given to two species of *Pseudohylesinus: P. grandis,* the grand fir bark beetle, and *P. granulatus,* the fir root bark beetle.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 15' Spruce Mountain, Washington quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1956, and Olympic National Park and Vicinity, Washington, scale 1: 125,000, issued by the U.S. Geological Survey in 1957; and *geology* - *Geologic Map of Washington,* scale 1:500,000 (Huntting et al. 1961). The Superintendent, Olympic National Park (Port Angeles, Washington), can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

Buckhorn, W. J., and P. W. Orr
1959. Forest insect conditions in the Pacific Northwest during 1959. Pac. Northwest Forest & Range Exp. Stn. USDA Forest Serv., 37 p., illus.

Crandell, Dwight R.
1964. Pleistocene glaciations of the southwestern Olympic Peninsula, Washington. U.S. Geol. Surv. Prof. Pap. 501B:B135-B139, illus.

Danner, Wilbert R.
1955. Geology of Olympic National Park. 68 p., illus. Seattle: Univ. Wash. Press.

Fonda, R. W., and L. C. Bliss
1969. Forest vegetation of the montane and subalpine zones, Olympic Mountains, Washington. Ecol. Monogr. 39: 271-301, illus.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Pomeroy, Kenneth B., and Dorothy Dixon 1966. These are the champs. Am. Forests 72(5): 14-35, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, *D.C.*

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table HA-1. — Tentative list of mammals for Hades Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex obscurus	dusky shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Tamiasciurus douglasi	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis roosevelti*	Roosevelt elk
	Odocoileus h. columbianus	black-tailed deer

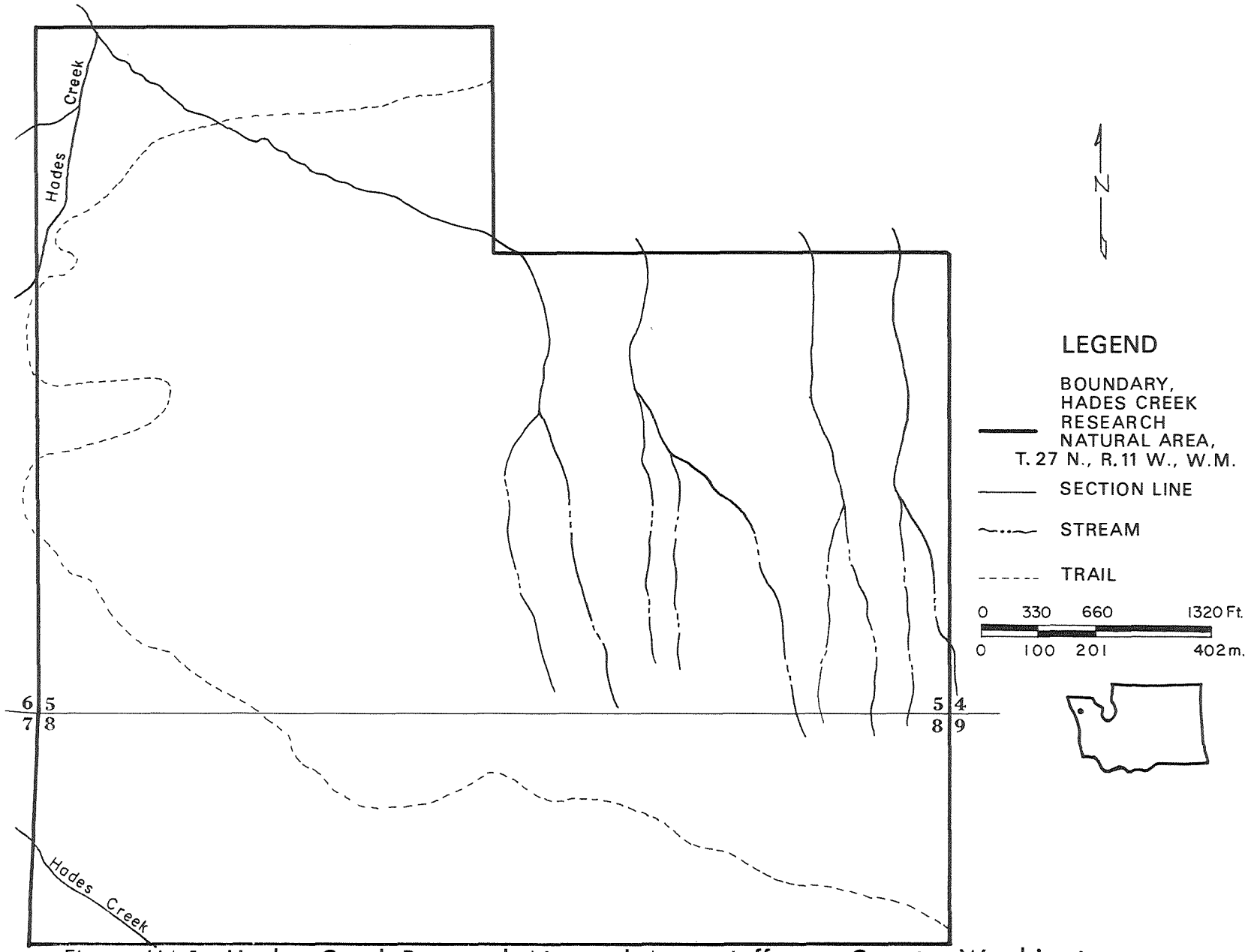

Figure HA-1.– Hades Creek Research Natural Area, Jefferson County, Washington.

Figure HA-2.-Natural features of the Hades Creek Research Natural Area. Upper left: Base of largest known Pacific silver fir, 2G8-cm. (82-in.) d.b.h. and 56.7 m. (186 ft.) in height. Upper right: Upper stem and crown of same Pacific silver fir and its associates. Bottom: Typical mixed community of Pacific silver fir and western hemlock; the relatively sparse understory here is dominated by herbaceous plants.

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HIGLEY CREEK RESEARCH NATURAL AREA[1]

Western hemlock stands on a mountain slope and valley bottom on the southwestern Olympic Peninsula.

The Higley Creek Research Natural Area was established to exemplify coastal western hemlock *(Tsuga heterophylla)* forest stands. The 194-ha. (480-acre) tract is located in Grays Harbor County, Washington, and is administered by the Olympic National Park (Port Angeles, Washington). The natural area occupies the S1/2 and the S1/2 N1/2, section 12, T. 23 N., R. 10 W., Willamette meridian. It lies at 47°30' N.latitude and 123°54' W.longitude.

ACCESS AND ACCOMMODATIONS

The natural area is located near Lake Quinault and can be reached via U.S. Highway 101 (to Amanda Park) and the North Shore Road along the lake. The edge of the tract varies from 750 to 1,200 m. (2,500 to 4,000 ft.) north of this road. An abandoned trail leads up Higley Creek from this road skirting the natural area; its obscure terminus is located behind a house 2.7 km. (1.7 miles) from U.S. Highway 101 or 6.9 km. (4.3 miles) west of the National Park Service's Quinault Ranger Station. No roads or maintained trails enter the tract. Access is by cross-country travel.

Commercial accommodations, as well as several excellent public campgrounds, are located 3 to 8 km. (2 to 5 miles) from the natural area in the vicinity of Amanda Park and Quinault.

[1]Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

ENVIRONMENT

The Higley Creek Research Natural Area extends from the floor of the Quinault River valley onto the lower slopes of Higley Peak (fig. HI-I). Topography is gentle and undulating for 300 to 800 m. (1,000 to 2,500 ft.) from the southern boundary of the tract and then rises steeply to the northern boundary. The broken mountain slopes typically vary from 30 to 50 percent and have a generally southern exposure. Several streams flow through portions of the natural area, and several smaller streams rise within it. Drainages cut by these streams produce locally complex microtopography in the southern half of the tract. Elevations range from about 120 m. (400 ft.) in the southwestern corner to 550 m. (1,800 ft.) in the northwestern corner.

According to Huntting et al. (1961), higher elevations in the natural area are located on upper Cretaceous - lower Tertiary sedimentary rocks belonging to the Soleduck formation, while at lower elevations these rocks are covered by recent deposits of alluvium and, possibly, glacial drift. The Soleduck formation developed from marine sediments which have been intensely folded and faulted and slightly metamorphosed (Danner 1955). The dominant, dark gray, massive to poorly-bedded graywackes and sandstones are commonly interbedded with slate, argillite, and volcanic rock. The natural area was glaciated at least three times during the Wisconsin epoch and at least once before that (Crandell 1964).

A maritime climate, wet with muted temperature extremes, prevails. Winters are mild and summers are cool with frequent cloudy days. Precipitation is heavy but highly seasonal with January and December the peak months. Only about 7 percent of the annual

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precipitation falls during June, July, and August; and some years a drought period of a month or more occurs. Snow is rare. Climatic data from the nearby Quinault Ranger Station are as follows (U.S. Weather Bureau 1956) :

Mean annual temperature	10.6°C. (51.0°F.)
Mean January temperature	3.8°C. (38.9°F.)
Mean July temperature	17.3°C. (63.2°F.)
Mean January minimum temperature	1.2°C. (34.2°F.)
Mean July maximum temperature	23.8°C. (74.9°F.)
Average annual precipitation	3,371 mm. (132.73 in.)
June through August precipitation	244 mm. (9.61 in.)
Average annual snowfall	30.2 cm. (11.9 in.)

The soils on the area have not been mapped or described. In the valley bottom, they appear relatively deep and loamy, and on the mountain slopes they are somewhat shallower and contain greater amounts of loose rock. At least a portion of the soils would probably be classed as Sols Bruns Acides.

BIOTA

Essentially all 194 ha. (480 acres) of the natural area are occupied by SAF cover type 224, Western Hemlock (Society of American Foresters 1954). The area would probably fall entirely within Kuchler's (1964) Type 1, Spruce - Cedar - Hemlock Forest, and contains elements of both the *Picea sitchensis* and *Tsuga heterophylla* Zones as defined by Franklin and Dyrness (1969).

Western hemlock is the most abundant tree within the research natural area, attaining diameters of 75 to 100 cm. (30 to 40 in.) b.h. and heights of 60 m. (200 ft.). Specimens up to 152-cm. (60-in.) d.b.h. and larger are occasionally encountered (fig. HI-2). Other coniferous tree species include western red-cedar *(Thuja plicata),* Douglas-fir *(Pseudotsuga menziesii),* Pacific silver fir *(Abies amabilis),* and Sitka spruce *(Picea sitchensis).* Western red-cedar is most common in wet areas on gentle topography, where it may occur as very large (in excess of 254-cm. or 100-in. d.b.h.), old specimens. Douglas-fir is common as large, old trees, averaging 125- to 150-cm. (50- to 60-in.) d.b.h. with a maximum of about 203 cm. (80 in.). Both Pacific silver fir and Sitka spruce are rare, the former being encountered on the mountain slopes and the latter on the flat topography in the valley bottom. Red alder *(Alnus rubra)* is common along larger streams and in some swampy areas (fig. HI-2). Bigleaf maple *(Acer macrophyllum)* is also occasionally found on moist slopes or along streamsides.

Western hemlock is clearly the climax species throughout most of the natural area; it is the only species consistently represented by all age classes. Seedlings and saplings of hemlock are abundant; some stand openings are completely choked by sapling hemlocks. Reproduction of western red-cedar, Douglas-fir, and Sitka spruce is generally absent. Much tree reproduction is found on rotting logs, "nurse logs," which often support hundreds of seedlings. Some of these can be expected to survive and their roots to reach mineral soil.

Four major community types were recognized within the natural area during the reconnaissance. These were (1) *Tsuga heterophylla/Polystichum munitum - Oxalis oregana;* (2) *Thuja. plicata - Tsuga heterophylla/Vaccinium alaskaense - Gaultheria shallon/ Blechnum spicant;* (3) *Tsuga heterophylla - Pseudotsuga menziesii/Gaultheria shallon Vaccinium parvifolium;* and (4) an *Alnus rubra* swamp type. The most common community type is the *Tsuga/Polystichum - Oxal1is* which is found both on mountain slopes and in the valley bottom. Typical understory species in this community include *Polystichum. munitum., Oxalis oregana, Blechnum spicant, Tiarella trifoliata, Maianthemum bifolium* var. *kamschaticum, Gal1ium triflorum,* and *Viola sempervirens.* The shrubby layer is not well developed, consisting primarily of *Vacccinium parvifolium.*

The *Thuja - Tsuga/Vaccinium - Gaultheria/ Blechnum* community is found on relatively wet habitats and gentle topography. The shrubby layer in this community is dominated by *Vaccinium alaskaense* and *Gaultheria shallon.* Important herbs include *Blechnum spicant, Rubus pedatus, Cornus canadensis, Polystichum munitum, Gymnocarpium dryop-*

teris, Athyrium filix-femina, Tiarella trifoliata, and *Galium triflorum,*

The *Tsuga – Pseudotsuga/Gaultheria - Vaccinium* community is generally found on drier habitats on the slopes. Vine maple *(Acer circinatum)* is a common shrub dominant along with the *Gaylt heria shallon.* Other shrubby species include *Berberis nervosa, Vaccinium parvifolium,* and *Rubus ursinus.* Herbaceous species may include *Polystichum munitum, Oxalis oregana, Trillium ovatum,* and *Viola sempervirens.*

Extremely wet or swampy areas on gentle topography are occupied by an open mosaic of tree, shrub, and herb-dominated stands (fig. HI-2). Red alder is the conspicuous tree species in such areas. These mosaics provide a rich variety of microhabitats for many plant and animal species not found elsewhere in the natural area. Plant dominants include the shrubs vine maple, *Gaultheria shallon, Rubus spectabilis, Menziesia ferruginea, Corydalis scoulariana, Stachys* sp., *Rhamnus purshiana,* and *Sambucus* sp. The rich selection of herbs includes *Athyrium, filix-femina, Lysichitum americanum, Gymnocarpium dryopteris, Carex* spp., *Scirpus* sp., *Boykinia major, Cardamine* sp., and *Chrysosplenium glechomaefolium,* as well as several species of grass.

The Roosevelt elk *(Cervis canadensis roosevelti)* is the most important animal present on the natural area; their trails ease the problem of access through the area. Undoubtedly they have also affected the composition of the understory vegetation (Kirk 1966, Sharpe 1956), Mammals believed to occur within the natural area are listed in table HI-I.

Streams and stream-sides are the only specialized habitats which are present. No lakes, ponds, rock outcrops, etc., exist within the natural area,

HISTORY OF DISTURBANCE

The most common natural disturbance encountered within the natural area is wind-throw of trees, which may occur either singly or in small patches (fig. HI-2). There is no evidence of recent wildfires; fire scars can be seen on very old Douglas-firs. The parasitic dwarf mistletoe *(Arceuthobium campylopodum)* is commonly found on western hemlock within the natural area. Human disturbance within the natural area is essentially nonexistent.

RESEARC H

No research is presently known to be in progress within the natural area. Special research opportunities existing here include studies of contrasts in community composition and structure associated with variations in soils and topography, and effects of Roosevelt elk on their habitat.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 15' Quinault Lake, Washington quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1955, and topographic map of Olympic National Park and Vicinity, Washington, scale 1: 125,000, issued by the U.S. Geological Survey in 1957; and *geology - Geologic Map of Washington,* scale 1: 500,000 (Huntting et al. 1961), The Superintendent, Olympic National Park (Port Angeles, Washington), can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

Crandell, Dwight R.
1964. Pleistocene glaciations of the southwestern Olympic Peninsula, Washington. U.S. Geol. Surv. Prof. Pap. 501B:B135-B139, illus.

Danner, Wilbert R.
1955. Geology of Olympic National Park. 68 p., illus. Seattle: Univ. Wash. Press.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kirk, Ruth
1966. The Olympic Rain Forest. 86 p., illus. Seattle: Univ. Wash. Press.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

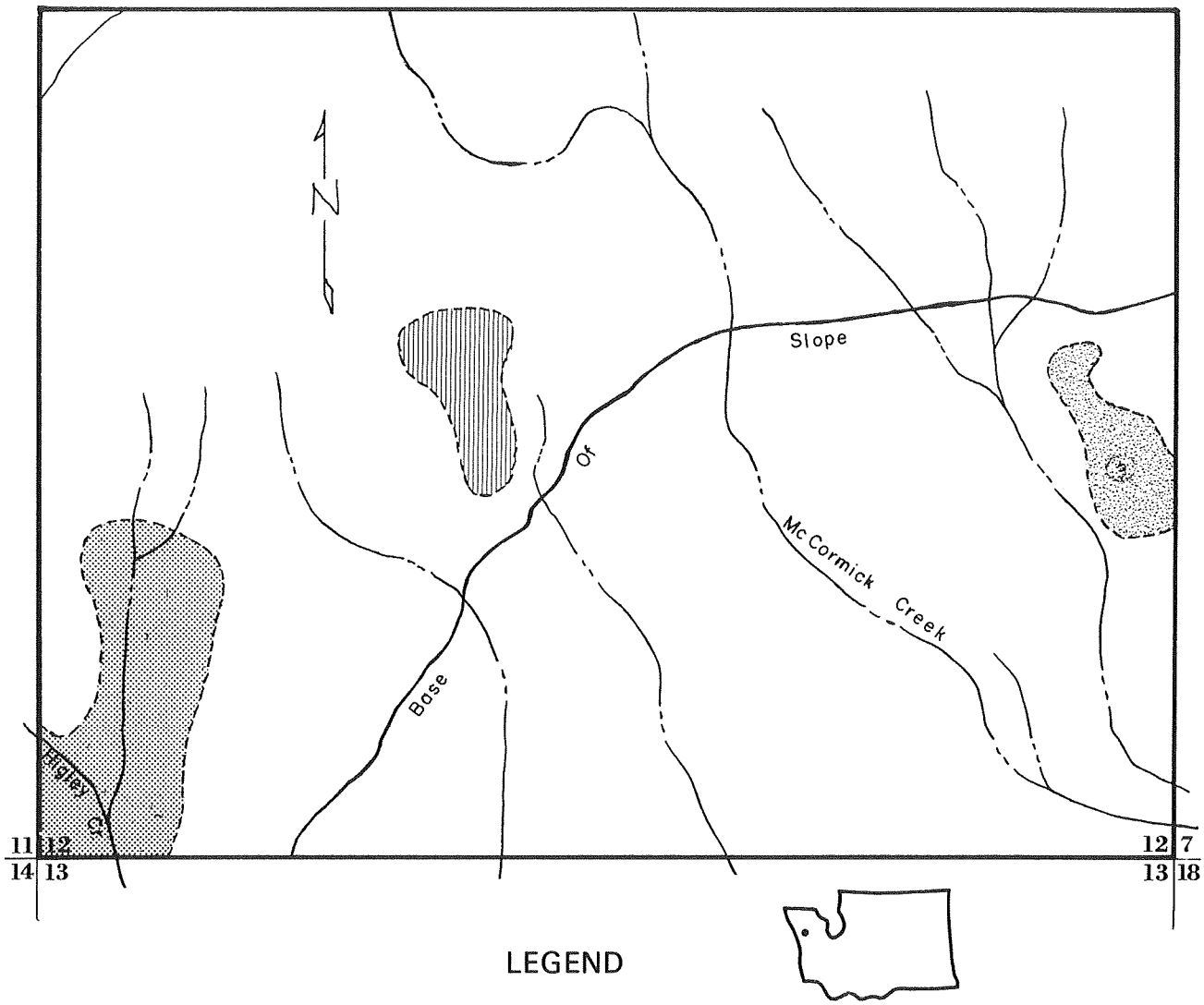
Sharpe, Grant William
1956. A taxonomical-ecological study of the vegetation by habitats in eight forest types of the Olympic rain forest, Olympic National Park, Washington. 335 p., illus. (Ph.D. thesis, on file at Univ. Wash., Seattle.)

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1956. Climatic summary of the United States - supplement for 1931 through 1952, Washington. Climatography of the United States 11-39, 79 p., illus.

Table HI-1. — Tentative list of mammals for Higley Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Sorex bendirii	marsh shrew
	Sorex obscurus	dusky shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Tamiasciurus douglasi	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis roosevelti*	Roosevelt elk
	Odocoileus h. columbianus	black-tailed deer



LEGEND

BOUNDARY, HIGLEY CREEK RESEARCH NATURAL AREA , T.23 N., R.10 W., W.M.

SECTION LINE

STREAM

BASE OF SLOPE

0 660 1320 2640 Ft.

0 201 403 805 m.

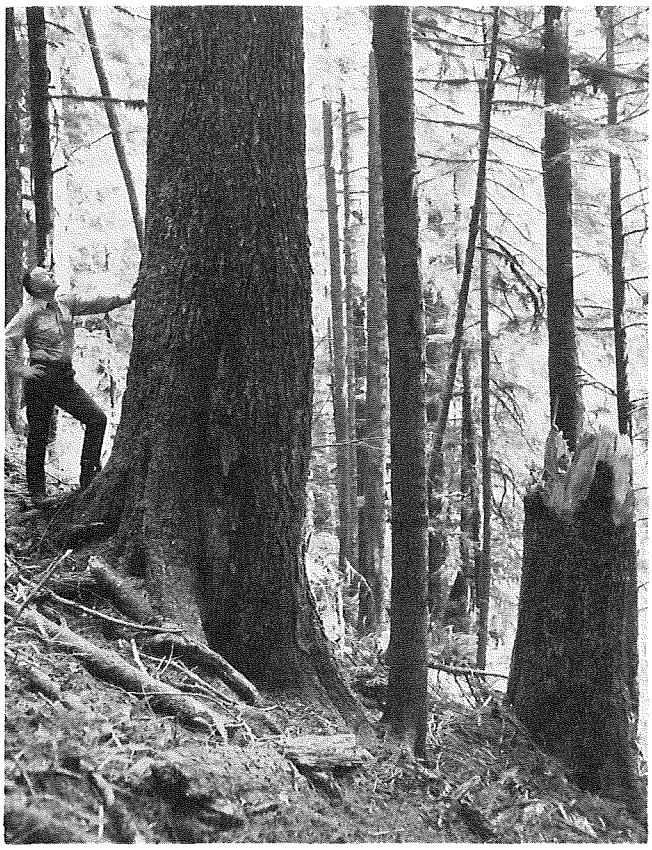
ENCLAVE OF SITKA SPRUCE—DOUGLAS-FIR TYPE

ENCLAVE OF DOUGLAS-FIR—WESTERN HEMLOCK TYPE

ENCLAVE OF DOUGLAS-FIR—SITKA SPRUCE—WESTERN HEMLOCK TYPE

Figure HI-1.– Higley Creek Research Natural Area, Grays Harbor County, Washington.

Figure HI-2.-Natural features of Higley Creek Research Natural Area. Upper left: Typical large western hemlock, with smaller hemlock in the background. Upper right: Swampy opening ringed with red alder. Bottom: Small patch of recently wind-thrown trees.



Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

HORSE RIDGE RESEARCH NATURAL AREA[1]

A unique western juniper/big sagebrush/threadleaf sedge community in near pristine condition.

The Horse Ridge Research Natural Area was established March 1967 as an example of western juniper *(Juniperus occidentalis)* - big sagebrush *(Artemisia tridentata)* vegetation within the juniper zone of central Oregon. The 240-ha. (600-acre) tract is located in Deschutes County, Oregon, and is administered by the Prineville District (Prineville, Oregon), Bureau of Land Management. The rectangular tract is located in sections 15 and 22, T. 19 S., R. 14 E., Willamette meridian, at 43°55' N. latitude, 120°02' W. longitude.

ACCESS AND ACCOMMODATIONS

The natural area is located about 31 km. (19 miles) southeast of Bend and is approached via U.S. Highway 20. Directions for locating the tract should be obtained at the Prineville District Office. Access is good during both summer and winter. Public accommodations are available in Bend; primitive camps which lack drinking water are available in the vicinity of the tract.

ENVIRONMENT

The Horse Ridge Research Natural Area varies in elevation from 1,250 to 1,430 m. (4,100 to 4,700 ft.). It is located on top of rolling topography (Horse Ridge) which rises above the surrounding flat to undulating plateau (fig. HR-2). Columbia River basalts underlie the entire area.

A continental climate prevails. Most precipitation occurs as snow during the cool, partly cloudy winter. Summers are warm, generally low in precipitation and largely cloudless. One to 4 months of drought are common. Climatic data from Bend are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	7.9°C. (46.3°F.)
Mean January temperature	-1.0°C. (30.2°F.)
Mean July temperature	17.6°C. (63.7°F.)
Mean January minimum temperature	-6.5°C. (20.3°F.)
Mean July maximum temperature	28.6°C. (83.6°F.)
Average annual precipitation	305 mm. (12.0 in.)
June through August precipitation	56 mm. (2.2 in.)
Average annual snowfall	91 cm. (36.0 in.)

Soils in the area have not been mapped. Cursory examination suggests they are sandy textured and developed in 30 to 60 em. (12 to 24 in.) of aerially deposited pumice over well cracked basalt bedrock.

BIOTA

Nearly all of the 240 ha. (600 acres) is characterized by a western juniper/big sagebrush/threadleaf sedge *(Carex filifolia)* community. A small area at the eastern edge is occupied by a stand of western juniper/big sagebrush/bluebunch wheatgrass *(Agropyron Spicatum)* with abundant surface stone. Vegetation can probably be assigned to SAF forest cover type 238, Western Juniper (Society of American Foresters 1954), and Kuchler's (1964) Type 24, Juniper Steppe Woodland. The area falls within the *Juniperus occidentalis* Zone of central Oregon (Franklin and Dyrness 1969).

The major plant community (fig. HR-2) is dominated by western juniper which conspicuously lacks decadent or dead specimens.

[1] Description prepared by Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

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Ground vegetation is dominated by big sagebrush and threadleaf sedge with some dead and decadent bitterbrush *(Purshia tridentata),* bluebunch wheatgrass, Idaho fescue *(Festuca idahoensis), Koeleria cristata,* and *Tetradymia canescens.* The soil surface is characteristically bare of litter and is covered by fine pumice gravel, 2- to 5-mm. diameter.

This plant community is interesting in several ways. Hybridization of bluebunch wheatgrass and bottlebrush squirrel tail *(Sitanion hystrix)* appears to be more common on this tract than elsewhere in the central Oregon juniper zone. Western juniper appears to affect distribution of plant species (fig. HR-2) - within the crown and root zone of western juniper, Idaho fescue tends to assume clear dominance to the near exclusion of big sagebrush and great reduction in threadleaf sedge. These conditions and the general dominance of threadleaf sedge tend to make this vegetation unique in the central Oregon area. Driscoll (1964) did not find this plant community common enough to warrant classification in his study of plant communities in central Oregon western juniper. Furthermore, this area apparently represents essentially ungrazed conditions; forage utilization data gathered by the Prineville District suggest that threadleaf sedge is sensitive to grazing and quickly decreases in abundance under heavy livestock use.

A list of mammals believed to utilize the natural area is provided in table HR-l. Mule deer *(Odocoileus hemionus)* are occasionally year around residents but frequently use the area for winter range.

HISTORY OF DISTURBANCE

An occasional burned-out juniper of large diameter can be found on the tract, indicating fires have occurred. Evidence of the extent of these fires could not be found. Normally only single trees are struck by lightning and burn, fires rarely spreading because of insufficient ground fuels.

Domestic livestock have apparently had little impact on the Horse Ridge Research Natural Area. Permanent water is a considerable distance below the ridge, suggesting that livestock have never been attracted to the area. As mentioned earlier, records in the Prineville District Office suggest livestock overuse causes a reduction in threadleaf sedge; the abundance of the sedge suggests minimal livestock disturbance. However, fencing may be necessary to prevent stock and increasing numbers of people from using the area.

RESEARC H

Baseline population levels of several bird and mammal species are presently under study on Horse Ridge Research Natural Area.[2] This is part of a larger, long-term eastern Oregon study which utilizes several other research natural areas in contrasting vegetation types. Research to date involves estimation of breeding bird populations based upon weekly, early-morning censuses during the breeding season within a 20-ha. (50-acre) grid and along a line transect.

The natural area provides interesting opportunities for research on: (1) hybridization of bluebunch wheatgrass with squirreltail and possibly native ryegrass *(Elymus* spp.); (2) evaluation of this unique plant community and the place of threadleaf sedge within the western juniper zone of central Oregon; and (3) evaluation of microchanges in herbaceous dominance as apparently influenced by juniper.

MAPS AND AERIAL PHOTOGRAPHS

No special topographic or geologic maps are available for the natural area which are sufficiently detailed to be useful. The District Manager (Prineville District, Bureau of Land Management) can provide details on the most recent aerial photo coverage of the area.

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[2] Research by Jay S. Gashwiler, Bureau of Sport Fisheries and Wildlife, Silviculture Laboratory, Bend, Oregon.

LITERATURE CITED

Driscoll, Richard S.
1964. Vegetation-soil units in the central Oregon juniper zone. USDA Forest Servo Res. Pap. PNW-19, 60 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Serv. Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, ill us.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31, 96 p., illus.

Table HR-1. — Tentative list of mammals for Horse Ridge Research Natural Area

Order	Scientific name	Common name
Insectivora	*Sorex merriami*	Merriam shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis subulatus	small-footed myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Pipistrellus hesperus	western pipistrel
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus californicus*	black-tailed jack rabbit
	Sylvilagus idahoensis	pigmy rabbit
	Sylvilagus nuttalli	mountain cottontail
Rodentia	*Dipodomys ordi*	Ord kangaroo rat
	Erethizon dorsatum	porcupine
	Eutamias minimus	least chipmunk
	Lagurus curtatus	sage vole
	Marmota flaviventris	yellow-bellied marmot
	Microtus longicaudus	long-tailed vole
	Microtus montanus	mountain vole
	Neotoma cinerea	bushy-tailed wood rat
	Onychomys leucogaster	northern grasshopper mouse
	Perognathus parvus	Great Basin pocket mouse
	Peromyscus maniculatus	deer mouse
	Reithrodontomys megalotis	western harvest mouse
	Spermophilus beecheyi	California ground squirrel
	Spermophilus beldingi	Belding ground squirrel
	Spermophilus townsendi	Townsend ground squirrel
	Thomomys talpoides	northern pocket gopher
Carnivora	*Canis latrans*	coyote
	Lynx rufus	bobcat
	Mephitis mephitis	striped skunk
	Mustela frenata	long-tailed weasel
	Spilogale putorius	spotted skunk or civet cat
	Taxidea taxus	badger
	Urocyon cinereoargenteus	gray fox
	Vulpes fulva	red fox
Artiodactyla	*Odocoileus h. hemionus*	mule deer

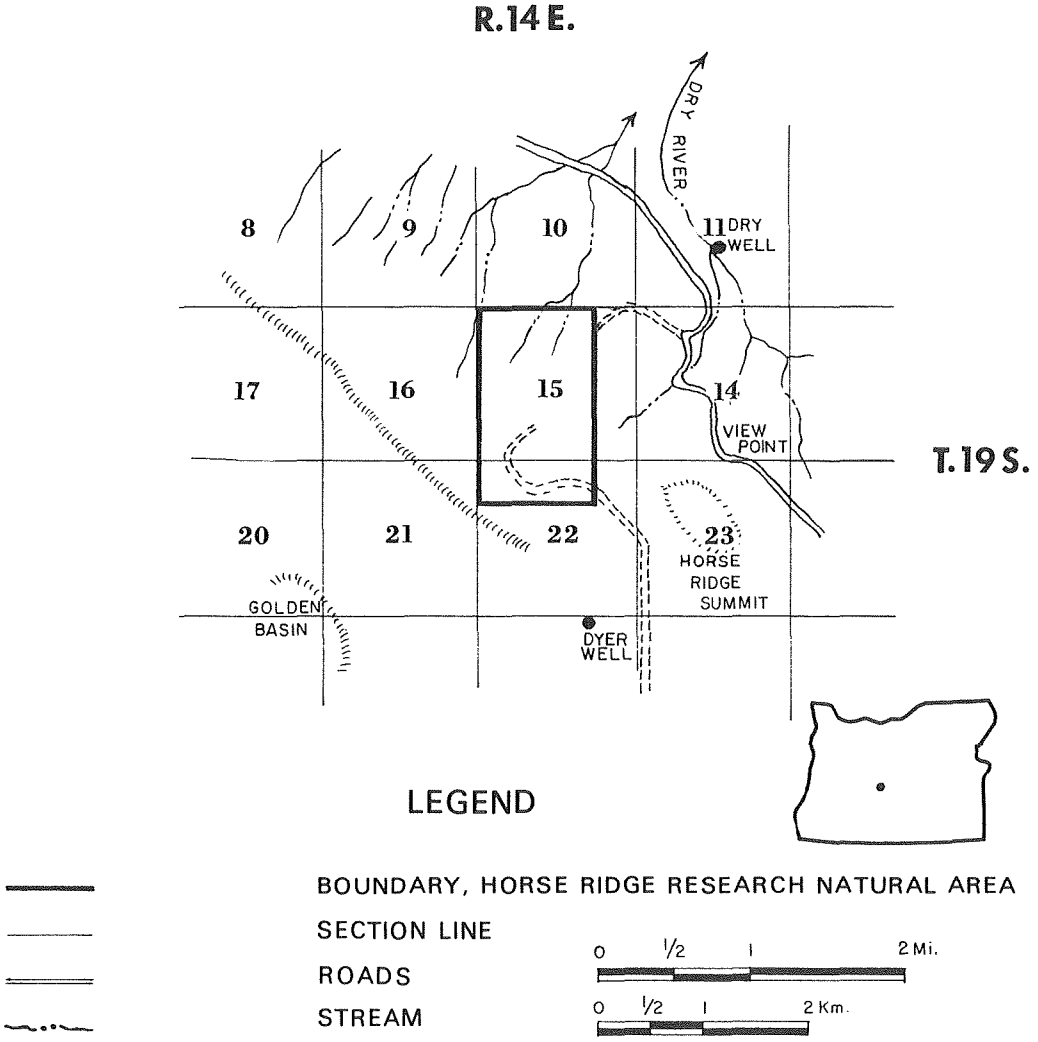

Figure HR-1.– Horse Ridge Research Natural Area, Deschutes County, Oregon.

Figure HR-2.-Communities of the Horse Ridge Research Natural Area. Upper left: A western juniper/big sagebrush/threadleaf sedge community with some bluebunch wheatgrass and Idaho fescue typical of those occupying the majority of the natural area. Upper right:
General northwesterly view from west end of tract showing typical western juniper woodland. Lower left:
Close view of ground vegetation dominated by big sagebrush and threadleaf sedge. Lower right: A view illustrating the apparent influence of western juniper on the distribution of ground vegetation-Idaho fescue dominates near the tree; big sagebrush and thread leaf sedge are common around the periphery.

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Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

JACKSON CREEK RESEARCH NATURAL AREA[1]

An old-growth Douglas-fir stand growing on a major river terrace in the western Olympic Peninsula.

The Jackson Creek Research Natural Area was established to exemplify the Douglas-fir *(Pseudotsuga menziesii)* forest type as it occurs on the western Olympic Peninsula. The 65-ha. (160-acre) tract is located in Jefferson County, Washington, and is administered by the Olympic National Park (Port Angeles, Washington). The natural area is rectangular occupying the NE1/4 NE1/4 section 13, T. 27' N., R. 10 W., and N1/2 NW1/4 and NW1/4 NE1/4 section 18, T. 27 N., R. 9 W., Willamette meridian (fig. JC-1). It lies at 47°51' N. latitude and 123° 55' W. longitude.

ACC ESS AN D ACCOMMODATIONS

The natural area is located on the south bank of the Hoh River immediately opposite the Hoh River Ranger Station and campground. The ranger station is at the end of the Hoh River Road about 30 km. (19 miles) from U.S. Highway 101. To reach the natural area, it is necessary to ford the Hoh River. This generally requires scouting up river from the campground until a log jam suitable for crossing is located. During recent years, such a log jam has been located only a short distance above the central campground area, but conditions change periodically. Although there are no trails, cross-country travel within the natural area is not difficult because of the open nature of the forest stand.

Commercial accommodations are available in Forks or Kalaloch, along U.S. Highway 101, from 48 to 64 km. (30 to 40 miles) away. However, the public campground at the end of the Hoh River Road is excellent, and there are several smaller state campgrounds along the road outside of the Park.

ENVIRONMENT

The natural area occupies gentle topography on terraces and benches in the Hoh River valley. Elevations range from about 207 to 402 m. (680 to 1,320 ft.). Jackson Creek flows through the middle of the natural area. The natural area is located on upper Cretaceous-lower Tertiary sedimentary rocks belonging to the Soleduck formation (Danner 1955, Huntting et al. 1961). However, bedrock is buried entirely beneath depositions of alluvium and, possibly, glacial drift at higher elevations. The valley of the Hoh River, including the natural area, was glaciated at least three times during the Wisconsin epoch and at least once before that (Crandell 1964).

A wet, mild, maritime climate prevails. Winters are mild, and summers are cool with frequent cloudy days. Precipitation is heavy, but less than 10 percent falls during summer months. The following climatic data are from the Forks Weather Station located approximately 35 km. (22 miles) northwest of the natural area (U.S. Weather Bureau 1965) :

Mean annual temperature	9.55°C.	(49.2°F.)
Mean January temperature	3.72°C.	(38.7°F.)
Mean July temperature	15.39°C.	(59.7°F.)
Mean January minimum temperature	0.17°C.	(32.3°F.)
Mean July maximum temperature	21.55°C.	(70.8°F.)

[1] Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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Average annual precipitation .. 2,974 mm. (117.10 in.) June through August
precipitation ..... 214 mm. (8.44 in.)
Average annual snowfall . ..... 348 em. (13.70 in.)

Precipitation is significantly higher on the natural area itself, probably averaging about 3,600 mm. (142 in.) annually (Kirk 1966).

Soils appear to be predominantly Sols Bruns Acides. Fonda[2] has described profiles with A1-B1-B2-C sequences from terraces in the vicinity of the natural area. The A1 horizons are apparently relatively thick (0 to 16 cm.).

BIOTA

Essentially all 65 ha. (160 acres) of the natural area can be classified as SAF forest cover type 229, Pacific Douglas-Fir (Society of American Foresters 1954). It would probably fall entirely within Kuchler's (1961) Type 1, Spruce-Cedar-Hemlock Forest, and the *Picea sitchensis* Zone as defined by Franklin and Dyrness (1969).

Four coniferous tree species are known to occur within the Jackson Creek Research Natural Area: Douglas-fir, western hemlock *(Tsuga heterophylla),* Sitka spruce *(Picea sitchensis),* and western red-cedar *(Thuja plicata).* Douglas-fir is overwhelmingly dominant, surprisingly so for a stand estimated to be around 275 years in age. Samples within the natural area indicate about 72 sq. m. per hectare of basal area (314 sq. ft. per acre), of which 87 percent is Douglas-fir.[3] Trees average 125- to 150-cm. (50- to 60-in.) d.b.h. and 68 m. (225 ft.) in height with maximum diameters of about 235 cm. (94 in.) b.h. (fig. JC-2). Western hemlock is well distributed over the natural area, but averages only about 11 percent of the stand volume. Western hemlock has relatively little representation in intermediate size classes (saplings and poles). Sitka spruce is generally uncommon in the overstory but is commonly encountered as reproduction growing on down logs; it is most common in swampy areas found in some portions of the natural area. Occasional red alder *(Alnus rubra)* and bigleaf maple *(Acer macrophyllum)* may also be encountered in the wetter, open areas.

The major climax species on the natural area appears to be western hemlock, although age class distributions indicate the climax condition is still far in the future. Sitka spruce may also be a minor climax species in these forests, since reproductive size classes up to saplings and small poles are encountered through most of the area. Climax status for the Sitka spruce would apparently contrast with normal conditions for the *Picea sitchensis* Zone (Franklin and Dyrness 1969). This is probably a partial consequence of the special conditions found in so-called "rain forest" valleys of the western Olympic Peninsula, e.g., the relatively open nature of many of the stands and selective grazing of hemlock seedlings by elk.[4]

Several community types can be recognized within the natural area including: (1) *Pseudotsuga menziesii/Pteridium. AquilinumAchlys triphylla,* (2) *Pseudotsuga menziesii/ Polystichum munitum-Oxalis oregana, (3) Picea sitchensis/Acer circinatum/Pteridium aquilinm.* The *Pseudotsuga/ PteridiumAchlys* community occupies much of the actual river-terrace habitat within the natural area (fig. JC-2). Typical species include *Pteridium aquilinum, Oxal1is oregana, Tiarella trifoliata, Vaccinium parvifolium, Achlys triphylla, Rubus pedatus, Blechnum spicant, Luzula parviflora, Trisetum Cernuum, Carex deweyana,* and *Mainthemum bifolium* var. *kamaschaticum.* The *Pseudotsuga/Polystichum-Oxalis* community is very similar in composition, lacking only the dominance of *Pteridium aquilinum.* This community type is most common in the eastern half of the natural area on gentle slopes and a higher level bench. The *Picea/Acer/Pteridium* community typifies the very open areas which appear relatively swampy in character. Tree cover is very low in these openings, but the coverage of brush species such as vine maple *(Acer circinatum)* and herbs such as *Pteri-*

[2] Personal communication from Dr. Richard W. Fonda, Biology Department, Western Washington State College, Bellingham.
[3] See footnote 2.
[4] See footnote 2.

dium aquilinum and various grasses and sedges is quite high.

The most important mammal within the natural area is the Roosevelt elk *(Cervus canadensis roosevelti)* which is particularly common during the winter and spring. A list of mammals believed to utilize the tract is provided in table JC-l.

Jackson Creek, which flows through the natural area for a small portion of its length, provides the only aquatic habitat within the natural area. The open swampy areas undoubtedly provide additional specialized habitat for a variety of plant and animal species not typical of the heavily forested area.

HISTORY OF DISTURBANCE

The Douglas-fir stand present on the natural area probably originated with a wildfire approximately three centuries ago; however, no fire scars were seen, which would provide evidence for more recent wildfires.

Human disturbance of the area appears to be very minor despite its proximity to the Hoh River campground; the Hoh River undoubtedly provides a major barrier against casual use of the area.

RESEARCH

The only research work known to have been conducted within the natural area is an examination and description of the Douglas-fir stands in connection with a study of the relationship between forest communities and environmental conditions in the Hoh River valley.[5] The natural area would appear to offer unusually good opportunities for studies of: (1) successional development and the factors which have retarded the rate of natural succession from Douglas-fir to hemlock; (2) the effect of Roosevelt elk on community composition and forest succession; and (3) occurrence of animals in sharply contrasting but contiguous community types (dense Douglas-fir forest vs. wet, brush- and herb-dominated openings).

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *TopogTaphy-15,* Mount Tom, Washington quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1955, and Olympic National Park and Vicinity, Washington, scale 1: 125,000, issued by the U.S. Geological Survey in 1957; and *geology -Geologic Map of Washington,* scale 1:500,000 (Huntting et al. 1961). The Superintendent, Olympic National Park (Port Angeles, Washington), can provide details on the most recent aerial photo coverage and forest type maps for the area.

[5] See footnote 2.

LITERATURE CITED

Crandell, Dwight R.
1964. Pleistocene glaciations of the southwestern Olympic Peninsula, Washington. U.S. Geol. Surv. Prof. Pap. 501B:B135-B139, illus.

Danner, Wilbert R.
1955. Geology of Olympic National Park. 68 p., illus. Seattle: Univ. Wash. Press.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kirk, Ruth
1966. The Olympic Rain Forest. 86 p., illus. Seattle: Univ. Wash. Press.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D. C.

U.S. Weather Bureau
1965. Climatic summary of the United States--supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table JC-1. — Tentative list of mammals for Jackson Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex obscurus	dusky shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Tamiasciurus douglasi	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis roosevelti*	Roosevelt elk
	Odocoileus h. columbianus	black-tailed deer

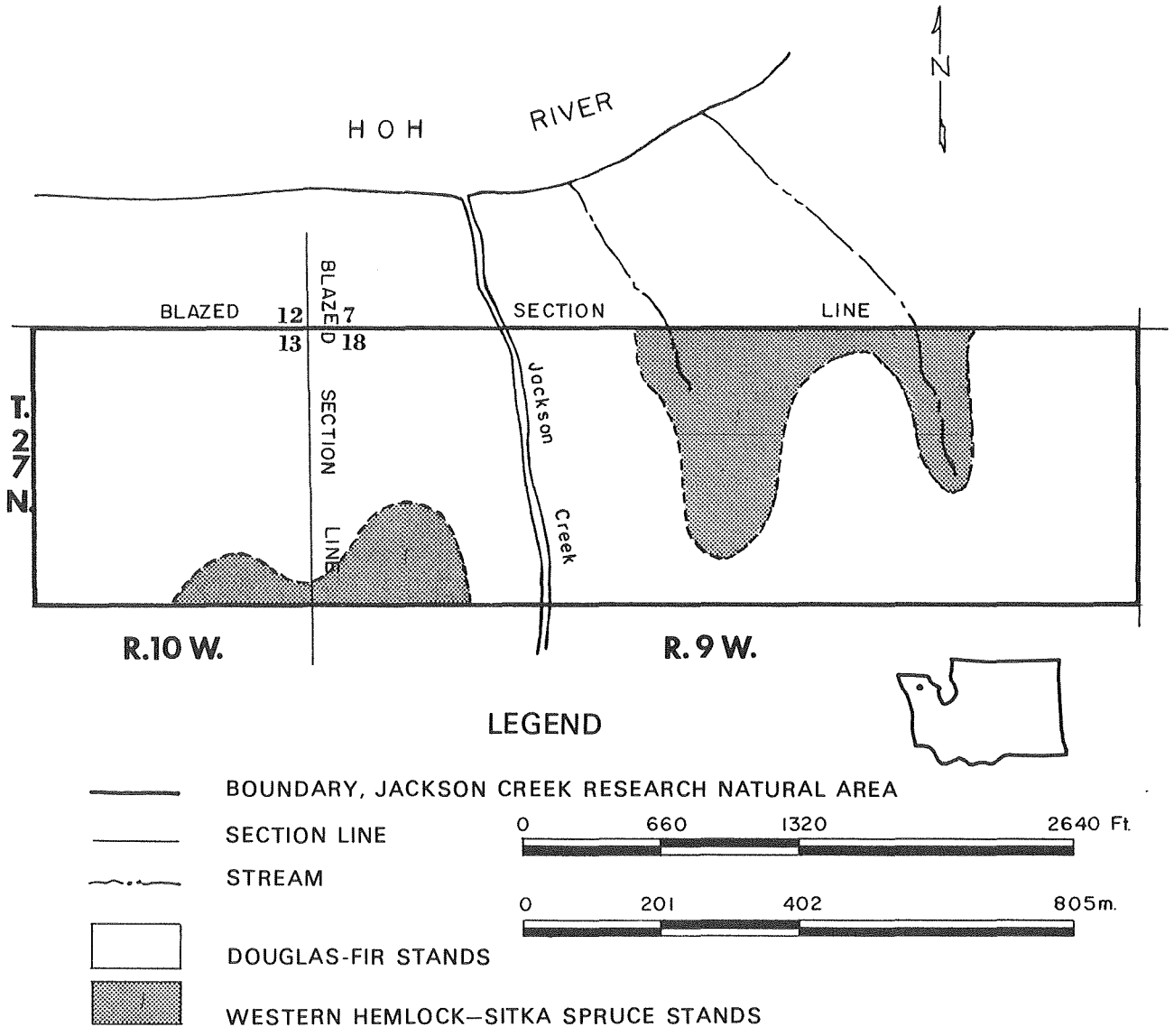
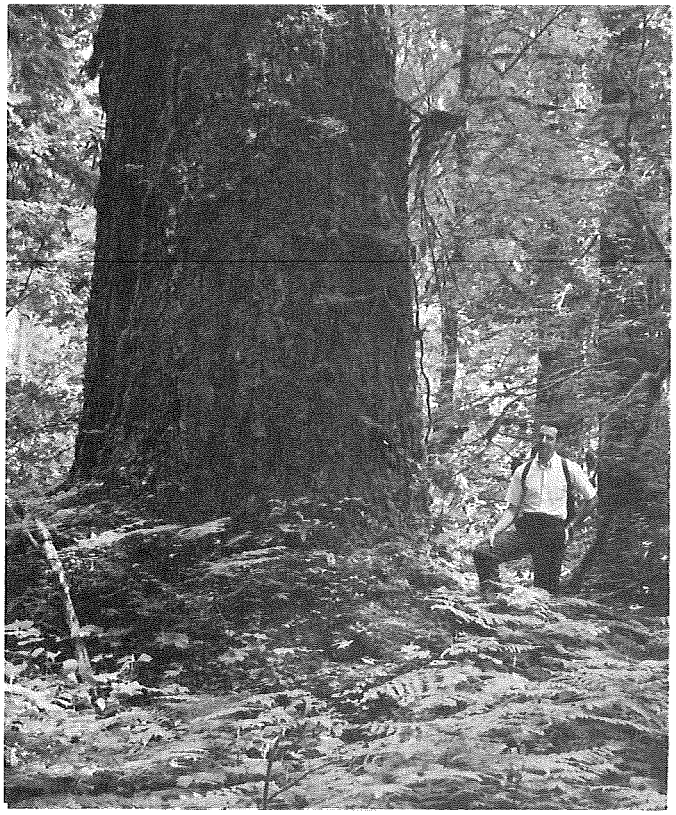
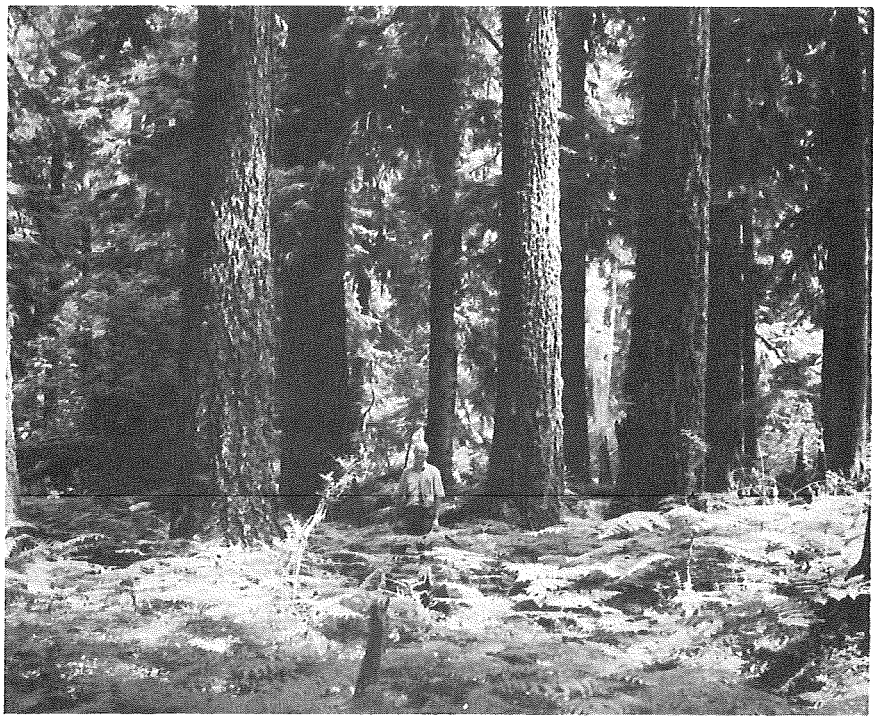


Figure JC-1.– Jackson Creek Research Natural Area, Jefferson County, Washington.

Figure JC-2.-Communities of the Jackson Creek Research Natural Area. Upper left: Old-growth specimen of Douglas-fir approximately 235-cm. (94-in.) d.b.h. Upper right: Ecotone between the Douglas-fir stands and a swampy, open area dominated by shrubs and herbs; reproduction of western hemlock is conspicuous. Bottom: Typical terrace community of *Pseudotsuga menziesii/ Pteridium aquilinum-Achlys triphylla* on the main river terrace within the natural area.





Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

LAKE TWENTYTWO RESEARCH NATURAL AREA[1]

"Subalpine" lake and old-growth western red cedar - western hemlock forest on a rugged mountain slope in the northern Cascades of Washington.

The Lake Twentytwo Research Natural Area was established on January 14, 1947, as a sample of virgin old-growth western red-cedar *(Thuja plicata)* - western hemlock *(Tsuga heterophylla)* forest. The 320-ha. (790-acre) tract is located in Snohomish County, Washington, and is administered by the Monte Cristo Ranger District (Granite Falls, Washington), Mount Baker National Forest. It includes: section 22 (except NWl/4 and W1/2 SW1/4), W1/2 SWl/4, SWl/4 NWl/4, and Sl/2 NWl/4 NW1/4 of section 23; and NEl/4 and E1/2 NWl/4 of section 27, T. 30 N., R. 8 E., Willamette meridian (fig. LA-I). It lies at 48°04' N. latitude and 121 °46' W.longitude.

ACCESS AND ACCOMMODATIONS

Access to the vicinity is via U.S. Highway 2 and State Highways 9 and 92 from Everett to Granite Falls and Forest Highway 7 to Verlot Ranger Station. Beyond the ranger station, follow Forest Highway 7 for 2.9 km. (1.8 miles) to the start of the Lake Twentytwo Trail.

The Lake Twentytwo Trail lies almost entirely within the natural area and traverses a large part of it. The trail climbs for 4 km. (2.5 miles) and 425 m. (1,400 ft.) of elevation to its terminus at the lake. There are no other trails or roads within the natural area boundary, and cross-country access to that part of the tract east of Twentytwo Creek and Twentytwo Lake is difficult.

The nearest commercial overnight accommodations are in Everett about 40 km. (25 miles) away, although food can be obtained at Verlot and Granite Falls. There are seven public campgrounds with 3 to 8 km. (2 to 5 miles) of the natural area.

ENVIRONMENT

The Lake Twentytwo Research Natural Area occupies essentially the entire drainage of Lake Twentytwo Creek except for some of the rugged cliffs and rock ridges south and west of Lake Twentytwo. Elevations range from about 335 m. (1,100 ft.) above sea level near the South Fork of the Stillaguamish River to about 1,100 m. (3,600 ft.) on the ridges southeast and west of Lake Twentytwo. Topography is steep to very steep and broken; a few small benches are present.

Lake Twentytwo lies entirely within the natural area. It is a 17.9-ha. (44.1-acre) lake with a maximum measured depth of 16 m. (53 ft.) (Wolcott 1961). The lake was created by glacial activity. Despite its location at a relatively low elevation of 750 m. (2,460 ft.), the lake and its environs have many aspects of a much higher subalpine lake; permanent snowfields are found within the lake basin (fig. LA-2).

The natural area is located on two major geologic formations (Huntting et al. 1961). Rocks in the upper part of the natural area are granitic intrusive rocks of Tertiary - Cretaceous age, while those at lower elevation are upper Jurassic -lower Cretaceous sedimentary rocks, The cirque basin in which Lake

[1]Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

This file was created by scanning the printed publication. Text errors identified by the software have been corrected; however, some errors may remain.

Twentytwo is located, as well as the lake itself, are obviously glacial features which originated during the Pleistocene.

The natural area is subject to a wet, cool, maritime climate. Annual precipitation is heavy and highly seasonal, although rain is not uncommon during the summer months. Summers are cool. This regional cool, wet climate is, of course, accentuated on the steep north slope occupied by the natural area. Climatic data from the nearest weather bureau station - Darrington, Washington, about 24 km. (15 miles) northeast - are as follows (U.S. Weather Bureau 1956, 1965). They probably approximate climatic conditions encountered at lower elevations in Lake Twentytwo Research Natural Area:

Mean annual temperature	9.6°C. (49.4°F.)
Mean January temperature	1.1°C. (33.9°F.)
Mean July temperature	17.4°C. (63.3°F.)
Mean January minimum temperature	-3.2°C. (26.1°F.)
Mean July maximum temperature	25.9°C. (78.7°F.)
Average annual precipitation	2,045 mm. (80.51 in.)
June through August precipitation	155 mm. (6.06 in.)
Average annual snowfall	120 cm. (47.4 in.)

Soils on the natural area have recently been mapped by U.S. Forest Service personnel as part of a soil survey of the Mount Baker National Forest (Snyder and Wade 1970). Most of the higher elevational area surrounding Lake Twentytwo is shown on the map as talus slopes and intrusive igneous rock outcrop areas. In the eastern, mid-elevation portion of the area soils are derived from metasedimentary rocks and are classed as coarse loamy, mixed Typic Ferrods. These soils have a dark reddish brown loam surface layer which is underlain at about 55 cm. (22 in.) by dark yellowish brown very gravelly loam. The more gently sloping low elevational areas near the northern boundary are occupied by three soil units derived from glacial drift material. These soils have been classified as a Typic Ustifluvent, Typic Ustipsamment, and a Typic Fragiorthod. Typically these soils have a brown gravelly loam surface and are underlain at varying depths by very gravelly loamy sand.

BIOTA

A gross estimate of areas by SAF forest types (Society of American Foresters 1954) is as follows:

No.	*Name*	*Area*
227	Western Red-cedar Western Hemlock	184 ha. (455 acres)
226	Pacific Silver Fir Hemlock	32 ha. (80 acres)
228	Western Red-cedar	16 ha. (40 acres)
221	Red Alder	10 ha. (25 acres)

Much of the acreage of Pacific silver fir - hemlock type is composed of small patches and stringers of trees. In addition to the areas classed as forest, there are approximately 30 ha. (75 acres) of brushfields, 28 ha. (70 acres) of "barrens" - cliffs, meadows, and talus and 18 ha. (45 acres) of water within the natural area. Kuchler's (1964) Types 2 (Cedar-Hemlock-Douglas Fir Forest), 3 (Silver Fir Douglas Fir Forest), 4 (Fir - Hemlock Forest), 25 (Alder - Ash Forest), and 52 (Alpine Meadows and Barren) are represented within Lake Twentytwo Research Natural Area. The natural area spans both the *Tsuga heterophylla* and *Abies amabilis* Zones of Franklin and Dyrness (1969) and includes many elements of the *Tsuga 1nertensiana* Zone in the lake basin.

The lower forests in the natural area are old-growth stands of western hemlock and western red-cedar. Some Pacific silver fir *(Abies amabilis)* are present as' well as an occasional Sitka spruce *(Picea sitchensis)* at lowest elevations. The largest trees are the red-cedar which average 1.5 to 2.5 m. (5 to 8 ft.) in diameter (fig. LA-2), with a maximum of nearly 3.7-m. (12-ft.) d.b.h. Hemlocks of all ages and sizes up to 130-cm. (50-in.) d.b.h. are present. Western hemlock appears to be the climax species, as reproduction of western red-cedar is generally absent and that of Pacific silver fir is sporadic at low elevations. The understory can be typified by *Vaccinium alaskaense, V. ovalifolium, Menziesia ferruginea, Blechnum spicant, Cornus canadensis, Rubus pedatus, Spaghnum girgensohnii,* and *Hylocomium splendens.* In wetter locations, e.g., along streams, *Oplopanax horridum,*

Athyrium filix-femina, Rubus spectabilis, Tolmeia menziesii, Ribes bracteosum, and *Boykinia major* are conspicuous.

Forests at higher elevations are characterized by Pacific silver fir, mountain hemlock *(Tsuga mertensiana),* and Alaska-cedar *(Chamaecyparis nootkatensis).* In older stands, the trees average 75- to 100-cm. (30- to 40-in.) d.b.h. The climax species appears to be silver fir, as reproduction of the others is sparse. A dense layer of shrubs is usually present, including *Vaccinium alaskaense, V. ovalifolium, Menziesia ferruginea, Rubus spectabilis,* and *Cladothaimnus pyrolaefiorus.* Dominant herbs are *Streptopus curvipes, Rubus pedatus, Blechnum spicant,* and *Maianthemum bifolium* var. *kamschaticum.*

Another major group of communities is brushfield stands; these vary in character depending on local moisture and temperature conditions. One type, conspicuous along the Lake Twentytwo Trail, is dominated by vine maple *(Acer circinatum);* it is found on scree slopes. Many other shrubs are present, such as *Rubus spectabilis,* Sitka alder *(Alnus sinuata), Sambucus* sp., *Ribes lacustre,* and *Oplopanax horridum.* The rich herb layer usually includes *Athyriurn filix-femina, Pteridium aquilinuin, Cryptogamma acrostichoides, Montia* spp., *Aruncus sylvester, Galiuin* sp., and *Tolmeia menziesii.* A part of one vine maple-dominated brushfield includes a small stand of Bigleaf maple *(Acer macrophyllum.)* 20- to 25-cm. (8- to 10-in.) d.b.h. (fig. LA-2).

The cirque basin occupied by Lake Twentytwo is a mosaic of habitats and communities, mostly nonforested (fig. LA-2). Habitats include wet rocky cliffs, margins of permanent snowpatches, boulder fields, scree slopes, and all uvial deposits along the lake shore; all are supplied with abundant moisture. The communities include: a variety of dense herbaceous stands dominated by species such as *Polygonum bistortoides, Athyriuim americanum, Carex* spp., *Veratrum viride, Valeriana sitchensis,* and *Caltha* sp.; dense shrub fields dominated by *Vaccinium ovalifolium, V. alaskaense, Menziesia ferruginea, Sorbus* sp., and *Cladothamnus pyrolaeflorus;* and patches of mostly small Pacific silver fir, mountain hemlock, and Alaska-cedar. Most communities have a distinctly subalpine aspect despite the 760-m. (2,500-ft.) elevation; *Phyllodoce empetriformis* and *Luetkea pectinata,* timberline species, are found along the lakeshore.

A variety of fauna inhabit the natural area. A list of mammals believed to utilize the tract as residents or transients is provided in table LA-I. Fish were planted in Lake Twentytwo over 30 years ago; Wolcott (1961) indicates rainbow trout were planted in 1951.

The specialized terrestrial habitats have already been mentioned, e.g., the cliffs, snowpatches, and scree slopes of the lake basin. There is also the lake itself and the entire length of Twentytwo Creek (fig. LA-2).

HISTORY OF DISTURBANCE

The Lake Twentytwo area has a long history of public use and human disturbance is evident in a few locations. At one time there was a YMCA camp on the shore of the lake; it was abandoned and the debris removed prior to establishment of the natural area. The original trail to the lake closely followed the creek. It was abandoned when the present trail was completed but is still evident in some locations. At present the most obviously disturbed areas are around the lake, especially at the north end, where campers, hikers, and fishermen have created bare openings and a system of trails. Recreational use of the trail and lake margins is heavy and continuing.

There is no evidence of wildfire within the natural area, and none have been recorded within historic times.

RESEARC H

No research is presently being conducted within the natural area. Some unique research opportunities would include (1) comparison of the forests of Lake Twentytwo Research Natural Area with those on the south-facing Long Creek Research Natural Area 3 km. (2 miles) away, and (2) study of the relationships between plant and animal communities and the environmental mosaic within the Lake Twentytwo basin.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 15' Granite Falls, Washington quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1956; and *geology - Geologic Map of Washington,* scale 1: 500,000 (Huntting et al. 1961). Either the District Ranger (Monte Cristo Ranger District) or Forest Supervisor (Mount Baker National Forest, Bellingham, Washington) can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Serv. Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Snyder, Robert V., and John M. Wade
1970. Mt. Baker National Forest soil resource inventory. 267 p. plus atlas of maps and interpretive tables. Northwest Reg., USDA Forest Servo

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1956. Climatic summary of the United States - supplement for 1931 through 1952. Washington. Climatography of the United States 11-39,79 p., illus.

———————
1965. Climatic summary of the United States - supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Wolcott, Ernest E.
1961. Lakes of Washington. Volume 1, Western Washington. Wash. State Dep. Conserv., Div. Water Resourc. Water Supply Bull. 14, 619 p., illus.

Table LA-1. — Tentative list of mammals for Lake Twentytwo Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex cinereus	masked shrew
	Sorex obscurus	dusky shrew
	Sorex palustris	northern water shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Ochotona princeps	pika
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus richardsoni	Richardson vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Spermophilus saturatus	Cascades mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. columbianus	black-tailed deer
	Oreamnos americanus	mountain goat

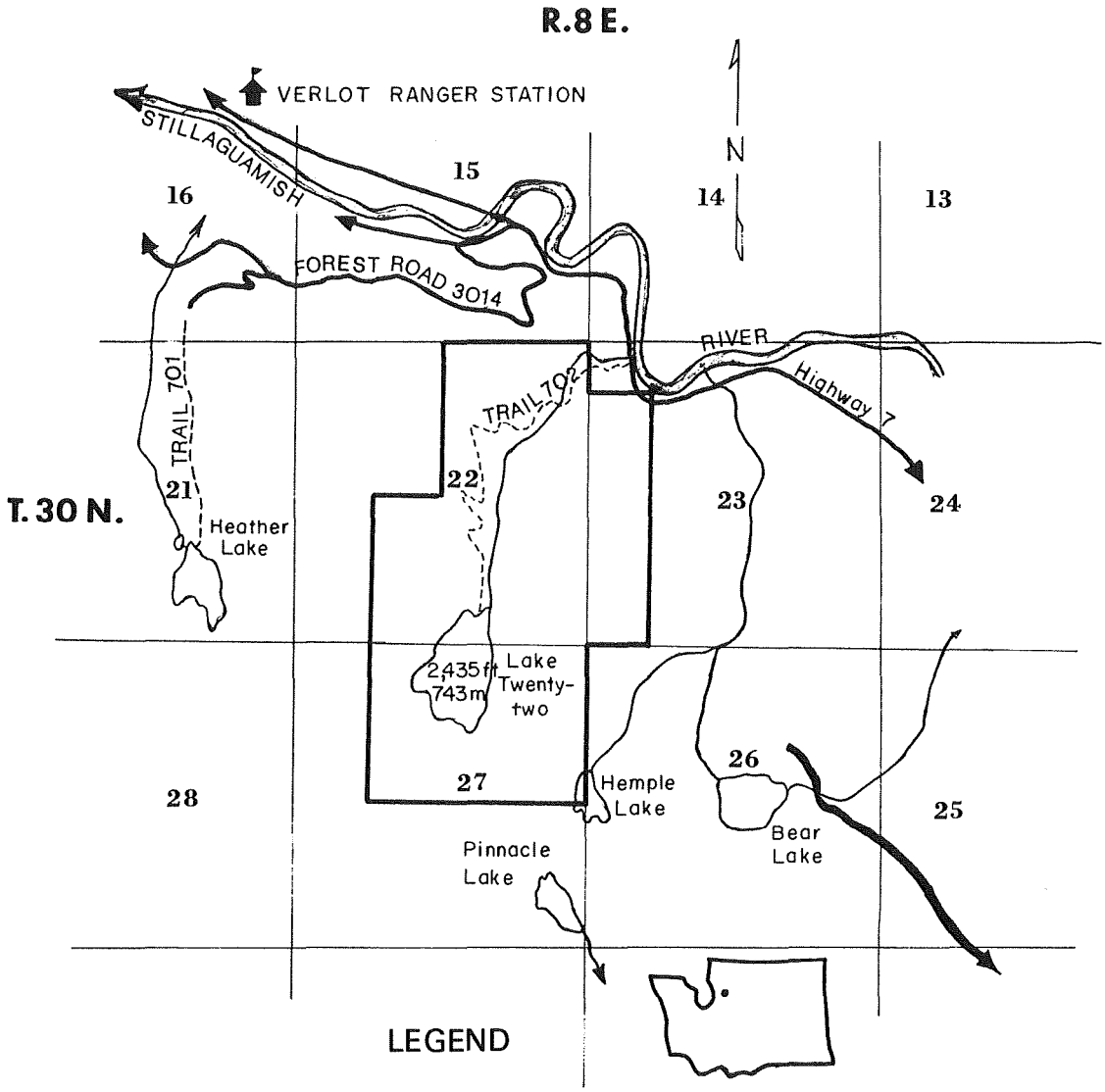
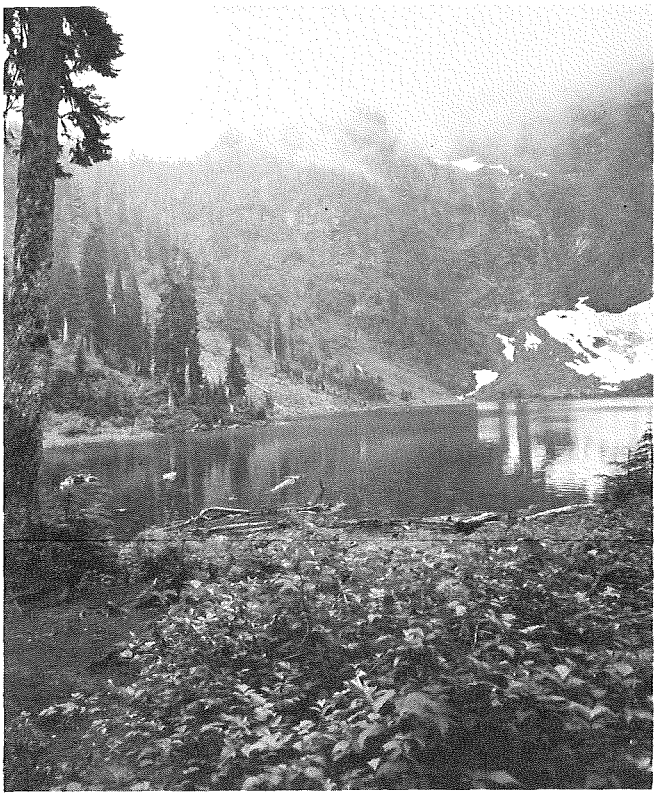


Figure LA-1.– Lake Twentytwo Research Natural Area, Snohomish County, Washington.

Figure LA-2.-Natural features of the Lake Twentytwo Research Natural Area. Upper left: Typical specimens of old-growth western red-cedar about 2.5-m. d.b.h. growing at lower elevations. Upper right: Lake Twenty two Creek which is included almost entirely within the natural area. Lower left: Small stand of Bigleaf maple (background) which averages 20- to 25-cm. d.b.h. and vine maple community (foreground) which dominates extensive areas of brushfields growing on talus. Lower right: A portion of Lake Twenty two and the surrounding basin; note the persistent snowbanks in this later summer photograph.



Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

LONG CREEK RESEARCH NATURAL AREA[1]

Western hemlock, western hemlock-western red cedar, and climax red alder stands on a south-exposed mountain slope in the northern Cascades of Washington.

Long Creek Research Natural Area was established on January 2,1947, as an example of virgin western hemlock *(Tsuga heterophylla)* - western red-cedar *(Thuja plicata)* forest type. It complements Lake Twentytwo Research Natural Area, which is located on a north-facing mountainside 4 km. (2.5 miles) to the west. The 259-ha. (640-acre) tract is located in Snohomish County, Washington, and is administered by the Monte Cristo Ranger District (Granite Falls, Washington), Mount Baker National Forest. The natural area occupies the W1/2 of section 17 and E1/2 NEl/4, El/2 SW1/4, and SE1/4 of section 18, T. 30 N., R. 9 E., Willamette meridian (fig. LC-1). It lies at 48°05' N. latitude and 121 °41' W.longitude.

ACCESS AND ACCOMMODATIONS

Access is via U.S. Highway 2 and State Highways 9 and 92 from Everett to Granite Falls and Forest Highway 7 to Verlot Ranger Station. Beyond the ranger station follow Forest Highway 7 east for 11.6 km. (7.2 miles) to Red Bridge Campground and turn left on Forest Road 3033. Beginning about 3.2 km. (2 miles) west of the junction, Road 3033 skirts the southern (lower) and, eventually, the western boundaries of the research natural area. In the near future a road providing access to the eastern boundary will be built. There are no trails or roads within the natural area boundary.

The nearest commercial overnight accommodations are in Everett about 56 km. (35 miles) away, although food can be obtained at Verlot and Granite Falls. There are seven public campgrounds within 3 to 14 km. (2 to 9 miles) of the natural area.

ENVI RONMENT

The Long Creek Research Natural Area occupies a portion of the south slope of Wiley Ridge. Elevations range from 1,100 m. (3,600 ft.) above sea level near the top of the ridge to about 380 m. (1,250 ft.) at the foot of the ridge near the South Fork of the Stillaguamish River. Topography is steep to very steep and broken on the slopes to gentle and rolling in the southern third of the area where the toe-slope of the ridge merges with the river terrace. One permanent stream, as well as approximately two-thirds of the Long Creek drainage, is almost entirely within the natural area.

The natural area is located on sedimentary bedrock of Pre-Middle Jurassic age (Huntting et al. 1961). However, this bedrock is covered by stratified glacial out-wash of Pleistocene age on lower portions of the natural area. This out-wash is of two types a lower deposit of compact brown sands and gravels of glacial fluvial origin overlain by a deep deposit of blue-gray hard varved silt of glaciolacustrine origin.[2] The varved material con-

[1] Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service. Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

[2] Information from "Report on Slide on South-Fork Stillaguamish River at Gold Basin Forest Camp." Sept. :30, ID54, 10 p. Typewritten report by Shannon and Wilson, Consulting Engineers, Seattle, to State of Washington Department of Fisheries. (Copy on me Verlot Hanger Station, Granite Falls, Washington.)

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sists of thin layers of silt, sand, and clay, horizontally bedded. Many of the beds are extremely unstable, especially when wet, resulting in slides and mudflows. The extensive mass land movements which characterize lower elevations in much of the natural area appear confined to this material.

A wet, cool, maritime climate characterizes the natural area. Annual precipitation is heavy and highly seasonal, although rain is not uncommon during the summer months, and summers are cool. Climatic data from the nearest weather bureau station (Darrington, Washington) about 19 km. (12 miles) northeast are as follows (U.S. Weather Bureau 1956, 1965). They probably approximate climatic conditions encountered at lower elevations in Long Creek Research Natural Area.

Mean annual temperature	9.6°C. (49.4°F.)
Mean January temperature	1.1°C. (33.9°F.)
Mean July temperature	17.4°C. (63.3°F.)
Mean January minimum temperature	-3.2°C. (26.1°F.)
Mean July maximum temperature	25.9°C. (78.7°F.)
Average annual precipitation	2,045 mm. (80.51 in.)
June through August precipitation	154 mm. (6.06 in.)
Average annual snowfall	120 cm. (47.4 in.)

Soils on the natural area have recently been mapped by U.S. Forest Service personnel as part of a soil survey of the Mount Baker National Forest (Snyder and Wade 1970). Soils on gently sloping terrain in the southern portion of the area are markedly unstable and are formed in deep glaciolacustrine deposits. These soils, classed as fine, mixed Andic Haplumbrepts, possess a brown silt loam to silty clay loam surface layer which grades into a slowly permeable silty clay subsoil at approximately 30 cm. (12 in.). On more steeply sloping terrain at intermediate elevations, mapped soils are coarse textured gravelly sandy loams over very deep deposits of very gravelly and cobbly sands. These are derived from marginal lake deposits and are classified as sandy, mixed Typic Ustifluvent. In the northern section of the area, near Wiley Ridge, soils are derived from metasedimentary rocks and are classed as coarse loamy, mixed Typic Ferrods. These soils have a dark reddish brown loam surface and are underlain at about 55 cm. (22 in.) by dark yellowish brown very gravelly loam.

BIOTA

Estimated areas by SAF forest types (Society of American Foresters 1954), as determined from the most recent type map available, are:

No.	*Name*	*Area*
224	Western Hemlock	162 ha. (400 acres)
227	Western Red-cedar - 'Western Hemlock	40 ha. (100 acres)
230	Douglas-Fir - Western Hemlock	40 ha. (100 acres)
221	Red Alder	16 ha. (40 acres)

Vegetation types present, according to Kuchler's (1964) classification, would include: Type 2, Cedar - Hemlock - Douglas - Fir Forest; Type 3, Silver Fir - Douglas Fir Forest; and Type 25, Alder-Ash Forest. The natural area is mainly within the *Tsuga heterophylla* Zone (Franklin and Dyrness 1969).

Stands dominated by western hemlock cover the bulk of the natural area (fig. LC-2), but the age, structure, understory composition, number, and species of associated conifers vary greatly from site to site. On the slopes are stands of western hemlock mixed with varying proportions of western red cedar and scattered Douglas-fir *(Pseudotsuga menziesii)* and Pacific silver fir *(Abies amabilis).* Western hemlock is the major climax species, and many small openings are choked with dense hemlock reproduction (fig. LC-2). Hemlocks in one of the stands examined were about 175 years in age, 60-cm. (24-in.) d.b.h. (maximum 81-cm. or 32-in.), and 38 m. (125 ft.) in height. The understory can be typified by *Vaccinium alaskaense, Blechnum spicant,* and *Hylocomium splendens.* Other species commonly present include *Vaccinium ovalifolium, V. parvifolium., Cornus canadensis, Clintonia uniflora, Polystichum munitum,* and *Rubus pedatus.*

On some benches and the upper slopes of the natural area, mixed stands of Pacific silver fir and western hemlock are encountered in which the silver fir appears to be the major climax species. The understory is dominated

by *Rhytidiopsis robusta, Vaccinium alaskaense, Rubus pedatus, Cornus canadensis, Clintonia uniflora.,* and *Blechnum spicant.* In one of these stands the 90- to 120-cm. (3to 4-ft.) diameter and 61-m. (200-ft.) tall hemlocks and silver firs were estimated (from borings) to be over 400 years old.

Within the natural area are large old-growth Douglas-fir 180- to 200-cm. (70- to 80-in.) d.b.h. (fig. LC-2). They are concentrated in the northeast corner of the tract and on drier sites, e.g., around the steep slopes and cliffs in section 18. In the latter location the Douglas-fir is associated with an understory distinguished by the occurrence of *Berberis nervosa, Gaultheria shallon, Acer circinatum, Eurhynchium oreganum, Linnaea borealis,* and Pacific yew *(Taxus brevifolia).* Western hemlock is the major climax species.

Around streams, seeps, and similar moist habitats, a community dominated by large western red cedar and a dense understory of *Oplopanax horridum, Athyrium filix-femina, Blechnum spicant,* and many other herbs may be encountered. Very large red-cedars are sometimes encountered on these sites.

A series of interesting red alder *(Alnus rubra)*-dominated communities are found on the unstable glacial deposits in the southern half of the natural area. The area appears to be a mosaic of stands of varying age and size depending upon when the last slump or landslide took place. Associated with the alder is black cottonwood *(Populus trichocarpa),* bigleaf maple *(Acer macrophyllum.),* and Sitka spruce *(Picea sitchensis).* The understory includes species of *Petasites, Equisetum, Stachys, Gal1ium,* and *Carex;, Rubus spectcibilis, R. ursinus, Oplopanax horridum,* and *Polystichum munitum;* and the rank growth obscures innumerable holes and erosion channels in the substrate. Older stands of red alder, Sitka spruce, bigleaf maple, and western red cedar are developing on small areas where the land surfaces have been stable for 30 to 50 years (fig. LC-2). Near the southern edge of the natural area a stand of stunted red alder, willow *(Salix;* sp.), and dense *Scirpus* sp. has developed on alluvial deposits of the eroded glacial silts.

Red alder appears to be the likely climax species throughout most of this area. Constant disturbance of the land surface due to mass soil movements and erosion perpetuates the alder and prevents the stands from developing beyond this successional stage.

Mammals believed to utilize the natural area are listed in table LC-l.

Except for the stream sides and unstable land surfaces associated with the glacial deposits, no specialized habitats are known within the natural area.

HISTORY OF DISTURBANCE

There is no evidence of recent fires or human disturbance within the Long Creek Research Natural Area, although a small structure is shown in the SWI/4 of section 17 on the U.S. Geological Survey map of the Silverton Quadrangle. A small farm once existed adjacent to the southern boundary and National Forest lands adjacent to the west, south, and east boundaries are in process of being logged.

RESEARC H

No research is presently being conducted on the natural area. The mosaic of communities and environments on the unstable till deposits appears to offer unique research opportunities, perhaps even of geomorphologic phenomena.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 15' Silverton, Washington quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1957; and *geology* - *Geologic Map of Washington,* scale 1:500,000 (Huntting et al. 1961). Either the District Ranger (Monte Cristo Ranger District) or Forest Supervisor (Mount Baker National Forest, Bellingham, Washington) can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Snyder, Robert V., and John M. Wade
1970. Mt. Baker National Forest soil resource inventory. 267 p. plus atlas of maps and interpretive tables. Northwest Reg., USDA Forest Servo

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1956. Climatic summary of the United States - supplement for 1931 through 1952, Washington. Climatography of the United States 11-39, 79 p., illus.

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1965. Climatic summary of the United States - supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table LC-1. — Tentative list of mammals for Long Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex cinereus	masked shrew
	Sorex obscurus	dusky shrew
	Sorex palustris	northern water shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis keeni	Keen myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Tamiasciurus douglasi	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx rufus	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. columbianus	black-tailed deer

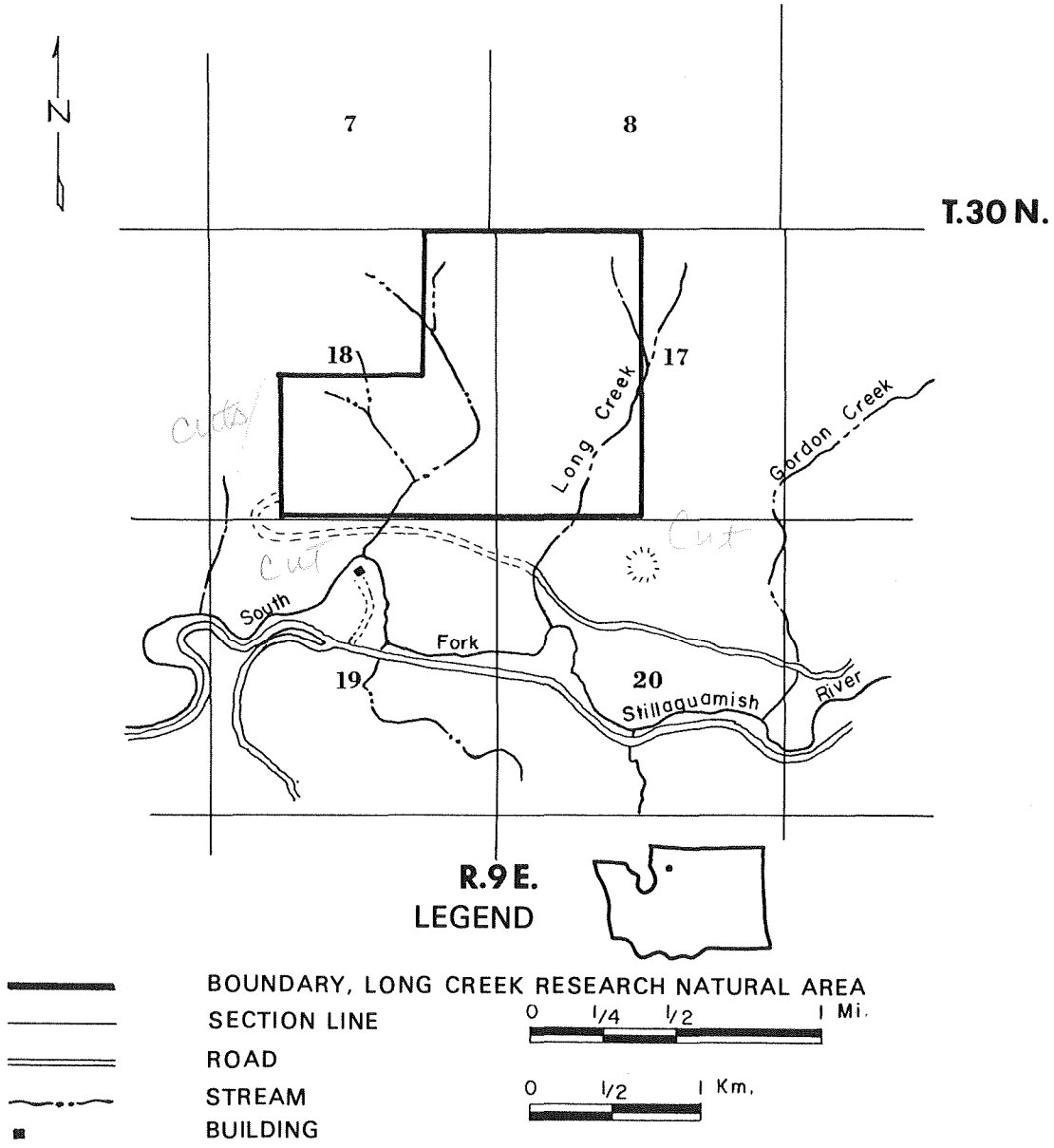
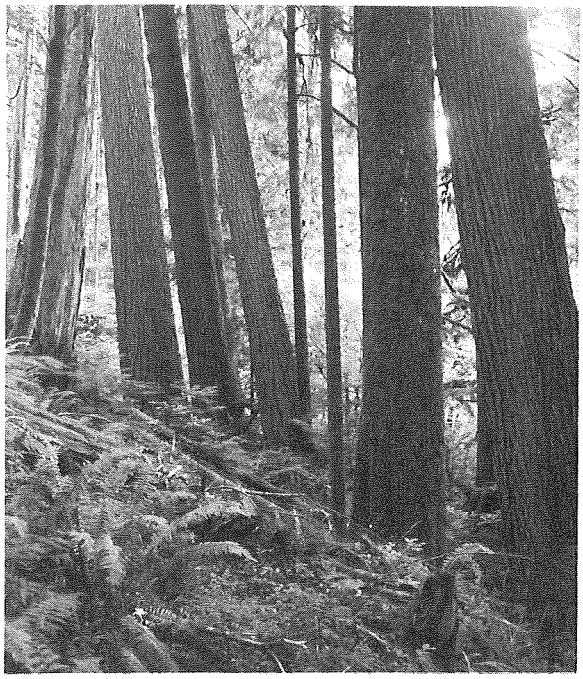


Figure LC-1.– Long Creek Research Natural Area, Snohomish County, Washington.

Figure L C-2. -Communities of the Long Creek Research Natural Area. Upper left: Typical stand of western hemlock averaging 45- to 70-cm. d.b.h. Upper right: Stand of red alder, Sitka spruce, bigleaf maple, and *Polystichum munitum* developed on portion of unstable glacio-lacustrine sediments at lower elevations. Lower left: Small opening in mature forest of western hemlock occupied by dense reproduction of western hemlock and small amounts of Pacific silver fir and western red-cedar. Lower right: Group of large, old-growth Douglas-firs averaging 175- to 200-cm. d.b.h.



Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

MAPLE KNOLL RESEARCH NATURAL AREA[1]

Bigleaf maple and Oregon white oak stands on opposite slopes of a foothill ridge in Oregon's Willamette Valley.

Maple Knoll Research Natural Area was established on December 27, 1966. It provides examples of bigleaf maple *(Acer macrophyllum)* and Oregon white oak *(Quercus garryana)* stands typical of hilly areas in and adjacent to the Willamette Valley in western Oregon. The 4.5-ha. (l00-acre) natural area is located in Benton County, Oregon, and is administered by the William L. Finley National Wildlife Refuge (Route 2, Box 208, Corvallis, Oregon), Bureau of Sport Fisheries and Wildlife. It is located in sections 31 and 32, T. 13 S., R. 5 W., Willamette meridian, at 44 °24' N.latitude and 123°20' W.longitude.

ACCESS AND ACCOMMODATIONS

The Maple Knoll Research Natural Area is located a short distance off U.S. Highway 99W, about 16 km. (10 miles) south of Corvallis. An all-weather graveled road approaches within about 0.8 km. (0.5 mile) of the tract. It is bounded by a fire road along its northeastern edge, but this road cannot be driven during winter months. A maintained trail traverses the natural area from west to east (fig. MA-l). Visitors should contact the Refuge Manager about the best route of approach. Commercial accommodations are available in Corvallis; there are no public campgrounds available within the refuge.

ENVIRONMENT

The Maple Knoll Research Natural Area occupies both slopes (north and south) and the top of a low, east-west oriented valley foothill ridge (fig. MA-2). Slopes are generally moderate. Elevations range from about 91 to 168 m. (300 to 500 ft.). There are no streams or springs within the natural area. A swampy area is located on low ground adjacent to its northern boundary.

The ridge occupied by the natural area is composed of light gray to yellowish brown arkosic micaceous sandstone with thin siltstone partings (Vokes et al. 1954). This material belongs to the Spencer formation of upper Eocene age. A narrow dike or sill-like body of intrusive igneous rocks runs from east to west along the ridge line; this intrusion may be composed of basalt, gabbro, or diabase.

The natural area is located in western Oregon, an area of mild, moist climate. However, it is within the Willamette Valley, which is located between the Coast and Cascade Ranges and is, therefore, subject to the somewhat warmer and drier climate typical of interior western Oregon valleys. The summer dry period is especially pronounced. Representative climatic data from the Corvallis weather station are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	11.6°C. (53.0°F.)
Mean January temperature	4.1°C. (39.4°F.)
Mean July temperature	19.2°C. (66.6°F.)
Mean January minimum temperature	0.6°C. (33.1°F.)
Mean July maximum temperature	27.1°C. (80.8°F.)
Average annual precipitation	957 mm. (37.67 in.)
June through August precipitation	49 mm. (1.93 in.)

[1] Description prepared by Dr. .J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory. Corvallis, Oregon.

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According to a recent soil survey, two soil series are found within the natural area. The Bellpine silty clay loam occupies the north slopes of the ridge, and the Dixonville silty clay loam occupies the ridge top and south slopes. The Dixonville series has been classified as a Brunizem and Pachic Ultic Argixeroll according to the old and new soil classifications, respectively. It consists of a well-drained silty clay loam surface soil over clay and is formed in colluvium from basic igneous rock. A typical horizon sequence is as follows: very dark brown A1 from 0 to 13 cm.; very dark gray brown A3 from 13 to 32 cm.; and very dark brown, clayey B2t from 32 to 66 cm. The Bellpine series (ex-Bellfountain soil series) has been classified as a Red-Yellow Podzolic and Typic Haploxerult. It consists of a moderately deep silty clay loam surface soil over clay and is typically formed in colluvium from sedimentary rocks. A typical horizon sequence is as follows: dark reddish brown A 1 from 0 to 15 cm.; dark reddish brown B 1 from 15 to 25 cm.; and dark red silty clay IIB2t from 25 to 50 cm.

BIOTA

Areas by vegetation types are as follows:

Name	*Area*
Bigleaf maple forest	14 ha. (35 acres)
Oregon white oak forest	18 ha. (45 acres)
Grassland	12 ha. (29 acres)

The Oregon white oak stands can be assigned to SAF forest cover type 233, Oregon White Oak (Society of American Foresters 1954); the Society does not recognize a type in which bigleaf maple is the dominant species. The oak forest can also be assigned to Kuchler's (1964) Type 26, Oregon Oakwoods, and bigleaf maple stands are possibly assignable to his Type 25, Alder-Ash Forests. The natural area is located within the Interior Valley *(Pinus-Quercus-Pseudotsuga)* Zone of Franklin and Dyrness (1969).

Bigleaf maple dominates the stands found on the north side of the ridge. These developed following logging of the area during or prior to World War II. Trees are relatively small in size averaging 25- to 40-cm. (10- to 15-in.) d.b.h. Scattered through the tract are older, larger specimens of grand fir *(Abies grandis)* which were not removed at the time of logging. Oregon white oak and Douglas-fir *(Pseudotsuga menziesii)* are also encountered. The trend of forest succession is not entirely clear; grand fir and bigleaf maple are generally both represented in reproductive size classes.

The forest stands on the top and south slopes of the ridge are dominated by Oregon white oak with a scattering of Douglas-fir. According to Anderson (1970), there is a relatively dense canopy cover (80 percent) and trees often exceed 18 m. (60 ft.) in height. Bigleaf maple are occasionally encountered in the south slope stands and, with Douglas-fir, appear to dominate reproductive size classes.

Composition of the understory community varies with aspect and strong changes in the overstory. Bigleaf maple stands on the north slopes typically have well-developed shrub and herbaceous layers. *Philadelphus lewisii, Corylus cornuta* var. *californica,* and Pacific yew *(Taxus brevifollia)* are common tall shrub species. *Polystichum munitum* dominates the herbaceous layer with a rich variety of associated herbs and mosses. The understory in the white oak stands is characterized by the low shrub and liana species *Rhus diversiloba.* The abundance of this species is believed a consequence of heavy grazing (Thilenius 1964, 1968). Other understory species encountered include *Rosa eglanteria, Symphoricarpos albus,* and *Rubus ursinus* in the shrub layer and *Galium* sp., *Osmorhiza nuda, Satureja douglasii,* and several perennial and annual grasses in the herb layer. The oak stands relate to Thilenius (1964, 1968) *Quercus garryana/Rhus diversiloba* community type.

The grasslands were not examined in detail. They have been heavily grazed and contain a high proportion of introduced species which include all of the annual grass dominants. In addition to a variety of herbaceous plants - perennial and annual grasses and forbs - bushes of *Rosa eglanteria* and *Rhus diver-*

siloba are scattered through the grasslands.

Mammals believed or known to reside or pass through the Maple Knoll Research Natural Area are listed in table MA-l. The avifauna of the oak stands are known in detail (Anderson 1970). There are 15 species which inhabit the tract as permanent residents, in addition to seven occasional species, 12 summer resident species, and three winter resident species. These include the hairy woodpecker *(Dendrocopos villosus),* downy woodpecker *(Dendrocopos pubescens),* black-capped chickadee *(Parus atricapillus),* white-breasted nuthatch *(Sitta carolinensis),* brown creeper *(Certhia familiaris),* Bewick's wren *(Thryomanes bewickii),* robin *(Turdus migratorius),* Hutton vireo *(Vireo huttoni),* Rufous-sided towhee *(Pipilo erythrophthalmus),* and Oregon junco *(Junco oreganus).*

HISTORY OF DISTURBANCE

Human activities have had a strong influence on the development of existing forest stands within the Maple Knoll Research Natural Area. The stands on the north slope of the ridge were logged 30 or more years ago. The original stands were probably a mixture of Douglas-fir, grand fir, and bigleaf maple. Selection of Douglas-fir during the logging operations assisted in the conversion of the stand to bigleaf maple. The Oregon white oak stands on the south slope of the ridge have probably never suffered significant logging. However, Habeck (1961, 1962) and Thilenius (1964, 1968) have provided abundant evidence that most of the closed canopy Oregon white oak stands in the Willamette Valley are a consequence of fire control activities instituted with the settlement of the valley in the early 1800's. Prior to this time, open oak savannas and grasslands were believed to have been maintained by periodic fires, possibly set by Indians.

Sheep heavily grazed the oak woodlands and grasslands on the south slope of the ridge until establishment of the wildlife refuge in 1963. No grazing of the area has been allowed since that time. This grazing has significantly altered the composition of the grassland communities and is one reason for the abundance of introduced species. As mentioned, it may also be one of the reasons for the abundance of *Rhus diversiloba* in the oak stands.

RESEARCH

The natural area has been used as a site for undergraduate research work by ecology and wildlife students from Oregon State University; the Refuge Manager can provide details. The south slope stands of Oregon white oak were one of five sampling sites used by Anderson (1970) in a study of fluctuations in composition and abundance of bird species in Oregon white oak stands.

Despite the disturbances by logging and grazing, the Maple Knoll Research Natural Area is a very valuable research tract since the communities are typical of many forested areas found in the Willamette Valley, and protected sites of these types are extremely rare. Successional studies in the maple, oak, and grassland types seem especially appropriate to determine what effect human activities have had on them and how rapidly they are returning to a more natural state now that logging and grazing have been eliminated. Other opportunities include the study of variations in community composition, structure, and productivity on contrasting but contiguous topography and soils and of variations in animal populations and behavior in strongly contrasting vegetation types.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include the following: *Topography* - 15' Monroe, Oregon quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1957; *geology* - *Geology of the West Central Border Area of the Willamette Valley, Oregon,* scale 1:62,500 (Vokes et al. 1954). Photographs taken in June 1970 can be purchased from the Agricultural Stabilization and Conservation Service, Benton County ASC Committee, P.O. Box 1027, Corvallis, Oregon. Photo DF J -1LL-67 provides the best coverage of the natural area.

LITERATURE CITED

Anderson, Stanley H.
1970. The avifaunal composition of Oregon white oak stands. The Condor 72: 417-423, illus.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Serv. Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Habeck, James R.
1961. The original vegetation of the mid-Willamette Valley, Oregon. Northwest Sci. 35(2):65-77, illus.

_____
1962. Forest succession in Monmouth Township, Polk County, Oregon since 1950. Mont. Acad. Sci. Proc. 21: 7-17, illus.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

Thilenius, John F.
1968. The *Quercus garryana* forests of the Willamette Valley, Oregon. Ecology 49: 1124-1133, illus.

Thilenius, John Fredrick
1964. Synecology of the white-oak *(Quercus garryana.* Douglas) woodlands of the Willamette Valley, Oregon. 151 p., illus. (Ph.D. thesis, on file at Oreg. State Univ., Corvallis.)

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31, 96 p., illus.

Vokes, H. E., D. A. Myers, and Linn Hoover
1954. Geology of the west central border area of the Willamette Valley, Oregon. U.S. Geol. Surv. Oil & Gas Invest. Map OM-150.

Table MA-1. — Tentative list of mammals for Maple Knoll Research Natural Area

Order	Scientific name	Common name
Marsupialia	*Didelphis marsupialis*	opossum
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Sylvilagus bachmani*	brush rabbit
	Sylvilagus floridanus	eastern cottontail
Rodentia	*Arborimus longicaudus*	red tree vole
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus canicaudus	gray-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma fuscipes	dusky-footed wood rat
	Peromyscus maniculatus	deer mouse
	Sciurus griseus	western gray squirrel
	Spermophilus beecheyi	California ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys bulbivorus	giant pocket gopher
Carnivora	*Canis latrans*	coyote
	Lynx rufus	bobcat
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Urocyon cinereoargenteus	gray fox
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Odocoileus h. columbianus*	black-tailed deer

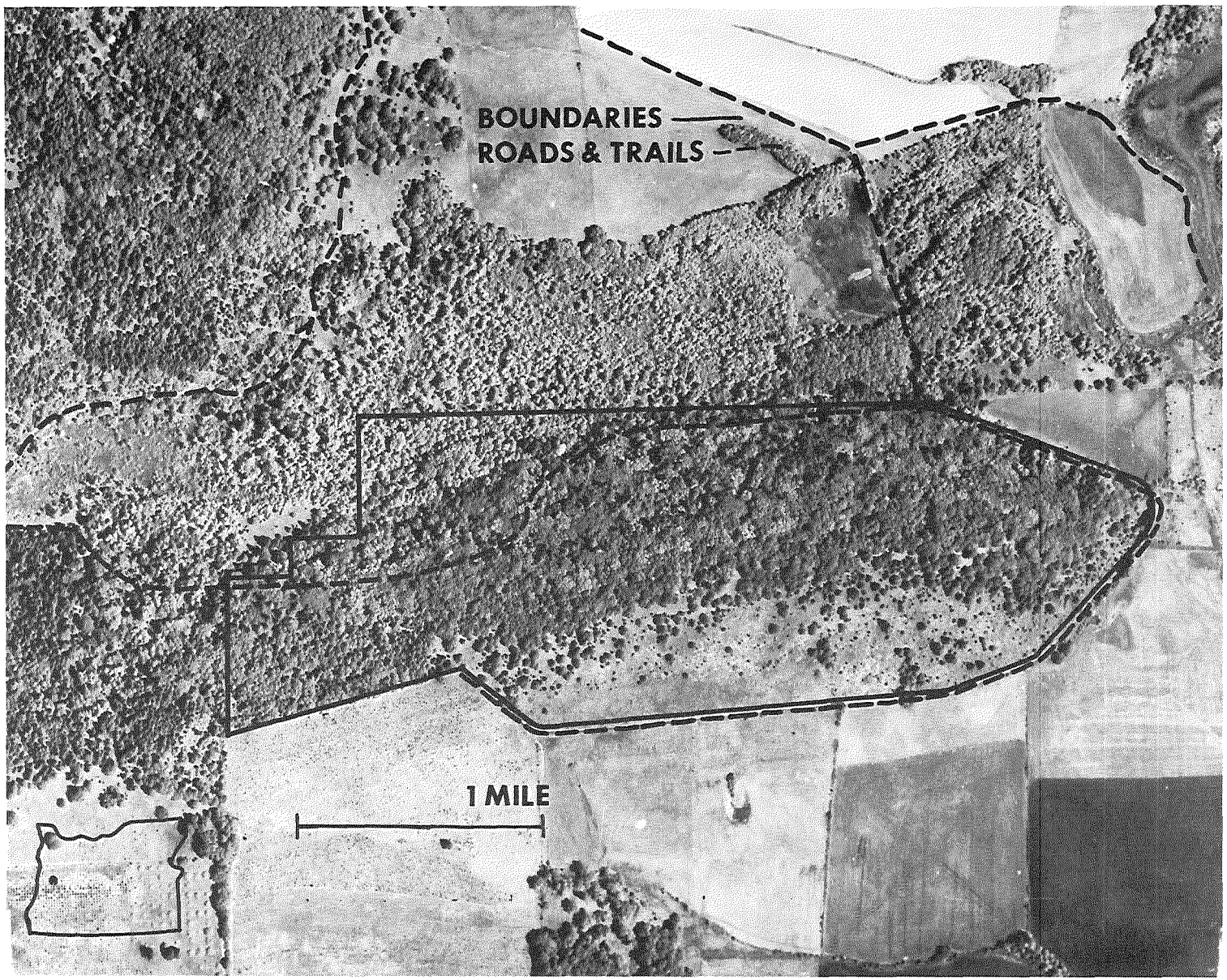
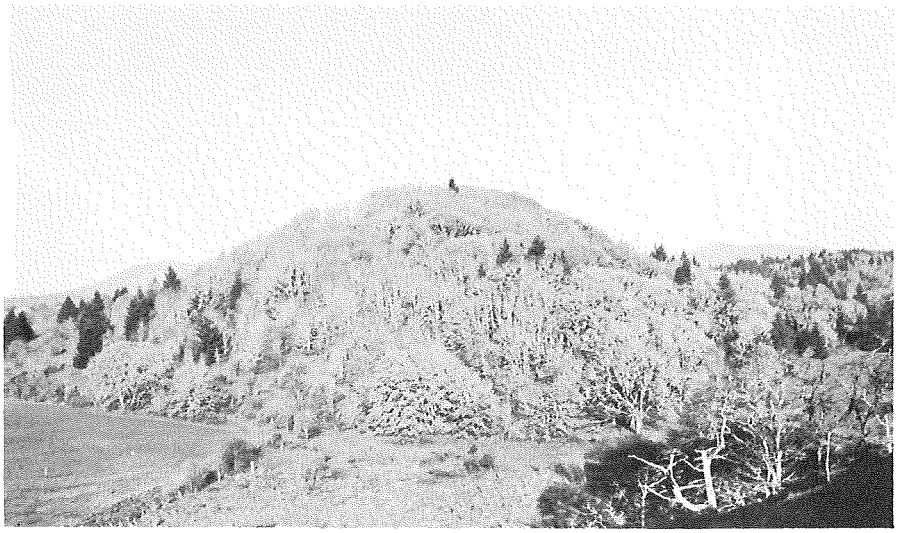


Figure MA-1.– Aerial photograph of Maple Knoll Research Natural Area, Benton County, Oregon, showing boundaries, vegetative patterns, and other features.

Figure MA-2. -Natural features of Maple Knoll Research Natural Area. Upper: Typical stand of bigleaf maple on the north slope of the tract. Center: View of the eastern edge of the natural area where the Oregon white oak and bigleaf maple stands found on south (left) and north (right) slopes, respectively, merge. Bottom: General view of the north side of the Maple Knoll Research Natural Area and its environs; Pigeon Butte Research Natural Area is on the left.



Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

MEEKS TABLE RESEARCH NATURAL AREA[1]

Ponderosa pine/pinegrass forest and intermingled stiff sagebrush-grass communities characteristic of the eastern slopes of the Washington Cascade Range.

The Meeks Table Research Natural Area was established in July 1948 to exemplify ponderosa pine/pinegrass *(Pinus ponderosa/Calamagrostis rubescens)* communities and associated grasslands typical of the Cascade Range in eastern Washington. The 27-ha. (68-acre) tract is located in Yakima County, Washington, and administered by the Naches Ranger District (Naches, Washington), Snoqualmie National Forest. Its elongated oval shape is dictated by topography (fig. ME-I). It is located in sections 5 and 6, T. 15 N., R. 14 E., Willamette meridian, at $46^0$15' N. latitude and $121^0$05' W. longitude.

ACCESS AND ACCOMMODATIONS

The tract is located about 65 km. (40 miles) northwest of Yakima and is approached via U.S. Highway 410. Directions should be obtained at the Naches Ranger Station for identifying the graveled Forest Service roads to the area and the trailhead location which leads to Meeks Table along a single, steep, narrow ridge. Access during summer is good but becomes very difficult during the winter due to snow. Public accommodations are available in Yakima and Naches; primitive forest camps are found in the vicinity of Meeks Table.

[1]Description prepared by Drs. Arthur R. Tiedemann, G. O. Klock, and H. W. Berndt, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forest Hydrology Laboratory, Wenatchee, Washington, and Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

ENVIRONMENT

The Meeks Table Research Natural Area varies in elevation from 1,280 to 1,585 m. (4,200 to 4,525 ft.). Topographically, Meeks Table is an isolated flat-topped butte, a remnant of a former basalt-capped plateau, rising 150 m. (500 ft.) above the surrounding rolling terrain. It is surrounded by precipitous cliffs with a 60- to 90-m. (200- to 300-ft.) vertical drop to talus slopes below.

A modified continental climate prevails. Most precipitation occurs as snow during the cool, cloudy winter. Summers are warm, generally low in precipitation, and largely cloudless. One to 3 months of drought are common. Climatic data from Bumping Lake located in a valley 16 km. (10 miles) west are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	4.7°C. (40.4°F.)
Mean January temperature	−4.9°C. (23.1°F.)
Mean July temperature	14.5°C. (58.2°F.)
Mean January minimum temperature	−10.0°C. (13.9°F.)
Mean July maximum temperature	23.6°C. (74.5°F.)
Average annual precipitation	1,214 mm. (47.8 in.)
July through August precipitation	69 mm. (2.7 in.)
Average annual snowfall	554 cm. (218.0 in.)

It is undoubtedly much drier and summers are warmer on the natural area itself.

Soils in the area have not been mapped, but some descriptions available in Rummell's (1951) research report follow. Weakly podzolized soils occur under forested stands which are developed in approximately 20 em. (8 in.) of volcanic ash over buried materials. A densely matted, freshly decomposed mull humus 5 em. (2 in.) thick, which is derived from

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pinegrass and conifer needle litter, covers the soil surface. Horizon sequences are:

A1	0 to 5 cm.	Light gray ashy sand with little organic matter; pH 6.4.
A2	5 to 20 cm.	Light brown loamy textured volcanic ash; crumb structure; abundant roots; pH 6.4.
B2	20 to 45 cm.	Gritty clay with strongly developed nut structure and colloidal staining on cleavage surfaces; pH 5.8.
IIBb	45 to 50 cm.+	Black fragmented clay; entire mass is dense waxy deposit.

The light-gray, ashy sand observed by Rummell appears to be lenses of volcanic ash resulting from the eruption of Mount Mazama or Mount St. Helens. In the IIBb horizon, remnants of glacial till have been observed. Shallower, nonpodzolized soils (Regosols or Entisols) occur in areas of sagebrush and grass which commonly have a biscuitswale microtopography. These soils are stonier since they lack the wind-deposited ash layers found on forested sites. The horizon sequence in a deeper, biscuit-type area is:

A1	0 to 15 cm.	Light brown loam; friable crumb structure; 20 to 40 percent stone.
B2	15 to 40 cm.	Brown gritty clay; cleavage planes show colloidal staining; 30 to 50 percent stone; pH 6.5.
D	40 cm.+	Moderately cracked bedrock of biabase material; slight lime depositions on rock surfaces.

There is little or no litter or organic layer present. Very shallow soils 5 to 10 em. (2 to 6 in.) deep occur along the windward side (southwest rim) of the butte and are occupied by very sparse vegetation.

BIOTA

Estimated areas by plant community are:

Name	*Area*
Stipa columbiana-Phlox diffusa-Artemisia rigida	10 ha. (25 acres)
Poa sandbergii-Eriogonum douglasi-Artemisia rigida	4 ha. (11 acres)
Pinus ponderosa/Calamagrostis rubescens-Lupinus laxiflorus	7 ha. (17 acres)
Pseudotsuga menziesii/ Calamagrostis rubescens-Arnica cordifolia	6 ha. (15 acres)

The areas of *Pinus/Calamagrostis-Lupinus* can be assigned to SAF cover type 237, Interior Ponderosa Pine (Society of American Foresters 1954), and Kiichler's (1964) Type 11, Western Ponderosa Pine Forest. The areas of *Pseudotsuga/Calamagrostis-Arnica* can be assigned SAF forest cover type 214, Ponderosa Pine-Western Larch-Douglas-Fir, and probably to Kuchler's Type 12, Douglas Fir Forest. The grass-stiff sagebrush *(Artemisia rigida)* communities probably fall within Kuchler's Type 55, Sagebrush Steppe. The entire tract appears to fall within the *Abies grandis* Zone found on the eastern slope of Washington's Cascade Range (Franklin and Dyrness 1969).

The *Poa sandbergii-Eriogonum douglasi--Artemisia rigida* community is found on the north and south extremes of Meeks Table (figs. ME-2 and ME-3). These are harsh, rocky outcrops with little soil development and sparse vegetative cover (22 percent). Low forbs and halfshrubs such as *Sedum stenopetallum, Arenaria congesta,* and *Eriogonum douglasi* account for more than half of the vegetal cover (table ME-I). Sandberg bluegrass *(Poa sandbergii)* and bottlebrush squirreltail *(Sitanion hystrix)* are the most abundant perennial grasses. Cheatgrass *(Bromus tectorum)* is common in this community. Bitterbrush *(Purshia tridentata)* and stiff sage comprise most of the shrub cover. Soil depth varies from 5 em. (2 in.) to 6 dm. (2 ft.). Soils are lower in cation exchange capacity, organic matter, and total nitrogen than the other communities on the Table (table ME-2). This community is similar to those found on the *Artemisia rigida-Poa sandbergii* habitat type described by Daubenmire (1970). Transitions with the forested communities and the

Stipa-Phlox-Artemisia community are gradual, with bitterbrush occurring mainly in this zone.

Stipa columbiana-Phlox diffusa-Artemisia rigida is the most extensive community type on Meeks Table, occurring in large openings between the forested areas (figs. ME-2 and ME-3). Total vegetal cover is 41 percent. Columbia needlegrass *(Stipa columbiana),* pinegrass *(Calamagrostis rubescens),* and Sandberg bluegrass are the predominant grasses (table ME-I). Numerous forbs and half-shrubs account for more than half of the cover in this community. *Sedum* is the most common forb and *Phlox diffusa* the most common halfshrub. Small annual forbs such as *Collinsia parviflora* and *Polygonum kelloggii* occur frequently. Stiff sage is the most common shrub but accounts for only 10 percent of the total cover. This community resembles sagebrush-grass communities which have been depleted by livestock overuse; however, livestock have never grazed Meeks Table. Within this community, there are areas resembling biscuit-swale topography with islands of pinegrass and bluebunch wheatgrass *(Agropyron spicatum.).* Soil depth ranges from 6 dm. (2 ft.) to 2.7 m. (9 ft.). Soil bulk density and pH are the highest of any of the communities (table ME-2). Contents of organic matter and total nitrogen are intermediate. Transition to the forest communities is marked by an abrupt rise in the topograpby of 15 to 30 em. (6 to 12 in.) similar to the rise in the islands in the biscuit-swale topography.

The *Pinus ponderosa/Calamagrostis rubescens/Lupinus laxiflorus* community has a stocking rate of 91 trees per ha. (37 trees per acre). Of these, 80 are ponderosa pine and 11 are Douglas-fir *(Pseudotsuga menziesii).* Ponderosa pines average 64-cm. (25-in.) d.b.h. and vary from sapling size to 163 em. (64 in.). The scattered Douglas-fir trees have an average d.b,h. of 46 em. (18 in.) and range in size from saplings to 84 em. (34 in.). Reproduction of both tree species is sparse. Crown cover of the overstory averages 26 percent but is as great as 70 percent in places. Cover of understory vegetation is 76 percent and clearly dominated by pinegrass and elk sedge *(Carex geyeri)* (table ME-I). These two species comprise two-thirds of the understory cover. *Lupinus laxiflorus* is the most abundant forb. Soils are 3 to 5 m. (10 to 17 ft.) deep and have the highest level of total nitrogen of any of the communities (table ME-2).

The *Pseudotsuga menziesii/Calamagrostis rubescens-Arnica cordifolia* community differs from the *Pinus/Calamagrostis-Lupinus* community in composition and cover of both overstory and understory and in stocking rate. Average number of trees per ha. is 398 (161 per acre) of which 234 (95 per acre) are Douglas-fir, 90 (36 per acre) are ponderosa pine, and the remainder are western larch *(Larix occidentalis)* and grand fir *(Abies grandis).* Douglas-fir trees range in size from saplings to 117 em. (46 in.), averaging 36 em. (14 in.). Ponderosa pine, western larch, and grand fir average 43-cm. (17-in.), 36-cm. (14in.), and 13-cm. (5-in.) d.b.h., respectively. Reproduction of Douglas-fir and grand fir is good. Crown cover of trees ranges from 20 to 100 percent and averages 51 percent. For such a high percentage of tree cover, the 46percent crown cover of understory vegetation is surprisingly high. Three-fourths of this cover is pinegrass and elk sedge (table ME-I). *Arnica cordifolia* is the predominant forb. Soil depth varies from 2 to 4.5 m. (7 to 15 ft.). Properties are similar to the soil of the *Pinus/ Calamagrostis-Lupinus* community except that bulk density and total nitrogen are lower (table ME-2).

Both of the forested communities are probably occupying habitats analogous to the *Pseudotsuga menziesii-Calamagrostis rubescens* habitat type of Daubenmire and Dauben mire (1968).

Mammals believed to utilize the natural area as residents or transients are listed in table ME-3.

HISTORY OF DISTURBANCE

Fire scars on ponderosa pine (fig. ME-3) indicate ground fires periodically burned the area prior to initiation of fire control programs in 1910. Lack of dominant old-growth Douglas-fir or grand fir and lush

grass growth further suggest that virtually all portions of Meeks Table were burned by ground fires. Catfaces on tall ponderosa pine attest to numerous lightning strikes on the butte.

Domestic livestock have never grazed the area because the very narrow, precipitous trail at the butte's west end is inimical to livestock passage. No other disturbance is known.

RESEARC H

Rummell (1951) evaluated the un-grazed vegetation and soils on Meeks Table and compared them with those on Devil's Table, about 16 km. (10 miles) distant, an area which had been overgrazed by livestock. Detailed studies of the vegetation and soils are in progress and some of the results are incorporated into this description; a complete report will be published in the future.[2]

The Meeks Table Research Natural Area provides interesting research opportunities: (1) on forest succession without a past history of livestock use; (2) on vegetation-soil relationships in relation to the intricate pattern of forested and non-forested plant communities; and (3) as a benchmark area for evaluating adjacent stands which have been grazed and logged.

MAPS AND AERIAL PHOTOGRAPHS

No special topographic or geologic maps are available for the natural area which are sufficiently detailed to be useful. Either the District Ranger (Naches Ranger District) or Forest Supervisor (Snoqualmie National Forest, Seattle, Washington) can provide details on the most recent aerial photo coverage of the area.

[2] Research by Drs. A. R. Tiedemann, G. O. Klock, and H. W. Berndt, U.S. Forest Service, Forest Hydrology Laboratory, Wenatchee, Washington.

LITERATURE CITED

Daubenmire, R.
1970. Steppe vegetation of Washington. Wash. Agric. Exp. Stn. Tech. Bull. 62, 131 p., illus.

Daubenmire, R., and Jean B. Daubenmire 1968. Forest vegetation of eastern Washington and northern Idaho. Wash. Agric. Exp. Stn. Tech. Bull. 60, 104 p., illus.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Serv. Res. Pap. PNW - 80,216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Rummell, Robert S.
1951. Some effects of livestock grazing on ponderosa pine forest and range in central Washington. Ecology 32: 594-607, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States-supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table ME-1. — Percent frequency and coverage of various plant species and groups within four plant communities on Meeks Table Research Natural Area

Plant life form and species	Community type: *Poa-Eriogonum-Artemisia*		*Stipa-Phlox-Artemisia*		*Pinus/Calamagrostis-Lupinus*		*Pseudotsuga/Calamagrostis-Arnica*	
	Frequency	Cover	Frequency	Cover	Frequency	Cover	Frequency	Cover
Grasses and sedges:								
Poa sandbergii	78	1.6	63	1.6				
Danthonia unispicata	22	.3	24	.8				
Sitanion hystrix	36	.9	29	.3				
Bromus tectorum	44	.9						
Stipa columbiana			90	8.8			10	1.0
Calamagrostis rubescens			12	2.4	100	42.7	77	19.3
Carex geyeri					90	11.2	97	12.0
Other grasses and sedges		.8		1.4		1.4		[1]
Total grasses and sedges		4.5		15.3		55.3		32.3
Forbs and halfshrubs:								
Eriogonum douglasi	54	1.9						
Antennaria dimorpha	60	1.4						
Arenaria congesta	76	1.0						
Sedum stenopetallum	92	1.4	68	1.1				
Allium acuminatum	26	[1]						
Lewisia rediviva	22	[1]						
Phlox diffusa			51	4.3				
Madia glomerata			41	.6				
Lomatium triternatum			41	.5				
Lomatium dissectum			41	.6				
Lomatium nudicaule			42	.8				
Collinsia parviflora			40	.1				
Polygonum kelloggii			49	.3				
Achillea millefolium					63	3.3		
Anaphilis margaritacea					50	.8		
Lupinus laxiflorus					96	8.3	47	1.7
Erythronium grandiflorum					47	.7	27	.2
Arnica cordifolia					70	3.0	90	6.5
Hieracium cynoglossoides					40	.7		
Frasera speciosa							13	1.0
Osmorhiza chilensis							13	.8
Other forbs and halfshrubs		6.3		13.9		3.7		2.2
Total forbs and halfshrubs		12.0		21.6		20.5		12.4
Shrubs:								
Artemisia rigida	26	1.4	49	3.7				
Purshia tridentata	12	2.9						
Arctostaphylos uva-ursi	2	.8					3	.3
Potentilla fruticosa			13	.2				
Holodiscus discolor					3	.2		
Ribes spp.							7	.5
Total shrubs		5.1		3.9		.2		.8
Total, all plants		21.6		40.8		76.0		45.5

[1]Trace.

Table ME-2. — Properties of the upper 8 cm. of soil on Meeks Table Research Natural Area

Community	Bulk density	Moisture percentage		Cation exchange capacity	pH	Organic matter	Total N	Total S
	g/cm.^{3}	.06 atm.	15 atm.	me./100 g.		.....	Percent	.....
Stipa-Phlox-Artemisia	1.30	28	15	26	6.3	3.2	0.14	0.018
Pinus/Calamagrostis-Lupinus	1.07	32	18	25	5.9	4.6	.18	
Pseudotsuga/Calamagrostis-Arnica	.96	36	23	24	5.9	4.0	.12	.011
Poa-Eriogonum-Artemisia	1.08	33	21	16	6.2	2.2	.09	

Table ME-3. — Tentative list of mammals for Meeks Table Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Sorex cinereus	masked shrew
	Sorex obscurus	dusky shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Lepus californicus	black-tailed jack rabbit
	Lepus townsendi	white-tailed jack rabbit
	Ochotona princeps	pika
	Sylvilagus nuttalli	mountain cottontail
Rodentia	*Clethrionomys gapperi*	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus montanus	mountain vole
	Microtus oregoni	Oregon or creeping vole
	Neotoma cinerea	bushy-tailed wood rat
	Perognathus parvus	Great Basin pocket mouse
	Peromyscus maniculatus	deer mouse
	Sciurus griseus	western gray squirrel
	Spermophilus saturatus	Cascades mantled ground squirrel
	Spermophilus townsendi	Townsend ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys talpoides	northern pocket gopher
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx rufus	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Taxidea taxus	badger
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer

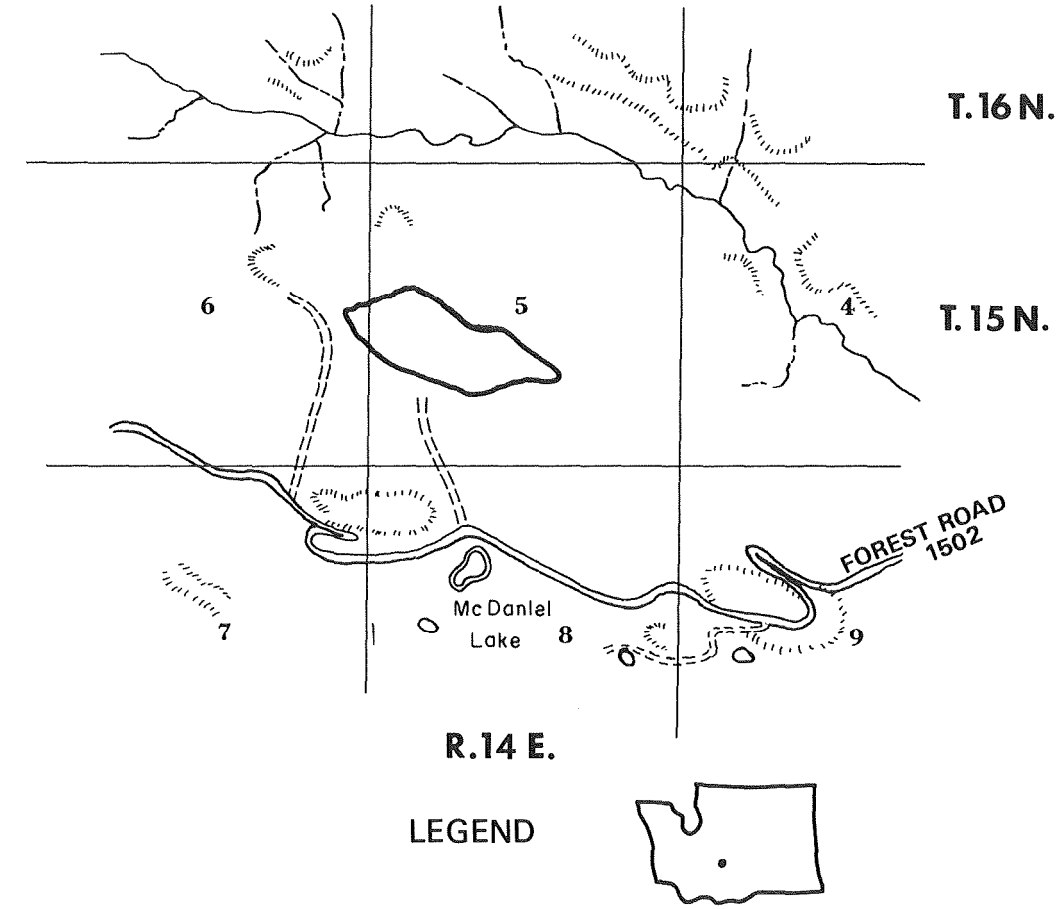

Figure ME-1.– Meeks Table Research Natural Area, Yakima County, Washington.

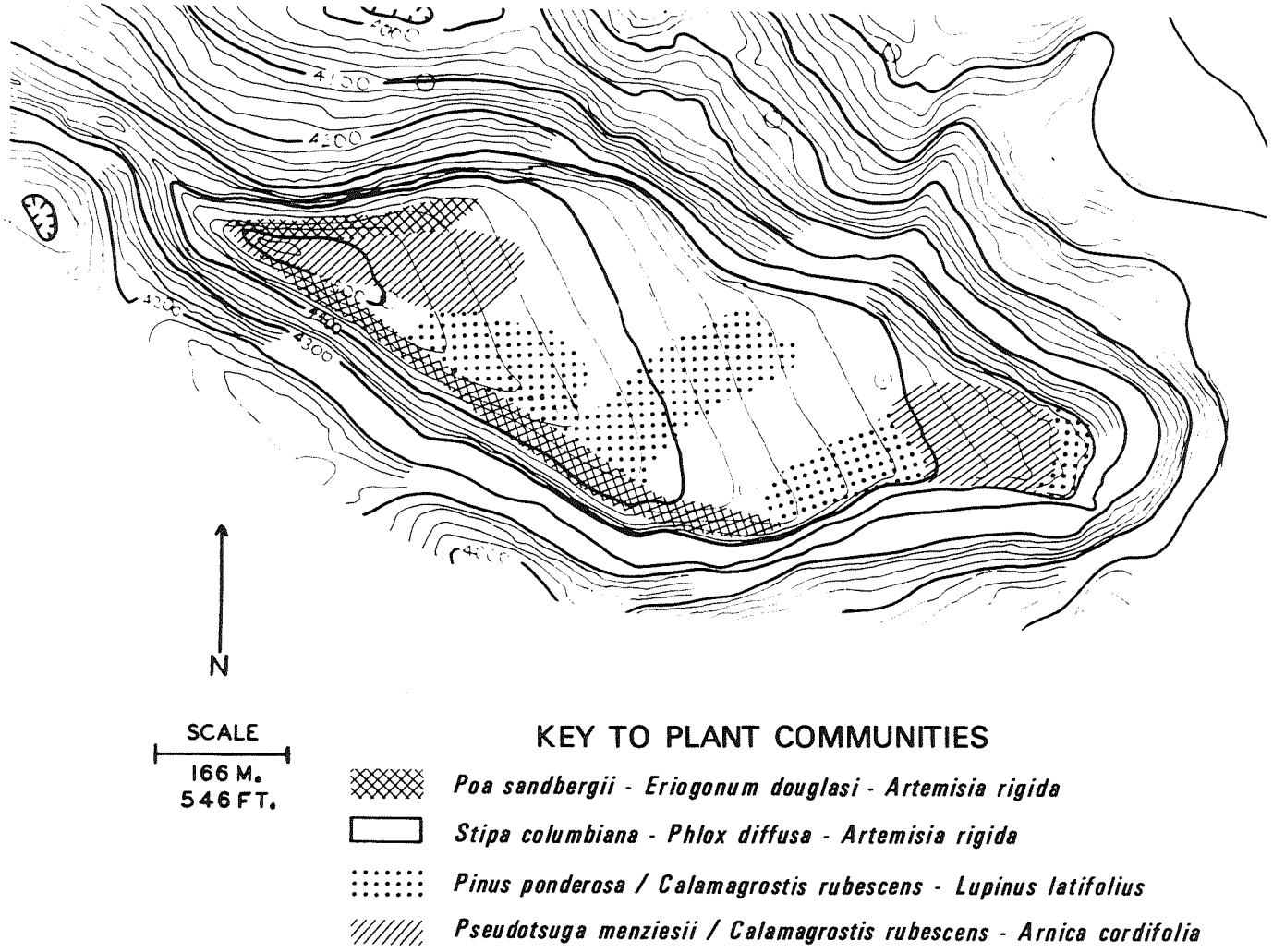

Figure ME-2.– Distribution of plant communities on Meeks Table Research Natural Area; contour interval is approximately 6 m. (20 ft.).

Figure ME-3.-Communities of Meeks Table Research Natural Area. Upper left: *Pinus/Calamagrostis-Lupinus* community; tree reproduction is scant and fire scars common (note tree left of meter board). Upper right: *Pseudotsuga/Calamagrostis-Arnica* community; Douglas-fir and grand fir dominate the reproduction. Lower left: *Poa-Eriogonum-Artemisia* community. Lower right: *StipaPhlox-Artemisia* community.

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METOLIUS RESEARCH NATURAL AREA[1]

Ponderosa pine forests on flat topography and steep westerly slopes typical of the east slope of the Cascade Range in central Oregon.

The Metolius Research Natural Area was established June 1931. It exemplifies ponderosa pine/bitterbrush *(Pinus ponderosa/Purshia tridentata)* (on flats) and ponderosa pine - Douglas-fir / green manzanita *(Pinus ponderosa - Pseudotsuga menziesii/Aretostaphylos patula)* (on steep westerly slopes) communities, These occupy extensive areas on the east slopes of the Cascade Range in central Oregon. The 581-ha, (1,140-acre) tract is located in Jefferson County, Oregon, and is administered by the Sisters Ranger District (Sisters, Oregon), Deschutes National Forest. The rectangular area encompasses parts of sections 25, 26, 35, and 36, T. 12 S" R. 9 E., Willamette meridian (fig. MI-1); boundaries are based on legal lines. It is located at 49° 40' N. latitude and 121 °40' W. longitude.

ACCESS AND ACCOMMODATIONS

Access is via U.S. Highway 20 and a forest road leading into the Metolius River drainage. The natural area is located about 29 km. (18 miles) northwest of Sisters and is most easily approached via U.S. Highway .20 and a series of paved forest roads. Access]s good during summer, but snow creates difficulties during the winter. Public accommodations are available at Camp Sherman, about 2 km.

[1] Description prepared by Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

(1 mile) south of the tract, and at Sisters, Oregon; there are numerous improved forest campgrounds in the general area.

ENVIRONMENT

The Metolius Research Natural Area occupies two contrasting landforms; the western half is located on a nearly flat bench along the Metolius River and the eastern half occupies the very steep, west slope of Green Ridge. Elevations range from about 850 to 1,460 m. (2,800 to 4,800 ft,).

The geology of the natural area is strongly correlated with the topography. Bedrock in the western half is basalt and basaltic andesite lavas (Williams 1957). These Pleistocene-Recent materials belong to the High Cascade formation. The natural area actually straddles the Metolius fault and steep slopes in the eastern half of the tract are actually a fault escarpment. These slopes and Green Ridge itself are composed of Pliocene and Pleistocene olivine basalts and basaltic andesites of the High Cascades (Williams 1957). The surface of the entire natural area has 2 to 5 cm. (1 to 2 in.) of dacite pumice from ancient Mount Mazama and up to 7 cm. (3 in.) of basaltic ash from cinder cones to the east (Taylor 1968) ..

A modified continental climate prevails. Most precipitation occurs as snow during the cool, cloudy winter. Summers are warm, generally low in precipitation and largely cloudless. One to three months of drought are common. Climatic data from Sisters, 22 km, (14 miles) southeast near the forest-steppe boundary, are as follows (West 1964):

Mean annual temperature	7.9°C. (45.5°F.)
Mean January temperature	−0.5°C. (31.0°F.)
Mean July temperature	17.4°C. (63.4°F.)
Mean annual precipitation	408 mm. (16.07 in.)
June through August precipitation	36 mm. (1.40 in.)

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Mean annual precipitation may be as much as 250 mm. (10 in.) higher on the natural area.

Soils on the natural area have not been mapped or described. Throughout the tract, they are primarily dacite pumice and other aeolian volcanic ejecta of sandy loam to loamy sand texture over buried profiles. Minimal profile development is evident and would probably be classed as Regosol. A soil profile described on similar habitat a short distance away appeared as follows (West 1964) :

0	5 to 0 cm.	Mull type humus from conifer and shrub litter.
A1	0 to 10 cm.	Dark brown (7.5 YR 4/4, dry) pumicy loamy sand; pH 7.3.
AC1	10 to 50 cm.	Strong brown (7.5 YR 5/6, dry) pumicy sand; pH 8.0.
AC2	50 to 132 cm.+	Brownish yellow (10 YR 6/6, dry) pumicy sand; pH 7.7; increasing size and density of gravel with depth.

BIOTA

Estimated area by plant community:

Name	*Area*
Pinus ponderosa/Purshia tridentata/Stipa occidentalis	260 ha. (640 acres)
Pinus ponderosa/Arctostaphylos patula	270 ha. (675 acres)
Pseudotsuga menziesii-Larix occidentalis-Pinus ponderosa/Arctostaphylos patula	51 ha. (125 acres)

The ponderosa pine communities can be assigned to SAF forest cover type 237, Interior Ponderosa Pine (Society of American Foresters 1954), and to Kuchler's (1964) Type 10, Ponderosa Pine Shrub Forest. The Douglas-fir-western larch *(Larix occidentalis*)-ponderosa pine community probably relates to SAF type 214, Ponderosa PineLarch-Douglas-Fir, and to Kuchler's Type 12, Douglas Fir Forest. Lower elevations in the area fall within the *Pinus ponderosa* Zone and higher elevations within the *Pseudotsuga menziesii* (or possibly *Abies grandis)* Zone of north central Oregon (Franklin and Dyrness 1969),

The sole overstory dominant in the *Pinus/Purshia/Stipa* community is ponderosa pine. Ground vegetation is clearly dominated by bitterbrush (fig. MI-2). Herbaceous vegetation is scanty, consisting mostly of western needlegrass *(Stipa occidentalis)* with occasional bottlebrush squirrel tail *(Sitanion hystrix)* and Ross's sedge *(Carex rossii).* It typifies key winter game range in this area,

The *Pinus/Arctostaphylos* community has overstory dominance of ponderosa pine but often has moderate to abundant Douglas-fir seedlings, saplings, and poles in the understory. Grand fir *(Abies grandis)* and incense cedar *(Libocedrus decurrens)* may also be present. Ground vegetation is dominated by green manzanita, often with abundant bitterbrush, western needlegrass, bottlebrush squirreltail, and Ross's sedge.

In the *Pseudotsuga - Larix - Pinus/Arctostaphylos* community, the pine and fir are mixed with moderate amounts of western larch in the overstory. Ground vegetation is dominated by green manzanita with western needlegrass, bottlebrush squirreltail, Ross's sedge and some *Fragaria Cuneifolia.*

Mammals believed to reside in or visit the natural area are listed in table MI-l. Mule deer *(Odocoileus hemionus)* use the area as winter range.

HISTORY OF DISTURBANCE

Fire-scarred ponderosa pine and the absence of dominant, old-growth Douglas-fir and grand fir indicate ground fires periodically burned nearly all portions of the tract prior to initiation of fire control programs about 1910 (fig. MI-2). Fire scars record 10 to 12 ground fire occurrences.

Domestic livestock, mainly sheep, passed through the area on their way to grazing grounds at higher elevations in earlier years. They do not appear to have significantly altered the vegetation.

On the other hand, mule deer make heavy use of the lower bench area for primary winter range. Deer apparently have or are causing some changes in ground vegetation on the bench; bitterbrush is moderately to severely browsed and many ponderosa pine saplings are high-lined.

RESEARCH

Numerous studies have been carried out in the vicinity of the natural area and are at least partially relevant there. They include: gradient analyses of vegetation on the east flank of the central Oregon Cascade Range conducted by West (1964, 1968, 1969) and Swedberg (1961); studies of the flora and communities on Black Butte by Sherman (1969) and Johnson (1961); and Sherman's (1966) study of spatial and chronological patterns of bitterbrush as influenced by ponderosa pine overstory. Only Swedberg (1961) actually used the natural area as a sampling site, however.

The Metolius Research Natural Area provides a variety of interesting research opportunities including: (1) determination of effects of game use on forested winter range heavily used by mule deer; (2) evaluation of soil-topographic-vegetational changes along an elevational and topographic gradient across a bench and up a steep, westerly slope; (3) evaluation of forest succession following cessation of natural ground fires; and (4) determination of influences of sharp topographic and elevational changes over short distances on biomass productivity.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area are: *Topogntphy-15'* Sisters, Oregon and Whitewater River, Oregon quadrangles, scale 1: 62,500, issued by the U.S. Geological Survey in 1959 and 1961, respectively; *geology-Geologic Map of the Central Part of the High Cascade Range, Oregon* (Williams 1957), and *Geologic Map of Oregon West of the 121st Meridian,* scale 1:500,000 (Peck 1961). Either the District Ranger (Sisters Ranger District) or Forest Supervisor (Deschutes National Forest, Bend, Oregon) can provide details on the most recent aerial photo coverage of the area.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Johnson, John Morris
1961. Taxonomy and ecology of the vascular plants of Black Butte, Oregon. 193 p., ill us. (M.S. thesis, on file at Oreg. State Univ., Corvallis.)

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Pub. 36, various paging, illus.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

Sherman, Robert James
1966. Spatial and chronological patterns of *Purshia tridentata* as influenced by *Pinus ponderosa* overstory. 81 p., illus. (M.S. thesis, on file at Oreg. State Univ., Corvallis.)

1969. Spatial and developmental patterns of the vegetation of Black Butte, Oregon. 80 p., illus. (Ph.D. thesis, on file at Oreg. State Univ., Corvallis.)

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, *D.C.*

Swedberg, Kenneth Charles
1961. The coniferous ecotone of the east slope of the northern Oregon Cascades. 118 p., illus. (Ph.D. thesis, on file at Oreg. State Univ., Corvallis.)

Taylor, Edward M.
1968. Roadside geology Santiam and McKenzie Pass highways, Oregon. Hollis M. Dole, ed., In Andesite Conference Guidebook. Oreg. Dep. Geol. & Miner. Ind. Bull. 62: 3-33, illus.

West, Neil E.
1968. Rodent-influenced establishment of ponderosa pine and bitterbrush seedlings in central Oregon. Ecology 49: 1009-1011, illus.

1969. Successional changes in the montane forest of the central Oregon Cascades. Am. Midland Natur. 81: 265271, illus.

West, Neil Elliott
1964. An analysis of montane forest vegetation on the east flank of the central Oregon Cascades. 272 p., illus. (Ph.D. thesis, on file at Oreg. State Univ., Corvallis.)

Williams, Howel
1957. A geologic map of the Bend quadrangle, Oregon and a reconnaissance geologic map of the central portion of the High Cascade Mountains. Oreg. State Dep. Geol. & Miner. Ind.

Table MI-1. — Tentative list of mammals for Metolius Research Natural Area

Order	Scientific name	Common name
Insectivora	*Scapanus orarius*	coast mole
	Sorex palustris	northern water shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	western pipistrel
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Ochotona princeps	pika
Rodentia	*Clethrionomys californicus*	California red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Sciurus griseus	western gray squirrel
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys mazama	Mazama pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Spilogale putorius	spotted skunk or civet cat
	Taxidea taxus	badger
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer

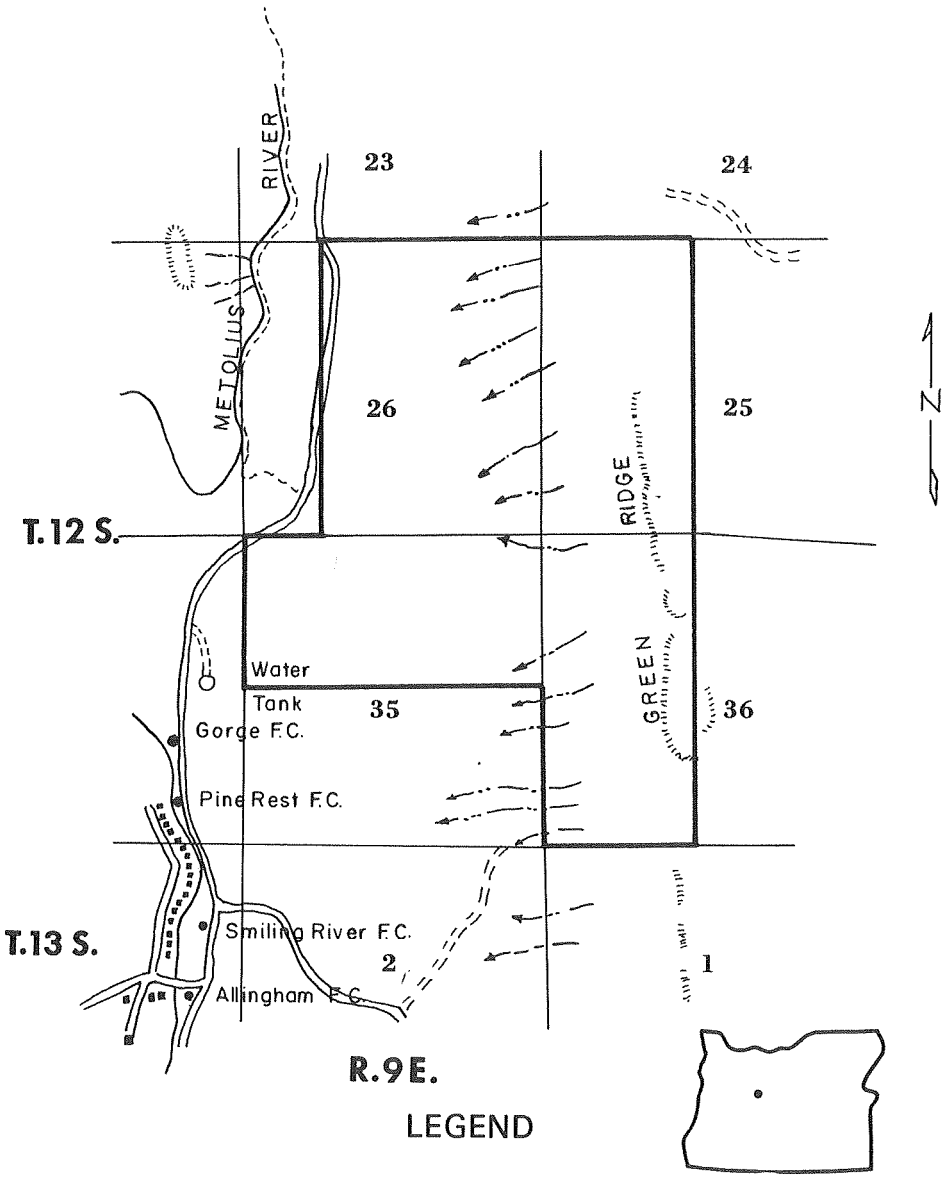

Figure MI-1.– Metolius Research Natural Area, Jefferson County, Oregon.

Figure M/-2.-Natural features of the Metolius Research Natural Area. Upper left: Flatland community of ponderosa pine, bitterbrush, and western needlegrass. Upper right: Rolling foothill community of ponderosa pine with seedling, sapling, and pole-sized Douglas-fir and an understory of bitterbrush, green manzanita, and western needlegrass. Lower left: Community of ponderosa pine, Douglas-fir, green manzanita, and western needlegrass found on steep westerly slopes. Lower right: Firescarred ponderosa pine located in flat portion of natural area; eight fires are recorded in this scar.

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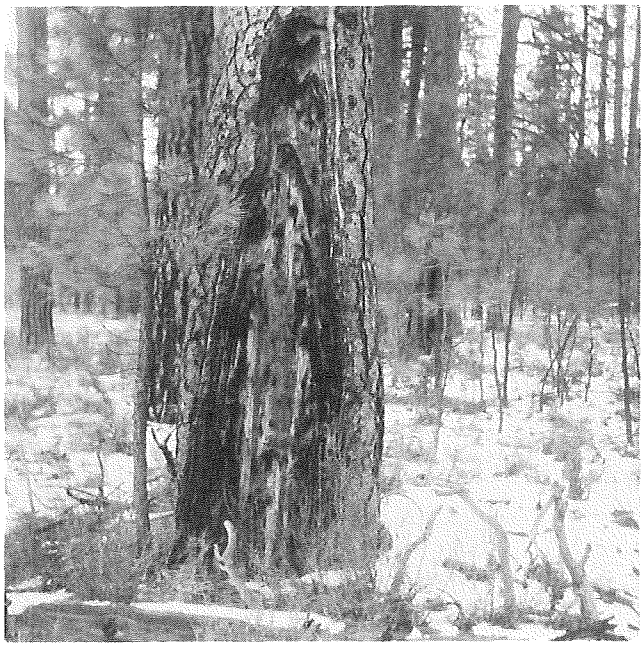


Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

MILL CREEK RESEARCH NATURAL AREA[1]

Transitional area between forest and grassland with mosaic of Oregon white oak, ponderosa pine, Douglas-fir and bunchgrass communities on the east slope of northern Oregon's Cascade Range.

The Mill Creek Research Natural Area was established on August 16, 1971, to exemplify the community mosaic found at the forest-grassland transition on the east slope of the northern Oregon Cascade Range. It contains representative, relatively undisturbed stands of bunchgrasses, Oregon white oak *(Quercus garryana)* with an understory of grasses and sedges, and Douglas-fir *(Pseudotsuga rnenziesii)* and ponderosa pine *(Pinus ponderosa).* The 330-ha. (815-acre) tract is located in Wasco County, Oregon, and is administered by the Barlow Ranger District (Dufur, Oregon), Mount Hood National Forest. The irregularly shaped tract is located in portions of sections 4, 8, 9, 16, and 17, T. 1 S., R. 11 E., Willamette meridian, at 45°30' N. latitude, 121 °20' W. longitude (fig. ML-1).

ACCESS AND ACCOMMODATIONS

Since this natural area lies within the Mill Creek drainage, the municipal watershed of the City of The Dalles, access is strictly controlled. It is necessary to obtain permission for entry and, possibly, a key from the Ranger District before entering the watershed, regardless of the approach route. This is in addition to obtaining permission to conduct research on the natural area itself.

The natural area is located about 27 km. (17 miles) west of Dufur, Oregon, and is approached by graveled county and National Forest roads. Dufur is 27 km. (17 miles) south of The Dalles on U.S. Highway 197. Access is good during the summer, but snow creates difficulties during the winter. Closest accommodations are in Dufur; developed forest camps are not convenient to the natural area.

ENVIRONMENT

The Mill Creek Research Natural Area varies in elevation from 790 to 1,040 m. (2,600 to 3,410 ft.). It is located on the gently to steeply rolling lower foothills of the east slope of the Cascade Range.

Parent rocks are grey hard basalt to grey to dark grey andesites. The area was glaciated during the Wisconsin period.

A modified marine climate prevails. Most precipitation occurs as rain or snow during the cool, cloudy winter. Summers are warm, generally low in precipitation and largely cloudless. One to 3 months of drought are common. Winds are often strong, particularly during the winter since this area is located near the mouth of the Columbia Gorge. Climatic data from The Dalles, located along the Columbia River about 24 km. (15 miles) northeast and 700 to 800 m. below the tract are as follows (U.S. Weather Bureau 1965): '

Mean annual temperature	12.4°C. (54.4°F.)
Mean January temperature	1.1°C. (34.0°F.)
Mean July temperature	23.2°C. (73.8°F.)
Mean January minimum temperature	−2.5°C. (27.6°F.)
Mean July maximum temperature	31.1°C. (88.0°F.)
Average annual precipitation	349 mm. (14.1 in.)
June through August precipitation	23.0 mm. (0.9 in.)
Average annual snowfall	6.0 cm. (23.5 in.)

[1]Description prepared by Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

This file was created by scanning the printed publication. Text errors identified by the software have been corrected; however, some errors may remain.

Soils in The Dalles watershed were mapped in 1970 by Paul Shields and Loren D. Herman. Their map can be examined at the Mount Hood National Forest headquarters or at the Dufur Ranger Station. Soils range from very shallow, slightly plastic cobbly loams overlying well-fractured, dark grey, hard basalt to moderately deep, slightly plastic, greyish loamy fine sands overlying grey to dark grey andesite. These materials are well drained, of moderately rapid permeableness and have weak surface stability.

BIOTA

Estimated areas by vegetation type are:

Name	*Area*
Forests of pole-sized Douglas-fir with mature ponderosa pine	166 ha. (410 acres)
Forests of Oregon white oak with mature ponderosa pine	126 ha. (310 acres)
Grassland	38 ha. (95 acres)
	330 ha. (815 acres)

The stands of Douglas-fir and ponderosa pine can be assigned to SAF forest cover type 214, Ponderosa Pine-Larch-Douglas-Fir (Society of American Foresters 1954), and Kuchler's (1964) Type 12, Douglas Fir Forest. The Oregon white oak stands with ponderosa pine can be assigned to SAF type 233, Oregon White Oak, and to Kuchler's Type 26, Oregon Oakwoods. The grassland areas can be assigned to Kuchler's Type 51, Wheatgrass-Bluegrass.

Bunchgrass communities dominate steep to moderately steep southeast slopes and many ridge tops (fig. ML-2). These openings are characterized by bluebunch wheatgrass *(Agropyron spicatum),* arrowleaf balsamroot *(Balscamorhiza sagittata),* Idaho fescue *(Festuca idahoensis),* Sandberg bluegrass *(Poa sandbergii),* with some needlegrass *(Stipa* spp.) and cheatgrass brome *(Bromus tectorum).* These communities appear similar to those described for Daubenmire's (1970) *Agropyron spicatum-Poa secunda* habitat type, lithosolic phase, but apparently include more arrowleaf balsamroot.

Oregon white oak-grass communities and stringers of the Douglas-fir-ponderosa pine forest tend to form a complex pattern with the shallow soil grassland openings. Two kinds of the Oregon white oak stands can be distinguished: those dominated by smaller trees 10-cm. (4-in.) or less d.b.h. and those dominated by trees 15-cm. (6-in.) or more d.b.h., the latter including scattered ponderosa pine. Small diameter oak stands have a crown cover of 30 to 50 percent. Ground vegetation is dominated by *Elymus glaucus* with abundant *Symphoricarpos albus,* elk sedge *(Carex geyeri),* and various forbs. Oak stands of larger diameter trees have a crown cover of 20 to 30 percent and the oaks tend to occur in groups or clumps. Ground vegetation is dominated by elk sedge with bitterbrush *(Purshia tridentata)* and some *Amelanchier arnifolia,* needlegrasses, and bluebunch wheatgrass. In these areas, bluebunch wheatgrass tends to assume a rhizomatous habit. In general, Oregon white oak stands are located on southeast and southerly slopes from ridgetops to the drainage bottom.

Stands dominated by Douglas-fir and ponderosa pine occur in swales and areas of deeper soil and on east and northeast slopes. Most ponderosa pine is mature to over-mature and is generally over 50-em. (20-in.) d.b.h., and 40 m. (120 feet) in height. The Douglas-fir is much younger and varies in diameter from 12- to 40-cm. (5- to 16-in.) d.b.h. Occasional grand fir *(Abies grandis)* and western larch *(Larix occidentalis)* are present. Ground vegetation is dominate0. by *Symphoricarpos albus,* elk sedge, occasional *Holodiscus discolor, Arnica cordifolia, Hieracium* spp., *Fragaria* spp., and other forbs.

A list of mammals believed to utilize the natural area as residents or transients is presented in table ML-l. Mule deer (*Odocoileus hemionus)* use the area as fall, winter, and spring range. Wild turkeys *(Meleagris merriami)* have been introduced in this area.

HISTORY OF DISTURBANCE

Fire scars on ponderosa pine indicate that ground fires periodically burned the area

prior to initiation of fire control programs; three to five wildfires are recorded in these scars. Some logging in the area occurred in the late 1800's. The area was also grazed, sometimes heavily, by domestic livestock prior to classification of the area as municipal watershed. No logging or grazing has been carried out for the past 60 years. The cheatgrass brome on a few of the steep south-facing grasslands suggests that vegetation was altered by grazing to at least some extent.

RESEARC H

No research is known on the area. It provides numerous interesting opportunities to study relationships between flora, fauna, plant communities, and environment within a mosaic of contiguous but very different kinds of vegetation-bunchgrass, Oregon white oak, and mixed conifer stands-in an area at the forest-grassland transition.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 7.5' Five Mile Butte, Oregon (scale 1: 24,000), and 15' White Salmon, Oregon - Washington (scale 1: 62,500) quadrangles issued by the U.S. Geological Survey in 1962 and 1967, respectively; and *geology - Geologic Map of Oregon West of the 121st Me1'idian,* scale 1:500,000 (Peck 1961). Either the District Ranger (Barlow District) or Forest Supervisor (Mount Hood National Forest, Portland, Oregon) can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

Daubenmire, R.
1970. Steppe vegetation of Washington. Wash. Agric. Exp. Stn. Tech. Bull. 62, 131 p., illus.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States-supplement for 1951 through 1960, Washington. Climatography of the United States 96-39, 92 p., illus.

Table ML-1. — Tentative list of mammals for Mill Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Sorex bendirii	marsh shrew
	Sorex obscurus	dusky shrew
	Sorex palustris	northern water shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis lucifugus	little brown myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Clethrionomys californicus	California red-backed vole
	Erethizon dorsatum	popcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Marmota flaviventris	yellow-bellied marmot
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Sciurus griseus	western gray squirrel
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys mazama	Mazama pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx rufus	bobcat
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer

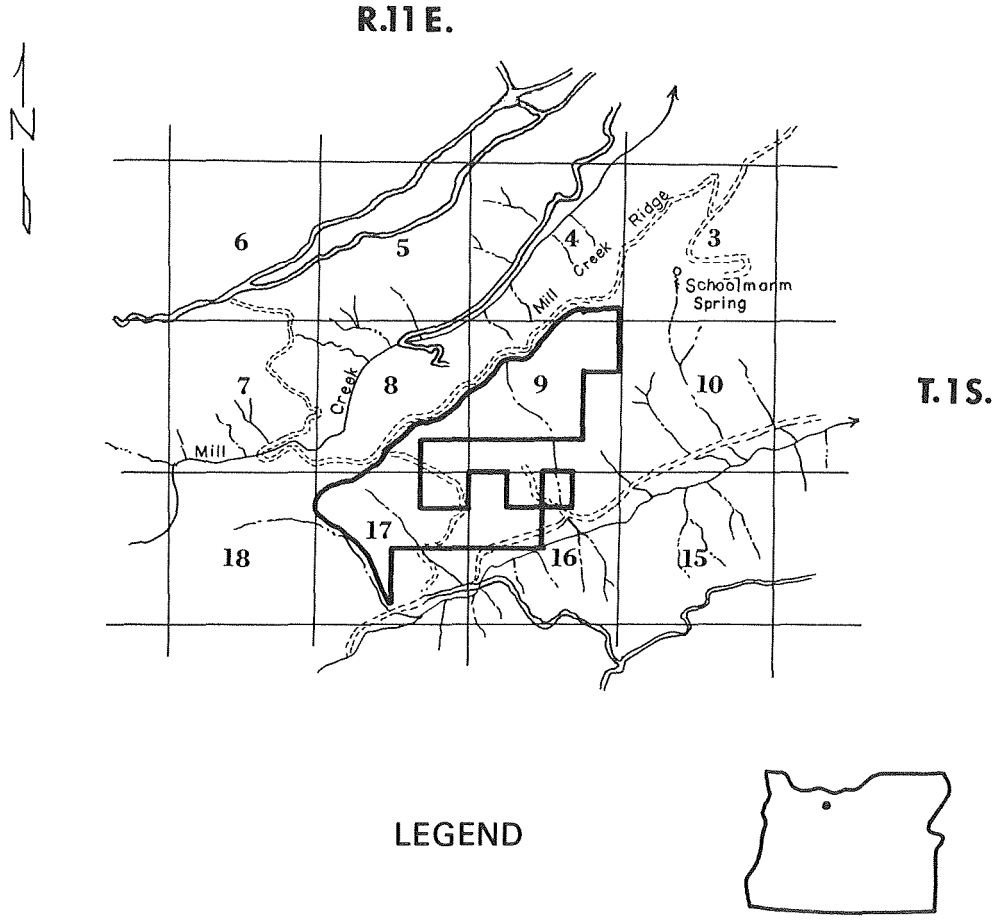
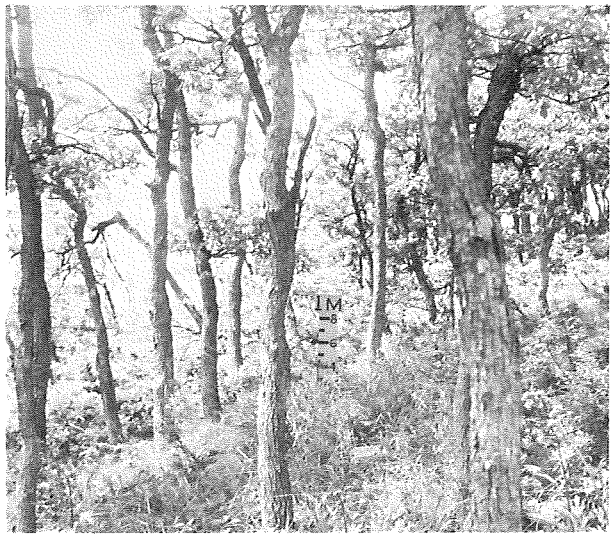
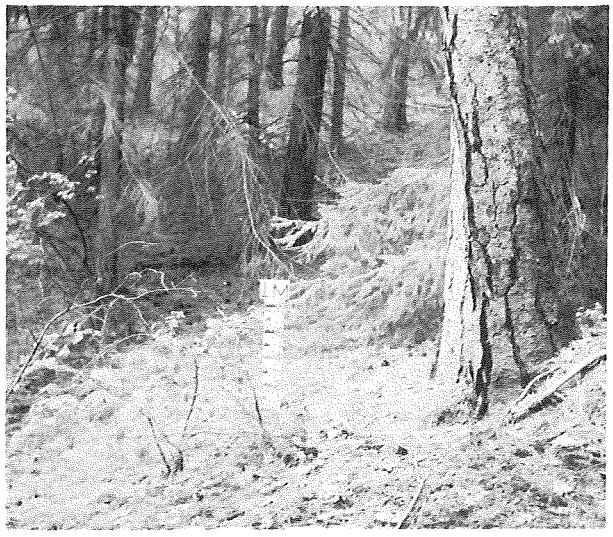


Figure ML-1.– Mill Creek Research Natural Area, Wasco County, Oregon.

Figure ML-2.-Plant communities in the Mill Creek Research Natural Area. Upper left: Horizontal view showing natural grassland of bunchgrasses and arrowleaf balsamroot in the foreground and forest of small size Oregon white oak and *Elymus glaucus* in the middle-ground with stringers of the Douglas-fir-ponderosa pine forest. The mosaic pattern of plant communities is directly related to soil characteristics; shallower soils support the grasslands. Upper right: View from a community of bunchgrass and arrowleaf balsamroot across the Mill Creek watershed showing an Oregon white oak and elk sedge stand, with occasional mature ponderosa pine, and the upper edge of Douglas-fir-ponderosa pine stand. Center left: Small Douglas-fir with *Elymus glaucus, Symphoricarp*os *albus,* elk sedge, and forbs as ground vegetation. Center right: Larger, clumped Oregon oak with occasional mature ponderosa pine and ground vegetation dominated by elk sedge and some bitterbrush, *Amelanchier alnifolia,* needlegrass, and bluebunch wheatgrass. Lower left: Pole-sized stand dominated by Douglas-fir with occasional old-growth ponderosa pine and ground vegetation of *Symphoricarpos albus,* elk sedge, and forbs. This community is characteristic of ridges with deeper soil and east to northeast slopes. Lower right: Cove community of Douglas-fir and ponderosa pine with *Symphoricarpos albus, Holodiscus discolor,* sedge and forbs.





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Pacific Northwest Forest and Range Experiment Station
Portland, Oregon.

MYRTLE ISLAND RESEARCH NATURAL AREA[1]

California-laurel with scattered old-growth Douglas-fir growing on a small island in the Umpqua River.

The Myrtle Island Research Natural Area was established on September 14, 1951, to preserve an old-growth stand of California-laurel *(Umbellularia californica).* The 11.3-ha. (28-acre) island is located in Douglas County, Oregon, and is administered by the Roseburg District (Roseburg, Oregon), Bureau of Land Management. The natural area occupies lot 9 of section 20 and lot 11 of section 21, T. 24 S., R. 7 W., Willamette meridian. It lies at 43°29' N. latitude and 123°34' W. longitude.

ACCESS AND ACCOMMODATIONS

Primary access is by State Highway 138 via either Sutherlin or Elkton. Between July and September, the island can be reached from the north shore of the river by wading (fig. MY-I). To reach the vicinity, leave State Highway 138 at Bullock Bridge, cross the bridge, and turn left on Cougar Creek Road. Drive along the river to the sign which marks the end of the county road (about 7.7 km. or 4.8 miles from the bridge); you are opposite Myrtle Island at this point. To approach the island by boat, leave State Highway 138 about 0.5 km. (0.3 miles) south of Bullock Bridge and drive along the Tyee Road on the south side of the Umpqua River for about 7.9 km. (4.9 miles) to a short spur road down to the riverbank. A boat can be placed in the river at this site which is a short distance upstream from the island.

Travel on the island is not difficult although there are no trails.

The nearest commercial accommodations are in Sutherlin.

ENVIRONMENT

The Myrtle Island Research Natural Area is a typical river island with a series of more or less identifiable terrace levels. Topography is gentle with the only steep slopes located along the edge of the river or as short pitches between terraces. The elevation of the natural area is about 97.5 m. (320 ft.). The surface of the island varies from about 1.5 to 12 m. (5 to 40 ft.) above water level during the summer months.

The natural area is made up of fluvial deposits of gravel, sand, and finer materials. River action is constantly changing the form of the island, eroding it in some areas and depositing new materials in others.

The natural area is located in the mild moist climatic region typical of western Oregon. However, it is within one of the valley systems located between the Coast Ranges and Cascade Range and is, therefore, subject to the somewhat warmer and drier climate typical of these areas. The summer dry period is especially pronounced. Representative climatic data from the Roseburg weather station which is about 32 km. (20 miles) southwest are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	12.1°C. (53.7°F.)
Mean January temperature	5.2°C. (41.1°F.)
Mean July temperature	19.9°C. (67.8F.)
Mean January minimum temperature	1.6°C. (34.9°F.)
Mean July maximum temperature	28.0°C. (82.4°F.)

[1] Description prepared by Dr. J. F. Franklin U.S. Department of Agriculture, Forest Service' Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

This file was created by scanning the printed publication. Text errors identified by the software have been corrected; however, some errors may remain.

Average annual precipitation…….830 mm. (32.66 in.)
June through August
precipitation ..... 47 mm. (1.85 in.)

Temperatures are probably slightly lower and precipitation slightly higher on the natural area.

The soils on the natural area are all alluvial. They vary widely in stone content, texture, and depth. The best soils are found on the high terraces where stands of California laurel occur. The soils there are deep, loamy sands with no horizon development. Deposition of soil parent materials is still actively occurring all over the island. Recent depositions of coarse gravels and stones on the western point of the island and finer materials on the higher terraces probably occurred during floods in the winter of 1964-65.

BIOTA

Estimated areas by cover types are:

Name	*Area*
California-Laurel-Douglas-fir	8.1 ha. (20 acres)
Other alluvial communities	3.2 ha. (8 acres)

The area seems to best fit Kuchler's (1964) Type 29, California Mixed Evergreen Forest *(Quercus-Arbutus-Pseudotsuga)* and does lie within the Interior Valley *(Pinus-Quercus-Pseudotsuga)* Zone of Franklin and Dyrness (1969).

California-laurel is the most abundant single tree species present on the island. With Douglas-fir *(Pseudotsuga menziesii)* it forms dense forests on the upper, older island surfaces (fig. MY -2). Occasional bigleaf maple *(Acer macrophyllum)* and one or two western red cedar *(Thuja plicata)* and incense-cedar *(Libocedrus decurrens)* are also present. The stand in the eastern two-thirds of the forested tract has the largest and oldest trees with California laurel reaching 50- to 60-cm. (20to 25-inches) d.b.h. and 15 to 21 m. (50 to 70 ft.) tall. The Douglas-fir average about 100-cm. (40-in.) d.b.h. and 38 to 46 m. (125 to 150 ft.) tall. The forest stand in the western third of the tract is composed of considerably smaller and younger trees.

The understory in the forested portion of the island is typically sparse with *Polystichum munitum* and *Rhus diversiloba* being the most important species. Other species present include *Trienta1is latifolia, Oxalis suksdorfii, Corylus Cornuta* var. *californica, Acer circinatum, Galium triflorum,* and several species of grass. Strong successional trends are absent. Reproduction of the scattered old-growth Douglas-fir is lacking. Other tree species also do not appear to be reproducing beneath the dense canopy of California laurel. The only exception to this statement is in the California-laurel stand at the extreme eastern point of the island. In this localized. area, reproduction of Oregon ash *(Fraxinus latifolia)* is scattered abundantly through the understory of *Rhus diversiloba* and *Polystichum munitum.*

A variety of open woodland, shrub, and weed communities occupies the western tip and northern shore of the island (fig. MY -2). These are for the most part lower lying areas which are subject to more frequent and severe disturbance by high waters. Included here is a stunted stand of Oregon white oak *(Quercus garryana)* and Oregon ash with a weedy understory; shrubby thickets of willows *(Salix* spp.) and white alder *(Alnus rhombifolia);* and a variety of herbaceous communities dominated by a rich collection of both native and alien grasses and weeds.

The mammals believed to utilize the natural area as residents or transients are listed in table MY -1. At one time, there was a small herd of wild angora goats which lived on the island but they are believed to have been eliminated by the flood of 1964. Several species of aquatic birds such as mallard ducks *(Anas platyrhynchos)* are found in the marshy areas adjacent to the northwest corner of the island.

HISTORY OF DISTURBANCE

Fire scars on old Douglas-fir indicate that ground fires have burned through at least part of the island sometime in the past. Axe marks also were noted in the bark of a few old-growth fir trees.

The entire island is subject to flooding

during peak runoffs. During the flood of the winter of 1964-65, all surfaces of the island were apparently under several feet of water. Extensive disturbance of the vegetation and deposition of coarse materials occurred at the western end of the island. This flood also eroded some of the southern banks of the island. Damage appears to have been minor in the California-laurel stands themselves although debris was lodged several feet up in the branches of many trees and shrubs (fig. MY -2).

RESEARCH

There is no research in progress on the Myrtle Island Research Natural Area. As the only island in the regional research natural area system, it offers special opportunities to study soil and vegetation development in relation to geomorphological processes. The general sparsity of ground vegetation under the groves of California-laurel, coupled with the high content of aromatic compounds in leaves and litter of this species, suggests the area may also be a fertile field site for allelopathic studies.

MAPS AND AERIAL PHOTOGRAPHS

Special maps and most recent photographs available are the following: *Topogmphy*15' Tyee, Oregon quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1955; and *geology-Geologic Map of Oregon West of 121st Meridian,* scale 1:500,000 (Peck 1961). The District Manager (Roseburg District), Bureau of Land Management, can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

U.S. Weather Bureau
1965. Climatic summary of the United States-supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31,96 p., illus.

Table MY-1. — Tentative list of mammals for Myrtle Island Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex pacificus	Pacific shrew
	Sorex trowbridgii	Trowbridge shrew
Chiroptera	*Antorzous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Sylvilagus bachmani*	brush rabbit
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys californicus	California red-backed vole
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma fuscipes	dusky-footed wood rat
	Peromyscus maniculatus	deer mouse
	Sciurus griseus	western gray squirrel
	Tamiasciurus douglasi	chickaree
Carnivora	*Bassariscus astutus*	ringtail or miner's cat
	Canis latrans	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Odocoileus h. columbianus*	black-tailed deer

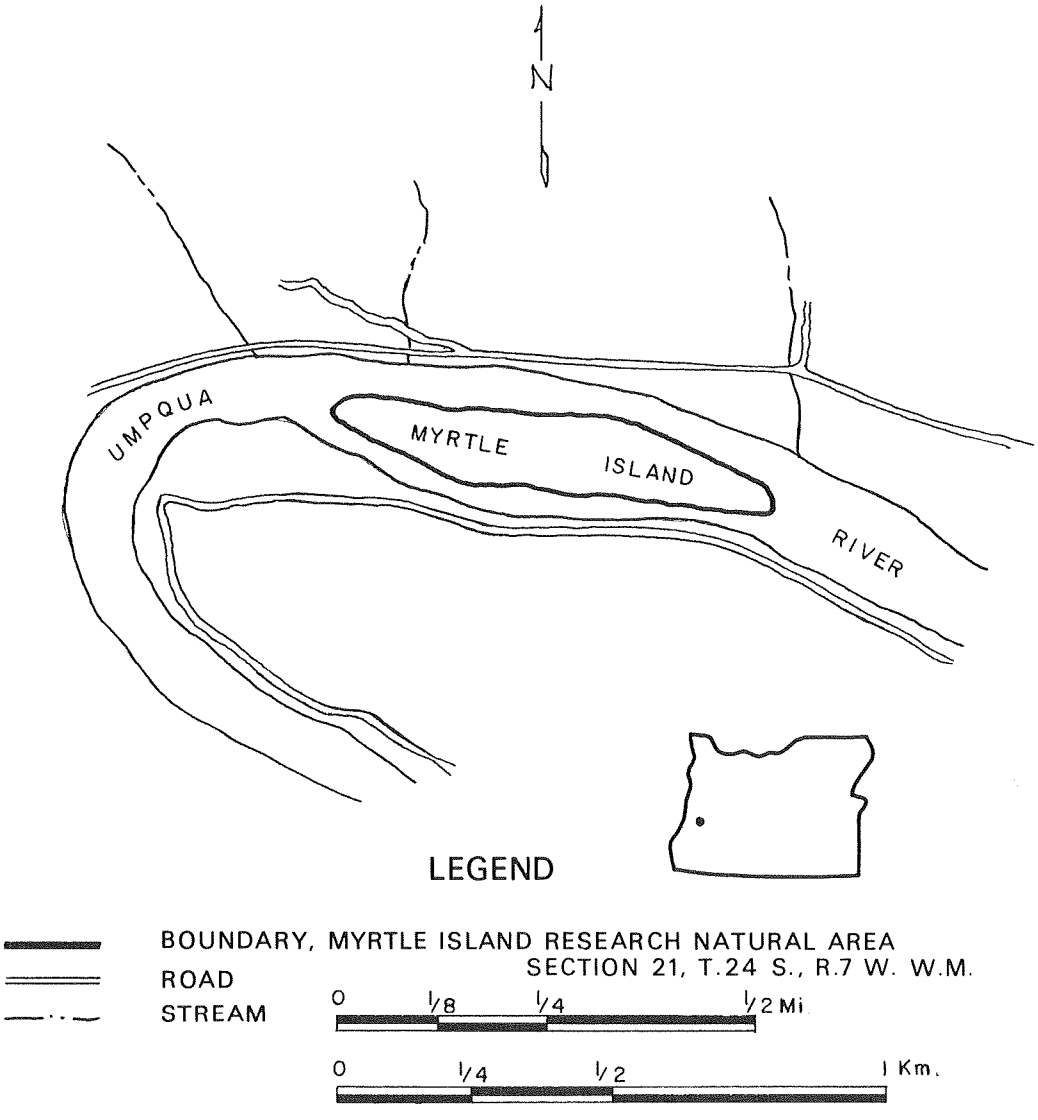
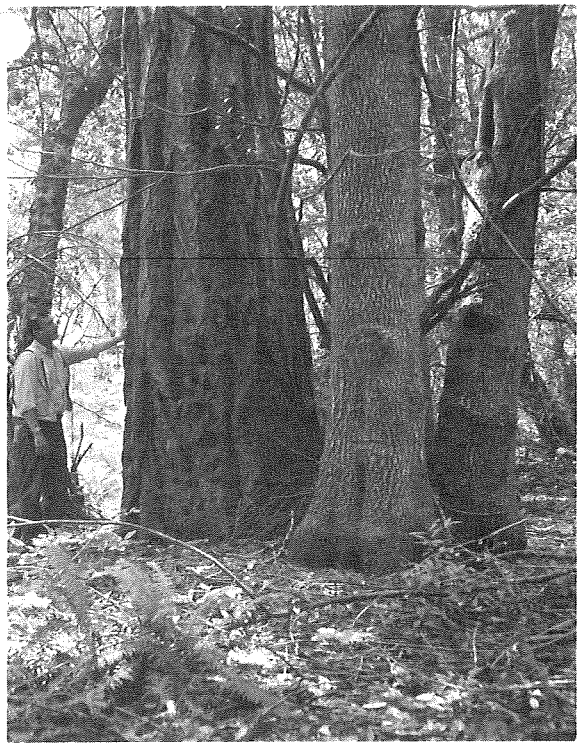


Figure MY-1.– Myrtle Island Research Natural Area, Douglas County, Oregon.

Figure MY-2.-Communities of the Myrtle Island Research Natural Area. Upper left: Old-growth Douglas-fir and California-laurel with a sparse understory typical of most of the island stands. Upper right: Grove of California-laurel with relatively dense understory of *Polystichum munitum*. Lower left: Seral shrub and herb community growing on stony materials deposited at the west end of the island in 1964. Lower right: Young stand of California-laurel showing damage suffered and debris deposited by flood waters.



Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

NESKOWIN CREST RESEARCH NATURAL AREA[1]

Sitka spruce and western hemlock growing on a headland immediately adjacent to the Pacific Ocean.

The Neskowin Crest Research Natural Area was established on October 26, 1941, as an example of Sitka spruce *(Picea sitchensis)*-western hemlock *(Tsuga heterophylla)* forest growing adjacent to the ocean. The 278-ha. (686-acre) tract is located in Tillamook County, Oregon, and is administered by the Hebo Ranger District (Hebo, Oregon), Siuslaw National Forest. It is also a part of the Cascade Head Experimental Forest, a 4,815-ha. (11,890-acre) area maintained by the Pacific Northwest Forest and Range Experiment Station for research and demonstration of management techniques in coastal spruce-hemlock forest (Madison 1957). The natural area occupies all of section 2 except the W1/2 NWl/4 SWl/4 and the W1/2 W1/2 of section 1, T. 6 S., R. 11 W., Willamette meridian (fig. NC-1). It lies at 45°05' N. latitude and 124 °00' W. longitude.

ACCESS AND ACCOMMODATIONS

Access is via U.S. Highway 101 between Otis Junction and Neskowin. A maintained trail, No. 1303, traverses the west half of the natural area entering it from the south. To reach this trail, turn west off U.S. Highway 101 onto Forest Road S61 at the Cascade Head summit. Continue on Forest Road S61 for about 6 km. (3.7 miles) to its junction with Forest Road S61K. Turn right on Road S61K and follow it for 0.3 km. (0.2 mile) to the trail head. Trail 1303 enters the southwestern corner of the natural area about 1.6 km. (1 mile) from the trail head; the entry point is presently unmarked. The southeastern corner of the natural area can conveniently be reached via Forest Roads S61, S61J, S61B, and a short cross-country walk. Follow Road S61 west for about 4 km. (2.45 miles) from U.S. Highway 101 and turn right on Road S61J for 0.5 km. (0.3 miles) to reach Road S61B. Leave Road S61B after approximately 0.3 km. (0.2 mile) and walk northwesterly along a definite ridge top to reach the natural area.

Numerous commercial accommodations are available at Neskowin 1.6 km. (1 mile) north and at Lincoln City, about 14 km. (9 miles) south. Neskowin Creek Forest Camp is located along the Neskowin scenic drive (old U.S. 101) within the experimental forest.

ENVIRONMENT

The Neskowin Crest Research Natural Area is topographically rugged. It occupies part of a headland which is dissected by numerous drainages. Along the northwest boundary, it plunges abruptly into the ocean in a series of cliffs. Topography is gentle only along major ridgetops; slopes are steep. Elevations range from sea level to over 427 m. (1,400 ft.) at the southeast corner. The tops of the ocean cliffs the lowest forested elevations - are 45 to 75 m. (150 to 250 ft.) in elevation. Numerous small permanent streams rise within the natural area, and drainages of several larger ones lie wholly or predominantly within the natural area.

The natural area lies entirely on volcanic bedrock, alkalic basalt flows, breccias, and

[1] Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

This file was created by scanning the printed publication. Text errors identified by the software have been corrected; however, some errors may remain.

water-lain pyroclastic rocks of late-Eocene age (Snavely and Wagner 1964, Snavely and Vokes 1949). Indeed, the headland which it occupies exists only because these volcanic materials are more resistant than surrounding sedimentary formations. However, there appears to be a capping of marine tuffaceous siltstone over the basalt bedrock in most locations; basaltic outcrops are generally confined to ocean cliffs.

The western Oregon marine climate is extremely pronounced in this ocean-side natural area. It is wet and cool; seasonal and diurnal fluctuations in temperature are minimal. Strong ocean winds sweep the area. Although the bulk of precipitation occurs in the winter, a summer drought period is absent. A dominant climatic phenomenon is the summer fog which envelops the headland on most warm summer days. These fogs condense on tree crowns and fall to the ground as "fog-drip." A study of precipitation in forests and in openings on Cascade Head near the natural area indicated a 26-percent increase in precipitation under stands due to fog-drip (Ruth 1954). The following climatic data are from the nearest climatic station at experimental forest headquarters (listed as Otis 2 NE in U .S. Weather Bureau 1965):

Mean annual temperature	13.3°C. (50.6°F.)
Mean January temperature	5.3°C. (41.5°F.)
Mean July temperature	15.3°C. (59.6°F.)
Mean January minimum temperature	2.2°C. (35.9°F.)
Mean July maximum temperature	20.9°C. (69.7°F.)
Average annual precipitation	2,496 mm. (98.26 in.)
June through August precipitation	163 mm. (6.42 in.)

Additional climatic data for this station and the vicinity are available in Ruth (1954). Since the weather station is lower in elevation and farther inland, temperatures are probably somewhat cooler and precipitation higher (especially when fog-drip is included) on the natural area.

Soils in the natural area have not been mapped or classified into series; however, profiles examined can be best characterized as Astoria-like Sols Bruns Acides. They have developed primarily from tuffaceous siltstones although basalt bedrock sometimes causes significant local modifications of the profiles. Soils are moderately fine textured and moderately well drained. A typical profile consists of the following horizons: 2- to 8-cm. 01 and 02; 5- to 10-cm. very dark brown silt loam All; 7- to 23-cm. dark brown A12; 15- to 40-cm. dark yellowish-brown silty clay loam A3 or B 1; 15- to 80-cm. dark yellowish-brown silty clay loam B2; and a B3 or C horizon, or both. Surface soils are strongly acid (e.g., pH 5.3), high in organic matter (e.g., > 20 percent) and total nitrogen (e.g., 0.50 percent), and low in percent base saturation (e.g., 10 percent).

BIOTA

Estimated area by SAF cover types (Society of American Foresters 1954) are:

No.	*Name*	*Area*
224	Western Hemlock	162 ha. (400 acres)
225	Sitka Spruce-Western Hemlock	105 ha. (259 acres)
223	Sitka Spruce	11 ha. (27 acres)

The area falls entirely within Kuchler's (1964) Type 1, Spruce-Cedar-Hemlock Forest and the *Picea sitchensis* Zone of Franklin and Dyrness (1969).

Only two tree species are present in significant numbers - Sitka spruce and western hemlock. Occasionally red alder *(Alnus rubra)* and rarely Douglas-fir *(Pseudotsuga menziesii)* are encountered in the spruce-hemlock stands. Large old Sitka spruce, which average around 215-cm. (85-in.) d.b.h. and 73 m. (240 ft.) in height, are the most impressive specimens. These trees are over 250 years of age. The bulk of the forest is composed of spruce and hemlock about 120 years old, 75-to 100cm. (30- to 40-in.) d.b.h., and 60 m. (200 ft.) tall (fig. NC-2). Over most of the natural area, both age classes are intermixed with old growth scattered through younger stands.

Successional processes are obvious throughout the natural area. Large old spruce are being wind-thrown or having their tops broken out. Large limbs broken from tops and wind-thrown trees showing extensive butt rot are

common. Succession is unquestionably toward replacement of the mixed forests by western hemlock; many open stands are choked with hemlock poles and saplings (fig. NC-2). Under denser stands, the proportion of hemlock to spruce seedlings is even higher.

The composition of the understory is quite uniform throughout the natural area. *Menziesia ferruginea, Polystichum munitum, Oxalis oregana., Maianthemum bifolium* var. *kamtschaticum, Montia sibirica,* and *Eurhynchium oreganum* are the constant and characteristic species (fig. NC-2). Less common species include *Vaccinium parvifolium, Clintonia uniflora, Rubus ursinus, Melica subulata, Trillium ovatum, Tiarella trifoliata, T. unifoliata, Galium triflorum,* and *Luzula parviflora. Gaultheria shallon* is relatively uncommon in the natural area, occurring mainly on rotten logs or stumps (fig. NC-2) except along the ocean cliffs where it is sometimes an understory dominant. On the lower slopes, along streams, and in seep areas, a dense tangle of shrubs and herbs develops, including the following as well as the aforementioned species: *Oplopanax horridum, Rubus spectabilis, R. parviflorus, Blechnum spicant, Ribes bracteosum, Dryopteris dilatata, Saimbucus melanocarpa, Athyrium filix-femina, Disporum smithii,* and *Stachys americana. Carex obnupta, Corydalis scouleri, Lysichitum americanum,* and *Chrysosplenium glechomaefolium* typify swampy areas.

Upland forest openings are encountered which are completely choked with shrubs such as *Rubus spectabillis, Menziesia,* and *Sambucus* (fig. NC-2). Tree regeneration under these dense shrub layers is often sparse or absent.

The mammals which are known or probable inhabitants of the natural area are listed in table NC-l. A varied avifauna is associated with the ocean cliffs along the northwest boundary of the natural area, and northern sea lions *(Eumetopias jubata)* frequent the adjacent ocean.

Streamsides and ocean cliffs are the only noteworthy specialized habitats.

HISTORY OF DISTURBANCE

The dominance of 120-year-old spruce and hemlock indicates the area has been subject to at least occasional fires, the last major one occurring about 1845. During recent years, winter windstorms have been the most important agent of natural disturbance. Most of the damage has occurred along the southern boundary, but severe east winds in 1971 did break many old-growth Sitka spruce at 2 to 5 m. (6 to 15 feet) above ground line all through the natural area. There is no evidence of human disturbance in the natural area.

RESEARC H

Some observational research on the fauna and plant communities is currently being conducted on the natural area. At the time the natural area was cruised (1934), a map was prepared showing the location of all large Sitka spruce specimens. Copies of this map are on file at the Pacific Northwest Forest and Range Experiment Station.

The natural area and its environs do offer some special research opportunities. The natural area is adjacent to the Neskowin Crest Scenic Area, an oceanside strip of ocean cliffs, forest, and natural grassy openings which will be maintained in a near-natural state primarily for recreational purposes. The Nature Conservancy's Cascade Head preserve is also nearby. There is, therefore, the possibility of utilizing the natural area as a part of ecological studies on this oceanside complex. The flora and plant communities of a small natural headland prairie adjacent to the southwest edge of the natural area (Hart Cape) have already been studied (Davidson 1967).

Neskowin Crest Research Natural Area is also a part of the Cascade Head Experimental Forest, much of which is similar in forest type and environment. The possibility exists of using other parts of the experimental forest for work involving destructive sampling or manipulation and using the natural area as a control site.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area are: *Topography-15'* Hebo, Oregon quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1955; and *geology -Geology of the Coastal Area Between Cape Kiwanda and Cape Foulweather, Oregon,* scale 1:62,500 (Snavely and Vokes 1949), *Geologic Sketch of Northwestern Oregon,* scale 1: 500,000 (Snavely and Wagner 1964), and *Geologic Map of Oregon West of the 121st Meridian.,* scale 1:500,000 (Peck 1961). Either the District Ranger (Hebo Ranger District) or Forest Supervisor (Siuslaw National Forest, Corvallis, Oregon) can provide details on the most recent aerial photo coverage and forest type maps for the area.

Copies of a topographic map (scale 8 in. = 1 mile, 50-ft. contour interval) of Cascade Head Experimental Forest, including Neskowin Crest Research Natural Area, which was prepared by Forest Service personnel in 1934, are on file at the Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. Records of a 1934 cruise of the area and a map showing location of old-growth Sitka spruce are also on file there.

LITERATURE CITED

Davidson, Eric Duncan
1967. Synecological features of a natural headland prairie on the Oregon coast. 79 p., illus. (M.S. thesis, on file at Oreg. State Univ., Corvallis.)

Franklin, Jerry F. and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Madison, Robert W.
1957. A guide to the Cascade Head Experimental Forest. USDA Forest Servo Pac. Northwest Forest & Range Exp. Stn., 14 p., illus. Portland, Oreg.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

Ruth, Robert H.
1954. Cascade Head climatological data 1936 to 1952. USDA Forest Servo Pac. Northwest Forest & Range Exp. Stn., 29 p. Portland, Oreg.

Snavely, Parke D., Jr., and H. E. Vokes
1949. Geology of the coastal area between Cape Kiwanda and Cape Foulweather, Oregon. U.S. Geol. Surv. Soil & Gas Invest. Prelim. Map 97.

Snavely, P. D., and H. C. Wagner
1964. Geologic sketch of northwestern Oregon. U.S. Geol. Surv. Bull. 1181-M, 17 p., illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States--supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31,96 p., illus.

Table NC-1. — Tentative list of mammals for Neskowin Crest Research Natural Area

Order	Scientific name	Common name
Marsupialia	*Didelphis marsupialis*	opossum
Insectivora	**Neürotrichus gibbsi*	shrew mole
	**Scapanus orarius*	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	**Sorex trowbridgii*	Trowbridge shrew
	Sorex vagrans	wandering shrew
	**Sorex yaquinae*	Yaquina shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	**Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	**Lasiurus cinereus*	hoary bat
	**Myotis californicus*	California myotis
	**Myotis evotis*	long-eared myotis
	**Myotis lucifugus*	little brown myotis
	**Myotis thysanodes*	fringed myotis
	**Myotis volans*	long-legged myotis
	**Myotis yumanensis*	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	**Lepus americanus*	snowshoe hare
	Sylvilagus bachmani	brush rabbit
Rodentia	**Aplodontia rufa*	mountain beaver
	Arborimus albipes	white-footed vole
	Arborimus longicaudus	red tree vole
	**Clethrionomys californicus*	California red-backed vole
	Erethizon dorsatum	porcupine
	**Eutamias townsendi*	Townsend chipmunk
	**Glaucomys sabrinus*	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	**Microtus oregoni*	Oregon or creeping vole
	Neotoma cinerea	bushy-tailed wood rat
	**Peromyscus maniculatus*	deer mouse
	**Tamiasciurus douglasi*	chickaree
	Thomomys mazama	Mazama pocket gopher
	**Zapus trinotatus*	Pacific jumping mouse
Carnivora	**Canis latrans*	coyote
	**Lynx rufus*	bobcat
	Martes americana	marten
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	**Spilogale putorius*	spotted skunk or civet cat
	Urocyon cinereoargenteus	gray fox
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	**Odocoileus h. columbianus*	black-tailed deer

*Habitation verified by sign, sighting, or collection.

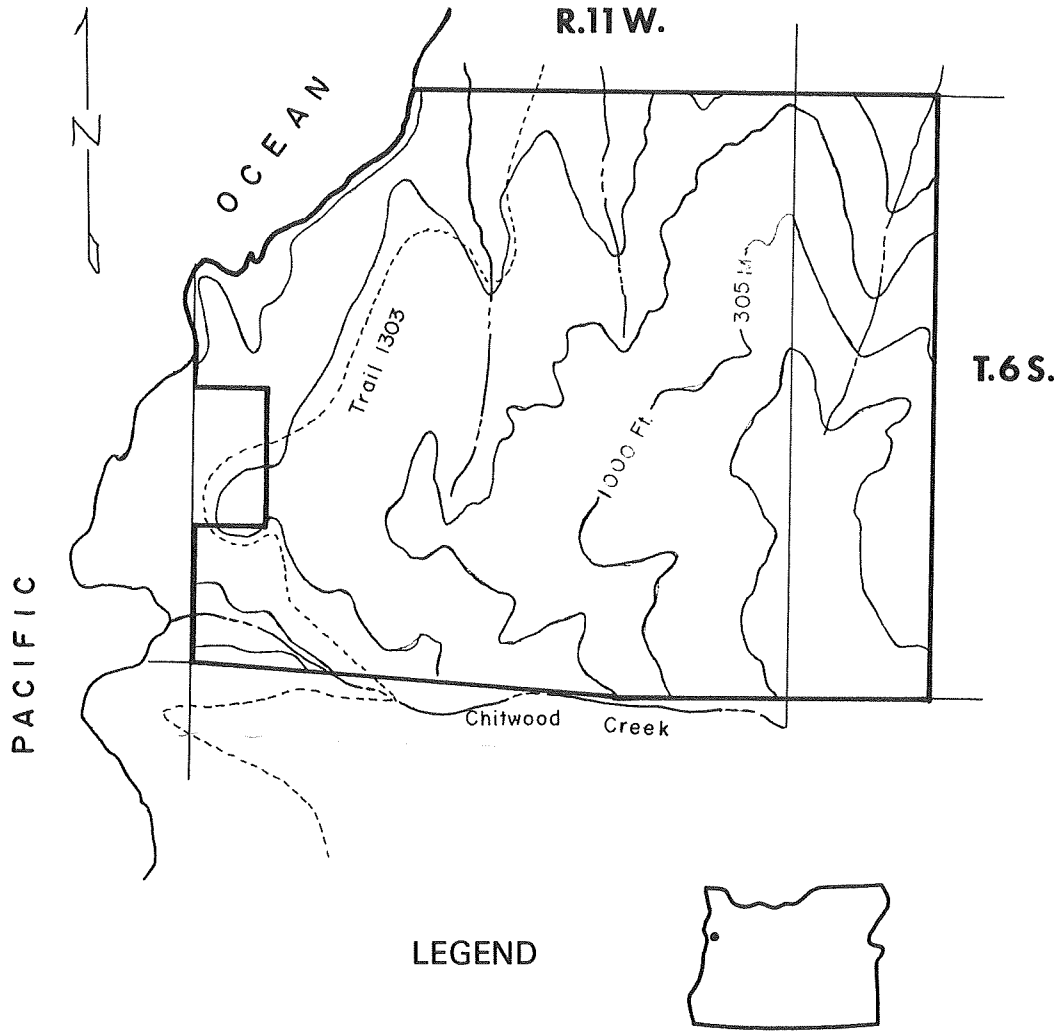
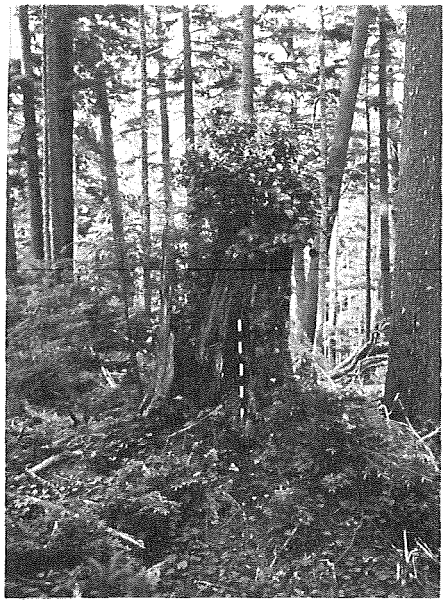


Figure NC-1.– Neskowin Crest Research Natural Area, Tillamook County, Oregon.

Figure NC-2.-Communities in the Neskowin Crest Research Natural Area. Upper left: Small opening choked with *Rubus spectabilis, Menziesia ferruginea,* and *Sambucus melanocarpa* up to 3 m. in height. Upper right: *Gaultheria shallon* growing on rotting stump. Lower left: Open stand of western hemlock and Sitka spruce with abundant regeneration of western hemlock. Lower right: 120-year-old Sitka spruce growing on rotting log with typical *Polystichum munitum-Oxalis oregana* understory.



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Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

NORTH FORK NOOKSACK RESEARCH NATURAL AREA[1]

Old-growth Douglas-fir, western hemlock, and western red-cedar growing on steep mountain slopes in the Northern Cascades of Washington.

The North Fork Nooksack Research Natural Area was established on April 10, 1934. It is an example of the Douglas-fir *(Pseudotsuga menziesii)* - western hemlock *(Tsuga heterophylla)* forests found at mid-elevations in the northern Cascade Range. The 605-ha. (1,495-acre) tract is located in Whatcom County, Washington, and is administered by the Glacier Ranger District (Glacier, Washington), Mount Baker National Forest. It is bounded on the south by State Highway 542, on the east by Welcome Creek, on the north by northern boundary line of sections 33, 34, and 35 and sections 26, 27, and 28, T. 40 N., R. 8 E., and on the west by the line between the Wl/2 and E1/2 of the NWl/4 of section 33, T. 40 N., R. 8 E. (fig. NF-1). The natural area, therefore, includes parts of sections 33, 34, 35, and 36, T. 40 N., R. 8 E., and section 2, T. 39 N., R. 8 E., Willamette meridian. It lies at 48°54' N. latitude and 121°45' W. longitude.

ACCESS AND ACCOMMODATIONS

North Fork Nooksack Research Natural Area is reached via State Highway 542, the Mount Baker Highway. It lies about 16 and 51 km. (10 and 32 miles) east of Glacier and Bellingham, Washington, respectively.

The natural area has no trails or roads within its boundaries. State Highway 542 bounds it for about 5 km. (3 miles). Remnants of an abandoned way trail may be found along the west boundary. A logging road cuts diagonally for about one-fourth mile across the extreme southeast corner of the area. At present the only way to penetrate the area is by traveling cross country. Care is required because of rock bluffs and the steep slopes. High elevations in the eastern portion of the tract are best reached via the Welcome Pass trail about 1 km. (0.5 mile) to the northeast and cross-country travel through subalpine meadows to the natural area itself.

Commercial accommodations are available in Bellingham or, to a limited extent, at Glacier. There are several public campgrounds in the vicinity along State Highway 542.

ENVIRONMENT

The North Fork Nooksack Research Natural Area covers a broad elevational span on the steep, south-exposed slope of a major mountain ridge. Elevations vary from 580 m. (1,900 ft.) along the highway to over 1,585 m. (5,200 ft.) along the northern boundary in section 35. Steep, broken slopes of 40 to 80 percent or more are common. Rock bluffs and small benches are occasionally encountered. The largest areas of gentle topography are the benches along portions of the highway and another near the center of section 35. O'Leary Creek, flowing through a rocky drainage and avalanche track (fig. NF -2), bisects the natural area. Welcome Creek forms the eastern boundary. Numerous seep areas and intermittent streams are present.

Geologically, the natural area is reportedly composed of sedimentary rocks (graywacke, argillite, and siltstones) of Upper Jurassic and Lower Cretaceous age (Huntting et al.

[1]Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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1961, Misch 1952). The region was, of course, heavily glaciated during the Pleistocene, and alpine glaciation has been a dominant geomorphologic process within the natural area.

A wet, cool maritime climate prevails. Annual precipitation is heavy with maxima in December and January and minima in July and August. Summers are generally cool with frequent cloudy days, but only about 10 percent of the annual precipitation occurs from June through August. Annual snowfall increases rapidly with elevation. Climatic conditions can be interpolated from data for the Glacier and Mount Baker Lodge stations, 13 km. (8 miles) west and 8 km. (5 miles) southeast, respectively (U.S. Weather Bureau 1956,1965):

	Glacier R.S.	*MI. Baker Lodge*
Elevation	286m. (937 ft.)	1,266 m. (4,150 ft.)
Mean annual temperature	8.4 °e. (47.2°F.)	4.5°e. (40.1°F.)
Mean January Temperature	-0.3°e. (31.4°F.)	-2.6°e. (27.3 of.)
Mean July temperature ..	16.9°e. (62.5°F.)	12.1°e. (53.8°F.)
Mean January minimum temperature .	-4.0°e. (24.8°F.)	_5.7°e. (21.8°F.)
Mean July maximum temperature ..	24.7°e. (76.5 of.)	17.5°e. (63.5 of.)
Average annual precipitation	1,474 mm. (58.03 in.)	2,821 mm. (111.08 in.)
June through August precipitation	155 mm. (6.09 in.)	313 mm. (12.32 in.)
Average annual snowfall	106 em. (41.9 in.)	1,398 em. (550.3 in.)

Unpublished precipitation data for the Shuksan weather station, 0.8 km. (0.5 mile) east of the southeast corner of the natural area, can be obtained from the U.S. Weather Bureau.

Soils on the natural area have recently been mapped by U.S. Forest Service personnel as part of a soil survey of the Mount Baker National Forest (Snyder and Wade 1970). At lower elevations, along the southern boundary of the area, soils are derived from glacial drift and are classed as coarse loamy, mixed Typic Fragiorthods. These soils have a brown to reddish brown gravelly loam to sandy loam surface layer which grades into a very gravelly loamy sand subsoil at 55 to 75 em. (22 to 30 in.). Soils in the northern portion of the area are classed as coarse loamy, mixed Typic Ferrods. According to the map, the northeastern section is occupied by soils derived from metasedimentary or metavolcanic rocks, and the northwestern portion contains soils derived from highly fractured igneous rocks, such as andesite. These soils have dark reddish brown to brown loam surface layers underlain by very gravelly loam to sandy loam at depths ranging from 25 to 55 em. (10 to 22 in.).

BIOTA

Areas by SAF forest types (Society of American Foresters 1954), so far as can be determined from the original inventory, are as follows:

No.	*Name*	*Age*	*Area*	
230	Douglas-Fir - Western Hemlock	Old	195 ha.	(482 acres)
230	Douglas-Fir - Western Hemlock	Young	54 ha.	(133 acres)
227	Western Red-cedar - Western Hemlock	Old	177 ha.	(437 acres)
224	Western Hemlock	Old	120 ha.	(296 acres)
221	Red Alder		2 ha.	(4 acres)
			548 ha.	(1,352 acres)

There are, in addition, 58 ha. (143 acres) classed as non-forested. This includes rock outcrops, subalpine meadow areas, and streamside brush fields. Vegetation types, as defined by Kuchler (1964) appear to include: Type 2, Cedar - Hemlock - Douglas Fir Forest; Type 3, Silver Fir - Douglas Fir Forest; Type 4, Fir - Hemlock Forest; and Type 52, Alpine Meadows and Barren. The natural area spans three major vegetation zones (Franklin and Dyrness 1969) - the *Tsuga heterophylla, Abies amabilis,* and *T. mertensiana* Zones. The *T. mertensiana* Zone is most poorly represented occurring only at highest elevations.

The major tree species are Douglas-fir,

western hemlock, western red-cedar *(Thuja plicata),* and Pacific silver fir *(Abies amabilis).* Mountain hemlocks *(Tsuga mertensiana)* are encountered at highest elevations. Red alder *(Alnus rubra)* and black cottonwood *(Populus trichocarpa)* are sporadically represented in wet areas and along streams.

The bulk of the natural area is occupied by mixed old-growth forests of Douglas-fir, western hemlock, and western red-cedar growing on moderate to steep slopes. In these stands, the Douglas-fir are scattered veterans 125- to 175-cm. (50- to 70-in.) d.b.h. and exceeding 600 years in age. These specimens average five to 10 per acre and make up 30 to 50 percent of the forest volume. Western hemlock and western red-cedar are more numerous, but they are generally smaller in size and younger. Succession in these stands is toward a climax forest of western hemlock. It is the only species reproducing itself in significant numbers (fig. NF -2). Typical understory species are *Polystichum munitum, Berberis nervosa, Linnaea borealis,* Pacific yew *(Taxus brevifolia), Viola sempervirens, Chimaphila umbellata,* and *Pyrola minor. Acer circinatum* is scattered but locally abundant. On driest slopes, *Pyrola asarifolia* and *Gaultheria shallon* are found.

The young-growth forests dominated by Douglas-fir and western hemlock occur as small patches and stringers. They are most extensive along the western edge of the natural area.

A different community is found on cool, moist benches at lower elevations within the natural area (fig. NF -2). The overstory consists of western hemlock, Douglas-fir, western red-cedar, and Pacific silver fir. Reproduction consists of hemlock and Pacific silver fir indicating the climax forest will include at least a percentage of both. The understory is much richer including *Vccccinium alaskaense, Cornus canadensis, Rubus pedatus, Clintonia uniflora, Oplopanax horridum, Athyrium filix-femina, Blechnum spicant, Polystichum munitum, Tiarella unifoliata,* and *Gymnocarppium dryopteris.*

At higher elevations, within the *Abies amabilis* Zone, the Douglas-fir and western Red-cedar are largely absent, and stands of Pacific silver fir and western hemlock are typical. Pacific silver fir appears to be the climax species; hemlock reproduction is sparse. Typical understory species are *Cornus canadensis, Rubus pedatus, Clintonia uniflora, Vaccinium alaskaense,* and *Tiarellaunifoliata.*

Finally, above about 1,375 m. (4,500 ft.), mountain hemlock replaces western hemlock as the major Pacific silver fir associate. These stands vary in understory characteristics from a relatively dense condition with well-developed, ericaceous shrub layers to a relatively open condition with a herbaceous understory. Subalpine meadows of varying type are associated with these stands but have not been examined in detail (fig. NF-2).

Mammals believed to utilize the tract as transients or residents are listed in table NF-l.

HISTORY OF DISTURBANCE

Human disturbance of the natural area has been and will probably continue to be minor because of its rugged and inaccessible character. Removal of dead or hazardous trees has been carried out along the highway. A short nature trail from the highway to the base of several large trees has periodically been opened and human visitation has been confined to a hectare or so in this vicinity.

Recent natural disturbances appear to have affected only limited areas within the tract. The occurrence of young stands of Douglas-fir indicates that portions of the natural area have been burned by wildfires during the last century. Avalanches have occurred in at least one drainage - that of O'Leary Creek.

RESEARCH

The North Fork Nooksack Research Natural Area has been used as a sampling site in a study of the amount and composition of forest floors under medium-altitude, old-growth coniferous forests in Washington (Gessel and Balci 1965). No additional research is presently known to be in progress.

This Research Natural Area is particularly valuable for ecological studies on a variety of stand types typical of the northern Cascades. The broad range in elevations, spanning three major vegetation zones, also provides special opportunities for research concerned with environmental gradients.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 15' Mount Shuksan, Washington, and Mount Baker, Washington, quadrangles, scale 1: 62,500, issued by the U.S. Geological Survey in 1953 and 1952, respectively; and *geology* - *Geologic Map of Washington,* scale 1: 500,000 (Huntting et al. 1961). Either the District Ranger (Glacier Ranger District) or Forest Supervisor (Mount Baker National Forest, Bellingham, Washington) can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Serv. Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Gessel, Stanley P., and A. Nihat Balci
1965. Amount and composition of forest floors under Washington coniferous forests, p. 11-23, illus. In C. T. Youngberg (ed.), Forest-soil relationships in North America. Corvallis: Oreg. State Univ. Press.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Misch, Peter
1952. Geology of the northern Cascades of Washington. Mountaineer 45(13): 4-22, illus.

Snyder, Robert V., and John M. Wade
1970. Mt. Baker National Forest soil resource inventory. 267 p. plus atlas of maps and interpretive tables. Northwest Reg., USDA Forest Servo

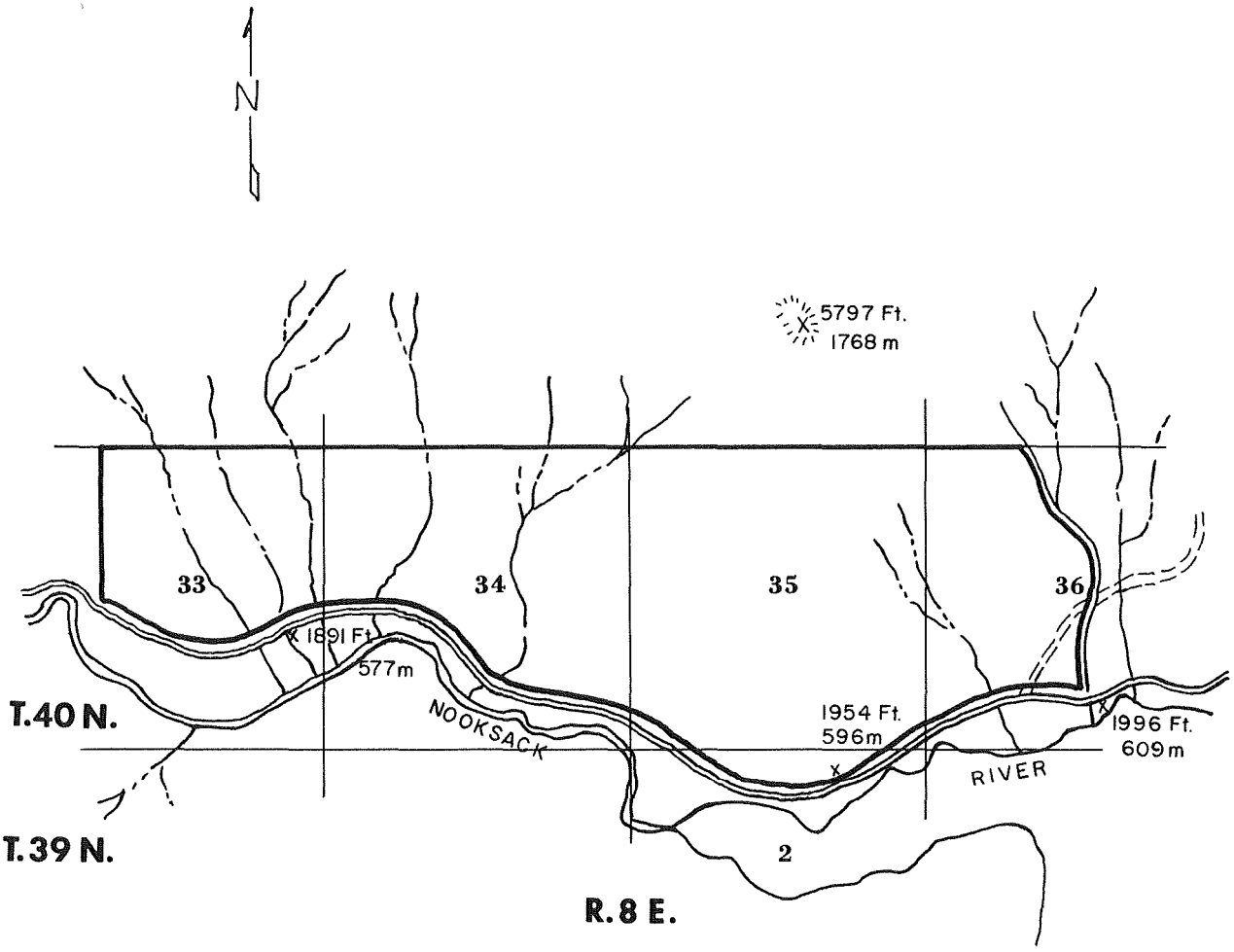
Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U. S. Weather Bureau
1956. Climatic summary of the United States - supplement for 1931 through 1952, Washington. Climatography of the United States 11-39, 79 p., illus.

1965. Climatic summary of the United States - supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table NF-1. — Tentative list of mammals for North Fork Nooksack Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex cinereus	masked shrew
	Sorex obscurus	dusky shrew
	Sorex palustris	northern watershrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis keeni	Keen myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Ochotona princeps	pika
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Marmota caligata	hoary marmot
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus richardsoni	Richardson vole
	Neotoma cinerea	bushy-tailed wood rat
	Ondatra zibethicus	muskrat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Synaptomys borealis	northern bog vole
	Tamiasciurus douglasi	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Gulo luscus	wolverine
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. columbianus	black-tailed deer
	Oreamnos americanus	mountain goat



LEGEND

BOUNDARY, NORTH FORK NOOKSACK RESEARCH NATURAL AREA

SECTION LINE

STREAM

HIGHWAY

SPUR ROAD

BENCH MARK

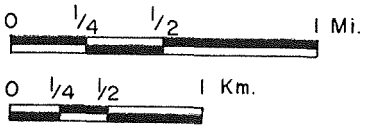
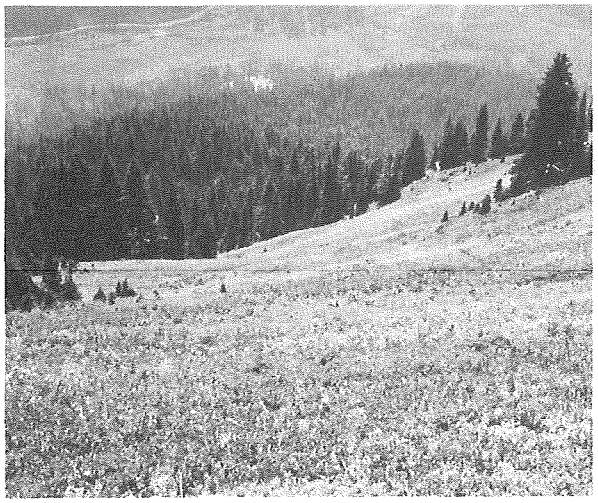
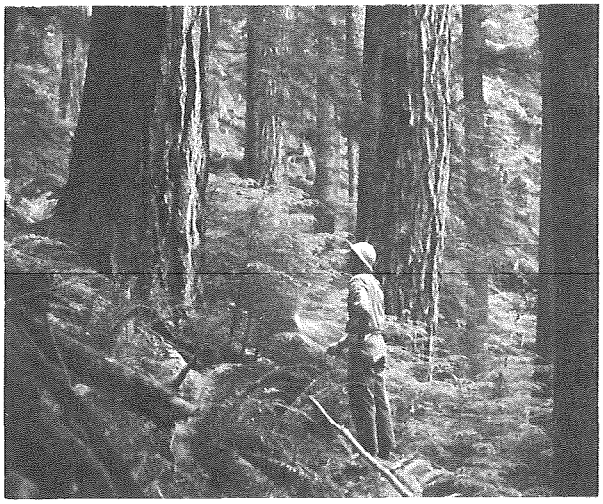
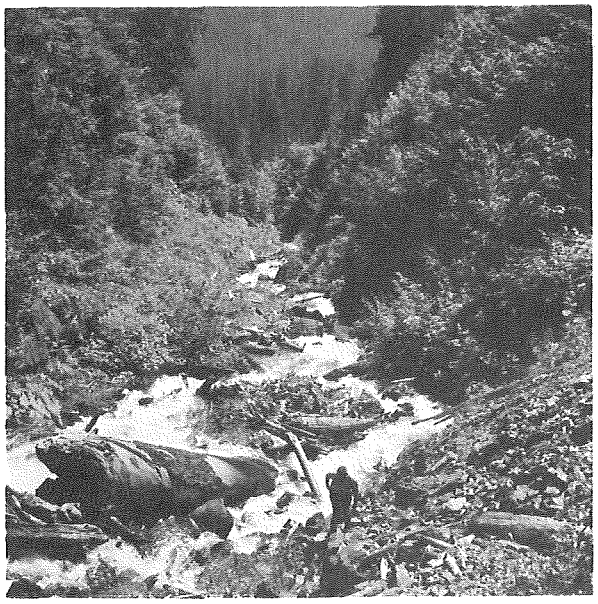


Figure NF-1.– North Fork Nooksack Research Natural Area, Whatcom County, Washington.

Figure NF-2.—Natural features of the North Fork Nooksack Research Natural Area. Upper left: Mixed stand of old-growth Douglas-fir, western redcedar, western hemlock, and Pacific silver fir on moist bench at low elevation in the natural area. Upper right: Dense reproduction of western hemlock, with smaller amounts of Pacific silver fir and western redcedar, developing in a small opening created by windthrow. Center left: Subalpine meadows and central portion of the natural area from the northern boundary; clearcuts are outside southern boundary. Center right: Typical old-growth Douglas-firs. Lower left: View down O'Leary Creek drainage which bisects the natural area, illustrating the steep stream gradient. Lower right: A portion of the upper drainage of O'Leary Creek showing damage caused by recurrent avalanches.







Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

OCHOCO DIVIDE RESEARCH NATURAL AREA[1]

Interior mixed conifer (ponderosa pine, Douglas-fir, grand fir, and western larch) forests and mountain meadows typical of central Oregon's Blue Mountains.

The Ochoco Divide Research Natural Area was established in July 1935 to exemplify the forests of ponderosa pine *(Pinus ponderosa)* and Douglas-fir *(Pseudotsuga menziesii)* and of grand fir *(Abies grandis),* western larch *(Larix occidentalis),* and Douglas-fir, characteristic of mid-elevations in the Blue Mountains of central Oregon. The 777-ha. (1,920acre) tract is located in Wheeler County, Oregon, and is administered by the Big Summit Ranger District (Prineville, Oregon), Ochoco National Forest. Its roughly rectangular shape includes portions of sections 28, 29,30,31, and 33 and all of section 32, T. 12 S., R. 20 E., Willamette meridian. It is located at 44 °30' N. latitude, and 120°20' W. longitude (fig. OD-l).

ACCESS AND ACCOMMODATIONS

The natural area is located about 48 km. (30 miles) northwest of Prineville on U.S. Highway 26 or about 14 km. (9 miles) northeast of Ochoco Ranger Station on Forest Roads 1222 and 1204. Forest Road 1204 passes through the southeastern corner of the tract. Access is good during summer, but snow creates difficulties during the winter.

[1] Description prepared by Dr. F. C. Hal!, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

Public accommodations are available in Prineville or in primitive forest camps in the vicinity of the natural area.

ENVIRONMENT

The Ochoco Divide Research Natural Area varies in elevation from 1,250 to 1,650 m. (4,100 to 5,400 ft.). Topography varies from undulating to rolling. The tract is located at the upper edge of an uplifted plateau and is underlain primarily by Clarno formation materials (Baldwin 1964). These late Eocene to early Oligocene deposits include rhyolite and basalt flows, tuffs and breccias, as well as some tuffaceous sedimentary rocks.

A modified continental climate prevails. Most precipitation occurs as snow during the cool, partly cloudy winter. Summers are warm, generally low in precipitation and largely cloudless. One to 3 months of drought are common. Climatic data from Ochoco Ranger Station located at 1,200 m. (3,980 ft.) in a valley 11 km. (7 miles) to the southeast are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	6.2°C. (43.1°F.)
Mean January temperature	-4.3°C. (24.3°F.)
Mean July temperature	16.3°C. (61.4°F.)
Mean January minimum temperature	−9.9°C. (14.2°F.)
Mean July maximum temperature	27.8°C. (82.1°F.)
Average annual precipitation	490 mm. (19.3 in.)
June through August precipitation	76 mm. (3.0 in.)
Average annual snowfall	175 cm. (69.0 in.)

Precipitation is higher and temperatures lower on the natural area itself.

Soils on the area have not been mapped or described. Forest soils are developed from aerially deposited volcanic ash over buried soil profiles (Hall 1967). They resemble Gray Wooded soils and are not podzolized.

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BIOTA

Estimated areas by vegetation types are:

Name	*Area*
Ponderosa pine forests	337 ha. (833 acres)
Grand fir - western larch - Douglas-fir forests	335 ha. (828 acres)
Wet and dry meadows	34 ha. (85 acres)
Grasslands	39 ha. (94 acres)
Western juniper - bunchgrass savannas	32 ha. (80 acres)

The distribution of these types is shown in figure OD-2. Ponderosa pine stands are generally assignable to SAF forest cover type 237, Interior Ponderosa Pine (Society of American Foresters 1954), although fir reproduction is common, and to Kuchler's (1964) Type 11 Western Ponderosa Forest. The mixed grand fir-western larch-Douglas-fir stands can be related to SAF type 213, Grand Fir - Larch - Douglas-Fir, and to Kuchler's Type 14, Grand Fir - Douglas Fir Forest. The western juniper *(Juniperus occidentalis)* stands can be assigned to SAF type 238, Western Juniper, and to Kuchler's Type 24, Juniper Steppe Woodland. The natural area is located within an *Abies grandis* Zone (Franklin and Dyrness 1969).

The forests dominated by old-growth ponderosa pine are also characterized by seedlings, saplings and sometimes poles of Douglas-fir, occasional western larch, and some grand fir. Ground vegetation is strongly dominated by pinegrass *(Calamagrostis rubescens)* (fig. 0 D-2). Other understory species are elk sedge *(Carex geyeri), Arnica cordifolia,* and *Lupinus* spp. Fire-scarred ponderosa pine are common. These stands have been classified as a mixed conifer/pinegrass community type by Hall (1967).

Grand fir - western larch - Douglas-fir stands are characteristic of north slopes. They vary in tree composition from nearly pure grand fir to a mixture of the three species. Ground vegetation is a moderately sparse stand of *Bromus vulgaris, Arnica cordifolia.,* pinegrass, *Lupinus latifolius,* elk sedge, *Carex concinnoides, Hieracium albiflorum,* and *Pyrola* spp. Stands where larch is abundant contain fire-charred, dead, and downed trees. These mixed conifer stands have been classified as the grand fir/woodland brome community type by Hall (1967).

The western juniper communities occur on steep slopes and shallow soils (fig. OD-2). They are dominated by scattered western juniper with bitter cherry *(Prunus emarginata),* and Idaho fescue *(Festuca idahoensis).* Past livestock use and present game use of this highly palatable community have degraded the range to a point where it is considered in poor condition. Furthermore, the soils are shallow and recover very slowly following misuse.

The remaining grassland and meadow communities have not been extensively examined. One mountain meadow located in the southern half of the tract is dominated by *Poa pratensis* and *Bromus carinatus* with occasional *Veratrum californicum* and some *Cirsium vulgare.* Past livestock use has also altered vegetation in this meadow which might be considered to be in fair range condition.

Mule deer use the area as summer range.

A complete list of mammals believed to utilize the natural area as residents or transients is provided in table OD-I.

HISTORY OF DISTURBANCE

Fire-scarred ponderosa pine indicate ground fires periodically burned the area prior to initiation of fire control programs about 1910. Hall (1967) has suggested that ponderosa pine/pinegrass communities constitute a fire climax which are shifting with fire control to grand fir and Douglas-fir climax. Dominance of fir reproduction in this plant community substantiates this hypothesis.

Some tree cutting, apparently for juniper fenceposts, occurred many years ago in the western juniper communities. A minor amount of timber was cut in connection with mining exploration work in the southwestern portion of the tract, the latest having occurred about 1966.

Domestic livestock grazed portions of the natural area between 1880 and 1963. Various segments of the tract were included in three grazing units - Nature Creek, Carrol Glade,

and Carrol Butte. The 600 acres of the natural area included in the Nature Creek unit were grazed from about 1880 to 1920 with about four bands of sheep for four months of the year. Numbers were gradually reduced, and from 1930 to 1960 one band continued to use the area. Sheep and cattle grazed the Carrol Glade grazing unit from 1880 to 1962 when the 950 acres of the natural area included in this grazing unit was fenced off. This Use consisted of from 300 to 500 cattle from 1930 to 1940 and one band of sheep, between July 1 and September 30 from 1940 to 1962. A stock driveway along the eastern edge of this grazing unit had considerable influence on the pattern of grazing use. The Carrol Butte grazing unit included about 400 acres of the natural area and, until 1960, had a pattern of sheep use comparable to the Nature Creek area. To summarize the effects of grazing, use appears to have affected the composition of communities with a high proportion of highly palatable species, such as the western juniper and moist meadow types. It does not appear to have severely affected ground vegetation in the forest communities.

Mining claims in the southern half of the tract caused disturbance of soil and vegetation; however, these claims are not currently active. The area has recently been withdrawn from mineral entry.

RESEARCH

No research is known to have been conducted within the natural area. However, plant communities similar to those found on the natural area were described and characterized in Hall's (1967) extensive study of this portion of the Blue Mountains.

The natural area provides interesting opportunities to evaluate: (1) biomass production as affected by soils and topography under a single macroclimate; (2) natural forest succession following control of ground fires; (3) game and non-game animal habitat in the absence of logging.

MAPS AND AERIAL PHOTOGRAPHS

No special topographic or geologic maps are available for the natural area which are sufficiently detailed to be useful. Either the District Ranger (Big Summit Ranger District) or Forest Supervisor (Ochoco National Forest, Prineville, Oregon) can provide details on the most recent aerial photo coverage of the area.

LITERATURE CITED

Baldwin, E. M.
1964. Geology of Oregon. Ed. 2, 165 p., illus. Eugene: Univ. Oreg. Coop. Bookstore.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Hall, Frederick Columbus
1967. Vegetation-soil relations as a basis for resource management on the Ochoco National Forest of central Oregon. 207 p., illus. (Ph.D. thesis, on file at Oregon State Univ., Corvallis.)

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31,96 p., illus.

Table OD-1. — Tentative list of mammals for Ochoco Divide Research Natural Area

Order	Scientific name	Common name
Insectivora	*Scapanus orarius*	coast mole
	Sorex obscurus	dusky shrew
	Sorex palustris	northern water shrew
	Sorex preblei	Preble shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis subulatus	small-footed myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Pipistrellus hesperus	western pipistrel
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Castor canadensis*	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Marmota flaviventris	yellow-bellied marmot
	Microtus longicaudus	long-tailed vole
	Microtus montanus	mountain vole
	Microtus richardsoni	Richardson vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Spermophilus beldingi	Belding ground squirrel
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys talpoides	northern pocket gopher
	Zapus princeps	western jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx canadensis	Canadian lynx
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Taxidea taxus	badger
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer

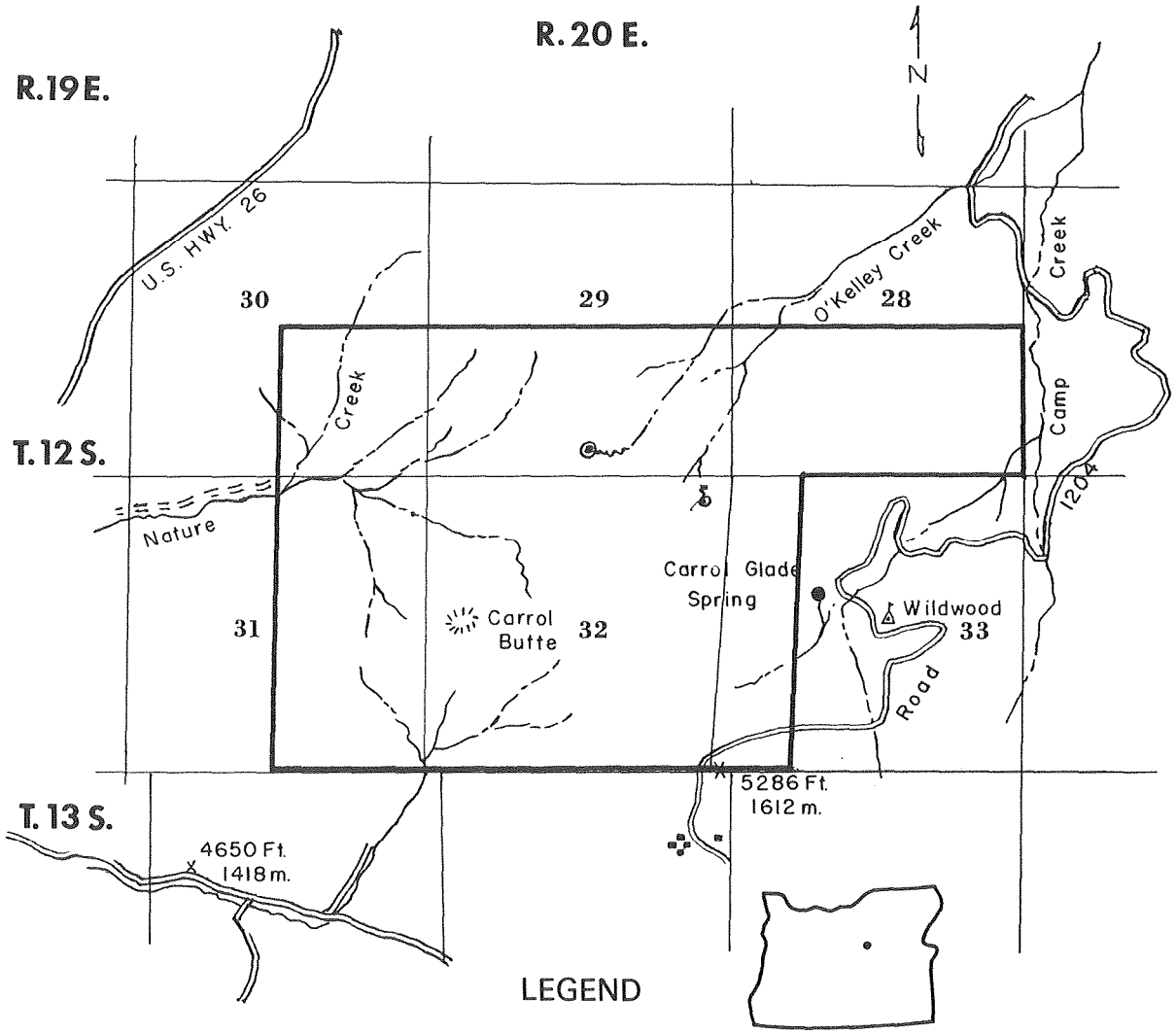
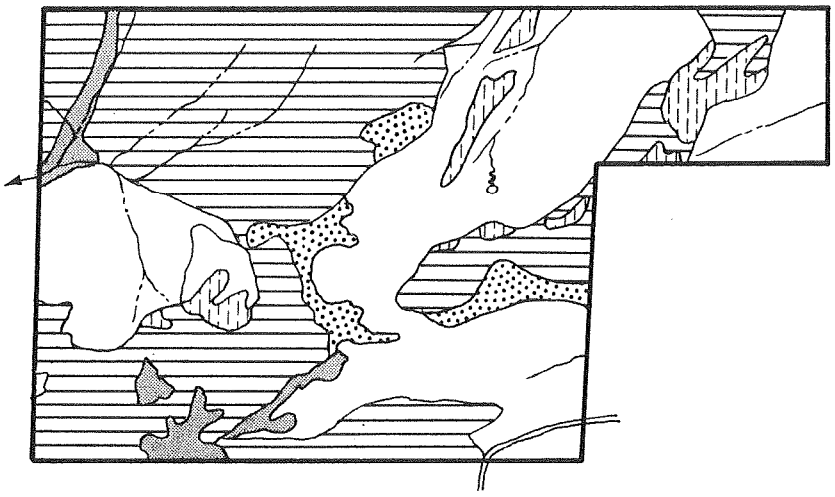
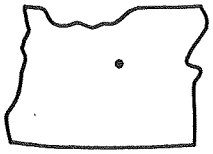


Figure OD-1.– Ochoco Divide Research Natural Area, Wheeler County, Oregon.



LEGEND



BOUNDARY, OCHOCO DIVIDE RESEARCH NATURAL AREA

STREAM

ROAD

0 1/4 1/2 1 Mi.

0 1/4 1/2 1 Km.

PONDEROSA PINE

GRAND FIR - WESTERN LARCH - DOUGLAS-FIR

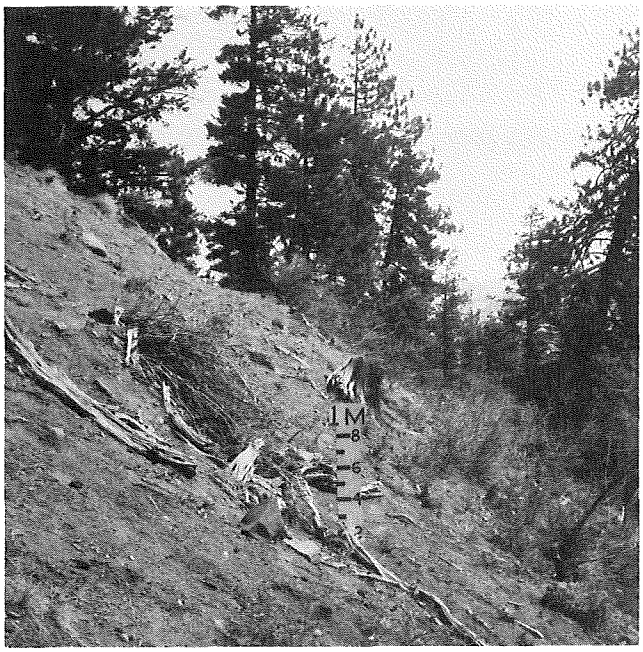
MEADOW

GRASSLAND

WESTERN JUNIPER

Figure OD-2.– Vegetation types in the Ochoco Divide Research Natural Area.

Figure OD-3.-Communities of the Ochoco Divide Research Natural Area. Upper left: Western juniper-bitter cherry/Idaho fescue community on shallow soil; vegetation has deteriorated from livestock and game animal use. Upper right: Moist meadow dominated by *Poa pratensis* and *Bromus carinatus* with some *Verbascum* and *Cirsium;* a deteriorated community resulting from past livestock grazing. Lower left: Ponderosa pine-grand fir/pinegrass community; pine dominates the overstory while fir dominates reproductive size classes. Lower right: Grand fir/pinegrass community approaching climax condition with dying Douglas-fir and sedge.



Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

OLALLIE RIDGE RESEARCH NATURAL AREA[1]

Subalpine mosaic of mountain meadows and true fir - mountain hemlock forest on some ridgetops in the western Cascades of Oregon.

The Olallie Ridge Research Natural Area was established on January 9, 1963, to provide examples of the mountain meadow and true fir *(Abies* spp.) - mountain hemlock *(Tsuga mertensiana)* communities found on high ridges in the western Cascades of Oregon. The 292-ha. (720-acre) tract is located in Lane County, Oregon, and is administered by the McKenzie Bridge Ranger District (McKenzie Bridge, Oregon), Willamette National Forest. The natural area is in two blocks each occupying the summit area of a ridgetop peak. The irregular boundaries (fig. OR-I) generally follow contour lines. The natural area is located in portions of sections 3, 4, 5, 8, 9, and 10, T. 17 S., R. 6 E., Willamette meridian, at 44 °06' N. latitude and 122°05' W. longitude.

ACCESS AND ACCOMMODATIONS

The Olallie Ridge Research Natural Area can only be reached on foot. Several maintained trails penetrate or border portions of the tract. To reach the vicinity, turn south off of U.S. Highway 126 (McKenzie River Highway) onto the South Fork Road (Forest Road 1663). Follow this road and then the East Fork Road (Forest Road 1778) to the trail heads for either Forest Trails 3326 or 3312, located on the slopes below the natural area. These trails provide the quickest access and require from 1 to 21J2 miles of foot travel to reach the natural area.

The nearest commercial accommodations are at Blue River or McKenzie Bridge along U.S. Highway 126. There are numerous improved public campgrounds along the McKenzie River and the South Fork of the McKenzie River, as well as a primitive campsite in the saddle between the two units of the natural area.

ENVIRONMENT

The Olallie Ridge Research Natural Area occupies summits of two peaks on a major, north-south trending ridge (fig. OR-2). Slopes are generally steep to moderate, and rock outcrops are common. There are no permanent streams or ponds within the natural area. Elevations range from about 1,341 to 1,686 m. (4,400 to 5,530 ft.) at the summit of O'Leary Mountain in the west unit and from 1,463 to 1,725 m. (4,800 to 5,660 ft.) on the summit of Horsepasture Mountain in the east unit.

The natural area lies within a geologically older (Eocene to Miocene) part of the Cascade Range known as the western Cascades (Peck et al. 1964; Williams 1957). The pyroxene andesites which dominate belong to the Sardine formation of Miocene age. Basalt, dacite, and various types of volcanic tuffs and breccias may also be present. Some data on lithology and petrography of the bedrock are found in Peck et al. (1964).

A cool, wet climate prevails. Summers are relatively dry; much of the heavy winter precipitation accumulates in snowpacks which probably attain maximum depths of 1 to 3 m. (3 to 9 ft.). The nearest climatic station (McKenzie Bridge) is at such a low elevation

1 Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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that the temperature and precipitation data are not very representative of conditions on the natural area. Isohyetal maps indicate the natural area receives an average annual precipitation slightly in excess of 2,000 mm. (80 in.).

Soils in the natural area have not been mapped or described. Forest soils are typically weakly developed Brown Podzolics developed at least partially in surficial layers of aeoliandeposited volcanic ash. Soils under the non-forested communities tend to be shallow and stony.

BIOTA

Approximately 118 ha. (290 acres) of the Olallie Ridge Research Natural Area are occupied by non-forested communities, including both meadow- and shrub-dominated types. The remaining area can be assigned to SAF forest cover types (Society of American Foresters 1954) as follows:

No.	*Name*	*Area*
205	Mountain Hemlock - Subalpine Fir	130 ha. (325 acres)
229	Pacific Douglas-Fir	33 ha. (82 acres)
211	White Fir	9 ha. (23 acres)

Kuchler's (1964) types represented include Silver Fir - Douglas Fir Forest (3), Fir Hemlock Forest (4), and possibly, Grand Fir Douglas Fir Forest (14), and Alpine Meadows and Barren (52). The natural area is located within the *Abies amabilis* Zone of Franklin and Dyrness (1969).

The most outstanding features of the Olallie Ridge Natural Area are the non forested communities which occupy a variety of habitats and support a rich flora. During a study of disjunction and endemism, Hickman (1968) examined the vascular plant flora of over 42 peaks; he found that Horsepasture Mountain is one of the most floristically diverse areas in the entire western Cascades. Hickman provides a checklist of species found on both Horsepasture and O'Leary Mountains; it includes at least 30 disjunct species of phytogeographic significance.

There are a variety of rock outcrop and meadow community types within the natural area. They include the following types described by Hickman (1968): Snowbed, Rocky Melt Seep, Wet Meadow, Mesic Meadow, Subalpine Xeric Meadow, Fine Gravel Scree, Outcrop Ridge, and Vertical Outcrop. Snowbed communities are found on outcrops or steep, open slopes of north aspect where snow accumulations reach considerable depth in winter. Characteristic species include *Claytonia lanceolata, Luetkea pectinata, Orogenia fusiforma, Erythronium grandiflorum.,* and *Mertensia bella.* The Rocky Melt Seep community occurs where snowmelt trickles over rock outcrops, particularly on south-facing slopes; such habitats are dry after midsummer. Typical species include *Dodecatheon jeffreyi, Lewisia triphylla, Mimulus brewerii, M. guttatus, Saxifraga. occidentalis* var. *rufidula,* and *Gayophytum. humile.*

The Wet Meadow community is one of the more extensive in the natural area. It is found on habitats with a constant moisture source and relatively deep soil. *Veratrum viride, Senecio triangularis,* and *Valeriana sitchensis* are characteristic dominants. Associated species include *Ribes bracteosum, Rubus spectabilis, Mitella oreweri, Ligusticum. grayi,* and *Hydrophyllum. fendleri,* and *H. tenuipes.*

The Mesic Meadow community is also well represented. It is dominated by herbaceous perennials which have sufficient time to set seed in early summer before moisture supplies are exhausted. Typical dominants are *Rubus parviflorus, Pteridium aquilinum,* and *Rudbeckia occidentalis.* Associated species include *Erigeron aliceae, Lupinus latifolius, Ribes binominatum., R. viscosissimum, Polygonurn phytolaccaefolium, Cirsium centaurea, Mertensia paniculata, Vicia americana* var. *truncata, Epilobium. angustifolium,* and *Gayophytum humile.*

A third common meadow type is the Subalpine Xeric Meadow community which is found on habitats intermediate between the mesic meadows and the dry, rocky surrounding areas. Representative species include *Gilia aggregata, Collomia linearis, Gayophytum. diffusum* var. *parviflorum, Orthocarpus imbricatus, Luina stricta, Polygonum minimium, P. douglasii, Navarretia divaricata,*

Microsteris gracilis, Collinsia parviflora, Potentilla glandulosa, Cerastium arvense, Calochortus lobbii, Rumex acetosella, Pachystima myrsinites, Amelanchier alnifolia var. *semiintegrifolia,* and *Phacelia heterophylia.* A closely associated community is confined to ridges of rapidly weathering rock (Fine Gravel Scree), Many of the species common in the xeric meadow community occur here, as well as *Lotus nevadensis, Sedum oregonense,* and *Sanicula graveolens.*

Outcrop Ridge communities are found where mass wasting of small fragments has produced outcroppings of small patches of parent rock which are barely exposed and eroded parallel to the general slope of the area. Many species root in the weathered cracks of the outcrops or pockets of finer material: *Delphinium menziesii* var. *pyramidale, Castilleja hispida, Penstemon procerus* var. *brachyanthus, Sedum stenopetalum, S. divergens, Eriophyllum. lanatum, Arctostaphylos nevadensis, Haplopappus hallii, Silene douglasii, Comandra umbellata, Lomatium martindalei, Sanicula graveolens, Eriogonum umbellatum, E. compositum, Juniperus Communis, Erigeron foliosus* var. *confinis, Arenaria capillaris* var. *americana, Erysimum asperurn, Antennaria rosea, Phacelia heterophylla, Anaphalis margaritacea,* and *penstemon cardwellii.* A few areas typifying the Vertical Outcrop community are present. Species adapted to these exposed environments include *Saxifraga bronchialis* var. *vespertina, Penstemon rupicola, Selaginella wallacei, Erigeron cascadensis, Polemonium pulcherrimum, Saxifraga caespitosa,* and *Heuchera micrantha.*

Tree species found within the natural area include mountain hemlock, Pacific silver fir *(Abies amabilis),* noble fir *(Abies procera),* western hemlock *(Tsuga heterophylla),* white fir *(Abies concolor),* subalpine fir *(Abies lasiocarpa),* and western white pine *(Pinus monticola).* All of the forests are relatively young in age (less than 130 years) and small in size; forest inventories of the area place all stands in either pole (maximum 28-cm. or ll-in. d,b.h,) or small sawtimber (maximum 53-em. or 21-in. d.b,h.) size classes.

As indicated, the bulk of the forests are of the mountain hemlock - true fir type (fig. OR-2). Pacific silver fir appears to be the major climax species based on reproductive success in closed forest stands. The understory is typically poor in shrubs and relatively rich in herbaceous species. Common understory plants include *Achlys triphylla, Cornus canadensis, Clintonia unifiora, Pyrola secunda, Viola sempervirens, Rubus lasiococcus, Vnccinium membranaceum, Osmorhiza chilensis,* and *Arnica* sp.

On the dry, south-exposed slopes, forests are more typically dominated by Douglas-fir or white fir or both; Pacific silver fir often dominates the tree reproduction in these stands. Typical understory plant species include *Symphoricarpos* spp., *Chimaphila umbellata,* vine maple *(Acer circinatum), Pyrola picta, Rosa gymnocarpa, Pteridium aquilinum, Achlys triphylla, Smilacina sessilifolia,* and *Vaccinium membranaceum.*

In addition to meadows and forests there are significant areas occupied by shrub dominated communities. These are typically found on wet sites adjacent to meadows or forests, on steep, north-facing slopes, and on talus associated with rock outcrops. Sitka alder *(Alnus sinuata)* is the common dominant on wetter substrates and north slopes where it forms dense thickets. Hickman (1968) considered this community to be a phase of his Wet Meadow type; they certainly are frequently associated with wet meadows and actually intergrade with them in some situations where the alder stems are more scattered. Deep winter snow accumulations and extensive snow creep cause strong bowing of the 3 to 5 m. (10 to 16 ft.) tall stems. In a nearby area the occurrence of these stands has been related to high soil water tables due to a nearly impervious subsoil[2], but in other regions they are associated with recurrent avalanches. Vine maple dominates the shrub communities on drier sites, and both species occasionally occur as co-dominants in mixed

[2] Unpublished soil survey data from the H. J. Andrews Experimental Forest on file at USDA Forest Service, Forestry Sciences Laboratory, Corvallis, Oregon.

stands. Both types of shrub communities appear to be stable as there is generally no evidence of forest encroachment.

The natural area is used as spring and early summer and fall range by blacktail deer *(Odocoileus hemionus columbianus)* and Roosevelt elk *(Cervus canadensis roosevelti).* Other mammals believed to occur within the natural area as residents or transients are listed in table OR-I.

HISTORY OF DISTURBANCE

The dominance of 130-year-old stands indicates the area has been subject to at least occasional fires, the last major one occurring in the mid-1800's. There are extensive areas of dead subalpine fir in and around the wet meadows which are probably the result of infestations of balsam woolly aphid over the last decade (Franklin and Mitchell 1967).

The natural area was intensively used as a sheep range until about the middle of the 1930's. There is still evidence of sheep camps around some grassy openings. Meadow composition has undoubtedly been strongly influenced by overgrazing of sheep.

RESEARCH

Extensive observations of the flora and plant communities of O'Leary and Horsepasture Mountains were made during Hickman's (1968) study of disjunction and endemism in the western Cascades of Oregon. His findings of floral diversity and community types have already been highlighted; for more complete information, see his original paper which includes commentary upon the adaptive strategies used by various disjunct species. The natural area has also been used as a collecting site in mycological studies.:)

The Olallie Ridge Research Natural Area provides an unusual opportunity for studying subalpine meadow-forest mosaics. Possible studies include variation in community composition, structure, productivity, and succession in relation to environmental factors. It is also an important refugium for disjunct populations of numerous plant species.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area are: *Topography* - 15' McKenzie Bridge, Oregon quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1955; and *geology* - *Reconnaissance Geologic Map and Sections of the Western Cascade Range, Oregon, North of Latitude* 43^0 *N.,* scale 1: 250,000 (Peck et al. 1964), *Geologic Map of the Central Park of the High Cascade Range, Oregon* (Williams 1957), and *Geologic Map of Oregon West of the 121st Meridian,* scale 1:500,000 (Peck 1961). Either the District Ranger (McKenzie Bridge Ranger District) or Forest Supervisor (Willamette National Forest, Eugene, Oregon) can provide details on the most recent aerial photo coverage and forest type maps for the area.

[3] Research by Dr. J. M. Trappe, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Franklin, Jerry F., and Russel G. Mitchell
1967. Successional status of subalpine fir in the Cascade Range. USDA Forest Servo Res. Pap. PNW-46, 16 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Hickman, James Craig
1968. Disjunction and endemism in the flora of the central western Cascades of Oregon: an historical and ecological approach to plant distributions. 335 p., illus. (Ph.D. thesis, on file at Univ. Oreg., Eugene.)

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geo!. Invest. Map 1-325.

Peck, Dallas L., Allan B. Griggs, Herbert G. Schlicker, and others
1964. Geology of the central and northern parts of the western Cascade Range in Oregon. U.S. Geol. Surv. Prof. Pap. 449, 56 p., illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

Williams, Howel
1957. A geologic map of the Bend quadrangle, Oregon and a reconnaissance geologic map of the central portion of the High Cascade Mountains. Oreg. State Dep. Geol. & Miner. Ind.

Table OR-1. — Tentative list of mammals for Olallie Ridge Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Sorex bendirii	marsh shrew
	Sorex palustris	northern water shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Ochotona princeps	pika
Rodentia	*Aplodontia rufa*	mountain beaver
	Arborimus longicaudus	red tree vole
	Clethrionomys californicus	California red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus richardsoni	Richardson vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Tamiasciurus douglasi	chickaree
	Thomomys mazama	Mazama pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Canis lupus	wolf
	Felis concolor	mountain lion or cougar
	Gulo luscus	wolverine
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer

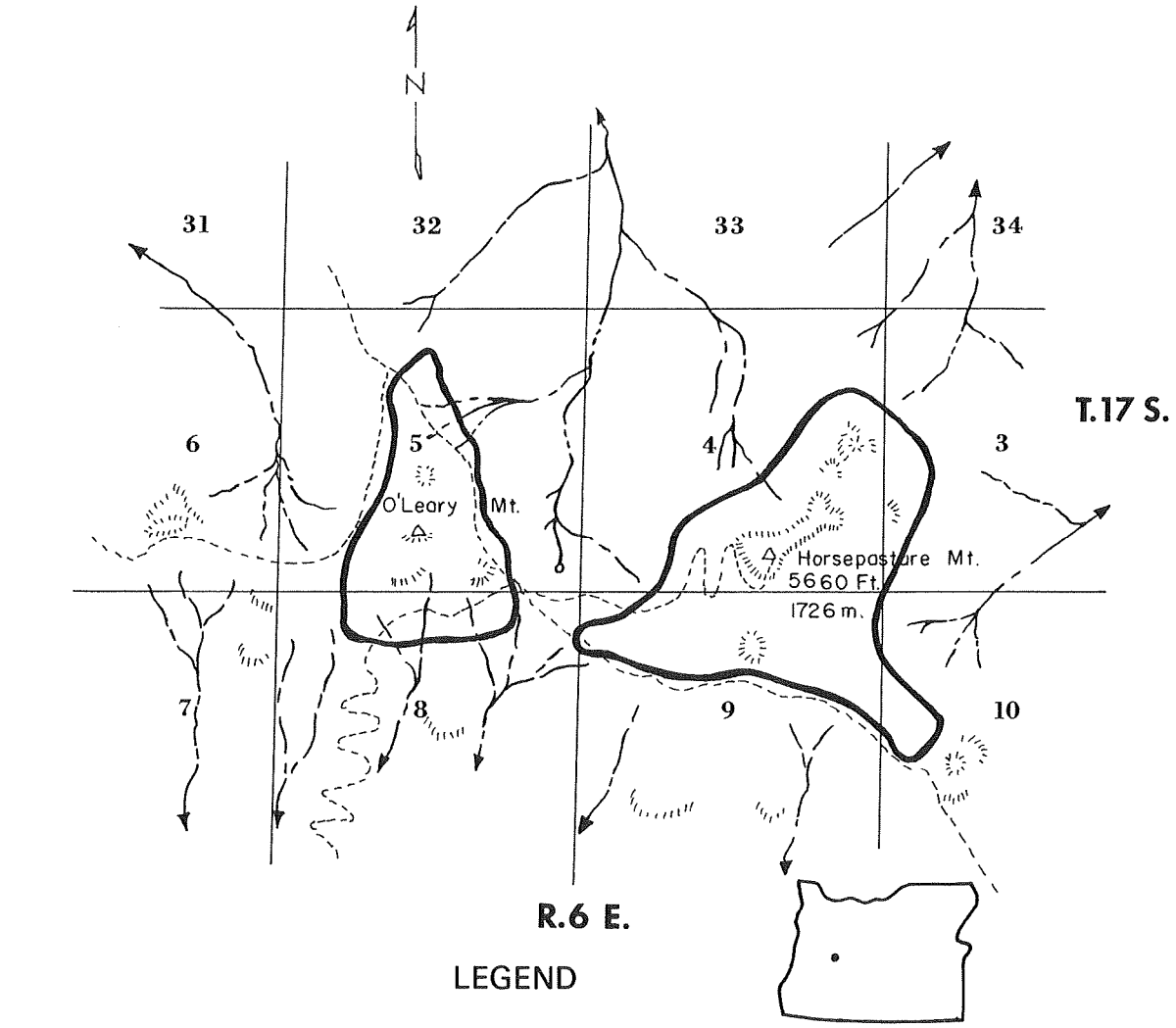

Figure OR-1.– Olallie Ridge Research Natural Area, Lane County, Oregon.

Figure OR-2.-Natural features of Olallie Ridge Research Natural Area. Upper left: Stand of noble fir, Pacific silver fir, and mountain hemlock typical of closed forest areas on cool, northerly exposed slopes. Upper right: Stand of Douglas-fir, grand fir, and western white pine typical of closed forest areas on drier, southerly aspects. Center left: Grassy opening typical of those found interspersed through forested areas on dry south slopes. Center right: Southeastern slopes of O'Leary Mountain; note the forest-meadow mosaic typical of southerly exposures and open nature of the true fir stand on the northeast slope. Bottom: Northwestern slopes of Horsepasture Mountain showing true fir-mountain hemlock stands and a wet meadow area surrounding a community of Sitka alder; note the numerous subalpine firs near the summit of the mountain which have been killed by insects.

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

PATAHA BUNCHGRASS RESEARCH NATURAL AREA[1]

A grassland-forest mosaic of blue-bunch wheatgrass and Douglas-fir communities located at the northern edge of the Blue Mountains in south-east Washington.

The Pataha Bunchgrass Research Natural Area was established in December 1968 as an example of mountain bunchgrass vegetation occurring at the transition from coniferous forest to steppe vegetation. The 20.7-ha. (51acre) tract is located in Garfield County, Washington, and is administered by the Pomeroy Ranger District (Pomeroy, Washington), Umatilla National Forest. It is located in the NW1/4 of section 1, T. 9 N., R. 42 E., Willamette meridian, at 46^{0}17' N. latitude and 117 °30' W. longitude.

ACCESS AND ACCOMMODATIONS

Access is via State Highway 128 from Pomeroy to the junction with Forest Road No. N-94 (Iron Spring Road), a distance of 22 km. (14 miles). Road N-94 passes along the eastern side of the tract (fig. PB-l). Access during summer is good but becomes difficult during the winter. Public accommodations are available in Pomeroy or about 9 km. (6 miles) south of the tract at Big Springs Forest Camp.

ENVIRONMENT

The Pataha Bunchgrass Research Natural Area has a mean elevation of 1,372 m. (4,500 ft.) with a total variation of about 60 m. (200 ft.). Topography varies from fiat to steep where it forms an upper part of the slope adjacent to Pataha Creek. The tract is located on the edge of a dissected plateau straddling the transition from the fiat plateau top to steep canyon slopes. Columbia River basalts underlie the entire area. They have been uplifted and severely dissected by natural erosion.

A modified maritime climate prevails. Most precipitation occurs as snow during the cool, cloudy winter. Summers are warm, generally low in precipitation and largely cloudless. One to 3 months of drought are common. Climatic data from Peola, located 3 km. (2 miles) to the north are as follows (U.S. Weather Bureau 1956):

Mean January temperature	7°C. (20°F.)
Mean July temperature	20°C. (65°F.)
Average annual precipitation	584 mm. (23.12 in.)
June through August precipitation	100 mm. (3.94 in.)
Average annual snowfall	229 cm. (90.00 in.)

Soils on the area have not been mapped recently; the Waha, Underwood, and Helmer soil series are possibly present (Washington Agricultural Experiment Stations 1954). Soil descriptions obtained at the time of the guidebook field examination are as follows:

(1) A shallow Lithosol with little profile development located on a plateau top of 0- to 5-percent slope and occupied by a bluebunch wheatgrass *(Agropyron spicaitum)-Idaho* fescue *(Festuca idahoensis)* community:

A	0 to 15 em.	Very dark brown (10 YR 2/2 moist, 2/8 dry) silt loam; slightly plastic, slightly sticky, with moderate, very fine subangular blocky structure; pH 6.7.

[1] Description prepared by Dr. F.C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

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B	15 to 25 cm.	Dark brown (7.5 YR 3/2 moist and dry) stony silt; slightly plastic, slightly sticky with strong, very fine subangular blocky structure; pH 6.7; 80- to 90-percent stone.
Bedrock	25 cm. +	Poorly cracked; evidence of restricted moisture drainage.

(2) A very shallow Lithosol with little profile development located on a 20-percent slope at the transition from plateau top to steep sideslope and occupied by a Sandberg's bluegrass *(Poa sondbergii*)-bluebunch wheatgrass community:

A	0 to 10 cm.	Dark brown (7.5 YR 2/2 moist, 3/2 dry) gravelly silt loam; slightly plastic, slightly sticky with weak, very fine granular structure; pH 6.8; 30- to 40-percent gravel.
B	10 to 20 cm.	Dark brown (7.5 YR 2/2 wet, 3/2 dry) very stony silt loam; slightly plastic, slightly sticky with weak, very fine granular structure; pH 6.8; 90- to 95-percent stone.
Bedrock	20 cm. +	Poorly cracked; evidence of restricted drainage.

(3) Profile with moderate development on steep (60- to 80-percent) southerly slope occupied by bluebunch wheatgrass community:

A	0 to 20 cm.	Dark brown (7.5 YR 2/2 moist, 3/3 dry) gravelly loam; slightly plastic, non-sticky with weak, very fine granular structure; pH 6.8; 30- to 40-percent gravel.
B	20 to 50 cm.	Dark brown (7.5 YR 2/2 moist, 3/2 dry) gravelly silt loam; plastic and slightly sticky with moderate, fine subangular blocky structure; pH 6.9; finely vesicular when dry; 20- to 40-percent stone, 20- to 30-percent gravel.
C	50 to 65 cm.	Dark brown (7.5 YR 3/2 moist, 4/4 dry) gravelly silt loam; plastic and slightly sticky with moderate, fine subangular blocky structure; pH 6.8; vesicular when dry; 20- to 40-percent stone, 20- to 30-percent gravel.
Bedrock	65 cm. +	Poorly cracked; evidence of clay depositions.

Moderate, northerly exposed slopes occupied by forest have Gray Wooded soils developed in 30 to 45 cm. (12 to 18 in.) of volcanic ash overlying buried soils which appear similar to the grassland soils.

BIOTA

Estimated areas by community types are:

Name	Area
Agropyron spicatum/Poa sandbergii	13 ha. (33 acres)
Pseudotsuga menziesii-Abies grandis/Vaccinium membranaceum	7 ha. (18 acres)

The forest stands probably are assignable to SAF forest cover Type 210, Interior Douglas-Fir (Society of American Foresters 1954), and Kilchler's (1964) Type 14, Grand FirDouglas Fir Forest. The grasslands best fit Kuchler's (1964) Type 51, Wheatgrass-Bluegrass. The area would fall within a ponderosa pine *(Pinus ponderosa)* Zone if it were present in this area. However, most vegetation in the Blue Mountains is strongly affected by topography and soils, and this tract is an excellent example. South slopes represent an upper elevational extension of the bunchgrass steppe, and north slopes represent a lower elevational extension of fir forest.

Bluebunch wheatgrass dominates the bunch grass stands (fig. PB-2). The relative position of wheatgrass in the plant community varies with soils and topography. On the plateau, it tends to dominate in both density and volume with Idaho fescue and Sandberg's bluegrass as constant and important associates. *Eriogonum herocleodes, Lupinus sericeus, Erigeron eatoni, E. bloomeri, Balsamorhiza serrata,* and *Achillea millefolium* are commonly present. On the transition from plateau to steep slopes, bluebunch wheatgrass codominates with Sandberg's bluegrass while L. *sericeus, E. eatoni, E. bloomeri,* and *B. serrata* are present. Bluebunch wheatgrass again dominates in both density and volume on steep south slopes. Sandberg's bluegrass and Idaho fescue are clearly subordinant in density and volume. Associated species are different, including *Berberis*

repens, Eriogonum heracleoides, and *Penstemon deustus;* and *Lupinus* and *Erigeron* spp. are generally absent. On the plateau top, the natural area contains a small example of grassland on rather deep soil, which Idaho fescue clearly dominates. Associated species are *Poa pratensis* and *Bromus tectorum.*

Most of the seven forested hectares (18 acres) represent seral stages of the *Abies grandis/Vaccinium membranaceum* association (Hall 1967). Douglas-fir *(Pseudotsuga menziesii)* dominates the tree overstory with occasional ponderosa pine (fig. PB-2). Reproduction is largely grand fir *(Abies grandis).* Ground vegetation is dominated by *Vaccinium membranaceum* and pinegrass *(Calamagrostis rubescens)* associated with species such as elk sedge *(Carex geyeri), Hieracium albiflorum, Lupinus latifolius,* and several well-developed colonies of the orchid *Cypripedium montanum.*

A *Pinus ponderosa/Calamagrostis rubescens* community forms an interrupted transitional band between grassland and Douglas-fir forest (fig. PB-2). Ponderosa pine clearly dominates and exhibits an open growth form with living branches extending within 3 m. (10 ft.) of the ground. Pinegrass strongly dominates ground vegetation, with other species such as *Spirea lucida,* elk sedge, *Lupinus latifolius,* and *Achillea millefolium* as common associates. Reproduction of Douglas-fir and grand fir is sporadic despite an abundant, adjacent seed source, suggesting this pine community is reasonably stable successionally.

Mammals believed to utilize the tract as residents or transients are listed in table PB1. Elk *(Cervus canadensis)* use the area as winter range and occasionally as spring or fall range during deeper snowfall. In general, they tend to move off the tract sufficiently early in the spring that grazing damage to grasses is prevented. Most forbs seem unpalatable to elk in this area.

HISTORY OF DISTURBANCE

Fire scars on ponderosa pine indicate periodic ground fires prior to initiation of fire control programs in 1910. Lack of dominant old-growth grand fir in the *Pseudotsuga-Abies/Vaccinium* community and downed western larch *(Larix occidentalis)* suggests all portions of the forest have burned at some time. Sufficient grass volume is present on the grassland to carry a fire so one should assume it has been burned. Fire scars suggest the last fire was about 1890.

Domestic livestock grazed the tract to some extent between 1890 and 1945, when livestock numbers in the allotment were reduced. Topography and lack of water have precluded extensive or heavy livestock use. The area has probably not been significantly altered by grazing.

RESEARC H

Vegetation and soil descriptions and environmental notes for the grasslands on the plateau top, a steep south slope, and the transitional area are available.[2] Vegetation analysis utilized the "three step method" in which a 1.9-cm. or % -in. loop is placed 100 times along each of two transects and on which vegetation or ground cover notes are made. Reconnaissance notes are also available for the forest vegetation.

The natural area provides interesting research opportunities on (1) effects of game use on bunch grass vegetation; (2) factors responsible for the mosaic pattern of forest and non-forest communities; (3) variation in bunch grass communities from flat plateau to steep slopes; and (4) biomass production as affected by soils and topography under a single macroclimate.

MAPS AND AERIAL PHOTOGRAPHS

No special topographic or geologic maps are available for the natural area which are sufficiently detailed to be useful. Either the District Ranger (Pomeroy Ranger District) or Forest Supervisor (Umatilla National Forest,

[2] Research by Dr. F.C. Hall, Division of Range and Wildlife, U.S. Forest Service, P.O. Box :3623, Portland, Oregon.

Pendleton, Oregon) can provide details on the most recent aerial photo coverage of the area.

LITERATURE CITED

Hall, Frederick Columbus
1967. Vegetation-soil relations as a basis for resource management on the Ochoco National Forest of Central Oregon. 207 p., illus. (Ph.D. thesis, on file at Oreg. State Univ., Corvallis.)

Kuchler, A.W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, *D.C.*

U .S. Weather Bureau
1956. Climatic summary of the United States - supplement for 1931 through 1952, Washington. Climatography of the United States 11-39, 79 p., illus.

Washington Agricultural Experiment Stations
1954. Soils of Washington and their related physiography. Asotin County Section. Wash. Agric. Exp. Stn. Circ. 258, 6 p., illus.

Table PB-1 — Tentative list of mammals for Pataha Bunchgrass Research Natural Area

Order	Scientific name	Common name
Insectivora	*Scapanus orarius*	coast mole
	Sorex merriami	Merriam shrew
	Sorex palustris	northern water shrew
	Sorex preblei	Preble shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis subulatus	small-footed myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Pipistrellus hesperus	western pipistrel
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Lepus californicus	black-tailed jack rabbit
	Sylvilagus nuttalli	mountain cottontail
Rodentia	*Clethrionomys gapperi*	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus montanus	mountain vole
	Microtus richardsoni	Richardson vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Spermophilus columbianus	Columbian ground squirrel
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus hudsonicus	red squirrel
	Thomomys talpoides	northern pocket gopher
	Zapus princeps	western jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx canadensis	Canadian lynx
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Taxidea taxus	badger
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer

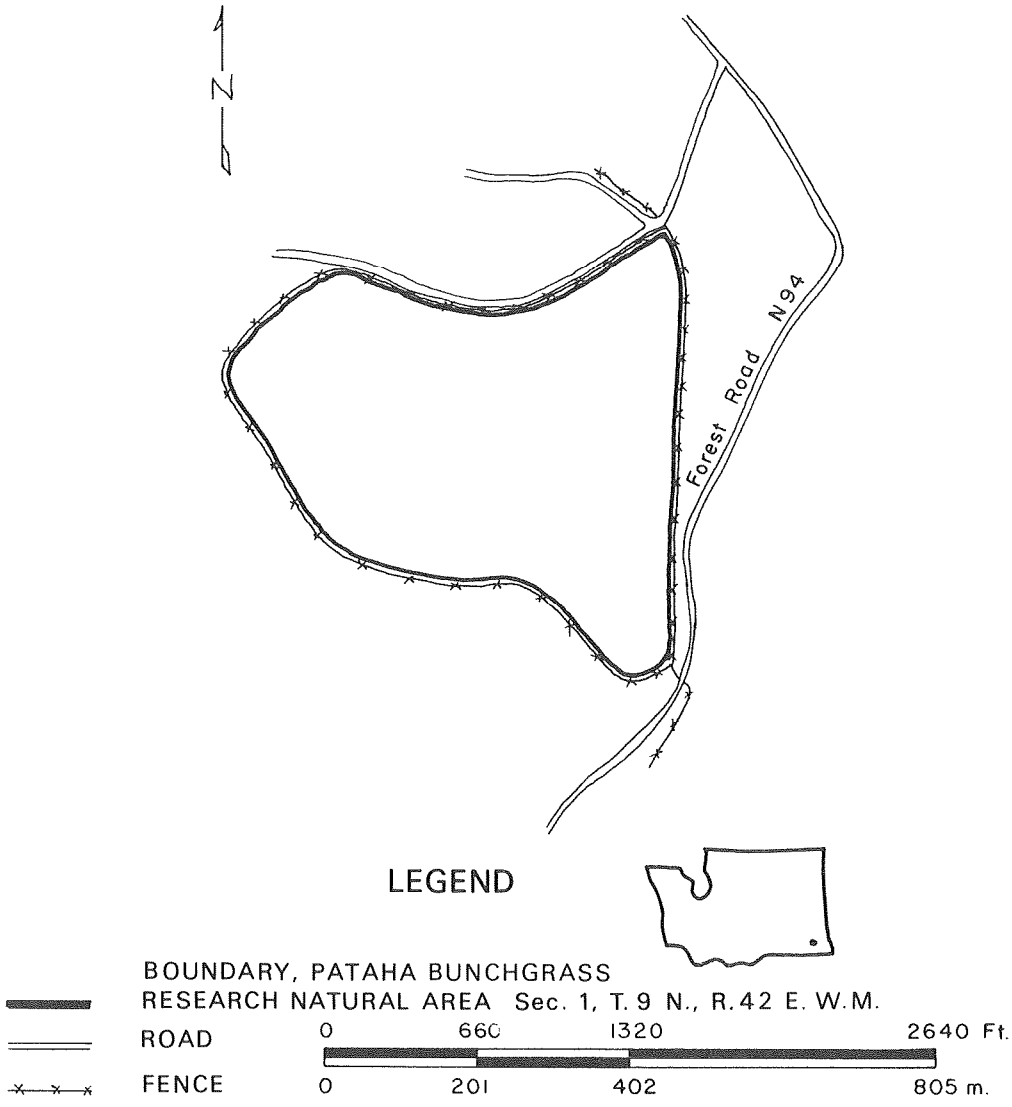

Figure PB-1.– Pataha Bunchgrass Research Natural Area, Garfield County, Washington.

Figure PB-2.-Natural features of Pataha Bunchgrass Research Natural Area. Upper left: Flat plateau top with bluebunch wheatgrass-Sandberg's bluegrass community on soils 3 to 4 dm. (12 to 18 in.) deep. Upper right: Topographic break from plateau to steep slopes occupied by community of Sandberg's bluegrass and low-density bluebunch wheatgrass growing on shallow soil 2 to 3 dm. (8 to 12 in.) deep. Lower left: Steep (60-percent), south slope occupied by bluebunch wheatgrass community with scattered Sandberg's bluegrass growing on deep, colluvial soil. Lower right: North-slope forest stand on *Abies grandis/Vaccinium membranaceum* habitat type with Douglas-fir, occasional ponderosa pine, and pinegrass.

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

PERSIA M. ROBINSON RESEARCH NATURAL AREA[1]

Ponderosa pine and Douglas-fir forest characteristic of lower elevations on the east slope of the Oregon Cascade Range.

The Persia M. Robinson Research Natural Area was established in March 1948. It exemplifies the ponderosa pine *(Pinus ponderosa)* and mixed pine-Douglas-fir *(Pseudotsuga menziesii)* typifying the lower forest zone on the east slope of the northern Oregon's Cascade Mountains. The 218-ha. (540-acre) tract is located in Wasco County, Oregon, and is administered by Bear Springs Ranger District (Route 1, Box 65, Maupin, Oregon), Mount Hood National Forest. The essentially square area is located in sections 10 and 11, T. 6 S., R. 10 E., Willamette meridian, at 45°05' N. latitude, and 121 °30' W. longitude (fig. PE-1).

ACCESS AND ACCOMMODATIONS

The natural area is located along U.S. Highway 26 about 35 km. (22 miles) southeast of Government Camp and 40 km. (25 miles) northwest of Warm Springs. The highway forms the eastern boundary of the tract. Access is good during both the summer and winter since snow is removed from the highway. Public accommodations are available at Government Camp or Warm Springs; there are several improved forest camps in the vicinity of the natural area.

[1]Description prepared by Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

ENVIRONMENT

The Persia M. Robinson Research Natural Area varies from approximately 850 to 950 m. (2,800 to 3,100 ft.) in elevation. Topography is undulating to rolling and is typical of lower foothills on the east slope of the Cascade Range.

The bedrock is composed of basalts and andesites, with andesitic flows probably predominant (Peck 1961).

A modified continental climate prevails. Most precipitation occurs as snow during the cool, cloudy winter. Summers are warm, generally low in precipitation and largely cloudless. One to 3 months of drought are common. Unpublished climatic data collected at Bear Springs Ranger Station located 5 km. (3 miles) north of the natural area are on file there. No relevant published data are available. Isohyetal maps suggest around 900 mm. (35 in.) of annual precipitation.

Soils in the area have not been mapped. Cursory examinations suggest aerially deposited pumicite is commonly mixed with residual materials.

BIOTA

Estimated areas by forest communities are:

Name	*Area*
Pinus ponderosa-Pseudotsuga menziesii/ Acer circinatum/Calamagrostis rubescens	107 ha. (265 acres)
Pseudotsuga menziesii-Abies grandis/ Acer circinatum	111 ha. (275 acres)

The ponderosa pine-Douglas-fir stands can be assigned to SAF forest cover type 214, Ponderosa Pine-Larch-Douglas-Fir (Society of American Foresters 1954) and Kuchler's Type 12, Douglas Fir Forest. Douglas-Fir grand fir *(Abies grandis)* stands probably belong to SAF type 213, Grand Fir-LarchDouglas-Fir and Kuchler's Type 14, Grand

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Fir-Douglas Fir Forest. The tract is located within the *Pseudotsuga menziesii* Zone found on the eastern slopes of the Cascade Range in northern Oregon and Washington (Franklin and Dyrness 1969).

Stand composition in this tract seems more closely related to ground fire history than to site variability (fig. PE-2). Stands currently dominated or co-dominated by ponderosa pine have minimal old-growth Douglas-fir. However, Douglas-fir seedlings and saplings are abundant and clearly dominate the smaller size classes; some poles are also present. Incense-cedar *(Libocedrus decurrens)* also occur occasionally. The understory in these communities is dominated by vine maple *(Acer circinatum), Symphoricarpos albus,* and *Ceanothus velutinus* in the shrub layer and pinegrass *(Calamagrostis rubescens)* and *Pteridium aquilinum* in the herb layer. Most of the *Ceanothus* is dead.

Douglas-fir-grand fir stands include occasional old-growth ponderosa pine in the overstory. Douglas-fir dominates the overstory and grand fir the seedling, sapling, and pole size classes. Western larch *(Larix occidentalis)* is sometimes a common stand constituent. Where crown cover of trees is dense, ground vegetation is minimal and typically composed of vine maple and pinegrass with occasional *Symphoricarpos, Pteridium,* and some forbs.

A list of mammals believed to utilize the natural area as residents or transients is provided in table PE-l.

HISTORY OF DISTURBANCE

Fire scarred ponderosa pine and western larch record periodic ground fires which burned the area prior to initiation of fire control programs about 1910. Lack of dominant old-growth grand fir and Douglas-fir in many communities further indicate that many portions of the tract have burned at some time.

Domestic livestock occasionally grazed the tract between 1890 and 1945 when livestock were removed from the general area. Cattle still drift into the area occasionally from adjacent lands. However, the natural area does not appear to have been significantly affected by grazing.

RESEARCH

No research is known on the tract. The natural area provides interesting opportunities to study: (1) forest succession in the absence of ground fires ; (2) biomass productivity in undisturbed forest stands; and (3) stand structure and development in natural stands. Comparisons are possible with conditions on logged areas on adjacent National Forest and Indian Reservation land.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 15' Mount Wilson, Oregon quadrangle, scale 1:62,500, issued by the U.S. Geological Survey in 1956; and *geology - Geologic Map of Oregon West of the 121st Meridian,* scale 1:500,000 (Peck 1961). Either the District Ranger (Bear Springs Ranger District) or Forest Supervisor (Mount Hood National Forest) can provide details on the most recent aerial photo coverage of the area.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D. C.

Table PE-1.— Tentative list of mammals for the Persia M. Robinson Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex obscurus	dusky shrew
	Sorex palustris	northern water shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Ochotona princeps	pika
Rodentia	*Aplodontia rufa*	mountain beaver
	Arborimus longicaudus	red tree vole
	Castor canadensis	beaver
	Clethrionomys californicus	California red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Sciurus griseus	western gray squirrel
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys mazama	Mazama pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Urocyon cinereoargenteus	gray fox
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer

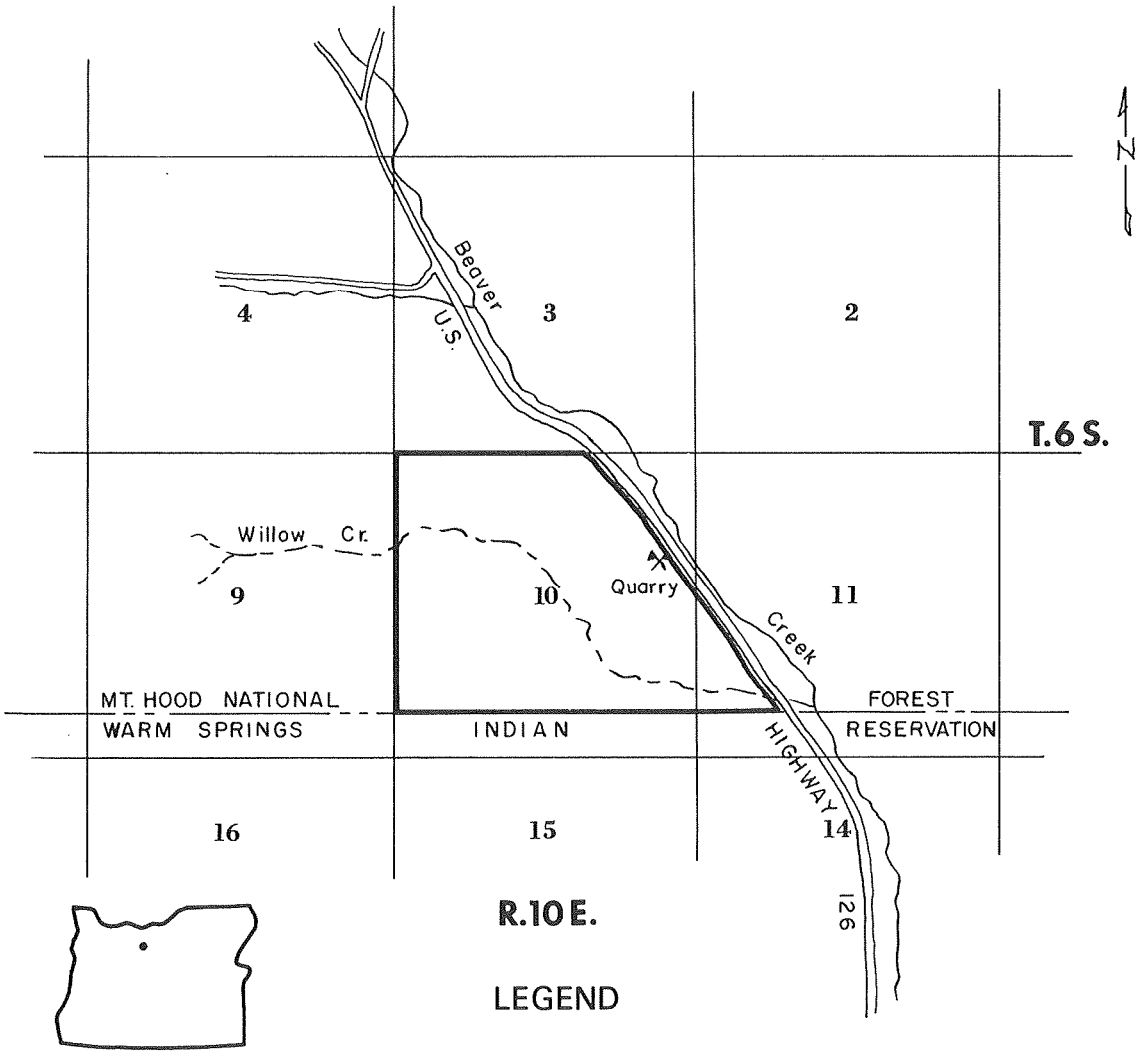

Figure PE-1.– Persia M. Robinson Research Natural Area, Wasco County, Oregon.

Figure PE-2. -Natural features of Persia M. Robinson Research Natural Area. Top: General view of forests along U.S. Highway 26 with ponderosa pine overstory and understory of Douglas-fir reproduction. Lower left: South slope community of ponderosa pine and some Douglas-fir with understory of vine maple, dead *Ceanothus velutinus, Pteridium aquilinum,* and pinegrass. Lower right: Typical ponderosa pine community found on east and north slopes with Douglas-fir reproduction and ground cover of vine maple, *Symphoricarpos albus,* pinegrass, and forbs.

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

PIGEON BUTTE RESEARCH NATURAL AREA[1]

Oregon white oak stands growing on a low hill in Oregon's Willamette Valley.

Pigeon Butte Research Natural Area was established December 27, 1966, to exemplify Oregon white oak *(Quercus garryana)* stands typical of those found in western Oregon's Willamette Valley. The 28-ha. (70-acre) tract is located in Benton County, Oregon, and is administered by the William L. Finley National Wildlife Refuge (Route 2, Box 208, Corvallis, Oregon), Bureau of Sport Fisheries and Wildlife. The natural area is located in section 32, T. 13 S., R. 5 W., Willamette meridian , at $44^0$24' N. latitude and $123^0$19' W. longitude.

ACCESS AND ACCOMMODATIONS

The natural area is found in the William L. Finley National Wildlife Refuge which is located about 16 km. (10 miles) south of Corvallis, a short distance off U.S. Highway 99W (fig. PI-I). The natural area is located about 0.2 km. (0.5 mile) from a graveled all-weather road. Several dirt fire patrol roads approach the tract. Visitors should inquire at the Refuge headquarters about the best route of approach. Numerous commercial accommodations are available in Corvallis; there are no campgrounds within the refuge.

[1] Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

ENVIRONMENT

The Pigeon Butte Research Natural Area occupies the northerly slopes of Pigeon Butte, a relatively isolated hill rising 76 m. (250 ft.) from the floor of the valley. All of the tract is located on gentle to moderate slopes. There are no streams or springs located within the natural area. Elevations range from about 91 to 168 m. (300 to 550 ft.).

The natural area is located on a hill of light gray to yellowish brown arkosic micaceous sandstone surrounded by Willamette Valley alluvium (Vokes et al. 1954). This material belongs to the Spencer formation of upper Eocene Age. A narrow dike or sill-like body of intrusive igneous rocks (probably basalt or gabbro) runs along the southern boundary of the natural area from east to west.

The natural area is located in western Oregon, an area of mild, moist climate. However, it is within the Willamette Valley, which is located between the Coast and Cascade Ranges and is, therefore, subject to the somewhat warmer and drier climate typical of interior western Oregon valleys. The summer dry period is especially pronounced. Representative climatic data from the Corvallis weather station, which is about 16 km. (10 miles) north, are as follows (U.S. Weather Bureau 1965) :

Mean annual temperature	11.6°C. (53.0°F.)
Mean January temperature	4.1°C. (39.4°F.)
Mean July temperature	19.2°C. (66.6°F.)
Mean January minimum temperature	0.6°C. (33.1°F.)
Mean July maximum temperature	27.1°C. (80.8°F.)
Average annual precipitation	957 mm. (37.67 in.)
June through August precipitation	49 mm. (1.93 in.)

The soils within the natural area have been mapped as the Dixonville silty clay loam. This soil series has been classified as a Brunizem and Pachic Ultic Argixeroll

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according to the old and new classifications, respectively. It consists of a well-drained, silty clay loam surface soil over clay and is formed in colluvium from basic igneous rock. A typical horizon sequence is as follows: very dark brown Al from 0 to 13 cm.; very dark gray brown A3 from 13 to 32 cm.; and very dark brown, clayey B2t from 32 to 66 cm.

BIOTA

Estimated areas by vegetation types are:

Name	*Area*
Oregon white oak closed forest	19 ha. (46 acres)
Oregon white oak savanna	7 ha. (18 acres)
Grassland	2 ha. (5 acres)

The areas of forest and savanna fit the Society of American Foresters (1954) cover type 233, Oregon White Oak, and Kuchler's (1964) Type 26, Oregon Oakwoods. The natural area lies within the Interior Valley *(Pinus-Quercus-Pseudotsuga)* Zone of Franklin and Dyrness (1969).

The major tree species in the natural area is Oregon white oak (fig. PI-2). Anderson (1970) indicates that about 82 percent of the canopy cover is composed of this species. Dominant oaks typically range up to 60-cm. (24-in.) d.b.h. with occasional specimens exceeding 90-cm. (36-in.) d.b.h. Heights of dominants are generally from 18 to 21 m. (60 to 70 ft.). Other tree species present include bigleaf maple *(Acer macrophyllum)* and Pacific dogwood *(Cornus nuttallii).* Grand fir *(Abies grandis)* and Douglas-fir *(Pseudotsuga menziesii)* are extremely uncommon.

The closed canopy oak forests found on the natural area are probably of relatively recent origin. Habeck (1961, 1962) documents a major conversion of prairie and oak savanna to closed oak forest since settlement of the Willamette Valley. Fire control activities instituted by the settlers are believed responsible for this major successional change. Thilenius' (1964, 1968) detailed analyses confirm the fact that most Oregon white oak stands originated after 1850. Typically they are composed of scattered large trees of open-grown form and averaging 237 years old which are surrounded by smaller oaks of forest-grown form averaging 74 to 105 years of age. The stands found on the natural area have this structure - a scattering of very large, old trees with the bulk of the stand made up of smaller oaks of forest-grown form.

Successional relationships within closed-canopy Oregon white oak stands are not clear (Franklin and Dyrness 1969). In the natural area bigleaf maple is the most conspicuous tree species in the reproductive size classes. Seedlings and saplings of oak are rarely found in closed canopy stands. Douglas-fir and grand fir, both of which have been suggested as climax species, are uncommon.

Most of the closed forest stands have relatively well-developed shrub and herb layers. Anderson (1970) describes a dense shrub layer averaging about 3,500 plants per ha. (1,400 per acre). *Corylus Cornuta* var. *californica, Amelanchier alnifolia, Crataegus douglasii,* and *Osmaronia cerasiformis* are the most common tall shrubs. *Rhus diversiloba* is one of the most common low shrubs, and it is also conspicuous in a liana growth form. Thilenius (1964) has hypothesized that *Rhus diversiloba* is favored by grazing of oak woodlands because of interconnections between shrub and liana growth forms and its less palatable status. Other common low shrubs are *Rubus ursinus, Symphoricarpos albus,* and *Rosa nutkana.* Typical herbs are *Polystichum munitum, Pteridium. aquilinum., Galium triflorum, Bromus laevipes, Montia sibirica, Hypericum perforatum., Lomatium utriculatum, Osmorhiza nuda, Satureia douglasii, Vicia americana.,* and *Tellima grandiflora.* Most of the closed forest stands seem to best fit the *Quercus garryana/Corylus cornuta/Polystichum munitum* community described by Thilenius (1964).

The savannas of Oregon white oak have not been carefully examined. The understory is typified by an abundance of grasses and forbs including many introduced species. *Rhus diversiloba* is also conspicuous in parts of the savanna.

The grasslands are located mostly on the upper west and northwest exposed slopes of Pigeon Butte (fig. PI-I). Communities are

dominated by a variety of perennial and annual grasses and forbs. Scattered bushes of *Rosa eglanteria* and *Rhus diversiloba* are also present. There is a high proportion of introduced species including all of the annual grass dominants. The grassland areas appear to be natural (as opposed to tracts created by settlers or latter-day farmers by clearing or burning). The composition has been strongly influenced by heavy grazing of domestic cattle and sheep. Successional status of the grasslands and savanna under the present regime of fire control and no grazing is unknown.

Mammals believed to reside within or to pass through the natural area are listed in table PI-I.

Anderson (1970) has provided a rather complete list of the bird species found on the natural area and data on seasonal fluctuations in their abundance. He lists 13 resident species, four occasional species, 13 summer residents, and 26 winter residents. Among the permanent residents are the hairy woodpecker *(Dendrocopos villosus),* downy woodpecker *(Dendrocopos pubescens),* scrub jay *(Aphelocoma coerulescens),* blackcapped chickadee *(Parus atricapillus)* , common bushtit *(Psaltriparus minimus),* white-breasted nuthatch *(Sitta carolinensis),* brown creeper *(Certhia familiaris),* Bewick's wren *(Thryomanes bewickii),* robin *(Turdus migratorius),* Rufous-sided towhee *(Pipilo erythrophthalmus),* and Oregon junco *(Junco oreganus).*

HISTORY OF DISTURBANCE

Human activities have significantly influenced natural processes on the natural area. As mentioned, fire control activities initiated upon settlement of the valley probably contributed to the development of the closed oak stands. The tract was heavily grazed by sheep and cattle until 1966. Some minor cutting of oaks was also carried out prior to establishment of the refuge. A rock quarry is located on the south side of Pigeon Butte just outside the natural area boundaries; it is not believed to have had any significant effect on the natural area itself, however.

RESEARC H

Several studies have been carried out within the Pigeon Butte Research Natural Area. The tract was used as a sampling site by Thilenius (1964, 1968) during ecological studies of Willamette Valley oak woodlands. Anderson (1970) used the natural area as one site in a study of bird fauna in Oregon white oak stands. Several classes in ecology and wildlife at Oregon State University, Corvallis, have utilized the natural area; details are available from the Refuge Manager.

The natural area is extremely valuable as a tract where near-natural communities typical of those found in the Willamette Valley can be studied; protected stands of Oregon white oak are extremely rare. Studies of the composition and structure and of successional and environmental relationships of Oregon white oak stands are especially appropriate. Since two natural areas representing other Willamette Valley vegetation types are nearby (Maple Knoll and Willamette Floodplain), it is also possible to use the tract as one site in studies concerning the entire valley mosaic.

MAPS AND AERIAL PHOTOGRAPHS

Special maps available include the following: *Topography* - 15' Monroe, Oregon quadrangle, scale 1:62,500, issued by the U.S. Geological Survey in 1957; *geology - Geology of the West Central Border Area of the Willamette Valley, Oregon,* scale 1:62,500 (Vokes et al. 1954). Aerial photos taken in June 1970 may be purchased from the Agricultural Stabilization and Conservation Service, Benton County ASC Committee, P. O. Box 1027, Corvallis. Photo DFJ-1LL-49 provides the best coverage of the natural area.

LITERA TU RE CITED

Anderson, Stanley H.
1970. The avifaunal composition of Oregon white oak stands. The Condor 72: 417-423, illus.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Habeck, James R.
1961. The original vegetation of the mid-Willamette Valley, Oregon. Northwest Sci. 35(2): 65-77, illus.

1962. Forest succession in Monmouth Township, Polk County, Oregon, since 1950. Mont. Acad. Sci. Proc. 21: 7-17, illus.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

Thilenius, John F.
1968. The *Quercus garryana* forests of the Willamette Valley, Oregon. Ecology 49: 1124-1133, illus.

Thilenius, John Fredrick
1964. Synecology ofthe white-oak *(Quercus garryana* Douglas) woodlands of the Willamette Valley, Oregon. 151 p., illus. (Ph.D. thesis, on file at Oreg. State Univ., Corvallis.)

U .S. Weather Bureau
1965. Climatic summary of the United States-supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31,96 p., illus.

Vokes, H. E., D. A. Myers, and Linn Hoover
1954. Geology of the west central border area of the Willamette Valley, Oregon. U.S. Geol. Surv. Oil & Gas Invest. Map OM-150.

Table PI-1. — Tentative list of mammals for Pigeon Butte Research Natural Area

Order	Scientific name	Common name
Marsupialia	*Didelphis marsupialis*	opossum
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Rodentia	*Eutamias townsendi*	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus canicaudus	gray-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma fuscipes	dusky-footed wood rat
	Peromyscus maniculatus	deer mouse
	Sciurus griseus	western gray squirrel
	Spermophilus beecheyi	California ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys bulbivorus	giant pocket gopher
Carnivora	*Canis latrans*	coyote
	Lynx rufus	bobcat
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Urocyon cinereoargenteus	gray fox
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Odocoileus h. columbianus*	black-tailed deer

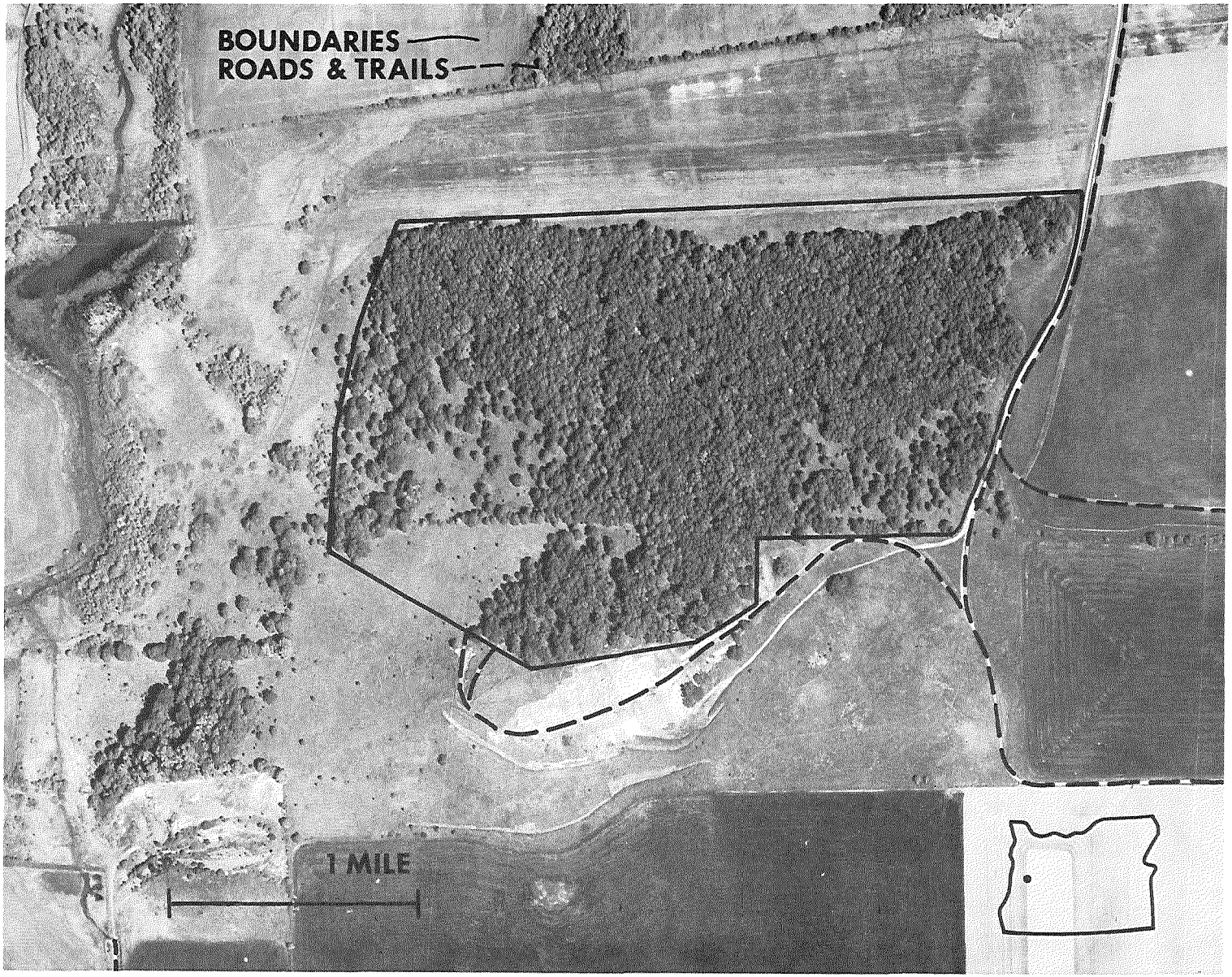
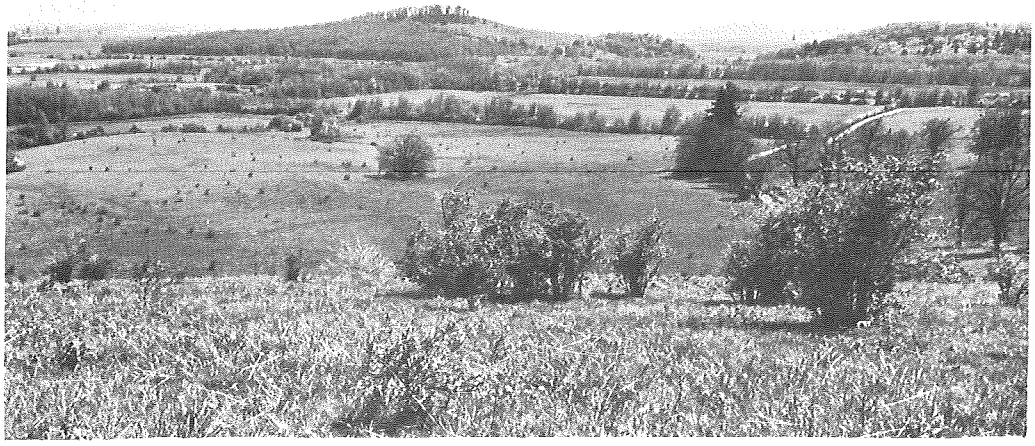


Figure PI-1.– Aerial photograph of Pigeon Butte Research Natural Area, Benton County, Oregon, showing boundaries, vegetative patterns, and other features.

Figure PI-2.-Natural features of Pigeon Butte Research Natural Area. Upper left: Typical closed stand of Oregon white oak near summit of Pigeon Butte. Upper right: Grassland and oak savanna near summit of Pigeon Butte. Center left: Oregon white oak stand showing abundant liana-form *Rhus diversiloba.* Center right: Large old-growth Oregon white oak trees of open-grown form within a closed forest stand; these are believed to be remnants of an oak savanna which originally occupied the area prior to initiation of fire control programs a century ago. Bottom: General view of Pigeon Butte and its environs from the north; the eastern edge of the Maple Knoll Research Natural Area is visible to the right of Pigeon Butte.



Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station Portland, Oregon.

PINE CREEK RESEARCH NATURAL AREA[1]

Ponderosa pine/bunchgrass on the glacially eroded Channeled Scablands of east-central Washington.

The Pine Creek Research Natural Area was established in December 1966 to exemplify relatively undisturbed savanna of ponderosa pine *(Pinus ponderosa.)* and bunch grasses found in the forest-grassland transition at the northeastern edge of eastern Washington's steppes. The 65-ha. (160-acre) tract is located in Spokane County, Washington, and is administered by the Turnbull National Wildlife Refuge (Route 3, Box 107, Cheney, Washington), Bureau of Sport Fisheries and Wildlife. It is a long and narrow tract located in section 5, T. 22 N., R. 42 E., Willamette meridian, at 47°25' N. latitude and 117°31' W. longitude (fig. PN-l).

ACCESS AND ACCOMMODATIONS

To reach the natural area, travel south from Cheney on the Cheney-Plaza county road for 6.4 km. (4 miles), then 3.2 km. (2 miles) east to the Refuge headquarters, where detailed directions will be provided. Access is excellent during the summer and good during the winter. Public accommodations are available in Cheney.

ENVIRONMENT

The Pine Creek Research Natural Area varies from 687 to 716 m. (2,250 to 2,350 ft.) in elevation. The undulating to rolling topography is typical of the eastern Washington Columbia Plateau.

The natural area is located on eastern Washington's well-known Channeled Scablands (Bretz 1959). The Columbia River basalts which characterize the entire Columbia Plateau provide the foundation of this landscape. An intricate network of drainage channels is carved into this bedrock and an overburden of loess. Glacial damming of the Columbia River by a lobe of the continental ice sheet is believed to have combined with successive massive floods released from glacially dammed lakes to produce the scablands. The natural area itself does not appear to have been directly glaciated.

A modified maritime climate prevails. Most precipitation occurs as rain or snow during the cool, cloudy winter. Summers are warm generally low in precipitation, and largel; cloudless. One to 3 months of drought are common. Climatic data from Spokane, located 29 km. (18 miles) northeast of the site are as follows (U .S. Weather Bureau 1965):

Mean annual temperature	8.8°C.	(47.8°F.)
Mean January temperature	−3.7°C.	(25.3°F.)
Mean July temperature	21.4°C.	(70.5°F.)
Mean January minimum temperature	−7.7°C.	(18.1°F.)
Mean July maximum temperature	28.7°C.	(83.7°F.)
Average annual precipitation	437 mm.	(17.2 in.)
June through August precipitation	56 mm.	(2.2 in.)
Average annual snowfall	147 cm.	(58.0 in.)

Soils in the area were mapped between 1955 and 1961. Complete information, using soil names and descriptions approved in 1965, is found in the Spokane County Soil Survey (Donaldson and Giese 1968). Nearly all of the soils in the natural area are mapped as Hesseltine very rocky complex, 0- to 30percent slopes. This complex consists of from 25 to 50 percent of basalt rock outcrops and

[1] Description prepared by Dr. F. C. Hall. U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

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unnamed very stony, very shallow soils. The remainder of the complex is Hesseltine silt loam, a dry upland soil with topsoil up to 4 dm. (16 inches) thick underlain by gravel deposits to a depth of up to 15 dm. (60 inches) and basalt bedrock. Small areas of Cocollala silty clay loam, a poorly drained meadow soil, are also present. Hesseltine-type soils are associated with forest communities and meadows with the Cocollala type. Semiahmoo muck is found in the potholes.

BIOTA

Estimated areas by community are as follows:

Name	*Area*
Pinus ponderosa/Festuca idahoensis	54 ha. (135 acres)
Populus tremuloides meadow	8 ha. (20 acres)
Kettle lakes and potholes	2 ha. (5 acres)

The *Pinus/Festuca* communities are probably assignable to SAF cover type 237, Interior Ponderosa Pine (Society of American Foresters 1954) and Kuchler's (1964) Type 11, Western Ponderosa Forest. The meadows with quaking aspen *(Populus tremuloides)* can probably be classified as SAF type 217, Aspen. The area falls within a zone of ponderosa pine savanna at the transition from closed forest to steppe vegetation (Daubenmire and Daubenmire 1968).

The ponderosa pine forest is characteristically rather open with 25- to 40-percent crown cover and ground vegetation dominated by Idaho fescue *(Festuca idahoensis)* and cheatgrass *(Bronmus tectorum.)* (fig. PN -2). This plant community comprises 70 to 80 percent of the forested area. Other common understory species are *Bromus japonicus, B. commutatus, B. mollis, Koeleria cristata, Potentilla glandulosa, Erigeron* spp., and *Hieracium scouleri.* The soils typically are variable in depth with some areas exceeding 10 dm. (40 in.) and others where bedrock is exposed (fig. PN -2).

Microtopographic swales within the forested area are dominated by ponderosa pine with a crown cover of 30 to 60 percent and ground vegetation clearly dominated by pinegrass *(Calamagrostis rubescens)* with some Idaho fescue and *Stipa occidentalis,* occasional *Symphoricarpos albus, Potentilla,* and *Arctostaphylos uva-ursi.* Soils in these microtopographic swales generally consist of a layer of aerially deposited volcanic ash over glacial outwash.

The *Pinus/ Festuca* communities are correlated with Daubenmire's *Pinus ponderosa/ Festuca idahoensis* habitat type, and the *Pinus/Calamagrostis* stands might be considered disjunct variants of his *Pseudotsuga rnenziesii/Calamagrostis rubescens* habitat type (Daubenmire and Daubenmire 1968).

In a portion of the southern half of the natural area, stone polygons surround areas of deeper soil on which occasional ponderosa pine may be found. The non-forested plant community found there is presently dominated by dense stands of cheatgrass on deeper soil and very sparse cheatgrass on stony soils. At least five species of lichens grow on the exposed rocks. This plant community is probably closely related to the lithosolic phase of Daubenmire's (1970) *Agropyron spicatum/ Poa sandbergii* habitat type.

Much of the quaking aspen meadow occurs as a border type or ecotonal vegetation along the edges of meadows or swamps (fig. PN -2).

A portion of the area classed as kettle lakes and potholes is covered by moist meadows dominated by *Phalaris arundinacea* along with some *Deschampsia caespitosa* (fig. PN-2). Most potholes in this natural area have standing water for most of the growing season and are dominated by *Scirpusvalidus* and/or *Scirpus acutus* (fig. PN -2). Because of the high water table and high organic matter content of the soil, probably Semiahmoo muck (Donaldson and Giese 1968), few other plants are found in these potholes. They are commonly bordered by the aspen meadow community.

Animals believed to utilize the natural area as residents or transients are listed in table PN-l. A rather complete list of resident and migratory fauna can be obtained from the Refuge Manager.

HISTORY OF DISTURBANCE

Fire scars on ponderosa pine indicate ground fires periodically burned through the area prior to initiation of fire control programs.

This area has not been grazed, logged, or otherwise disturbed since establishment of the Refuge in 1937. However, stumps clearly show that much of the old-growth ponderosa pine was removed many years ago.

The presence and often dominance of cheatgrass and Japanese brome in many stands also suggest that heavy livestock use prior to Refuge establishment has affected the vegetation, particularly in the more open plant communities; consequently, the area must be considered disturbed by livestock grazing. No other serious disturbances are known.

RESEARCH

Some research on the Pine Creek Research Natural Area is being conducted by ecology students at Eastern Washington State College, Cheney, Washington. Information on these investigations may be obtained from the Refuge Manager or from the Biology Department at Eastern Washington State College.

Voucher specimens of some bird and animal species and most plant species are available at Refuge Headquarters for inspection.

The natural area provides interesting research opportunities on (1) natural development of plant communities without land treatment measures, a situation nearly impossible to find in this locality; (2) elevations of the interface between forest communities and non-forest, moist or wet marsh communities; and (3) evaluation of faunal activity in a natural plant community lacking current human disturbance.

MAPS AND AERIAL PHOTOGRAPHS

No special topographic or geologic maps which are sufficiently detailed to be useful are known for the natural area. The Wildlife Refuge Manager (Turnbull National Wildlife Refuge, Cheney, Washington) can provide details on the most recent aerial photo coverage of the area.

LITERATURE CITED

Bretz, J. Harlen
1959. Washington's channeled scabland. Wash. State Div. Mines & Geol. Bull. 45, 57 p., illus.

Daubenmire, R.
1970. Steppe vegetation in Washington. Wash. Agric. Exp. Stn. Tech. Bull. 62, 131 p., illus.

_____ and Jean B. Daubenmire
1968. Forest vegetation of eastern Washington and northern Idaho. Wash. Agric. Exp. Stn. Tech. Bull. 60, 104 p., illus.

Donaldson, N. *C.,* and L. D. Giese
1968. Soil survey of Spokane County, Washington. USDA Soil Conserv. Servo & Wash. Agric. Exp. Stn., 143 p., illus.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States-supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table PN-1. — Tentative list of mammals for Pine Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Sorex vagrans*	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis lucifugus	little brown myotis
	Myotis subulatus	small-footed myotis
	Myotis yumanensis	Yuma myotis
	Pipistrellus hesperus	western pipistrel
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus californicus*	black-tailed jack rabbit
	Sylvilagus nuttalli	mountain cottontail
Rodentia	*Erethizon dorsatum*	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Marmota flaviventris	yellow-bellied marmot
	Microtus longicaudus	long-tailed vole
	Microtus montanus	mountain vole
	Microtus pennsylvanicus	meadow vole
	Neotoma cinerea	bushy-tailed wood rat
	Onychomys leucogaster	northern grasshopper mouse
	Perognathus parvus	Great Basin pocket mouse
	Peromyscus maniculatus	deer mouse
	Reithrodontomys megalotis	western harvest mouse
	Spermophilus columbianus	Columbian ground squirrel
	Tamiasciurus hudsonicus	red squirrel
	Thomomys talpoides	northern pocket gopher
Carnivora	*Canis latrans*	coyote
	Lynx rufus	bobcat
	Mephitis mephitis	striped skunk
	Mustela frenata	long-tailed weasel
	Taxidea taxus	badger
Artiodactyla	*Odocoileus virginanus*	white-tailed deer

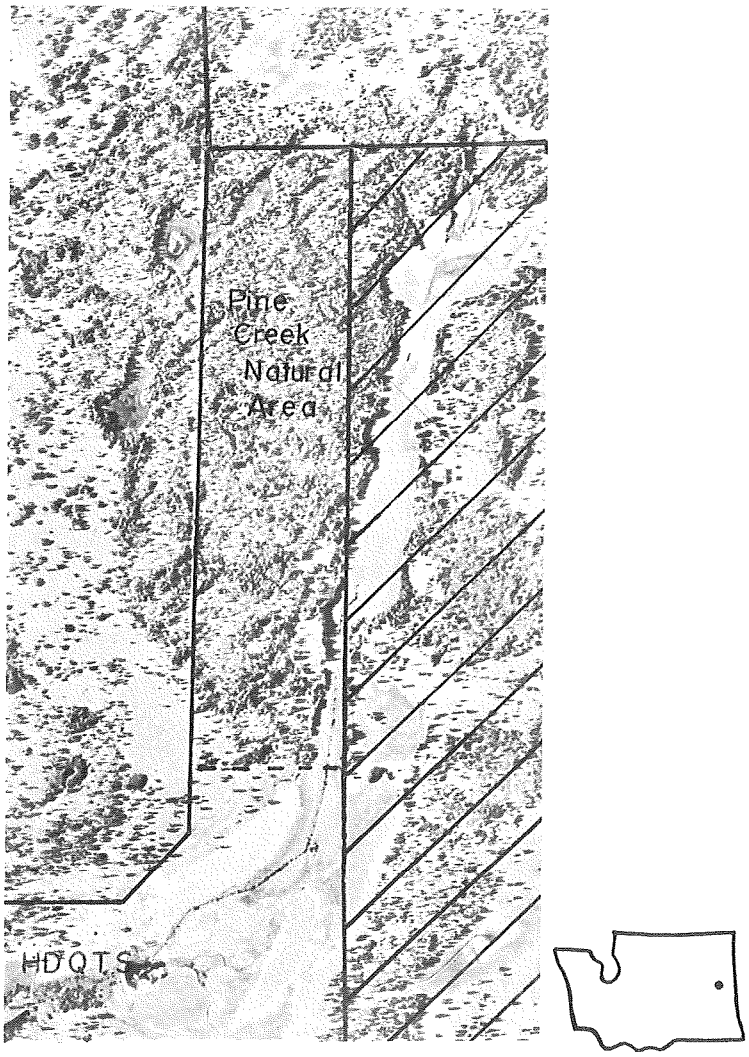

Figure PN-1.– Pine Creek Research Natural Area, Spokane County, Washington.

½ MILE

Figure PN-2.-Communities in the Pine Creek Research Natural Area. Upper left: *Pinus ponderosa/Festuca idahoensis* stands with some cheatgrass are the most common community on gently mounded uplands; note exposed bedrock in background. Upper right: Network of very stony soil surrounding mounds of deep soil; mounds are dominated by cheatgrass; rocky areas support at least five species of lichen. Lower left: Moist meadow at the southeast edge of the natural area dominated by *Phalaris arundinacea.* Lower right: *Scirpus* marsh near center of the tract which has seasonal standing water; quaking aspen occurs along the edges.

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

PORT ORFORD CEDAR RESEARCH NATURAL AREA[1]

Port-Orford-cedar and Douglas-fir growing on a rugged, geologically diverse site on the southwestern Oregon Coast Ranges.

The Port Orford Cedar Research Natural Area was established on October 26, 1937, as a sample of virgin old-growth Port-Orford-cedar *(Chamaecyparis lawsoniana).* The 454ha. (1,122-acre) tract is located in Coos County, Oregon, and is administered by the Powers Ranger District (Powers, Oregon), Siskiyou National Forest. The natural area occupies section 35, a portion of the E1/2 of section 34 located south of Johnson Creek, that part of section 26 located south of Johnson Creek and west of the Coquille River, and a small part of section 36 which lies west of the Coquille River, all in T. 32 S., R. 12 W., Willamette meridian (fig. PO-I). It lies at 42°45' N. latitude and 124°05' W. longitude.

ACCESS AND ACCOMMODATIONS

Primary access is via Powers, Oregon, which lies 29 km. (18 miles) south of State Highway 42 on State Highway 242 and about 34 and 48 km. (21 and 30 miles) from Myrtle Point and Coquille, respectively. To reach the vicinity of the natural area, travel south from Powers on Forest Road 333 for about 29 km. (18 miles). The natural area can also be reached from Gold Beach on U.S. Highway 101 by traveling east along the Rogue River to Agness and then north on Forest Road 333.

There are no roads or trails within the Port Orford Cedar Research Natural Area, although remains of an old trail can be found along part of the southern boundary. Entrance into the area is difficult, involving either bush-whacking or wading. For access to the southeast and eastern portions of the natural area, cross the bridge at Ferris Ford Work Center (opposite Daphne Grove Forest Camp), hike uphill along the south boundary for several hundred yards and penetrate the natural area at or above the 380 m. (1,250 ft.) contour. To reach the southwestern corner and upper slopes of the natural area, follow Forest Road 333 south past Daphne Grove Forest Camp, thence on Forest Road 3301 to the head of Jim Hayes Creek and the top of the ridge, and walk north through a c1earcut into the natural area. Access is also possible by fording Johnson Creek (easiest at its mouth) from Forest Road 326 or the South Fork of the Coquille River from Road 333.

The nearest commercial accommodations are in Powers, Myrtle Point, Coquille, and Gold Beach. However, there are several improved forest camps along Forest Road 333 in the vicinity of the natural area: Daphne Grove, Myrtle Grove, and Boundary.

ENVIRONMENT

The Port Orford Cedar Research Natural Area is topographically rugged except for occasional benches and some broad ridgetops. Slopes are particularly steep along Johnson Creek and the Coquille River. Elevations range from 259 m. (850 ft.) along these streams to nearly 760 m. (2,500 ft.) on the ridgetop in the southeast corner. Two small

[1] Description prepared by Dr . J.F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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streams - Jim Hayes and Fall Creeks - lie mostly within the natural area.

The natural area is complex geologically (Diller 1903, Wells 1955, Peck 1961, Baldwin and Hess 1971) (fig. PO-2). Sedimentary materials (sandstones, siltstones, and conglomerates) make up most of the bedrock. The bulk of these belong to the Galice Formation which consists of "Dark gray to black argillite and fine to medium grained sandstone with minor amounts of conglomerate containing sedimentary clasts ... " (Baldwin and Hess 1971). This formation is Upper Jurassic in age. The contact line between this formation and the Middle Eocene Umpqua Formation (middle member) occurs along a fault line which runs north and south along the eastern edge of the natural area. Diller's (1903) mapping indicated the Tyee Formation contacted the Galice Formation directly in this area but this has been corrected by Baldwin and Hess (1971). An intrusion of gabbro covers about 40 ha. (100 acres) in the southeast corner of section 35. An extensive outcropping of serpentinite occupies the northeastern point of the natural area, and recent geological mapping of the Powers Quadrangle (Baldwin and Hess 1971) suggests this body extends much further south in the natural area than Diller (1903) indicates. Finally, a small outcrop of chert is located in the northwest corner of the natural area along Johnson Creek.

The climate is wet and mild. Precipitation is seasonal, with a peak in January and December and a minimum in July and August. The summer drought period is more pronounced than in the northern Oregon and Washington coastal mountains. The following climatic data are from the closest weather station at Powers (U .S. Weather Bureau 1965):

Mean annual temperature	12.0°C.	(53.6°F.)
Mean January temperature	6.6°C.	(43.8°F.)
Mean July temperature	17.6°C.	(63.6°F.)
Mean January minimum temperature	1.6°C.	(34.8°F.)
Mean July maximum temperature	25.0°C.	(77.0°F.)
Average annual precipitation	1,535 mm.	(60.44 in.)
June through August precipitation	56 mm.	(2.19 in.)

Since Powers is about 150 m. (500 ft.) lower in elevation, temperatures are lower and precipitation higher on the natural area; isohyetal maps (Oregon State Water Resources Board 1959) indicate 2,500 to 2,800 mm. (100 to 110 in.) annual precipitation.

Soil profiles are not strongly developed in the area although soils are often deep. Soil surveys are not available, but most soils tend toward Reddish-Brown Lateritics with 5 to 10 cm. (2 to 4 in.) thick Al horizons or Brown Podzolics with minimal A2 development and weak B2ir horizons. On some steep slopes and ridgetops, Lithosols with AI-AC-C horizon sequences are encountered.

BIOTA

Estimated areas by SAF cover types (Society of American Foresters 1954) are: Cover type 231, Port-Orford-Cedar-Douglas-Fir, 328 ha. (810 acres), and type 229, Pacific Douglas-Fir, 126 ha. (310 acres). The area falls within Kuchler's (1964) Type 2, CedarHemlock-Douglas Fir Forest and the *Tsuga heterophylla* Zone of Franklin and Dyrness (1969).

Douglas-fir *(Pseudotsuga menziesii)* and Port-Orford-cedar are the most important tree species present, composing approximately 75 and 25 percent, respectively, of the old-growth forests which dominate the areas (fig. PO-3). Grand fir *(Abies grandis),* western hemlock *(Tsuga heterophylla),* western red-cedar *(Thuja plicata),* sugar pine *(Pinus lambertiana),* western white pine *(Pinus monticola),* and Pacific yew *(Taxus brevifolia)* are also present. Hardwoods are well represented although not usually in the highest canopy level. Tanoak *(Lithocarpus densiflorus),* golden chinkapin *(Castanopsis chrysophylla),* and Pacific madrone *(Arbutus menziesii)* are most abundant and widespread; occurrences of bigleaf maple *(Acermacrophyllum),* Oregon ash *(Fraxinus latifolia),* red alder *(Alnus rubra)* and California-laurel *(Umbellularia californica)* are more localized. Most of the natural area is covered with forests of large, old trees. Although ages are not accurately known, many of the dominant specimens are undoubtedly 400 to 500 years

old. Douglas-firs of this age average nearly 60 m. (200 ft.) in height and l30-cm. (50-in.) d.b.h.; Port-Orford-cedar are a little smaller - 53 m. (175 ft.) tall and 100-cm. (40-in.) d.b.h. The largest Port-Orford-cedar measured during a 1936 cruise was 208.3-cm. (82-in.) d.b.h.

A variety of plant communities are found on the natural area. Typically, the stands have a dense understory of shrubs and small trees such as *Rhododendron macrophyllnm, Vaccinium parvifolium, V. ovatum,* tanoak, golden chinkapin, *Gaultheria shallon.,* and *Berberis nervosa. Rhododendron* may attain heights of 8 m. (25 ft.) and diameters of 10 to 15 cm. (4 to 6 in.). Herbaceous species include *Polystichum munitum., Galium triflOrum , Oxalis oregana, Viola sempervirens, Goodyera oblongifolia, Rubus ursinus, Trillium ovatum, Whipplea modesta, Hierochloe occidentalis,* and *Linnaea borealis.* Succession generally seems to be toward replacement of the dominant Douglas-fir and Port-Orford-cedar by western hemlock. Hemlock seedlings and saplings are usually most abundant; those of grand fir and Port-Orford-cedar are less common or absent. However, sprout and seedling reproduction of tan oak is as abundant, or more so, than that of western hemlock in many stands, suggesting it may be a climax species.

Polystichum munitum dominates the understory on moister sites such as well watered slopes or in seep areas (fig. PO-3). A greater variety of herbs and greatly reduced shrub coverage are also typical. Western red-cedar is generally found only on these sites. Tree regeneration is mainly western hemlock.

There are some areas of shallow rocky soil, where communities are dominated by tanoak and Pacific madrone 50- to 75-cm. (20- to 30-in.) d.b.h. The understory is very dense, with 100-percent canopy coverage of low trees and shrubs - *Rhododendron macrophyllum,* tan oak, *Vaccinium ovatum,* golden chinkapin, *Gaultheria shallon,* and *Berberis nervosa.* Herbs are few, but include unusual species such as *Hemitomes congestum., Boschniakia hookeri,* and *Habenaria unalaschensis.* Conifers of any size are relatively rare in these stands; tan oak is reproducing abundantly and appears to be the climax species.

Stands on the serpentinite areas are more open, composed of smaller trees (no western hemlock and little grand fir present), and include a large variety of understory species (fig. PO-3), A community dominated by Douglas-fir, Port-Orford-cedar, Californialaurel, and *Xerophyllum tenax* is typical on some serpentines; *Erythronium. Oreganum, Hierochloe occidentalis, Synthyris reniformis, Rhododendron occidentale, Senecio bolanderi, Iris innominata,* and *Berberis piperiana.* are typical associates. On the dry serpentinite nose above the confluence of Johnson Creek and the Coquille River, the vegetation is a mosaic of trees, dense shrub thickets, and grassy openings (fig. PO-3). Douglas-fir, western white pine, and Port-Orford-cedar are the major trees interspersed with thickets of *Rhamnus californica* var. *occidentalis, Rhododendron occidentale,* and Canyon live oak *(Quercus chrysolepis).* The grassy openings are rich in species such as *Festuca subuliflora, Cheilanthes siliquosa, Silene Campanulata, Zigadenus fremontii, Broiaea coronaria, Calochortus tolmei, Castilleja pruinosa, Achillea millefolium., Erysimum concinnum, Polystichum lonchitis, Lomatium* sp., and *Sedum spathulifolium.*

There are a number of wet benches and swales within the natural area (fig, PO-3). Red alder, Oregon ash, and bigleaf maple typify these areas as well as dense stands of *Carex obnupta,* C. *amplifolia,* and other Cyperaceae.

Mammals believed to utilize the natural area as residents or transients are listed in table PO-I. Roosevelt elk frequent the area during the fall, winter, and spring. The natural area also provides a rich variety of habitats for amphibians. Among the species occurring here are the Del Norte salamander *(Plethodon elongatus),* Dunn's salamander *(Plethodon dnnni),* Pacific giant salamander *(Dicamptodon ensattus),* clouded salamander *(Aneides ferreus),* Oregon salamander *(Ensatina escholtzii),* northwestern salamander *(Ambystoma gracile),* rough-skinned newt

(Taricha granulosa), and the Pacific treefrog *(Hyla regilla).*

Most of the specialized habitats present in the Port Orford Cedar Research Natural Area have already been mentioned. These include lithosolic tanoak-Pacific madrone sites, serpentinite areas, and swales. There is also a small, shallow pond (several acres in size) which appears to have been formed by a land slump northwest of the center of the NE1/4 of section 35.

HISTORY OF DISTURBANCE

There is evidence in fire scars on old Douglas-fir and Port-Orford-cedar that ground fires have burned through the area periodically. None appears to have occurred in recent years. The introduced root pathogen, *Phytophthora. lateralis,* has not yet invaded the natural area to any substantial degree in contrast to the situation in the nearby Coquille River Falls Research Natural Area. This pathogen, which is invariably fatal to Port-Orford-cedar, has apparently killed only a few trees at the edge of the natural area along the South Fork of the Coquille River and at the head of Jim Hayes Creek. More damage can be expected in the future.

Human disturbance of the area is minimal. There are remains of mine workings along Johnson Creek on the north edge of the natural area. Approximately 3 ha. (7 acres) on the western edge of the natural area was accidentally clear-cut when adjacent tracts were logged about 15 years ago.

RESEARCH

There are no research studies in progress on the Port Orford Cedar Research Natural Area. Some data on community structure and limited plant collections have been obtained by Forest Service personnel.

This natural area is especially rich in research opportunities. These include study of (1) community composition, structure and dynamics, and soil development on widely varying parent materials, and (2) the fauna and fiora of an isolated pond. The possible eventual invasion of the area by *Phytophthora lateralis* makes community studies especially timely. The large number of southern or Californian species, especially on serpentinite, makes the area of special interest to the taxonomist or plant geographer.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography* - 15' Powers and Agness, Oregon, quadrangles, scale 1: 62,500, issued by the U.S. Geological Survey in 1954; and *geology* - *Description of the Port 0rford Quadrangle,* scale 1:250,000 (Diller 1903), *Geologic Map of the Powers Quadrangle, Oregon,* scale 1: 62,500 (Baldwin and Hess *1971), Preliminary Geologic Map of Southwestern Oregon ...* , scale 1:250,000 (Wells 1955), and *Geologic Map of Oregon West of the 121st Meridian,* scale 1: 500,000 (Peck 1961). Either the District Ranger (Powers Ranger District) or Forest Supervisor (Siskiyou National Forest, Grants Pass, Oregon) can provide details on the most recent aerial photo coverage and forest type maps for the area.

Forest type and topographic maps (scale 3 in. = 1 mi., 50-ft. contour interval) prepared by Forest Service personnel in 1938 are on file at the Pacific Northwest Forest and Range Experiment Station, Portland, Oregon, as are records of a 1938 cruise of the natural area.

LITERATURE CITED

Baldwin, Ewart M., and Paul D. Hess
1971. Geology of the Powers Quadrangle, Oregon. Oreg. State Dep. Geol. & Miner. Ind. Geol. Map Ser. 5.

Diller, J. S.
1903. Description of the Port Orford quadrangle. U.S. Geol. Surv. Geol. Atlas of U.S., Folio 89.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Rilchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

(Oregon) State Water Resources Board
1959. Rogue River Basin. 440 p., illus. Salem.

Peck, Dallas L.
1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D. C.

U.S. Weather Bureau
1965. Climatic summary of the United States-supplement for 1951 through 1960, Oregon. Climatography of the United States 86-39, 96 p. illus.

Wells, Francis G.
1955. Preliminary geologic map of southwestern Oregon west of meridian 122° west and south of parallel 43° north. U.S. Geol. Surv. Miner. Invest. Field Stud. Map MF38.

Table PO-1. — Tentative list of mammals for Port Orford Cedar Research Natural Area[1]

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	**Scapanus orarius*	coast mole
	Sorex bendirii	marsh shrew
	Sorex pacificus	Pacific shrew
	**Sorex trowbridgii*	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Arborimus albipes	white-footed vole
	Arborimus longicaudus	red tree vole
	Castor canadensis	beaver
	Clethrionomys californicus	California red-backed vole
	Erethizon dorsatum	porcupine
	**Eutamias townsendi*	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Neotoma fuscipes	dusky-footed wood rat
	**Peromyscus maniculatus*	deer mouse
	Spermophilus beecheyi	California ground squirrel
	**Tamiasciurus douglasi*	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Bassariscus astutus*	ringtail or miner's cat
	**Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	**Lynx rufus*	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis roosevelti*	Roosevelt elk
	**Odocoileus h. columbianus*	black-tailed deer

[1] Asterisk (*) indicates habitation verified by sign, sighting, or collection.

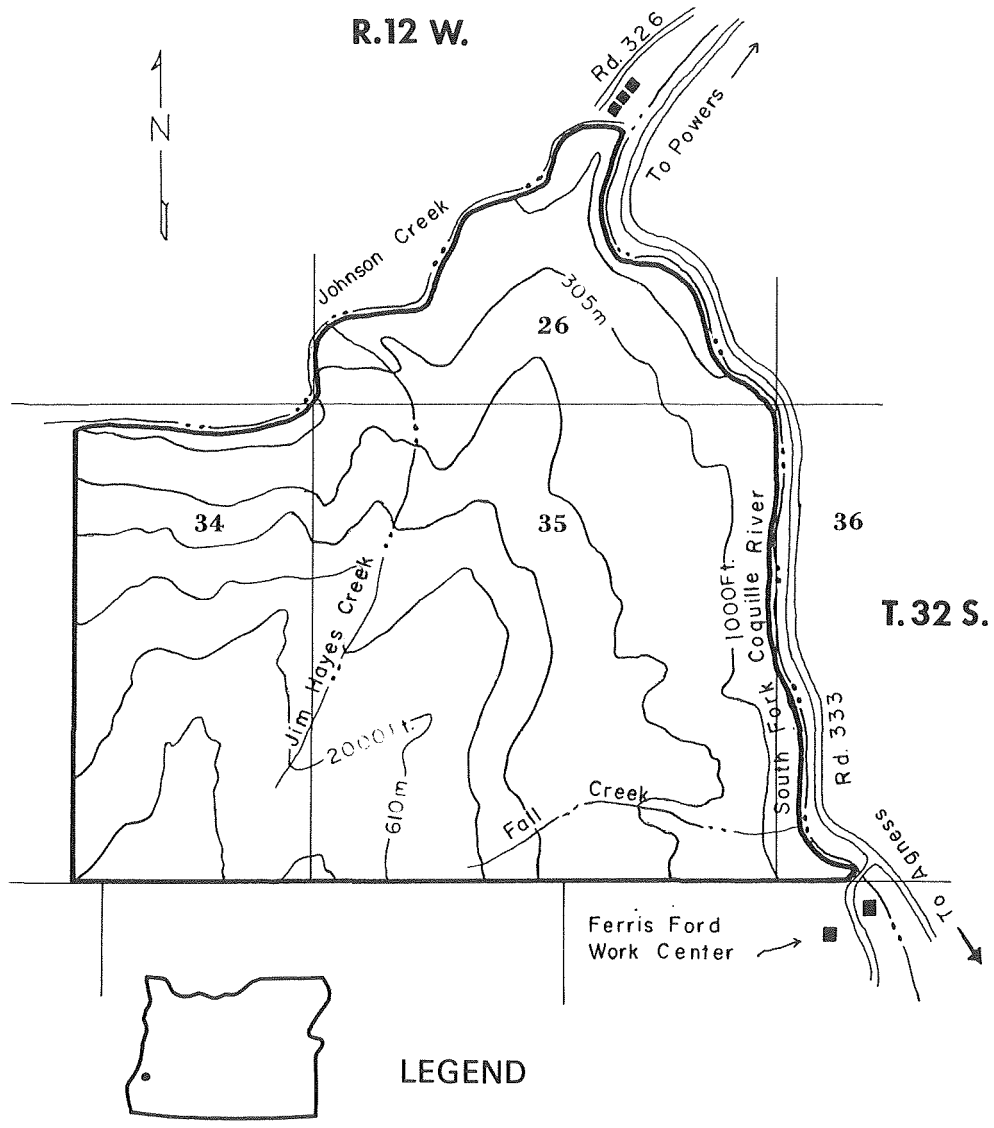


Figure PO-1.– Port Orford Cedar Research Natural Area, Coos County, Oregon.

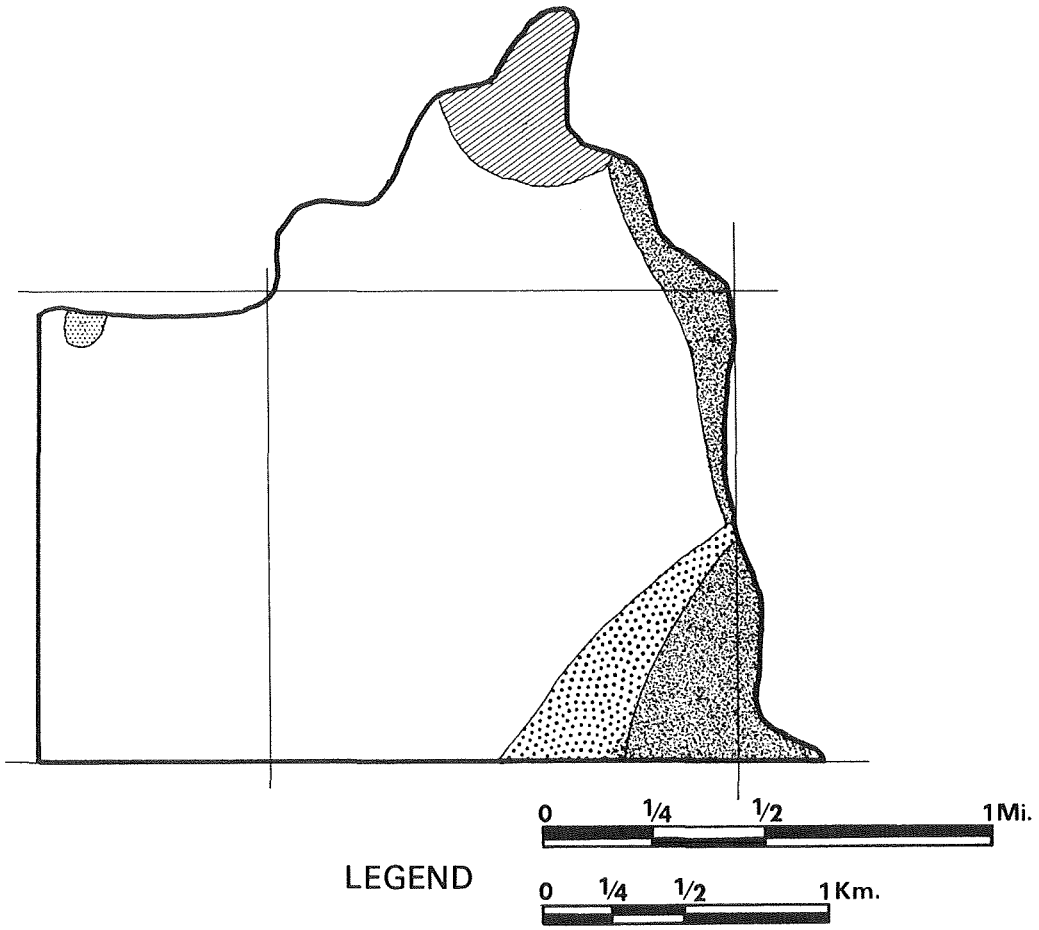
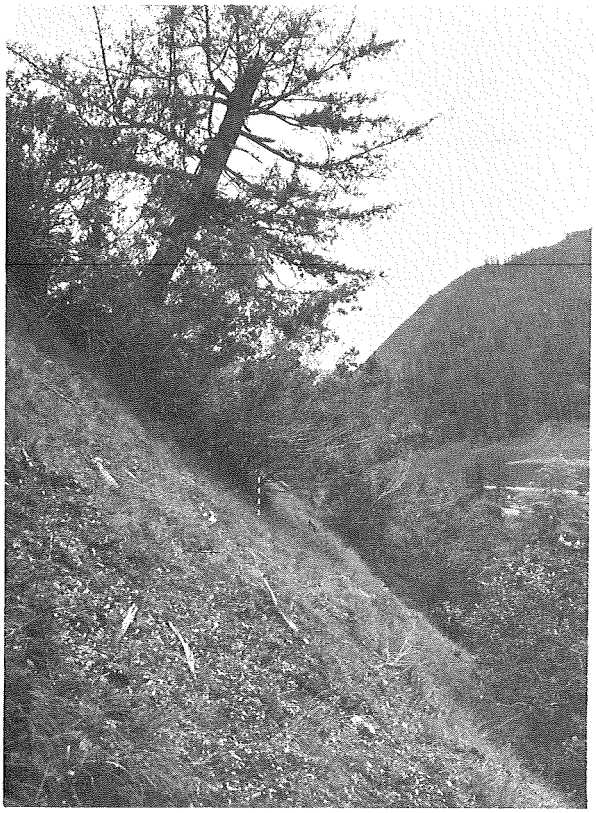


Figure PO-2.– Geology of Port Orford Cedar Research Natural Area (after Diller 1903); recent mapping indicates the Serpentinite extends further south than is shown here (Baldwin and Hess 1971).

Figure PO-3.-Communities in the Port Orford Cedar Research Natural Area. A: Mixed stand of grand fir, bigleaf maple, and western hemlock on a wet bench; understory dominated by *Polystichum munitum.* B: Open vegetational mosaic on serpentinite ridge with stunted Douglas-fir, Canyon live oak, and *Rhamnus californica; Festuca* spp. and forbs occupy the openings. C: Mixed stand of Port-Orford-cedar and Douglas-fir on uplands, average d.b.h. 1 DO-em. D: Swale dominated by red alder and *Carex obnupta.*

A



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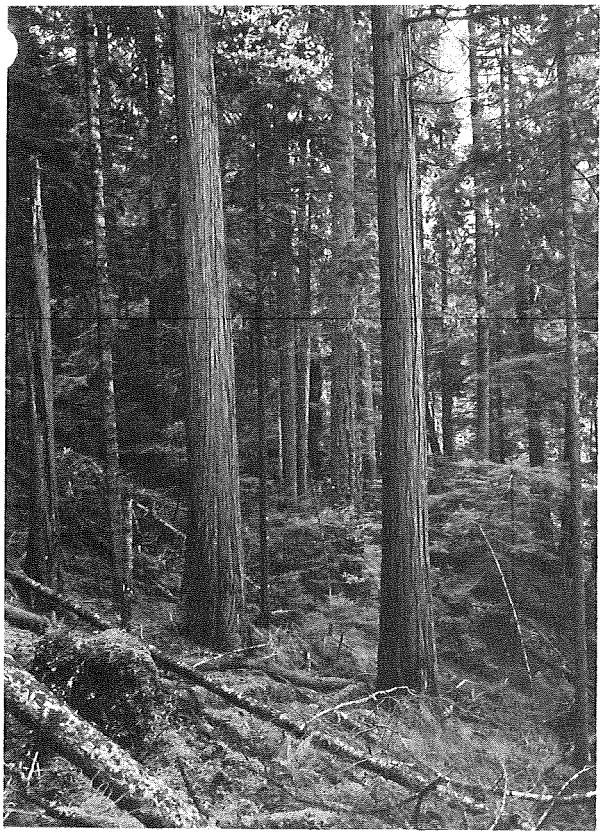

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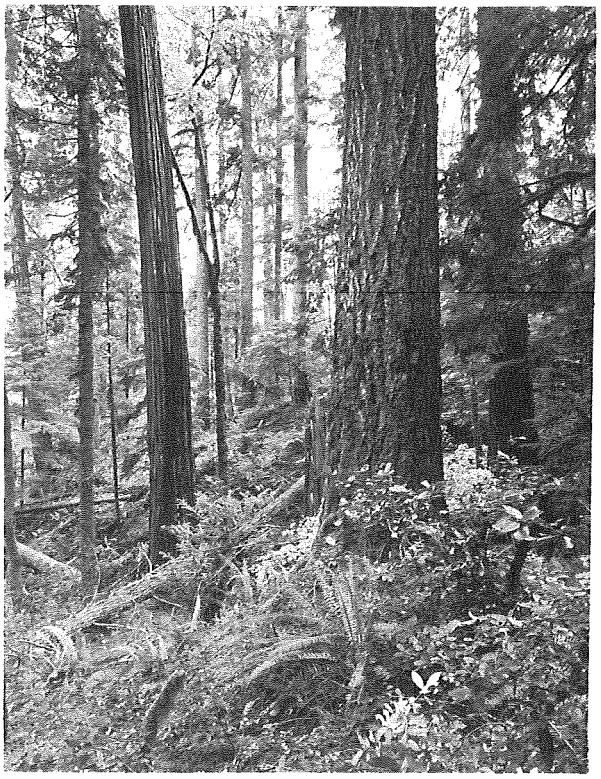
Figure PO-3.-Communities in the Port Orford Cedar Research Natural Area (continued). E: Extensive swale on slump bench dominated by Oregon ash and *Carex obnupta*. F: Mixed forest stand located on serpentinite; Douglas-fir dominates, but Port-Orford-cedar (center) and Pacific madrone (center and right) are also present in the overstory and *Xerophyllum tenax* and tanoak in the understory. G: Typical mixed upland forest dominated by Douglas-fir, Port-Orford-cedar, and western hemlock, with tanoak and *Polystichum munitum* in the understory; note the bigleaf maple in the background (just left of center). H: Forest stand on one of the infrequent benches found along the South Fork of the Coquille River; the river forms the natural area boundary in this area.

E

F



G

H

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

PRINGLE FALLS RESEARCH NATURAL AREA[1]

A two-unit natural area containing ponderosa pine/bitterbrush and lodgepole pine/bitterbrush communities typical of the northern Mount Mazama pumice area in south-central Oregon.

The Pringle Falls Research Natural Area was established June 1936, to exemplify the topographically related mosaic of lodgepole pine *(Pinus contorta)* and ponderosa pine *(Pinus ponderosa)* forests characteristic of a large area of aerially-deposited Mount Mazama (Crater Lake) pumice in south-central Oregon. The 470-ha. (1, 160-acre) tract is located in Deschutes County, Oregon, and is administered by the Bend Ranger District (Bend, Oregon), Deschutes National Forest. It is also a part of the Pringle Falls Experimental Forest, a 4,477-ha. (11,055-acre) area maintained by the Pacific Northwest Forest and Range Experiment Station for research and demonstration of management techniques in ponderosa and lodgepole pine forests (Mowat 1954). The natural area is in two units. Unit 1, the western block, contains 227 ha. (560 acres) and includes nearly all of section 33T. 21 S., R. 9 E., Willamette meridian; and Unit 2, the eastern block, contains 243 ha. (600 acres) and encompasses most of section 35 and a small portion of section 34, T. 21 S., R. 9 E., Willamette meridian (fig. PR-l). Both units lie at approximately 43 °03' N. latitude and 121 °40' W. longitude.

[1] Description prepared by Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

ACCESS AND ACCOMMODATIONS

The natural area is located approximately 57 km. (35 miles) southwest of Bend and approximately 18 km. (11 miles) northwest of Lapine and is approached via U.S. Highway 97 and Forest Service roads. Directions can be obtained at the Silviculture Laboratory or Ranger Station in Bend. Access to the area is good in the summer, but snow makes winter access difficult. In general, travel through the natural area is quite easy. Forest roads are all around the tracts and one traverses the east unit in an east-west direction (fig. PR-l). Several old trails provide access to major segments of both units (fig. PR-l). The high elevations at the northeast corner of the east unit can be reached via a logging road.

Public accommodations are available in Bend and Lapine; primitive campgrounds are available at the northern edge of the experimental forest and at Wickiup Reservoir 5 km. (3 miles) west of the area.

ENVIRONMENT

Topography and elevational range contrast on the two units of the natural area. Unit 1, the western block, is located on nearly flat topography with a total elevational range of 1,310 to 1,320 m. (4,290 to 4,310 ft.). Unit 2, the eastern block, varies from flat or rolling to relatively steep on some slopes (fig. PR-l). Elevations range from 1,310 to 1,470 m. (4,280 to 4,820 ft.).

Both tracts are located on a plateau upon which 3 to 12 dm. (2 to 5 ft.) of dacite pumice was aerially deposited following the eruption of Mount Mazama (now Crater Lake) 6,600 years ago. Bedrock in the area is mapped as basalt and basaltic andesite lavas of Pleistocene to Recent age (Williams 1957). Cruiser and Wampus Buttes, which

This file was created by scanning the printed publication. Text errors identified by the software have been corrected; however, some errors may remain.

partially occupy the east unit, are basaltic cinder cones.

A modified continental climate prevails. Most precipitation occurs as snowfall during the cool, cloudy winter. Summers are warm, generally low in precipitation and largely cloudless. One to 3 months of drought are common. Climatic data from Wickiup Reservoir located 3 km. (2 miles) west of the tract are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	5.7°C.	(42.3°F.)
Mean January temperature	−4.2°C.	(24.5°F.)
Mean July temperature	15.9°C.	(60.7°F.)
Mean January minimum temperature	−10.6°C.	(12.8°F.)
Mean July maximum temperature	26.8°C.	(80.3°F.)
Average annual precipitation	525 mm.	(20.7 in.)
June through August precipitation	58 mm.	(2.3 in.)

The principal soil in the area has been classified as the Lapine series (Tarrant 1947). The Lapine soil is loamy coarse sand, textured and derived from aerially deposited dacite pumice. It is well drained and occupies 2to 25-percent slopes. The pumice varies from 80 to 130 cm. (30 to 50 in.) in depth over buried soil profiles. A small area in the northern half of Unit 1, which is easily recognized by its grass dominated understory, is covered by the Wickiup soil series. The Wickiup is also a loamy coarse sand soil formed in aerially deposited dacite pumice. It differs from the Lapine by having a seasonally high water table. The Wickiup occurs on slopes of 0 to 5 percent and on pumice deposits ranging from 130 to 150 cm. (50 to 60 in.) in depth.

Wickiup Reservoir, located 3 km. (2 miles) above and to the west of the natural area, has apparently influenced the level of the water tables in this locality. Small ponds and lakes 0.5 to 1 km. (0.25 to 0.5 mile) west of Unit 1 have had water levels raised from 1 to 1.5 m. (3 to 5 ft.) since installation of the reservoir.

BIOTA

Estimated areas by plant community are:

Name	*Unit 1 Area*	*Unit 2 Area*
Pinus ponderosa/Purshia tridentata		79 ha. (195 acres)
Pinus ponderosa-Pinus contorta/Purshia tridentata		121 ha. (300 acres)
Pinus ponderosa-Pinus lambertiana/Ceanothus velutinus		26 ha. (65 acres)
Pinus contorta/Purshia tridentata	226 ha. (560 acres)	16 ha. (40 acres)

The distribution of community types, as defined by timber and ground vegetation type maps prepared in 1934, is illustrated in figure PR-2. Both *Pinus ponderosa/Purshia tridentata* and *Pinus ponderosa-Pinus contorta/Purshia tridentata* can be assigned to SAF forest cover type 237, Interior Ponderosa Pine (Society of American Foresters 1954), and Kuchler's (1964) Type 10, Ponderosa Pine Shrub Forest. *Pinus ponderosa-Pinus lambertiana/Ceanothus velutinus* communities could probably be assigned to SAF forest cover type 243, Ponderosa Pine-Sugar PineFir, and Kuchler's Type 5, Mixed Coniferous Forest. *Pinus contorta/Purshia tridentata* stands can be categorized as SAF forest cover type 218, Lodgepole Pine; Kuchler does not recognize lodgepole pine type. The natural area falls within a *Pinus ponderosa* Zone according to Dyrness and Youngberg (1966). The very recent, 6,600-year-old, pumice deposit has not weathered to produce zonal type soils; therefore it is difficult if not impractical to assign the area to a "climatic vegetation zone."

Unit 1, the western block, is completely dominated by pure or nearly pure lodgepole pine. Eighty to 90 percent of the area is characterized by lodgepole pine and bitterbrush *(Purshia tridentata)* with a sparse herbaceous cover composed of western needlegrass *(Stipa occidentalis),* Ross's sedge *(Carex rossii),* bottlebrush squirrel tail *(Sitanion hystrix),* and *Fragaria cuneifolia* (fig. PR-3). A lodgepole stand with strikingly different ground vegetation occurs in the northern half of the area (figs. PR-2 and PR-3): Here the ground vegetation is co-dominated by bitterbrush and Idaho fescue *(Festuca idahoensis)* with *Arctostaphylos uva-ursi, Achil-*

lea millefolilium, bottlebrush squirreltail, *Lnpinus latifolius,* and *Fragaria.* Youngberg and Dahms (1970) have described these communities, their soils, and forest productivity.

Unit 2, the eastern block, has minor amounts of pure lodgepole pine (fig. PR-2). Its undulating to rolling topography is associated with stands of ponderosa pine, bitterbrush, and western needlegrass (Dyrness and Youngberg 1966) (fig. PR-3). In some cases, particularly on concave lower slopes, lodgepole pine grows in association with ponderosa. Ponderosa pine and bitterbrush are the conspicuous overstory and ground vegetation dominants, respectively; in addition, Ross's sedge, western needlegrass, bottlebrush squirreltail, and, at times, *Arctostaphylos parryana* var. *pinetorum* are present. At higher elevations and on northerly slopes, sugar pine *(Pinus lambertiana)* and white fir *(Abies concolor)* become significant elements in the plant community. Associated with the increase in these tree species is a decrease in bitterbrush, an increase in *Arctostaphylos,* and occurrence of *Ceanothus velutinus.*

Mule deer *(Odocoileus hemionus)* and Rocky Mountain elk *(Cervus canadensis)* use the area as spring-summer and fall range. Other mammals believed to utilize the area as residents or transients are listed in table PR-1.

HISTORY OF DISTURBANCE

Fire scars on ponderosa pine indicate ground fires periodically burned the area prior to initiation of fire control programs in 1910 (fig. PR-3); general fires are indicated in 1605, 1672, 1716, 1731, 1769, 1788, 1823, 1855, 1871, and 1886. Lack of dominant oldgrowth fir in the presence of abundant fir reproduction further suggests most portions of the ponderosa forest have burned at some time. In many cases, charred trees and logs are in evidence in lodgepole pine communities suggesting fire also has occurred in these areas.

Domestic sheep apparently grazed the area at one time on their way to high elevation pasture. Utilization has been scant to light, and consequently, the vegetation can be considered unaltered by livestock use. Game use tends to be moderate with noticeable but apparently not detrimental utilization of bitterbrush. No other significant disturbance is known.

RESEARC H

Since the natural area is a part of the Pringle Falls Experimental Forest, a great deal of research has been and is being conducted on the tract. Two fenced areas were established in each block about 1934 providing 8 ha. (20 acres) in the east unit and 6 ha. (15 acres) in the west unit from which grazing has been excluded for about 35 years (fig. PR-2). These plots contain permanent points which have been photographed at least twice. The two plots in the eastern unit (plots 27 and 28) are also sites where periodic measurements are made of forest growth and mortality. Between 1938 and 1948, annual gross increment of ponderosa pine averaged 1.65 cu. m. per ha. per year (118 bd. ft. per acre per year) and mortality averaged 0.70 cu. m. per ha. (50 bd. ft. per acre) resulting in a net growth of 0.95 cu. m. per ha. per year (68 bd. ft. per acre per year). Most mortality was caused by western pine barkbeetle *(Dendroctonus ponderosae).* A portion of the natural area has also been used as a baseline data source in studies of the epidemiology of tree-killing insects, including the bark beetle, by the now-defunct Bureau of Entomology and Plant Quarantine.

Baseline population levels of several bird and mammal species are also being studied on both units of the Pringle Falls Research Natural Area.[2] This is part of a larger, long-term eastern Oregon study utilizing several other Research Natural Areas representing different vegetation types. At present the research involves estimating breeding bird populations based upon weekly early morning censuses during the bird breeding season within a gridded area.

[2] Research by Mr. Jay S. Gashwiler, Wildlife Research Biologist, Bureau of Sport Fisheries and Wildlife, P. O. Box 1208, Bend, Oregon.

The natural area provides interesting opportunities to study: (1) biomass productivity in relation to soil and topographic factors; (2) forest succession since initiation of fire control practices; and (3) undisturbed forest in comparison with similar tracts on the experimental forest which have been carefully managed under controlled experimental conditions. The natural area also provides a benchmark site for studies of undisturbed vegetation over the range of south-central Oregon's pumice plateau area; Pringle Falls, Goodlow Mountain, Bluejay, and Metolius Research Natural Areas span the Mount Mazama pumice deposits from south to north.

Pringle Falls Research Natural Area is also a part of the Pringle Falls Experimental Forest, which is similar in forest type and environment. The possibility exists of using other parts of the experimental forest for work involving destructive sampling or manipulation and using the natural area as a control.

MAPS AND AERIAL PHOTOGRAPHS

Several special maps covering the natural area were prepared by Civilian Conservation Corps crews during the 1930's and are on file at the Pacific Northwest Forest and Range Experiment Station's headquarters in Portland or Silviculture Laboratory in Bend. Most of the maps have a scale of 4 inch equals 1 mile. Included are a topographic map with a 10-foot contour interval and maps of timber types, timber size classes, tree reproduction density and species, and ground cover. Data from a timber cruise of the natural area conducted at the same time are also on file.

The District Ranger (Bend Ranger District), the Project Leader (Silviculture Laboratory, Bend), or Forest Supervisor (Deschutes National Forest, Bend, Oregon) can provide details on the most recent aerial photo coverage of the area.

LITERATURE CITED

Dyrness, C. T., and C. T. Youngberg
1966. Soil-vegetation relationships within the ponderosa pine type in central Oregon pumice region. Ecology 47: 122-138, illus.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Mowat, Edwin L.
1954. A guide to the Pringle Falls Experimental Forest. Pac. Northwest Forest & Range Exp. Stn. USDA Forest Serv., 24 p., illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D. C.

Tarrant, Robert F.
1947. First forest soil survey gives significant results. USDA Forest Servo Pac. Northwest Forest & Range Exp. Stn. Res. Note 36, 4 p., Portland, Oreg.

U.S. Weather Bureau
1965. Climatic summary of the United States-supplementfor 1951 through 1960, Oregon. Climatography of the United States 86-31,96 p., illus.

Williams, Howel
1957. A geologic map of the Bend Quadrangle, Oregon and a reconnaissance geologic map of the central portion of the High Cascade Mountains. State Oreg. Dep. Geol. & Miner. Ind.

Youngberg, C. T., and W. G. Dahms
1970. Productivity indices for lodgepole pine on pumice soils. J. For. 68: 90-94, illus.

Table PR-1. — Tentative list of mammals for Pringle Falls Research Natural Area

Order	Scientific name	Common name
Insectivora	*Sorex palustris*	northern water shrew
	Sorex vagrans	wandering shrew
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	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus californicus*	black-tailed jack rabbit
	Sylvilagus nuttalli	mountain cottontail
Rodentia	*Castor canadensis*	beaver
	Erethizon dorsatum	porcupine
	**Eutamias amoenus*	yellow-pine chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus montanus	mountain vole
	Neotoma cinerea	bushy-tailed wood rat
	**Peromyscus maniculatus*	deer mouse
	**Sciurus griseus*	western gray squirrel
	**Spermophilus lateralis*	mantled ground squirrel
	**Tamiasciurus douglasi*	chickaree
	**Thomomys mazama*	Mazama pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Mephitis mephitis	striped skunk
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	**Taxidea taxus*	badger
	Urocyon cinereoargenteus	gray fox
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	**Cervus canadensis*	wapiti or elk
	**Odocoileus h. hemionus*	mule deer

* Habitation verified by sign, sighting, or collection.

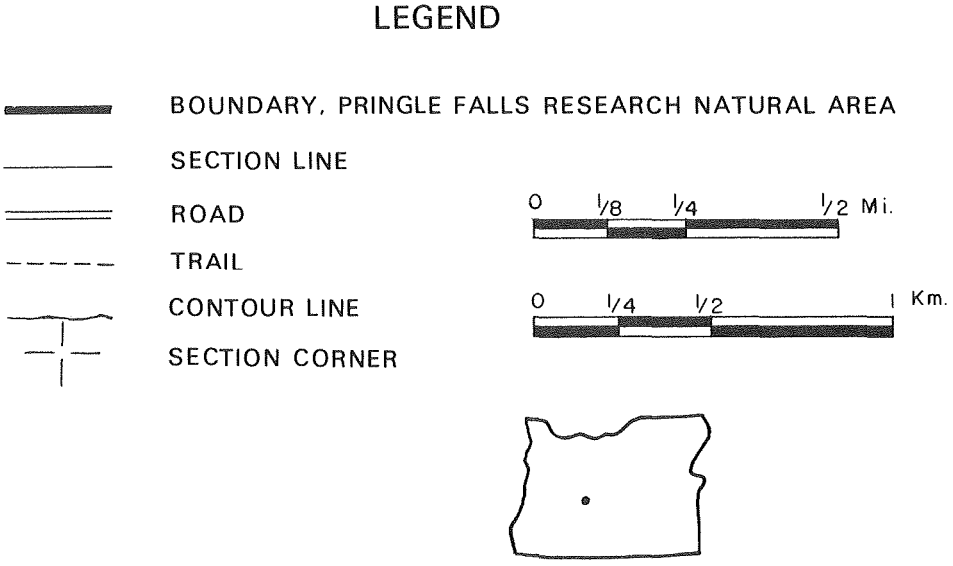
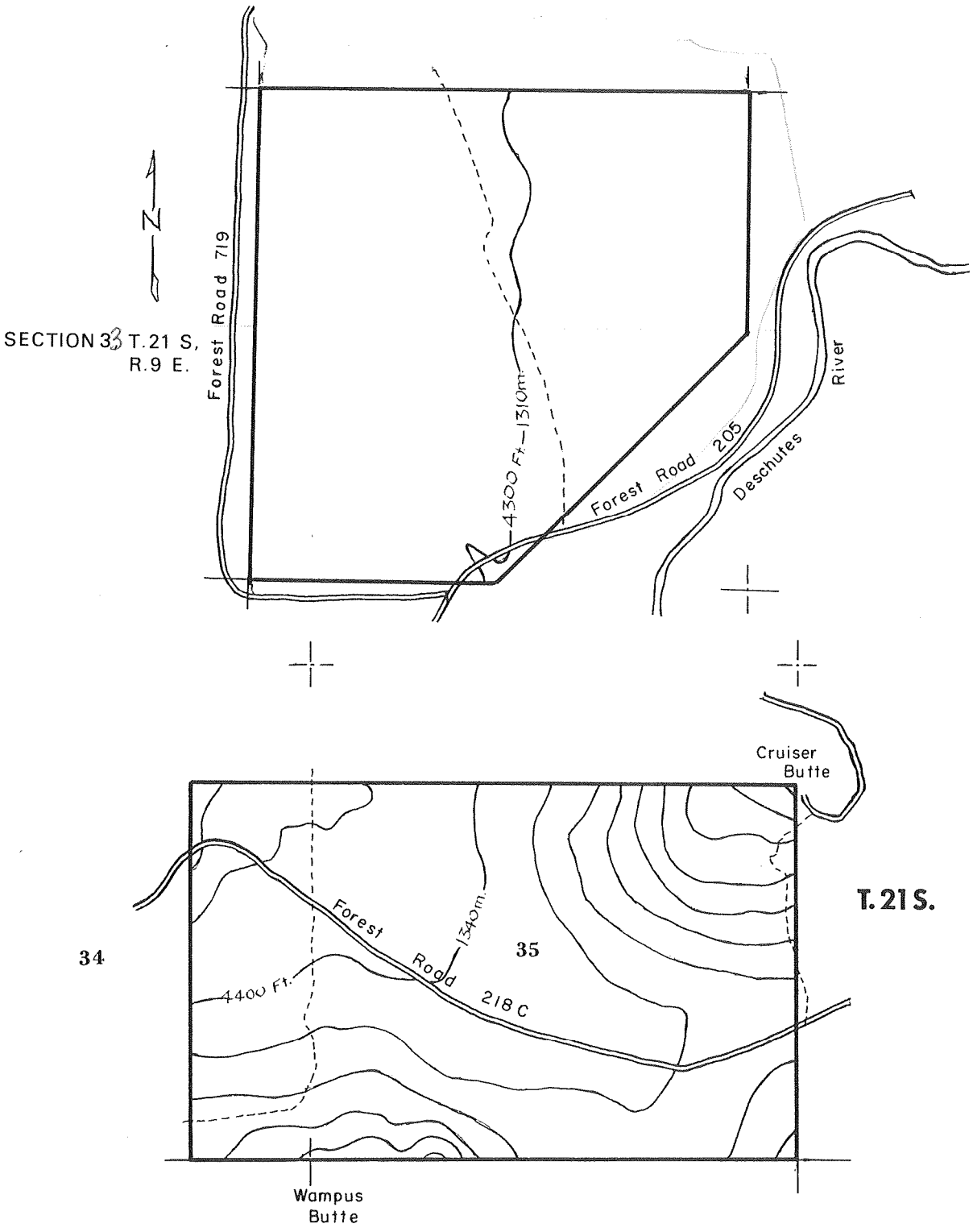


Figure PR-1.– Pringle Falls Research Natural Area, Deschutes County, Oregon. Upper area is the west block and the lower area is the east block. (20-foot contour intervals.)


N
SECTION 33 T. 21 S., R. 9 E.
Forest Road 719
4300 Ft.
1310m.
Forest Road 205
Deschutes River
Cruiser Butte
T. 21 S.
34
35
Forest Road 218 C
1340m.
4400 Ft.
Wampus Butte
R. 9 E.

LEGEND

Pinus contorta / GRASS

Pinus cortorta / Purshia tridentata

Pinus ponderosa – P. contorta / Purshia tridentata

Pinus ponderosa / Purshia tridentata

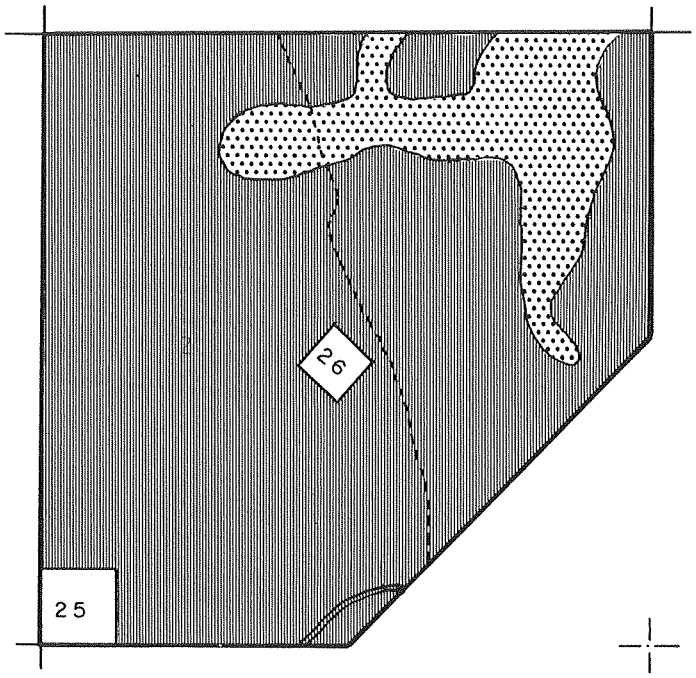
Pinus ponderosa – P. contorta / Ceanothus velutinus

Pinus ponderosa / Ceanothus velutinus

Pinus ponderosa – P. lambertiana / Ceanothus velutinus

ECOLOGICAL STUDY PLOTS

Figure PR-2.– Distribution of forest community types on the Pringle Falls Research Natural Area (from 1934 timber and ground vegetation type maps).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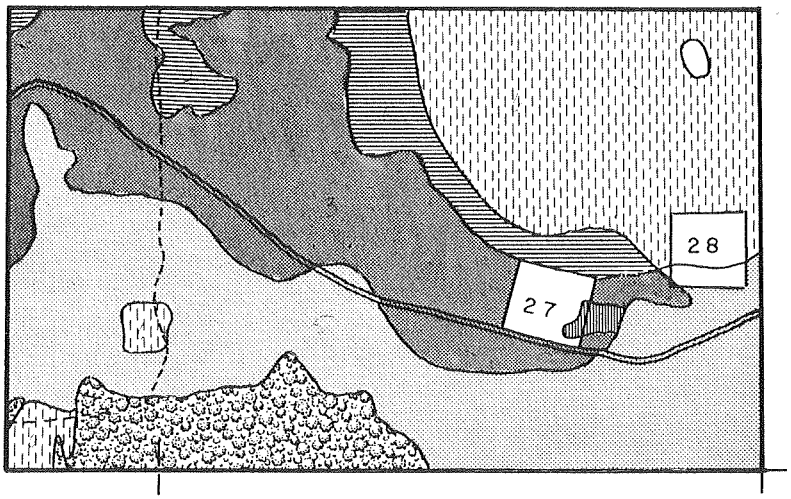
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Figure PR-3.-Communities of the Pringle Falls Research Natural Area. Top: Ponderosa pine, bitterbrush, and western needlegrass stand typical of the east block; note fire scar on tree nearest the meter board. Lower left: Stand of lodgepole pine, bitterbrush, and western needlegrass typical of the west block. Lower right: Stand of lodgepole pine, bitterbrush, and Idaho fescue typically found on finer textured soils.

1M

1M

1M

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

QUINAULT RESEARCH NATURAL AREA[1]

A coastal plain tract of western hemlock, Sitka spruce, western red-cedar, and Douglas-fir located on the southwestern edge of the Olympic Peninsula.

The Quinault Research Natural Area was established on June 18, 1932, as an example of Sitka spruce type in its natural state. The 594-ha. (l,468-acre) tract is located in Grays Harbor County, Washington, and is administered by the Quinault Ranger District (Quinault, Washington), Olympic National Forest. The natural area occupies all except 2 ha. (5 acres) of section 31 and the W1/2 and Wl/2 NEl/4 of section 32, T. 23 N., R. 9 W., and the Nl/2 of section 6 and Wl/2 NWl/4 of section 5, T. 22 N., R. 9 W., Willamette meridian. It lies at 47°27' N. latitude and 123°52' W. longitude.

ACCESS AND ACCOMMODATIONS

Access is via U.S. Highway 101 which crosses the west side of the Quinault Research Natural Area (fig. QU-1) about 64 km. (40 miles) north of Hoquiam and 1.6 km. (1 mile) south of Amanda Park. No other roads or trails enter the tract. Commercial accommodations as well as several excellent public campgrounds are located 3 to 8 km. (2 to 5 miles) from the natural area in the vicinity of Lake Quinault.

[1] Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

ENVIRONMENT

The Quinault Research Natural Area varies from about 122 to 366 m. (400 to 1,200 ft.) in elevation with the bulk of the area at 122 to 152 m. (400 to 500 ft.). Topography is flat to gently rolling except along the eastern edge where the steep lower slopes of Quinault Ridge are encountered. Willaby and Boulder C reeks flow through the tract, and several of their small tributaries rise within it.

The natural area straddles the contact between marine terrace deposits of Pleistocene age and basalt flows and breccias formed during the Eocene epoch (Huntting et al. 1961). The latter materials, belonging to the Metchosin formation (Danner 1955), are limited to the slope of Quinault Ridge. The terrace deposits are covered with drift deposited by alpine glaciers which occupied the area three times during the Wisconsin age and at least once, pre-Wisconsin (Crandell 1964).

A maritime climate, wet with muted temperature extremes, prevails. Winters are mild and summers are cool with frequent cloudy days. Precipitation is heavy but highly seasonal with January and December the peak months. Only about 7 percent of the annual precipitation falls during June, July, and August, and some years a drought period of a month or more occurs. Snow is rare. Climatic data from the nearby Quinault Ranger Station are as follows (U.S. Weather Bureau 1956) :

Mean annual temperature	10.6°C. (51.0°F.)
Mean January temperature	3.8°C. (38.9°F.)
Mean July temperature	17.3°C. (63.2°F.)
Mean January minimum temperature	1.2°C. (34.2°F.)
Mean July maximum temperature	23.8°C. (74.9°F.)
Average annual precipitation	3,371 mm.(132.73 in)
June through August precipitation	244 mm. (9.61 in.)
Average annual snowfall	30.2 cm. (11.9 in.)

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The soils on the area have not been mapped or described. They appear relatively deep and loamy with varying amounts of loose rock. At least a portion would probably be classed as Sols Bruns Acides. Soils on gentle topography are underlain by compacted glacial till.

BIOTA

Estimated areas by SAF cover types (Society of American Foresters 1954) are:

No.	*Name*	*Area*
224	Western Hemlock	314 ha. (775 acres)
225	Sitka Spruce-Western Hemlock	162 ha. (400 acres)
227	Western Redcedar-Western Hemlock	81 ha. (200 acres)
230	Douglas-Fir-Western Hemlock	24 ha. (60 acres)

The area would probably fall entirely within Kuchler's (1964) Type 1, Spruce-CedarHemlock Forest, and the *Picea sitchensis* Zone as defined by Franklin and Dyrness (1969).

Western hemlock *(Tsuga heterophylla),* Sitka spruce *(Picea sitchensis),* Douglas-fir *(Pseudotsuga menziesii),* and western red-cedar *(Thuja plicata)* dominate the Quinault Research Natural Area. Although all four species are distributed throughout the area, there tend to be local concentrations (fig. QU -1). Sitka spruce is best represented in the central portion of the natural area but does not occur as a pure stand. Western hemlock is the most abundant species and occurs as a pure or nearly pure type (80 percent by volume) on some of the slopes along the eastern boundary. It also dominates a comparatively young stand along the western boundary . Western red-cedar is most abundant in the northwestern corner of the tract. Douglas-fir dominates a small knoll in the center of the tract and a well-drained area along the northwest boundary. Pacific silver fir *(Abies amabilis)* is found in small numbers along the lower slopes of Quinault Ridge.

The forests on the natural area vary widely in size and age. The oldest and largest diameter trees present are Douglas-fir and western red-cedar (fig. QU -2). Approximately 400-year-old Douglas-fir reach heights of almost 90 m. (300 ft.) and diameters of 180 cm. (70 in.) or more at b.h. Sitka spruce and western hemlocks are generally much younger, perhaps 15Q to 200 years in age in the central portion of the natural area. The spruce dominants are in excess of 75 m. (250 ft.) tall and have diameters averaging 90 to 100 cm. (35 to 40 in.) b.h. and, not infrequently, reaching 150 to 180 cm. (60 to 70 in.) b.h. Hemlocks are generally somewhat smaller. The stand of young western hemlock along the western boundary has trees averaging 50- to 60-cm. (20- to 24-in.) d.b.h.

Succession in the Quinault Research Natural Area is primarily toward replacement of existing mixed forests by western hemlock. Only western hemlock is consistently represented in all age classes. Seedlings and saplings of hemlock are abundant; some stand openings are completely choked by sapling hemlocks (fig. QU-2). Reproduction of western red-cedar and Douglas-fir is almost universally absent. Small Sitka spruce seedlings are common, especially on rotten logs, but they are not so abundant as those of hemlock, and sapling spruce are rarely found under stands. Open, wet depressions dominated by large, old western red-cedar and Sitka spruce provide a possible successional exception; spruce saplings are almost as abundant in these areas as those of hemlock. Along Quinault Ridge, Pacific silver fir is reproducing under closed forests and will apparently be a part of the climax forest.

Most tree reproduction is found on rotting logs, "nurse logs," which often support hundreds of hemlock and spruce seedlings (fig. QU-2). Some of these survive and their roots reach mineral soil. The consequences are visible throughout the area as lines of mature trees growing along the remains of the original nurse logs (fig. QU -2).

The understory is luxuriant throughout, although relatively poor in species of vascular plants (fig. QU -2). *Vaccinium parvifolium, Polystichum munitum,* and *Oxalis oregana* are major dominants. *Tiarella trifoliata, Gaultheria shallon, Rubus urslinus, Luzula parvi-*

flora, Maianthemum bifolium var. *kamschaticum, Blechnum spicant, Galium triflorum,* and *Viola sempervirens* are less common. Wet depressions or swampy areas differ considerably. Species there include *Rubus spectabilis,* vine maple *(Acer circinatum), Viola glabella, Trillium ovatum, Cardamine* sp., *Galium aparine, Rhamnus purshiana,* and several Cyperaceae.

Since the natural area lies within the so-called "rain forest" region of the western Olympic Peninsula, mosses and liverworts blanket the ground, down logs, shrubs, and tree trunks. Some of the more common ground species are *Eurhynchium oreganum, Hypnum circinale, Rhytidiadelphus loreus, Mnium menziesii, Hylocomium splendens,* and *M. insigne.* Among the abundant epiphytes are *Pseudisothecium stoloniferum, Porella navicularis, Rhytidiadelphus loreus, Radula bolanderi, Frullania nisqualensis, Scapania bolanderi,* and *Ptilidium californicum.*

The Roosevelt elk *(Cervis canadensis roosevelti)* is the most important animal present. Elk use the natural area as a wintering ground. The relatively open, park-like nature of most of the tract is a consequence of their activity; their trails ease the problems of access through the area. Undoubtedly, they have also affected the composition of the understory vegetation (Sharpe 1956). Other mammals believed to utilize the area as residents or transients are listed in table QU-l.

Invertebrates recorded by Shelford (1963) during a visit in 1945 included: millipedes *(Harpaphe haydeniana),* centipedes *(Arctogeophilus melanonotus* and *Otocryptops* sp.), spiders *(Hexura picea* and *Antrodiaetus hageni),* numerous brown silverfish, camel crickets *(Pristoceuthophilus* sp.), ground beetles *(Scaphinotus angusticollis velutinus),* click beetles *(Ctenicera protracta),* Sitka bumblebee *(Bombus sitkensis),* yellow jacket *(Vespula arenaria),* the lavavorid fly *(Ursophyte migriceps),* and the boring beetle *(Pidonia gnathoides).*

Streams and streamsides are the only specialized habitats which are present. No lakes, ponds, rock outcrops, etc., exist within the natural area.

HISTORY Of DISTURBANCE

There is evidence that fires burned over the area 200 or more years ago. Some fire scars can be seen on old western red cedar and Douglas-fir. There is no indication of more recent fires.

Human disturbance prior to establishment of the natural area is believed to have had a minor influence on natural conditions. At one time an old pioneer road ran through the area near the base of Quinault Ridge. During World War I the Spruce Production Division built two short skidways into Section 31 and took out a few spruce trees. Finally, some dead cedar was utilized for fence posts.

There has been no disturbance since establishment except for that associated with maintenance of U.S. Highway 101.

RESEARC H

A number of scientists have visited the area in connection with zoologic, geologic, botanic, and paleological studies of the Olympic Peninsula but generally have not published their observations with specific reference to the natural area. One exception is Dr. Victor E. Shelford whose observations on invertebrate fauna (Shelford 1963) were cited earlier. The natural area has been visited as part of two studies currently being made of temperate forest communities on the Olympic Peninsula.[2]

Special research opportunities which exist on the Quinault Research Natural Area include possibilities for studying (1) the effects of Roosevelt elk on their habitat and (2) the ecology of epiphytic mosses and lichens.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural

[2] Studies by Dr. R. W. Fonda, Biology Department, Western Washington State College, Bellingham, Washington and Mr. Edward Tisch, Biology Department, Peninsula College, Port Angeles, Washington.

area include: *Topography* - 15' Quinault Lake, Washington quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1955; and *geology* - *Geologic Map of Washington,* scale 1:500,000 (Huntting et al. 1961). Either the District Ranger (Quinault Ranger District) or Forest Supervisor (Olympic National Forest, Olympia, Washington) can provide details on the most recent aerial photo coverage and forest type maps for the area.

Records of the 1931 timber inventory and copies of the original forest type and topographic maps, prepared by Forest Service personnel, are on file at the Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

LITERATURE CITED

Crandell, Dwight R.
1964. Pleistocene glaciations of the southwestern Olympic Peninsula, Washington. U.S. Geol. Surv. Prof. Pap. 501B:B135-B139, illus.

Danner, Wilbert R.
1955. Geology of Olympic National Park. 68 p., illus. Seattle: Univ. Wash. Press.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW - 80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Sharpe, Grant William
1956. A taxonomical-ecological study of the vegetation by habitats in eight forest types of the Olympic Rain Forest, Olympic National Park, Washington. 335 p., illus. (Ph.D. thesis, on file at Univ. Wash., Seattle.)

Shelford, Victor E.
1963. The ecology of North America. 610 p., illus. Urbana: Univ. Ill. Press.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1956. Climatic summary of the United States - supplement for 1931 through 1952, Washington. Climatography of the United States 11-39, 79 p., ill us.

Table QU-1. — Tentative list of mammals for Quinault Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex obscurus	dusky shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Tamiasciurus douglasi	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis roosevelti*	Roosevelt elk
	Odocoileus h. columbianus	black-tailed deer

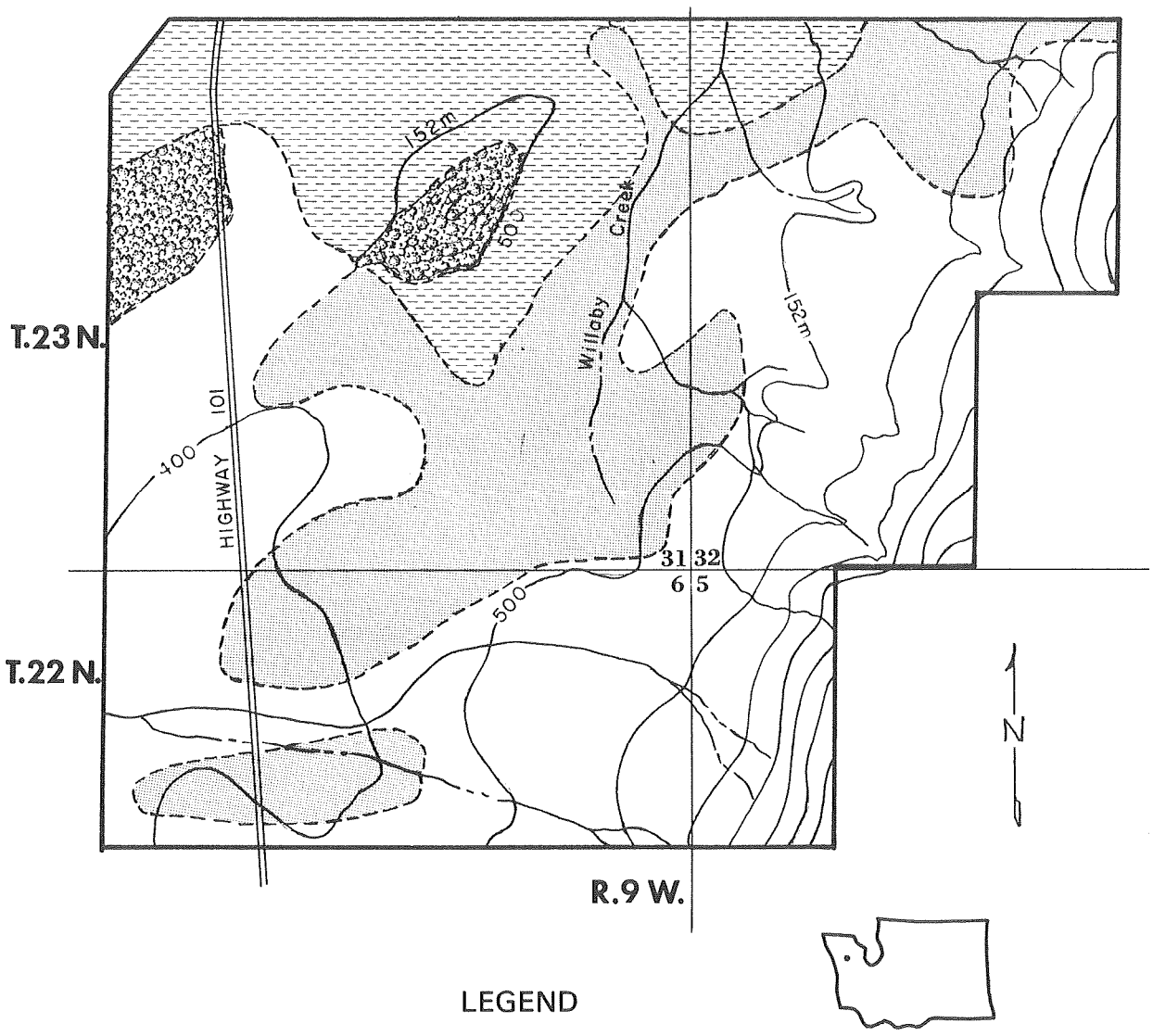
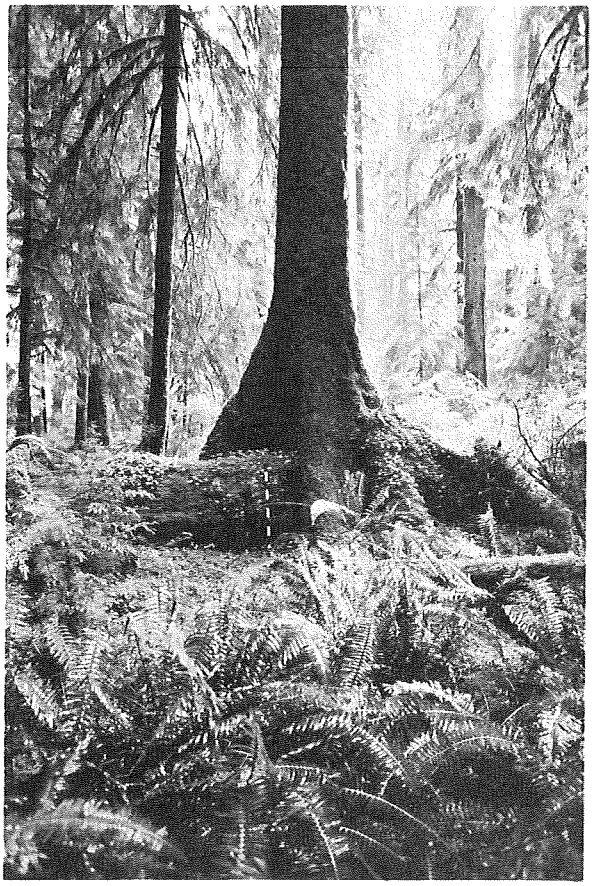


Figure QU-1.– Quinault Research Natural Area, Grays Harbor County, Washington, showing general area of tree species concentration.

Figure OU-2.-Communities of the Quinault Research Natural Area. Upper left: Old-growth specimen of western red-cedar approximately 150-cm. d.b.h. growing in swampy area. Upper right: Open stand of western hemlock and Sitka spruce about 200 years in age showing dense reproduction of western hemlock. Lower left: Abundant reproduction of western hemlock and other species on typical rotting "nurse" log. Lower right: Mature specimen of Sitka spruce showing the log upon which it originally developed; typical dense understory of *Polystichum munitum* in the foreground.



Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

RAINBOW CREEK RESEARCH NATURAL AREA[1]

Virgin grand fir-western white pine, Douglas-fir - ponderosa pine and western larch stands typical of the interior mixed-conifer forest zone in the northern Blue Mountains of southeastern Washington.

The Rainbow Creek Research Natural Area was established November 6, 1968. It exemplifies three forest types which are ecologically and commercially important in the northern Blue Mountains of northeastern Oregon and southeastern Washington. The 170-ha. (420-acre) tract is located in Columbia County, Washington, and is administered by the Pomeroy Ranger District (Pomeroy, Washington), Umatilla National Forest. Unfenced, topographic boundaries give it an irregular shape (fig. RC-1). It occupies portions of sections 14, 22, 23, and 26, T. 7 N., R. 40 E., Willamette meridian. It lies at 47°15' N.latitude and 117°50' W. longitude.

ACCESS AND ACCOMMODATIONS

Access is rather difficult because the nearest road terminates approximately 3 km. (2 miles) from the tract at Godman Guard Station. Trail No. 3138 leads from Godman Guard Station to the edge of the natural area descending 480 m. (1,600 ft.) in elevation. Specific directions can be obtained from the Pomeroy District Ranger. Motorized vehicular traffic is prohibited on the trail by the Regional Forester because the Rainbow Research Natural Area lies entirely within the designated Wanaha Back-Country Area. Public accommodations are available in Dayton, Washington, about 40 km. (25 miles) northwest. Primitive camps are located along the Skyline Road, and there is a developed campground at Godman Guard Station.

ENVIRONMENT

The Rainbow Creek Research Natural Area varies from 1,100 m. (3,600 ft.) to a maximum of 1,440 m. (4,700 ft.) in elevation at the summit of Sugarloaf Butte. The topography varies from rolling to steep on the slopes of the butte and all aspects are present (figs. RC-1 and RC-2).

The natural area is on an uplifted portion of Columbia basalt flows with some volcanic ash deposits in the forested areas. Sugarloaf Butte represents a residual island in this deeply eroded and dissected area.

A modified continental climate prevails with cool, moist, partly cloudy winters and warm, dry, cloudless summers. Precipitation is moderate and seasonal, usually occurring as snow. The nearest climatic station (Dayton, Washington) is 32 km. (20 miles) northwest of the tract on the Columbia Basin plateau and outside of the topographically modified climate; data from this station are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	10.5°C.	(50.9°F.)
Mean January temperature	−0.2°C.	(31.6°F.)
Mean July temperature	21.5°C.	(70.7°F.)
Mean January minimum temperature	−4.3°C.	(24.3°F.)
Mean July maximum temperature	30.6°C.	(87.2°F.)
Average annual precipitation	495 mm.	(19.5 in.)
June through August precipitation	58 mm.	(2.3 in.)
Average annual snowfall	58 cm.	(23.0 in.)

[1] Description prepared by Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

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The variability of the soils is reflected in the vegetational diversity (fig. RC-2). Basaltic colluvial soils are common under moderately dense to dense forest cover. These soils are commonly covered with a layer of aerially deposited volcanic ash and appear to fall in the Umatilla and shallow, stony Umatilla categories (Washington State Agricultural Experiment Station 1954). They may be broadly classed as Gray Wooded. Shrub and grassland soils tend to be shallow, stony Lithosols with little to moderate profile development. These soils are located on upper portions of the butte, on ridge tops, and on steeper, colluvial areas.

BIOTA

Estimated areas by cover type are:

Name	*Area*
Grand fir-western white pine	57 ha. (140 acres)
Douglas-fir-ponderosa pine	93 ha. (230 acres)
Western larch	16 ha. (40 acres)
Grass and shrubs	4 ha. (10 acres)

The primary forest types of interest are the grand fir *(Abies grandis)* and western white pine *(Pinus monticola)* stands which are probably assignable to SAF forest cover type 213, Grand Fir-Larch-Douglas-Fir (Society of American Foresters 1954), and Kuchler's (1964) Type 14, Grand Fir-Douglas Fir Forest. The Douglas-fir *(Pseudotsuga menziesii)* and ponderosa pine *(Pinus ponderosa)* forests form an intricate inter-grading mosaic and probably best fit SAF type 214, Ponderosa Pine-Larch-Douglas-Fir, or Kuchler's Type 11, Western Ponderosa Forest, and Type 12, Douglas Fir Forest. The western larch *(Larix occidentalis)* stand is assignable to SAF type 212, Larch-Douglas-Fir, and is what Kuchler considers seral to his Type 14, Grand Fir-Douglas Fir Forest. Grasslands are dominated by wheatgrasses *(Agropyron* spp.) and fall in Kuchler's Type 51, Wheatgrass-Bluegrass. The entire area lies within the *Abies grandis* Zone of the Blue Mountains (Franklin and Dyrness 1969).

The grand fir-western white pine type (fig. RC-2) occurs at lower elevations, in the draws, and on the north slopes of Sugarloaf Butte. Western white pine varies from a minor component to a co-dominant in the stands (fig. RC-2), constituting 20 to 40 percent of the total basal area (trees over 15-cm. or 6-in. d.b.h.). Grand fir comprises 40 to 60 percent of the basal area and Douglas-fir and western larch account for the rest. Ground vegetation is dominated by *Vaccinium membranacium,* along with Pacific yew *(Taxus brevifolia),* thinleaf alder *(Alnus tenuifolia.), Rosa* spp., and 10 to 15 species of forbs and grasses. Tree reproduction is composed almost entirely of grand fir; western white pine reproduction is nearly absent.

The Douglas-fir-ponderosa pine forests occur primarily on the south and west slopes of Sugarloaf (fig. RC-1) where they are associated with small areas of grass and shrub communities. The stand of pole-sized western larch (fig. RC-2) occurs on a northwest slope and represents natural forest succession following catastrophic fire.

Rocky Mountain elk *(Cervus canadensis)* use the area extensively as summer range. The animals usually migrate down Butte Creek to winter along the Wanaha River. Grass utilization by elk appears to be causing some change in the grassland communities and may be influencing reproduction of Pacific yew within the forest stand. Other mammals believed to utilize the tract as residents or transients are listed in table RC-l.

HISTORY OF DISTURBANCE

Occasional fire-blackened snags and the western larch stand indicate some history of catastrophic fires.

Domestic livestock, primarily sheep, grazed the tract to some extent between 1890 and about 1945 when they were removed. In the past 20 to 30 years, elk numbers have increased significantly and presently may be altering some aspects of the non-forested plant communities.

Recreation use is rather high and increasing. Grazing from pack and saddle stock might have some influence on bottom land communities along the watercourses but should not influence the forest or upper grassland communities.

RESEARC H

No research is known on the area. The natural area provides interesting opportunities to study: (1) effect of slope aspect on vegetation; (2) soil-vegetation relationships and factors responsible for the mosaic pattern of forest and non-forest communities; (3) natural successional relationships of both western white pine and western larch; and (4) biomass production as affected by soils and topography under a single macroclimate.

MAPS AND AERIAL PHOTOGRAPHS

No special topographic or geologic maps are available for the natural area which are sufficiently detailed to be useful. Either the District Ranger (Pomeroy Ranger District) or Forest Supervisor (Umatilla National Forest, Pendleton, Oregon) can provide details on the most recent aerial photo coverage of the area.

LITERATURE CITED

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW -80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

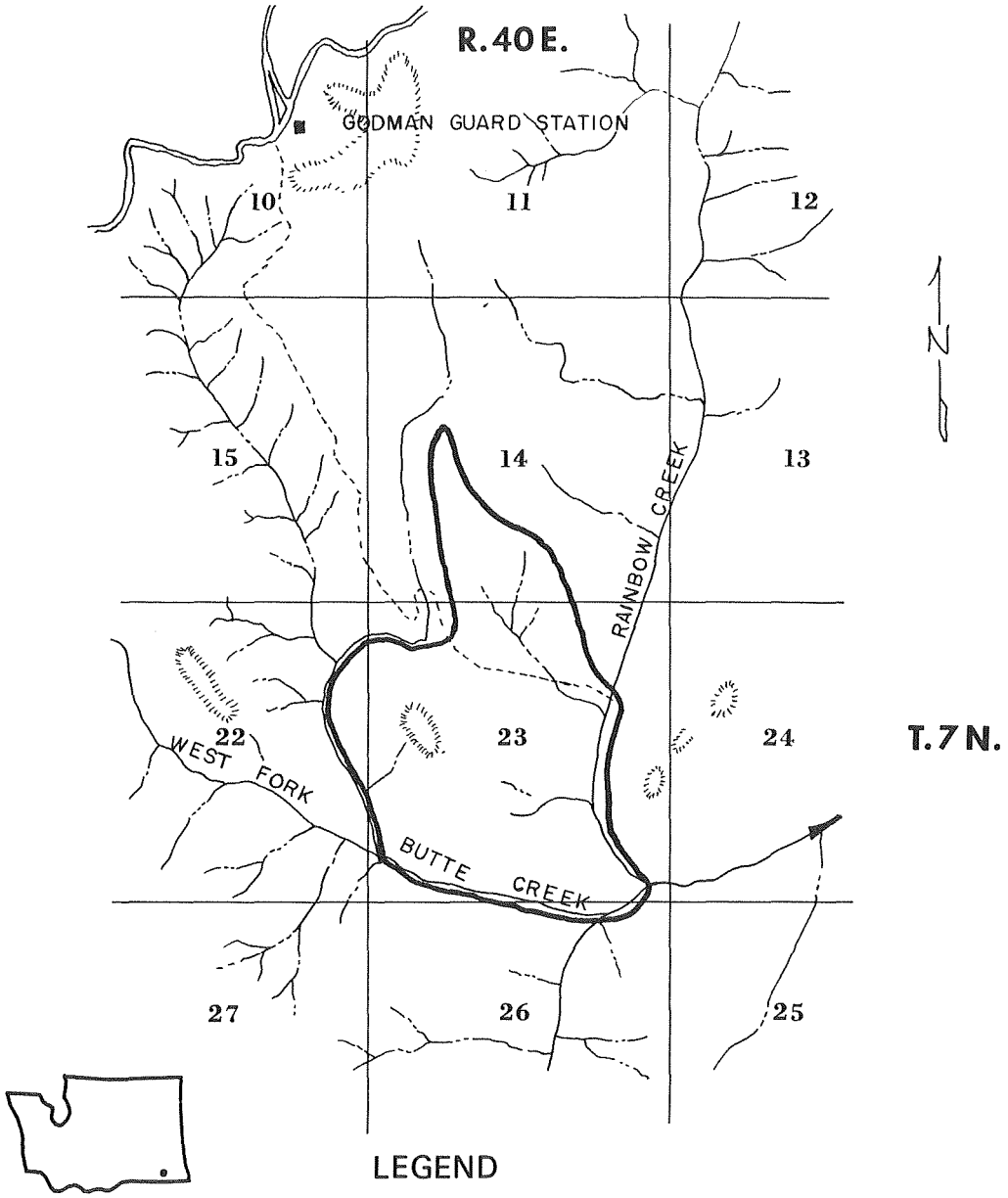
Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States--supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Washington State Agricultural Experiment Station
1954. Soils of Washington and their related physiography. Columbia County Section. Wash. Agric. Exp. Stn. Circ. 282, 6 p., illus.

Table RC-1. — Tentative list of mammals for Rainbow Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Scapanus orarius*	coast mole
	Sorex palustris	northern water shrew
	Sorex preblei	Preble shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis subulatus	small-footed myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Sylvilagus nuttalli	mountain cottontail
Rodentia	*Castor canadensis*	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus montanus	mountain vole
	Microtus richardsoni	Richardson vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Spermophilus columbianus	Columbian ground squirrel
	Spermophilus lateralis	mantled ground squirrel
	Tamiasciurus hudsonicus	red squirrel
	Thomomys talpoides	northern pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx rufus	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer



LEGEND

BOUNDARY, RAINBOW CREEK RESEARCH NATURAL AREA

SECTION LINE

ROADS

STREAM

BUILDING

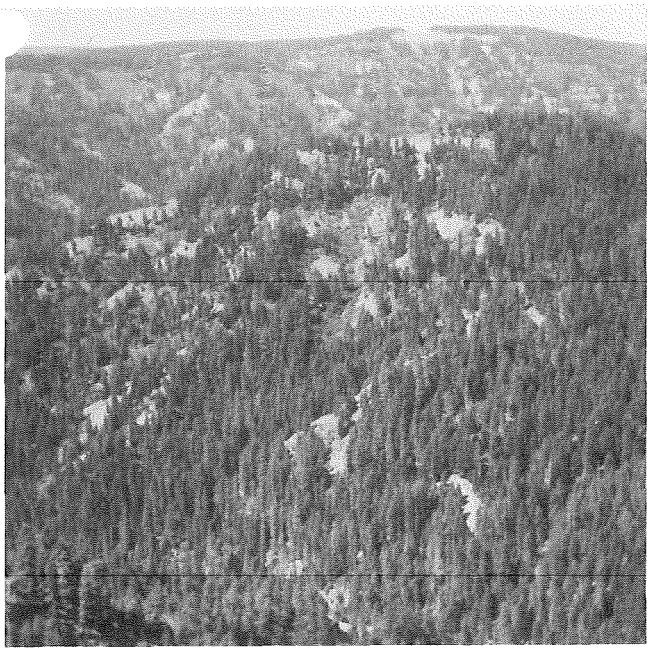
TRAIL

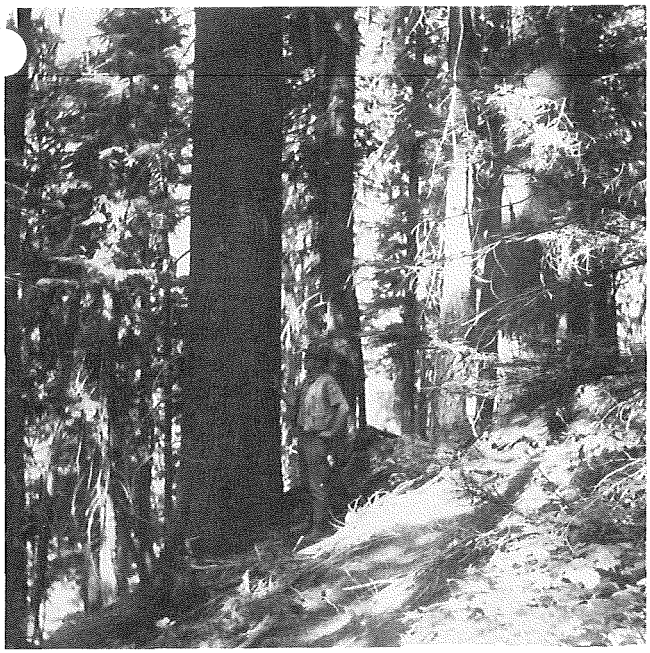
0 1/4 1/2 1 Mi.

0 1/4 1/2 1 Km.

Figure RC-1.– Rainbow Creek Research Natural Area, Columbia County, Washington.

Figure RC-2.-Natural features of the Rainbow Creek Research Natural Area. Upper left: Aerial view of Sugarloaf Butte showing the southerly slope which has western white pine in the draws and on the lower slope (the two bottom photographs were taken in this area). Upper right: Aerial view of the northwest slope showing the stand of western larch and some bunchgrass openings. Lower left: Stand of grand fir and western white pine with some Douglas-fir on lower slope position; Pacific yew, *Vaccinium membranaceum, Rosa* spp., and forbs dominate the understory. Lower right: One of the largest western white pines; note clumped branches on the Pacific yew behind the pine caused by heavy browsing of elk in winter.





Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

RATTLESNAKE HILLS RESEARCH NATURAL AREA[1] [2]

Shrub-steppe vegetation (e.g., big sagebrush communities) in the arid interior of southeastern Washington.

The Rattlesnake Hills Research Natural Area was established to provide examples of the shrub-steppe communities characteristic of the most arid portions of the Pacific Northwest. It is an island of natural vegetation surrounded by expanses of cultivated fields under dryland or irrigated management regimes. The 33,350-ha. (75,000-acre) tract is located within the boundaries of the U.S. Atomic Energy Commission's Hanford Works Reservation in Benton County, Washington. Research on the tract is managed for the Atomic Energy Commission by the Battelle Memorial Institute, Pacific Northwest Laboratories, Richland, Washington. The eastern boundary of the natural area is formed by State Highway 240, while the western boundary follows the natural skyline of the Rattlesnake Hills (fig. RH-1). It is located at 46°30' N. latitude and 119°40' W. longitude.

ACCESS AND ACCOMMODATIONS

The natural area is most easily reached via State Highway 240 from Richland which is 24 km. (15 miles) to the south and east. There are numerous access roads which enter and traverse parts of the tract; these are marked but are blocked by locked gates. Vehicular traffic is restricted to existing roads; off-road travel by vehicles is prohibited. Several roads are paved; to provide all-weather access to most of the natural area, some of the most troublesome unimproved routes have been stabilized with river gravel and crushed rock.

It is necessary to obtain permission to enter the tract from the Pacific Northwest Laboratories' Arid Lands Ecology Project and the Atomic Energy Commission's Richland Operations Office. Inquiries for permission to use the reserve should be directed to Dr. Burton E. Vaughn, Manager, Ecosystems Department, Battelle-Northwest, Richland, Washington 99352. There are no restrictions on photography within the natural area, but firearms are not allowed unless needed to perform research.

There are no living accommodations on the natural area, but numerous facilities are available in the nearby cities of Richland, Pasco, Kennewick, and Benton City.

ENVIRONMENT

The Rattlesnake Hills Research Natural Area occupies the northeasterly facing slopes of the Rattlesnake Hills, the southern extremity of Yakima Ridge, and intervening gentle slopes and valleys. Elevations range from 150 m. (500 ft.) on the valley floor to 1,060 m. (3,500 ft.) along the crest of the Rattlesnake Hills. The tract is underlain by layers of Columbia River basalt of Miocene age but these are covered by eolian and alluvial materials of variable thickness (Huntting et al. 1961).

The climate of the natural area can be characterized as arid with hot summers and cold winters. Most of the annual precipitation occurs during the late fall and winter, with snow a regular occurrence during winter months. The climate has been observed for over 20 years at a meteorological station

[1] Description prepared by Dr. W. H. Rickard, Battelle Memorial Institute, Pacific Northwest Laboratories, Richland, Washington.

[2] Also known as the Arid Lands Ecology Reserve.

This file was created by scanning the printed publication. Text errors identified by the software have been corrected; however, some errors may remain.

located a few miles east of the natural area (latitude 46°34' N., longitude 119°35' W., elevation 224 m. or 733 ft.). Data collected at this station are available as monthly summaries and include daily values for air temperature, precipitation, wind speed and direction, relative humidity, and solar radiation. Some average values are as follows:

Mean annual temperature	11.7°C. (53.1°F.)
Mean January temperature	−1.3°C. (29.6°F.)
Mean July temperature	20.4°C. (68.8°F.)
Mean January minimum temperature	−10.2°C. (13.7°F.)
Mean July maximum temperature	33.3°C. (91.7°F.)
Average annual precipitation	171.2 mm. (6.74 in.)
Average annual snowfall	32.0 cm. (12.6 in.)

Although the meteorological station yields relevant data, it is not representative of the climate of the entire natural area. A series of 25 stations have been located throughout the tract and since 1969 have provided data on precipitation and maximum and minimum air temperature (Hinds and Thorp 1959). These data are also available as monthly summaries. An automated microclimatological station has recently been established at 366-m. (1,200-ft.) elevation within the Grassland Biome study area.

Soils within the natural area have been mapped (Hajek 1966). Based on acreage, the Warden and Ritzville silt loams occupy most of the land area; they are found on the lower and middle slopes of the Rattlesnake Hills. Steep slopes, ridge crests, draw bottoms, and alluvial fans are mapped as Lickskillet, Kiona, and Scooteney silt loams. The basal plains are mapped as Esquatzel silt loam, Ephrata stony loam, Burbank sandy loam, and Hezel and Koehler sand. These series are classified by great soil group and according to the 7th Approximation in table RH-l.

The **Ritzville silt loam** series consist of dark colored soils midway up the slopes of the Rattlesnake Hills. They have developed under *Artemisia* and bunchgrasses from windlaid deposits which usually include small amounts of volcanic ash. The surface 2 dm. are usually a very dark grayish brown (10 YR 4/2) soil. Ritzville soils are usually more than 15 dm. deep, but bedrock may be encountered within as little as 6 dm. of the surface. The **Warden silt loam** series occur on the lower slopes of the Rattlesnake Hills and adjoin Ritzville soils at elevations near 360 m. (1,200 ft.). The surface 2 dm. are dark grayish brown in color (10 YR 4/2). The subsoil is strongly calcareous at about 5 dm. The soil is usually more than 15 dm. deep. **Kiona silt loams** are associated with Ritzville and Warden soils and occupy steep slopes and ridges. The surface soil is very dark grayish brown (10 YR 3/2) and about 1-dm. thick. The dark brown (10 YR 4/3) subsoil contains large basalt fragments 4 dm. and larger in diameter. **Lickskillet silt loams** occupy ridge tops above 765-m. (2,500 ft.) elevation in the Rattlesnake Hills. These soils are shallow over basalt bedrock with fragments of basalt present throughout the soil profile. This series is similar to the Kiona series except that the surface soils are darker (very dark brown, 10 YR 2/2). **Esquatzel silt loams** are formed in recent alluvium. The color and texture of the subsoil vary with the stratified nature of the alluvial deposits. Esquatzel soils are associated with Ritzville and Warden soils and often seem to have developed from sediments eroded from these two series. **Scooteney stony silt loams** are found on the northerly-facing slopes of the Rattlesnake Hills and are usually confined to the bottoms of narrow draws and fan-shaped areas where draws empty out onto the adjoining plain. These soils are often severely eroded with numerous outcrops of basalt. The surface soil is usually dark grayish (10 YR 4/2). **Ephrata sandy loams** are associated with the Burbank soils. The surface soil is very dark grayish brown (10 YR 3/2), and the subsoil is dark grayish brown (10 YR 4/2). The medium textured surface soil is underlain by gravelly materials many meters in depth. **Burbank loamy sands** are coarse-textured soils underlain by gravel. The surface soil averages about 4-dm. thick but can have thicknesses of up to 7 dm. The gravel content of the subsoil may range from 20 to 80 percent by volume. The surface soil is a very dark grayish brown (10 YR 3/2), and the subsoil is dark grayish brown (10 YR

4/2). **Hezel sands** have developed under *Artemisia* and *Grayia* in coarse sandy alluvial deposits. Relief characteristically consists of hummocky terraces and dune-like ridges. The surface soil, which is approximately 9 dm. deep, is very dark brown (10 YR 3/3) and was probably formed in wind-blown sand which mantled finer textured lacustrine sediments. The subsoil is a dark grayish brown (10 YR 4/2), sandy loam. **Koehler sands** are similar to other sandy soils but differ in that the sand mantles a lime and silica cemented "hardpan" layer. The surface soil is very dark grayish brown (10 YR 3/2) and the calcareous subsoil (10 YR 4/2) is encountered at about 5 dm.

Chemical characterizations of soils and pond sediments have been published (Wildung and Hajek 1969, Wildung, Hajek, and Price 1968). Selected data for the Ritzville and Warden series are provided in table RH-2.

BIOTA

Vegetation. - The Rattlesnake Hills Research Natural Area was selected as a natural area primarily because of the presence of undisturbed stands of several typical shrub steppe communities, although the vegetation mosaic also includes some disturbed plant communities. Of particular interest are the stands representative of the *Artemisia tridentata/ Agropyron spicatum, Artemisia tridentata/Poa secunda,* and *Eriogonum thymoides/Poa secunda* Associations described by Daubenmire (1970). However, some rare but ecologically significant associations are also present such as the *Eurotia lanata/ Poa secunda* type (Daubenmire 1970). Undisturbed or even lightly disturbed examples of the various shrub steppe communities found in the natural area are extremely difficult to find elsewhere. Some of the communities included within the tract can be related to Kuchler's (1964) Types 55, Sagebrush Steppe *(Artemisia- Agropyron),* 40, Saltbush - Greasewood *(Atriplex-Sarcobatus),* and possibly 51, Wheatgrass-Bluegrass *(Agropyron-Festuca).* The natural area is located entirely within the *Artemisia tridentata/Agropyron spicatum* Zone, the most arid vegetative zone found in eastern Washington (Daubenmire 1970).

The *Artemisia tridentata/Agropyron. spicatum* Association (fig. RH-2) occurs at elevations generally above 300 m. (1,000 ft.), and the *Artemisia tridentata/Poa secunda* Association occurs below this elevation on gentle slopes and on the plain. Both kinds of vegetation are subject to fire damage. When fire burns through a stand of the *Artemisia/Agropyron* or *Artemisia/Poa* Associations, the shrubs are effectively killed but the understory grasses survive. There are a number of stands dominated exclusively by bunch grasses which have been created in this way; shrubs gradually re-invade these areas. Under grazing stress, the perennial grasses are weakened, and invasion by alien winter annuals, especially cheatgrass brome *(Bromus tectorum)* is prevalent (fig. RH-2).

The *Artemisia tridentata/Agropyron spicatum* Association is dominated by big sagebrush *(Artemisia tridentata)* and bluebunch wheatgrass *(Agropyron spicatum.).* Hopsage *(Grayia spinosa)* is sometimes present in the shrub layer along with the low shrubs *Erigeron filifolius* and *Phlox longifolia.* Big sagebrush coverage varies from 5 to 26 percent in this association (Daubenmire 1970). Bluebunch wheatgrass is the major perennial grass with a typical coverage value of around 50 percent. Sandberg bluegrass *(Poa secunda)* is always present with around 30-percent cover. Small amounts of *Stipa comata* and *Poa cusickii* are also typical. Annuals usually present include cheatgrass brome, *Festuca octoflora, F. pacifica, Descurainia filipes,* and *Draba Verna.*

The *Artemisia tridentata/Poa secunda* Association lacks any large grasses and has a higher density of big sagebrush (Daubenmire 1970). Big sagebrush coverage is typically around 35 percent. The only significant perennial grass is Sandberg bluegrass. Very minor amounts of several annuals, such as cheatgrass brome, *Descurainia,* and *Draba,* are present. Stands typical of this association typically have only half the indigenous taxa (five to ten on forty 20-cm. by 50-cm. plots) that stands typifying the *Artemisia/Agropy-*

ron Association have (15 to 20 indigenes) (Daubenmire 1970).

Along the ridge crests that form the main mass of the Rattlesnake Hills, basalt outcrops support vegetation characteristic of the *Eriogonum thymoides/Poa secunda* Association (fig. RH-2). Here low growing plants of *Eriogonum thymoides, Phlox hoodii, Haplopappus stenophyllus,* and *Balsamorhiza rosea* and Sandberg bluegrass grow widely spaced as clumps rooted in the rock crevices. Figure RH-2 includes a close-up photograph of *Lewisia rediviva,* one of the plants found in these lithosolic habitats. At the crest of the Rattlesnake Hills snow accumulates in deep drifts on the eastern slopes as it is transported by strong westerly winds. The melting snow provides soil moisture which is exploited by plants not found elsewhere on the reserve. Especially conspicuous are *Lupinus* spp. (fig. RH-2) and a perennial bunchgrass, Idaho fescue *(Festuca idahoensis).*

Permanent springs are scarce on the reserve. Two of the most copious are located at Rattlesnake Springs and in Snively Gulch. The extent of the riparian vegetation in Snively Gulch is illustrated in fig. RH-2. The important species are black cottonwood *(Populus trichocarpa), Salix exigua,* as well as other *Salix* species, *Prunus americana, Rhus glabra,* and *Philadelphus lewisii.* Although riparian communities occupy only a few acres, they are an extremely important nesting habitat for birds. The springs also provide drinking water for numerous birds and mammals and support an aquatic fauna.

Although big sagebrush and, sometimes, hopsage are the common shrub dominants over most of the natural area, there are several thousand acres on the lower slopes of the Rattlesnake Hills occupied by winterfat-*(Eurotia lanata)* dominated communities (fig. RH-2). The factors that tend to keep sagebrush from growing on these sites are not known. There are also about 40 ha. (100 acres) of land near Rattlesnake Springs which support greasewood *(Sarcobatus vermiculatus).* Greasewood is confined to the area where an alkaline-saline soil combines with a perched water table to provide suitable habitat.

In the past, plant ecology research on the Rattlesnake Hills Research Natural Area has centered around the mineral and water relationships of halophytes (Rickard and Cline 1965, Rickard 1965a, Rickard 1965b, Rickard 1967b, and Rickard and Keough 1968), the influence of microclimate on the growth of winter annuals (Hinds and Rickard 1968, Rickard, Hinds, and Gilbert 1971) and the composition of the plant communities (Dauben mire 1970). Radionuclides have proved useful in obtaining data on the root distribution of big sagebrush (Price 1965).

Current studies in plant ecology are concerned with measuring primary production of winter annuals on abandoned cultivated fields at different elevations in relation to climatic and edaphic variables, especially soil moisture, temperature, and nitrogen. Estimates of aboveground productivity have been made over the past several years. The results of harvests of two old fields at different elevations of the natural area at the time of peak yield in 1971 are shown below; results are expressed as grams of ovendry material per square meter of ground ± the standard error of the mean for total material:

Taxa	Elevation	
	300 m. (1,000 ft.)	515 m. (1,700 ft.)
Bromus tectorum	198	233
Poa secunda	1	0
Sisymbrium altissimum	10	6
Amsinckia lycopsoides	2	0
Descurainia pinnata	0	1
Tragopogon dubius	0	14
Microseris laciniata	0	2
Holosteum umbellatum	0	7
Total live material	211 ± 11	263 ± 38

The dominant plant on both fields is clearly cheatgrass - 94 and 88 percent of the total production on the low elevation and high elevation fields, respectively. After 28 years of abandonment, native plants still have made little progress in colonizing these old field habitats. Old fields also appear more productive than pristine stands of vegetation; for example, total live material produced aboveground in a stand of the *Artemisia tridentata-Agropyron spicatum* Association

has been measured at less than 100 g/m^2.

Fauna. - The game animals characteristic of the natural area are the mule deer *(Odocoileus hemionus),* cottontail rabbit *(Sylvilagus nuttallii),* chukar *(Alectoris gracea),* ring-necked pheasant *(Phasianus colchicus),* sage grouse *(Centrocercus urophasianus),* California quail *(Lophortyx californicus),* and mourning dove *(Zenaidura macroura).* Only the chukar and dove exist in populations of sufficient size to support even limited hunting pressure.

The fur-bearing animals are the coyote *(Canis latrans),* badger *(Taxidea taxus),* and bobcat *(Lynx rufus).* The population levels of these animals are unknown but badgers are probably more scarce than coyotes; the bobcat is rarely seen on the natural area.

The most abundant small mammal in the reserve is the Great Basin pocket mouse *(Perognathus parvus)* (fig. RH-2). This mammal has been intensively studied by Dr. T. P. O'Farrell by mark-recapture technique in several vegetation types on the natural area. A study of the distribution of small mammals in relation to the elevational gradient in the Rattlesnake Hills has been carried out by Kritzman (1970). Other small mammals that occur on the project are deer mouse *(Peromyscus maniculatus),* northern grasshopper mouse *(Onychomys leucogaster),* western harvest mouse *(Reithrodontomys megalotis),* Townsend ground squirrel *(Citellus townsendii),* vagrant shrew *(Sorex vagrans),* sage-brush vole *(Lagurus curtatus),* and northern pocket gopher *(Thomonys talpoides).* Blacktail jackrabbits *(Lepus californicus)* occur on the natural area but mostly at low elevations, and the least chipmunk *(Eutamias minimus)* occurs only at high elevations.

The most abundant breeding birds in steppe vegetation at low elevations are the horned lark *(Eremophila alpestris)* and western meadowlark *(Sturnella neglecta).* There are fewer individuals of the sage sparrow *(Amphispiza belli),* sage thrasher *(Oreoscoptes montanus),* and loggerhead shrike *(Lanius ludovicianus).* At higher elevations the vesper sparrow *(Pooecetes gramineus)* and Brewer's sparrow *(Spizella breweri)* are important breeding birds. Many birds are migrants and utilize the reserve for resting and feeding stops. This is particularly true of the white crowned sparrow *(Zonotrichia leucophrys),* warblers *(Parulidae),* and vireos *(Vireo* spp.).

The riparian tree-shrub communities provide breeding sites for the black-billed magpie *(Pica pica),* western and eastern kingbird *(Tyrannus verticalis* and *T. tyranus),* lazuli bunting *(Passerina amoena),* red-shafted flicker *(Colaptus cafer),* and starling *(Sturnus vulgaris).* Killdeer *(Charadrois Vociferus)* and long-billed curlew *(Numenius americanus)* nests have been found in the vicinity of Rattlesnake Springs. A survey of bird populations in riparian plant communities in winter has been reported for the Yakima River flood plain near Richland (Rickard 1964).

Birds of prey nest on the natural area, especially the sparrow hawk *(Falco sparverius),* Swainson's hawk *(Buteo swainsoni),* great horned owl *(Bubo virginianus),* marsh hawk *(Circus cyaneus),* and burrowing owl *(Speotyto cunicularia).* The golden eagle *(Aquila chrysaetos)* is a frequent winter visitor.

Little is known about the dynamics of the populations of reptiles on the natural area. Some information is available concerning the altitudinal distribution of the side-blotched lizard *(Uta stansburiana)* (Rickard 1968) as well as the time of onset of winter dormancy (Rickard 1967). Other reptiles observed on the natural area are the Pacific rattlesnake *(Crotalus viridis),* gopher snake *(Pituophi8 melanoleucus),* yellow-bellied racer *(Coluber constrictor),* and the short-horned lizard *(Phrynosoma douglassi).*

The invertebrate fauna of the natural area have received little attention. A taxonomic survey of foliage dwelling insects has been under way for several years by Dr. Wyatt Cone of Washington State University. To date several hundred species of insects have been identified and related to various plant species on the tract. The ground-dwelling beetles have been investigated to some extent (Hakonson and Rickard 1969, Rickard and Haverfield 1965, Rickard 1968, Rickard 1970a, Rickard 1970b, and Rickard 1971), The autumn emergent darkling beetles *(Steno-*

morpha and *Pelecyphorus)* are especially abundant and these insects provide a substantial part of the coyote diet during the few weeks the beetles are active on the soil surface. During one especially favorable season, autumn emergent beetles were estimated to provide 20 kg. of live biomass per hectare.

HISTORY OF DISTURBANCE

The grazing history of the natural area prior to 1943 is not documented. However, local ranchers recall sheep and cattle grazing in the Rattlesnake Hills prior to that time. No grazing has been allowed since 1943, and the area is now fenced in its entirety to exclude wandering livestock. The condition of the various plant communities and abundance of several highly palatable forage plants such as winterfat *(Eurotia)* and hopsage *(Grayia)* suggest that whatever grazing took place has probably been a minor disturbing influence. Water was probably a seriously limiting factor in utilization of the tract by domestic stock.

Some portions of the natural area were also farmed prior to Federal acquisition of the tract in 1943. The communities on these abandoned fields are undergoing natural succession and are being utilized in comparative studies with the natural vegetation.

Most recent human disturbance has resulted from off-road military vehicle use during war games in 1965. These left numerous track scars on part of the landscape. Under present management, human disturbance is minimal and existing roadways are improved in lieu of new road construction.

Fire has been and continues to be an important natural disturbance. An extensive wildfire occurred in the summer of 1957 and was mostly confined to the *Artemisia/Agropyron* association at elevations above 300 m. (1,000 ft.).

RESEARCH

Field research on the Rattlesnake Hills Research Natural Area has been very actively pursued since 1965. Biological scientists and technicians of the Battelle Laboratories and students and faculty from the University of Washington, Washington State University, Oregon State University, and University of Idaho are utilizing the tract. Sixteen hectares (40 acres) of the natural area are presently designated and under study as the ALE (Arid Lands Ecology) coordinating site in the International Biological Program's Grassland Biome project.

Much of the ongoing research has been cited earlier in this description of the natural area; included is research in climatology and micrometeorology, plant ecology (both autecology and synecology), animal ecology, hydrology, and soil science. Some specific studies involve: productivity and mineral relationships of plants in abandoned cultivated fields and in pristine plant communities; studies of small mammal populations under various plant community manipulations, such as treatment with selected herbicides and addition of moisture using controlled sprinkler irrigation; and hydrologic and mineral nutrient relationships in a phreatophyte community.

Research facilities are concentrated at three laboratory sites on the natural area. These are: a small 20- by 40-foot metal building located at Rattlesnake Springs; a building complex located at the 360-m. (1,200ft.) level at the southern end of the reserve; and another building complex located at the crest of the Rattlesnake Hills, also near the southern edge of the reserve. The first two facilities are primarily utilized in biological research, and the last named is an astronomical facility.

MAPS AND AERIAL PHOTOGRAPHS

U.S. Geological Survey topographic maps are available for the entire natural area; scientists should consult the U.S. Geological Survey's index to topographic maps in Washington to determine the quadrangle(s) of specific interest to them. The geology of the area is included on the *Geologic Map of*

Washington, scale 1: 500,000 (Huntting et al. 1961). The Manager of the Ecosystems Department at Battelle-Northwest (Richland, Washington 99352) can provide details on availability of aerial photographs and other special maps.

LITERATURE CITED

Daubenmire, R.
1970. Steppe vegetation of Washington. Wash. State Agric. Exp. Stn. Tech. Bull. 62, 131 p., illus.

Hajek, B. F.
1966. Soil survey of the Hanford project in Benton County , Washington. At. Energy Comm. Res. & Dev. Rep. BNWL-243, 17 p.

Hajek, Benjamin F., and Raymond E. Wildung
1969. Chemical characterization of pond sediments. Northwest Sci. 43: 130134.

Hakonson, T. E., and W. H. Rickard
1969. Radionuclide deposition and elimination in a darkling beetle. Northwest Sci. 43: 23-28, illus.

Hinds, W. T., and W. H. Rickard
1968. Soil temperatures near a desert steppe shrub. Northwest Sci. 42: 5-13, illus.

_____ andJ. M. Thorp
1969. Biotic and abiotic characteristics of the microclimatological network on the arid lands ecology reserve. At. Energy Comm. Rep. BNWL-SA2733, 57 p.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kritzman, E. G.
1970. Niche fit and overlap of *Peromyscus maniculatus* and *Perognathus parvus* in eastern Washington. 86 p. (M.S. thesis, on file at Univ . Wash., Seattle.)

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Price, K. R.
1965. A field method for studying root systems. Health Phys. 11: 15211525.

Rickard, W. H.
1964. Bird surveys in cottonwood-willow communities in winter. Murrelet 45: 22-25.

1965a. Sodium and potassium accumulation by greasewood and hopsage leaves. Bot. Gaz. 126: 116-119.

1965b. The influence of greasewood on soil moisture penetration and soil chemistry. Northwest Sci. 39: 36-42, illus.

1967a. Onset of winter dormancy in lizards and beetles. Northwest Sci. 41: 92-95, illus.

1967b. Seasonal soil moisture patterns in adjacent greasewood and sagebrush stands. Ecology 48: 1034-1038, illus.

1968. Field observations on the altitudinal distribution of the side-blotched lizard. Northwest Sci. 42: 161-164.

1970a. Ground-dwelling beetles on burned and unburned vegetation. J. Range Manage. 23: 293-294, illus.

1970b. The distribution of ground dwelling beetles in relation to vegetation, season, and topography in the Rattlesnake Hills, southeastern Washington. Northwest Sci. 44: 107-113, illus.

1971. Observations on the altitudinal distribution of *Eleodes hispilabris* Say. (Coleoptera: Tenebrionidae) in relation to elevation and temperatures in the Rattlesnake Hills, Am. Midland N at. 85: 521-526, illus.

_____and J. F. Cline

1965. Mineral transfer in a greasewood community and ion uptake by grasses. Health Phys. 11: 1371-1374,

_____ and L. E. Haverfield

1965. A pitfall trapping survey of darkling beetles in desert steppe vegetation. Ecology 46: 873-875.

_____ W. T, Hinds, and R. O. Gilbert

1971. Environmental and biologic observations on contrasting slopes of small earth mounds. Northwest Sci. 45: 7-18, illus.

_____and R. F. Keough

1968. Soil-plant relationships of two steppe desert shrubs. Plant & Soil 29: 205-212.

Wildung, R. E., B. F. Hajek, and K. R. Price

1968. Chemical characterization of the arid soil organic fraction, Comparative chemical properties of plant lignins. At. Energy Comm. Rep. BNWL-982.

Table RH-1. — Classification of the various soil series found within the Rattlesnake Hills Research Natural Area according to the old and new systems of soil classification

Soil series	*Genetic classification*	*7th Approximation*
Ritzville silt loam	Brown Integrade to Regosol	Andic Aridic Haplustoll
Warden silt loam	Sierozem Integrade to Regesol	Andic Mollic Camborthid
Kiona silt loam	Sierozem Integrade to Regesol	Andic Mollic Camborthid
Lickskillet silt loam	Lithosol	Lithic Haplustoll
Scooteney stony silt loam	Sierozem Integrade to Regosol	Andic Mollic Camborthid
Ephrata stony loam	Sierozem Integrade to Regosol	Mollandeptic Camborthid
Burbank loamy sand	Regosol	Typic Torripsamment
Hezel sand	Regosol	Typic Torrifluvent
Koehler sand	Regosol	Mollic Durothid

Table RH-2. — Selected chemical properties of the Warden (Wa) and Ritzville (Ri) soil series within the Rattlesnake Hills Research Natural Area

Sample depth	pH		Organic matter		Calcium		Potassium		Total exchangeable bases	
(decimeters)	Wa	Ri	Wa	Ri	Wa	Ri	Wa	Ri	Wa	Ri
			Percent		..... Pounds per acre				me./100 g.	
0 - 1	7.1	6.9	1.3	1.4	3,100	2,200	1,210	1,300	12.3	11.0
1 - 2	7.3	7.1	.6	.9	2,700	2,500	780	1,190	11.4	12.5
2 - 3	7.3	7.3	.5	1.0	3,200	2,600	410	1,100	12.1	13.0
3 - 4	7.2	7.3	.5	.7	3,200	2,400	300	980	12.2	13.0
5 - 6	7.4	7.4	.5	.9	3,400	3,100	160	800	12.8	13.4
7 - 8	7.3	7.5	.3	.7	3,100	3,200	120	700	11.7	13.4
9 - 10	7.5	7.7	.3	.5	3,400	2,700	160	540	12.8	12.5

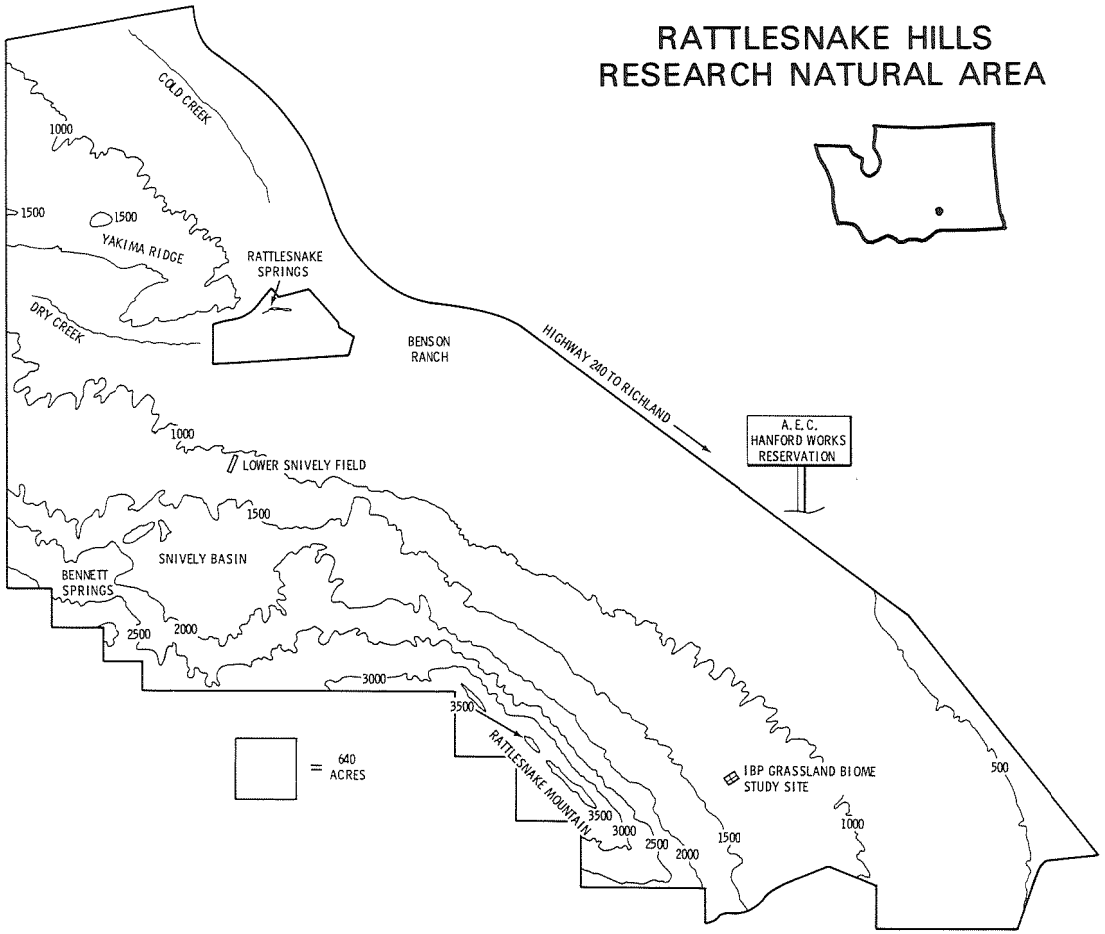
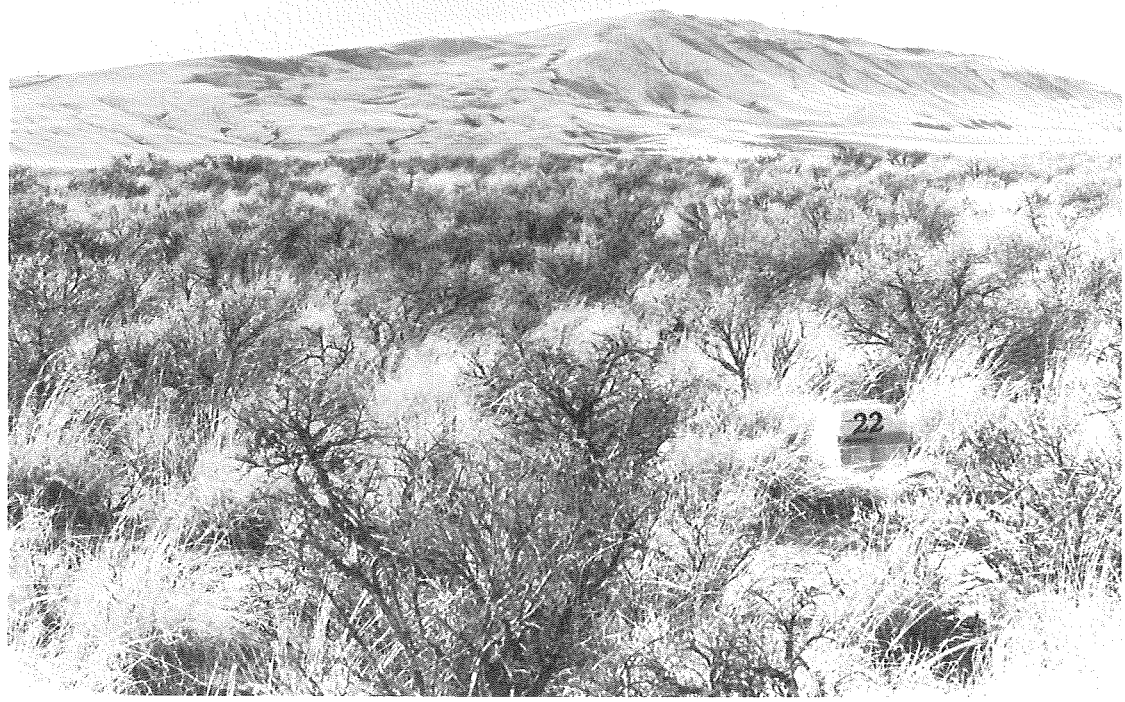


Figure RH-1.– Rattlesnake Hills Research Natural Area, Benton County, Washington.

Figure RH-2.-Natural features of Rattlesnake Hills Research Natural Area. (All photos courtesy of Dr. T. P. O'Farrell, Battelle Northwest.) A: Pristine community representative of the *Artemisia tridentata/Agropyron spicatum* Association which is typical of higher elevations; note the Rattlesnake Hills in the background. B: Community dominated by big sagebrush and hopsage typical of those found on the basal plain; the understory is composed of cheatgrass brome, an alien annual grass which is highly successful on habitats disturbed by grazing.

A



B

Figure RH-2.-Natural features of Rattlesnake Hills Research Natural Area (continued). C: Winterfat forms island-like stands which are surrounded by communities of big sagebrush on the lower slopes of the Rattlesnake Hills. D: The most extensive stand of deciduous shrubs and trees which is found along a spring-fed brook below Snively Basin.

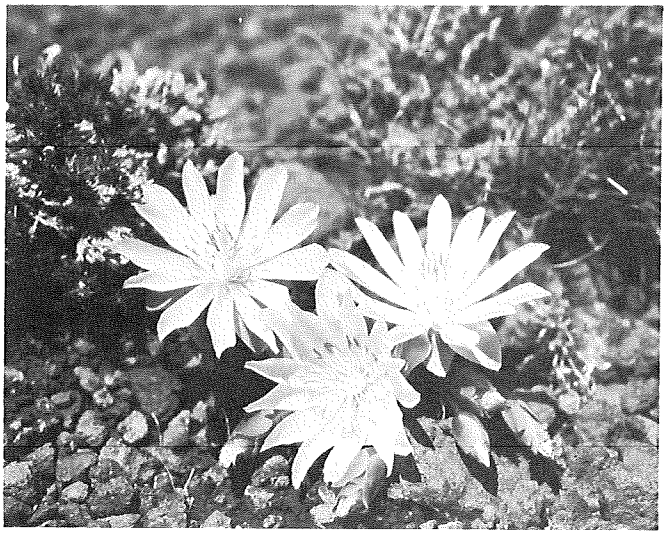
C

D

Figure RH-2.-Natural features of Rattlesnake Hills Research Natural Area (continued). E: Lithosolic communities inhabit stony outcrops in the Rattlesnake Hills; typical species illustrated here are *Balsamorhiza rosea* and Sandberg bluegrass. F: *Lewisia rediviva,* another conspicuous plant on lithosolic sites in the Rattlesnake Hills. G: *Lupinus* providing a conspicuous display of color following snow melt; snowdrifts persist late into the spring on northeast-facing slopes at the crest of the Rattlesnake Hills. H: The most abundant mammal on the natural area, the Great Basin pocket mouse *(Perognathus parvus).*

E

F



G

H

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

SISTER ROCKS RESEARCH NATURAL AREA[1]

Pacific silver fir stands on a mountain ridgetop of Eocene-Oligocene volcanics in the Washington Cascade Range.

The Sister Rocks Research Natural Area was established on September 5, 1967. It exemplifies Pacific silver fir *(Abies amabilis)* stands as they occur on mountain slopes and ridgetops in older (Eocene-Oligocene) volcanic portions of the Cascade Range. The 87ha. (215-acre) tract is located in Skamania County, Washington, and is administered by the Wind River Ranger District (Carson, Washington), Gifford Pinchot National Forest. The tract occupies portions of sections 2, 3, 10, and 11, T. 5 N., R. 6 E., Willamette meridian (fig. SR-1), based upon natural features and locations of Roads N63 (on the west) and N63J (proposed, on the north). It lies at 45°56' N. latitude and 122°03' W. longitude.

ACCESS AND ACCOMMODATIONS

Access to the vicinity is easiest from the south via the Columbia River (U.S. Highway 830), Carson, and the Wind River valley (Forest Roads 30, N73, N64, and N63); it can also be approached from the west via Amboy and Forest Roads N56, N54, and N58. Forest Trail 155 begins at the northern point of the natural area and extends its entire length (fig. SR-1). The trail provides access to central and southern portions of the tract and bounding roads (existing and planned) to the remainder. At present, eastern portions are least accessible.

The nearest commercial accommodations are in Stevenson, Washington, about 40 km. (25 miles) away, or occasionally, in Cougar. However, there are several improved forest camps in the adjacent Wind River valley.

ENVIRONMENT

The Sister Rocks Research Natural Area occupies a broad, north-trending ridgetop. Slopes are generally gentle to moderate (20to 30-percent) except along the lower margins of the area where steeper (60- to 80-percent) slopes occur. Elevations range from about 1,100 to 1,280 m. (3,600 to 4,200 ft.).

Geologically, the natural area is simple. Underlying bedrock is composed of Eocene-Oligocene volcanics, predominantly andesitic in character (Huntting et al. 1961). Included within the overburden are elements of various Pleistocene and/or Recent volcanic ash and pumice falls, some of the ejecta forming distinct layers.

The climate is wet and cold. Precipitation is seasonal, peaking during winter months and reaching low levels during the summer period. Much of the winter precipitation occurs as snow and accumulates in snowpacks which probably attain maximum depths of 2 to 3 m. (70 to 120 in.) based on a nearby snowcourse at Oldman Pass (U.S. Soil Conservation Service n.d.). The following climatic data are from the Wind River weather station, which is about 19 km. (12 miles) southeast of and 600 m. (2,000 ft.) below the natural area (U.S. Weather Bureau 1965):

Mean annual temperature	8.7°C. (47.8°F.)
Mean January temperature	0.0°C. (32.0°F.)
Mean July temperature	17.5°C. (63.5°F.)

[1] Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

This file was created by scanning the printed publication. Text errors identified by the software have been corrected; however, some errors may remain.

Mean January minimum temperature ..... −3.7°C. (25.3°F.)
Jean July maximum temperature ...26.9°C. (80.5°F.)
Average annual precipitation ...2,528 mm. (99.51 in.)
June through August precipitation ..... 119 mm. (4.67 in.)

Temperatures are undoubtedly considerably lower and precipitation somewhat higher on the natural area.

Soils in the natural area are generally podzolic with distinctive A2-B2 sequences; they have not been mapped or classified into series, however. A typical profile from the center of the tract had the following horizon sequence: 01 and 02, 6 to 0 cm.; A2, 0 to 3 cm.; IIA1b, 3 to 6 cm.; IIB2b, 6 to 11 cm.; and IIB3b, 11 cm. plus. The A2 has developed in Mount St. Helens "W" pumice which is about 450 years in age (Crandell 1969); the buried profile was developed from andesite and scoria.[2]

BIOTA

All 87 ha. (215 acres) of the Sister Rocks Research Natural Area are classified as SAF cover type 226, Pacific Silver Fir-Hemlock (Society of American Foresters 1954). The area falls within Kuchler's (1964) Types 33 or 4 (Silver Fir-Douglas Fir or Fir-Hemlock Forest) and the *Abies amabilis* Zone of Franklin and Dyrness (1969).

Pacific silver fir dominates the natural area, frequently occurring in pure stands (fig. SR-2). Western hemlock *(Tsuga heterophylla)* is the most common associate (fig. SR-2). Douglas-fir *(Pseudotsuga menziesii)* is nearly absent at higher elevations but becomes occasional to common in some lower slope stands; on local type maps, there are 24 ha. (59 acres) on which Douglas-fir is a major component. Noble fir *(Abies procera)* is also scattered through the area, and the presence of snags and stumps of this species suggests it was once more common. Noble fir, mountain hemlock *(Tsuga mertensiana),* and lodgepole pine *(Pinus contorta)* occur with Pacific silver fir in a young stand at the southern edge of the natural area; this small segment is part of a larger area (outside the natural area) which was burned by a wildfire in 1902 (fig. SR-2).

Pacific silver firs in the natural area are typically 65- to 100-cm. (25- to 40-in.) d.b.h. and 36 to 43 m. (120 to 140 ft.) tall. Stem analyses of similar Pacific silver firs growing nearby suggest a wide ,range of ages, with 250 to 350 years most common.:)

Pacific silver fir is clearly the climax tree species throughout the natural area, based upon size class distributions and reproductive success. Consequently, pure, uneven-aged Pacific silver fir stands are the hypothetical climax here, and much of the area already approximates this structure and composition. Douglas-fir and noble fir occur only as large, old individuals; in many areas, they are present as dead or dying specimens or as stumps and down logs. The relatively tolerant western hemlock is likewise failing to reproduce in significant numbers and is primarily represented by old, over-mature specimens.

Based upon Franklin's (1966) classification of the subalpine forests in this part of the Cascade Range, there are three major community types within the natural area: The *Abies amabilis/Streptopus curvipes (Erythronium montanum* phase) and *Abies amabil1is/Vaccinium alaskaense* Associations, and an *Abies procera/Xerophyllum tenax* community. The *Abies amabilis/Streptopus curvipes* Association is most common in the central portion of the natural area. This community has well-developed shrub and herb layers. *Vaccinium ovalifolium, V. alaskaense, V. membranaceum,* and *Menziesia ferruginea* are the dominant shrubs. The abundant herbs include *Tiarella unifoliata, Rubus pedatus, R. lasiococcus, Clintonia uniflora, Erythronium montanum, Streptopus curvipes,* and *Cornus canadensis. Rhytidiopsis robusta, Brachythecium velutinum,* and *Dicranum*

[2] Unpublished data provided by Dr. H. W. Smith, Agronomy Department, Washington State University, Pullman.

[3] Unpublished data provided by Mr. F. R. Herman and on file at U.S. Forest Service, Forestry Sciences Laboratory, Corvallis, Oregon.

fuscescens are the most common mosses. The *Abies amabilis/Vaccinium alaskaense* Association is typical along the lower margins of the area. *Vaccininm alaskaense, V. membranaceum, Cornus canadensis, Berberis nervosa, Xerophyllnm tenax, Chimaphila umbellata,* and *Rhytidiopsis robusta* are common constituents. The *Abies procera/Xerophyllum tenax* community is a pioneer type which characterizes the small area of 50-yearold burn found at the southern margin of the natural area. *Xerophyllnm tenax* and *Vaccinium membranaceum* are the most abundant understory plants.

Mammals believed to utilize the natural area as residents or transients are listed in table SR-l.

HISTORY OF DISTURBANCE

Road construction has caused, and will continue to cause, some disturbance along the margins of the natural area and, in connection with clear-cutting of adjacent lands, will produce some edge effects. However, most of the area is free of human disturbance except for the trail. The trail is used occasionally by hikers, berry pickers, and hunters. There is no evidence that wildfires have occurred within the natural area for several centuries outside of the strip of 1902 burn which was included to provide a contrast with the oldgrowth stands.

RESEARC H

The Sister Rocks Research Natural Area has been used as a sampling site for studies of subalpine forests and soils in the southern Washington Cascade Range (Franklin 1966) and for a study of characteristics and distribution of Recent pumice and ash falls.[4]

This natural area is particularly valuable as a site for studies of the ecology of Pacific silver fir, offering a variety of stand types and conditions, including pure stands and a recently burned area.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topogmphy-15'*LookoutMountain, Washington quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1953; and *geology-Geologic Map of Washington,* scale 1:500,000 (Huntting et al. 1961). Either the District Ranger (Wind River Ranger District) or Forest Supervisor (Gifford Pinchot National Forest, Vancouver, Washington) can provide details on the most recent aerial photo coverage and forest type maps for the area.

[4] Research by Dr. H. W. Smith, Agronomy Department, Washington State University, Pullman.

LITERATURE CITED

Crandell, Dwight R.
1969. The geologic story of Mount Rainier. U.S. Geol. Surv. Bull. 1292, 43 p., illus.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Franklin, Jerry Forest
1966. Vegetation and soils in the subalpine forests of the southern Washington Cascade Range. 132 p., illus. (Ph.D. thesis, on file at Wash. State Univ., Pullman.)

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, *D.C.*

U.S. Soil Conservation Service
n.d. Summary of snow survey measurements for Washington 1915-1969. Various paging, illus. USDA Soil Conserv. Serv. and Wash. Dep. Ecol.

U.S. Weather Bureau
1965. Climatic summary of the United States-supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table SR-1. — Tentative list of mammals for Sister Rocks Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Sorex obscurus	dusky shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Spermophilus saturatus	Cascades mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys talpoides	northern pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx rufus	bobcat
	Martes americana	marten
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. columbianus	black-tailed deer

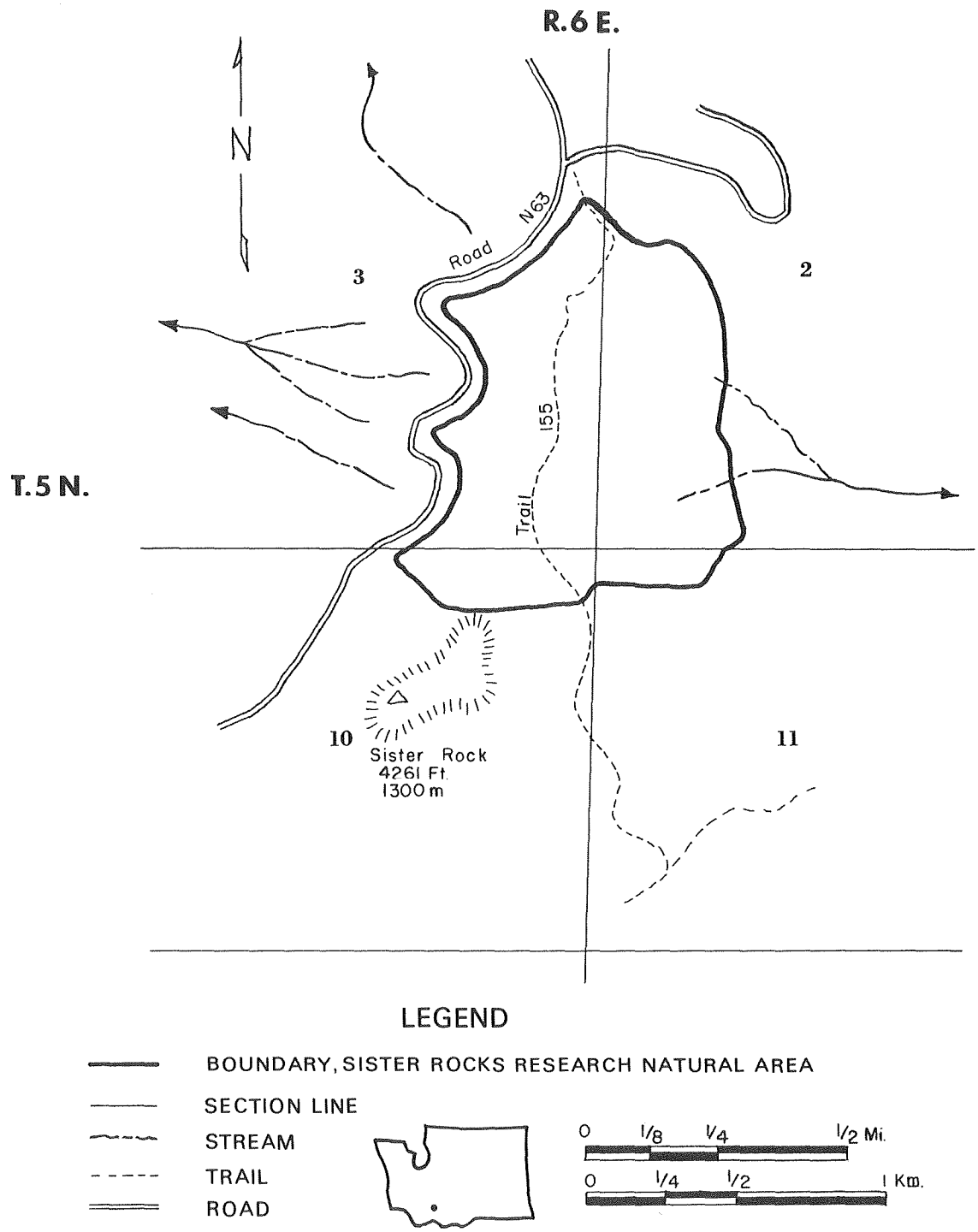


Figure SR-1.– Sister Rocks Research Natural Area, Skamania County, Washington.

Figure SR-2.-Communities of the Sister Rocks Research Natural Area. Upper left: Pure stand of Pacific silver fir with dense reproduction 0.5 to 1 m. tall. Upper right: Mixed stand of Pacific silver fir and western hemlock, the latter represented only by large, over-mature specimens. Lower left: Noble *fir/Xerophyllum tenax* community growing on area burned by wildfire in 1902 and located at the southern edge of the natural area. Lower right: Mixed stand of Pacific silver fir, Douglas-fir, and western hemlock with abundant seedlings, saplings, and poles of Pacific silver fir.

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

TURNBULL PINE RESEARCH NATURAL AREA[1]

Ponderosa pine/bunchgrass savanna and pothole lakes and ponds characteristic of east central Washington.

The Turnbull Pine Research Natural Area was established December 1966 to exemplify nearly pristine ponderosa pine *(Pinus ponderosa)* savanna at the transition from forest to grassland and a series of free-water potholes characteristic of the Channeled Scablands found on the basalt plateau of east-central Washington. The 81-ha. (200-acre) tract is located in Spokane County, Washington, and is administered by the Turnbull National Wildlife Refuge (Route 3, Box 107, Cheney, Washington), Bureau of Sport Fisheries and Wildlife. The irregularly shaped tract is located in section 25, T. 21 N., R. 43 E., Willamette meridian, at 47°27' N. latitude and 117°30' W. longitude (fig. TP-l).

ACCESS AND ACCOMMODATIONS

The natural area is located 2.5 km. (1.5 miles) south of Cheney, Washington, along the Cheney-Plaza County road which forms the tract's west boundary. Access is excellent during the summer and generally good during the winter. Public accommodations are available at Cheney.

ENVIRONMENT

The Turnbull Pine Research Natural Area ranges from 685 to 715 m. (2,250 to 2,350 ft.) in elevation. Topography is generally undulating to rolling except around the pothole lakes which are often surrounded by steep slopes or rock cliffs (fig. TP-2).

The natural area is located on eastern Washington's well-known Channeled Scablands (Bretz 1959). The Columbia River basalts which characterize the entire Columbia Plateau provide the foundation of this landscape. An intricate network of drainage channels are carved into this bedrock and an overburden of loess. Glacial damming of the Columbia River by a lobe of the continental ice sheet is believed to have combined with successive massive floods released from glacially dammed lakes to produce the scablands. The natural area itself was probably never actually glaciated.

A modified maritime climate prevails. Most precipitation occurs as rain or snow during the cool, cloudy winter. Summers are warm, generally low in precipitation, and largely cloudless. One to 3 months of drought are common. Climatic data from Spokane, about 29 km. (18 miles) north, are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	8.8°C. (47.8°F.)
Mean January temperature	−3.7°C. (25.3°F.)
Mean July temperature	21.4°C. (70.5°F.)
Mean January minimum temperature	−7.7°C. (18.1°F.)
Mean July maximum temperature	28.7°C. (83.7°F.)
Average annual precipitation	437 mm. (17.2 in.)
June through August precipitation	56 mm. (2.2 in.)
Average annual snowfall	147 cm. (58.0 in.)

Soils in the area were mapped sometime between 1955 and 1961, and complete information is found in the Spokane County Soil Survey (Donaldson and Giese 1968). Hesseltine soils are predominant on the area with the major portion mapped as Hesseltine very rocky complex, 0- to 30-percent slopes. This mapping unit includes from 25- to 50-percent

[1] Description prepared by Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

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basalt rock outcrops and unnamed very stony, very shallow soils, with the remainder being Hesseltine silt loam. Hesseltine silt loam is a dry upland soil with topsoil down to 4 dm. (16 in.) deep, underlain by coarse gravel and stones to a depth of up to 15 dm. (60 in.) over basalt bedrock. Minor areas of other Hesseltine-type soils also occur. The Hesseltine soils are typically forested. Soils in the meadows and around pothole borders are the Cocollala silty clay loam. This soil ranges up to 14 dm. (60 in.) deep and is formed in volcanic ash deposits mixed with silty alluvium. Highly organic Semiahmoo muck soils are found in the potholes (e.g., in fig. TP-2), which suggests natural pond succession and eutrophication.

BIOTA

Estimated areas by vegetation type are as follows:

Name	*Area*
Ponderosa pine forest	65 ha. (160 acres)
Grassland	8 ha. (20 acres)
Quaking aspen	4 ha. (10 acres)
Aquatic (kettle lakes and potholes)	4 ha. (10 acres)

The forest stands are assignable to SAF forest cover type 237, Interior Ponderosa Pine (Society of American Foresters 1954), and Kuchler's (1964) Type 11, Western Ponderosa Forest. The grasslands best fit Kuchler's Type 51, Wheatgrass-Bluegrass with some Type 50, Fescue-Wheatgrass. The kettle lakes and potholes with their associated meadow vegetation would probably fit Kuchler's Type 49, Tule Marshes. The natural area falls in a zone of ponderosa pine savanna where ponderosa forests gradually grade into Columbia Basin bunchgrass.

Ponderosa pine *(Pinus ponderosa)* forests may be divided into two community types: *Pinus ponderosa/Festuca idahoensis* and *Pinus ponderosa/Symphoricarpos albus/Calamagrostis rubescens.* The *Pinus/Festuca* type is characteristic of convex topography and shallower soils. Pine crown cover varies from 20 to 40 percent; ground vegetation is generally dominated by Idaho fescue *(Festuca idahoensis)* and bluebunch wheatgrass *(Agropyron spicatum.),* with *Bromus* spp., Sandberg bluegrass *(Poa sandbergii), Koeleria cristata, Potentilla glandulosa,* and *Erigeron* spp. (see fig. PN -2 in Pine Creek Research Natural Area description). They appear related to Daubenmire and Daubenmire's *(1968) Pinus ponderosa/Festuca idahoensis* Association.

The *Pinus/Symphoricarpos/Calamagrostis* community type is characteristic of lower concave microtopography and small swale bottoms (fig. TP-2). Pine crown cover varies from 35 to 50 percent. Ground vegetation is co-dominated by *Symphoricarpos albus* and pinegrass *(Calamagrostis rubescens).* Other important components are Idaho fescue, elk sedge *(Carex geyeri),* and *Fragaria virgliniana* var. *platypetala.* This community does not clearly fit any of Daubenmire and Daubenmire's (1968) associations. It is probably a variant of their *Pinus ponderosa/Symphoricarpos albus* Association in which pinegrass is far more important than their classification recognizes. Variations in microtopography and soil depth seem related to these two forest communities.

Quaking aspen *(Populus tremuloides)* communities occasionally occur in small meadows (fig. TP-2) and as stringers around lakes and meadows. Quaking aspen is clearly dominant. Associated vegetation is *Symphoricarpos albus, Solidago* spp., thinleaf alder *(Alnus tenuifolia),* water birch *(Betula occidentallis),* and *Cornus stolonifera.*

The grasslands generally occur on convex surfaces of the gentle, undulating topography and appear associated with shallow soils (fig. TP-2). Other than very occasional ponderosa pine, they are dominated by bluebunch wheatgrass, Idaho fescue, and *Bromus* spp. on deeper soils. On shallower soils they are dominated by Sandberg bluegrass and *Bromus* spp. with some Idaho fescue and bluebunch wheatgrass.

The 4 ha. (10 acres) of kettle and pothole lakes are characterized by free-water ponds which retain their water all season long and which are surrounded by gradations from very wet to moderately moist meadow vegetation

(fig. TP-2). Western yellow pond lily *(Nuphar polysepalus)* often colonizes free-water areas. Ponds are often edged by wet meadows characterized by tule *(Scirpus accutus* and/or *S. validus)* with occasional colonies of cattails *(Typha latifolia).* Where moisture and free water are less abundant, the tule grades into moist meadow dominated by *Phalaris arundinacea,* which is often associated with *Deschampsia caespitosa.* Most pothole lakes are surrounded by rock ledges or steep slopes from 10 to 25 feet high (fig. TP-2).

Mammals believed to utilize the natural area as residents or transients are listed in table TP-l. A list of resident and transitory birds can be obtained from the Refuge Manager.

HISTORY OF DISTURBANCE

Fire scars on ponderosa pine indicate ground fires periodically burned the area prior to fire control programs.

RESEARC H

Some research is being conducted by ecology students at nearby Eastern Washington State College, Cheney, Washington. Information may be obtained from the Refuge Manager or from the Biology Department of Eastern Washington State College. Voucher specimens of some birds and animals and most plant species are available for inspection at Refuge Headquarters.

The natural area provides unique opportunities to study: (1) the ecology of pothole lakes and their associated meadow vegetation under undisturbed conditions; (2) interfaces between dry upland non-forested vegetation and forested vegetation on slopes and between forest and meadow and meadow and free water; (3) relationships of faunal species distribution to vegetation over these extremely variable environmental conditions; and (4) aquatic communities.

MAPS AND AERIAL PHOTOGRAPHS

No special topographic or geologic maps are available for the natural area which are sufficiently detailed to be useful. The Refuge Manager (Turnbull National Wildlife Refuge, Cheney, Washington) can provide details on the most recent aerial photo coverage of the area.

Since refuge establishment in 1937, grazing, tree cutting, and other disturbances have been prohibited on the original 20 ha. (50 acres) of this natural area (the northwestern corner of the present tract). The natural area was expanded to 81 ha. (200 acres) in 1968 and the 61-ha. (I50-acre) addition had received some light use by cattle each year between 1937 and 1968. The old-growth ponderosa pine was logged prior to Refuge establishment, and present forest stands are sapling and pole sized with occasional larger trees. Domestic livestock also used the area, sometimes heavily, prior to Refuge establishment. The abundance of *Bromus* spp. suggests livestock overuse produced some modification of ground vegetation.

LITERATURE CITED

Bretz, J. Harlen
1959. Washington's channeled scabland. Wash. State Div. Mines & Geol. Bull. 45, 57 p., illus.

Daubenmire, R., and Jean B. Daubenmire
1968. Forest vegetation of eastern Washington and northern Idaho. Wash. Agric. Exp. Stn. Tech. Bull. 60, 104 p., illus.

Donaldson, N. C., and L. D. Giese
1968. Soil survey of Spokane County, Washington. USDA Soil Conserv. Servo & Wash. Agric. Exp. Stn., 143 p., illus.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States-supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table TP-1. — Tentative list of mammals for Turnbull Pine Research Natural Area

Order	Scientific name	Common name
Insectivora	*Sorex vagrans*	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis lucifugus	little brown myotis
	Myotis subulatus	small-footed myotis
	Myotis yumanensis	Yuma myotis
	Pipistrellus hesperus	western pipistrel
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus californicus*	black-tailed jack rabbit
	Sylvilagus nuttalli	mountain cottontail
Rodentia	*Erethizon dorsatum*	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Marmota flaviventris	yellow-bellied marmot
	Microtus longicaudus	long-tailed vole
	Microtus montanus	mountain vole
	Microtus pennsylvanicus	meadow vole
	Neotoma cinerea	bushy-tailed wood rat
	Ondatra zibethicus	muskrat
	Onychomys leucogaster	northern grasshopper mouse
	Perognathus parvus	Great Basin pocket mouse
	Peromyscus maniculatus	deer mouse
	Reithrodontomys megalotis	western harvest mouse
	Spermophilus columbianus	Columbian ground squirrel
	Tamiasciurus hudsonicus	red squirrel
	Thomomys talpoides	northern pocket gopher
Carnivora	*Canis latrans*	coyote
	Lynx rufus	bobcat
	Mephitis mephitis	striped skunk
	Mustela frenata	long-tailed weasel
	Taxidea taxus	badger
Artiodactyla	*Odocoileus h. hemionus*	mule deer
	Odocoileus virgianus	white-tailed deer

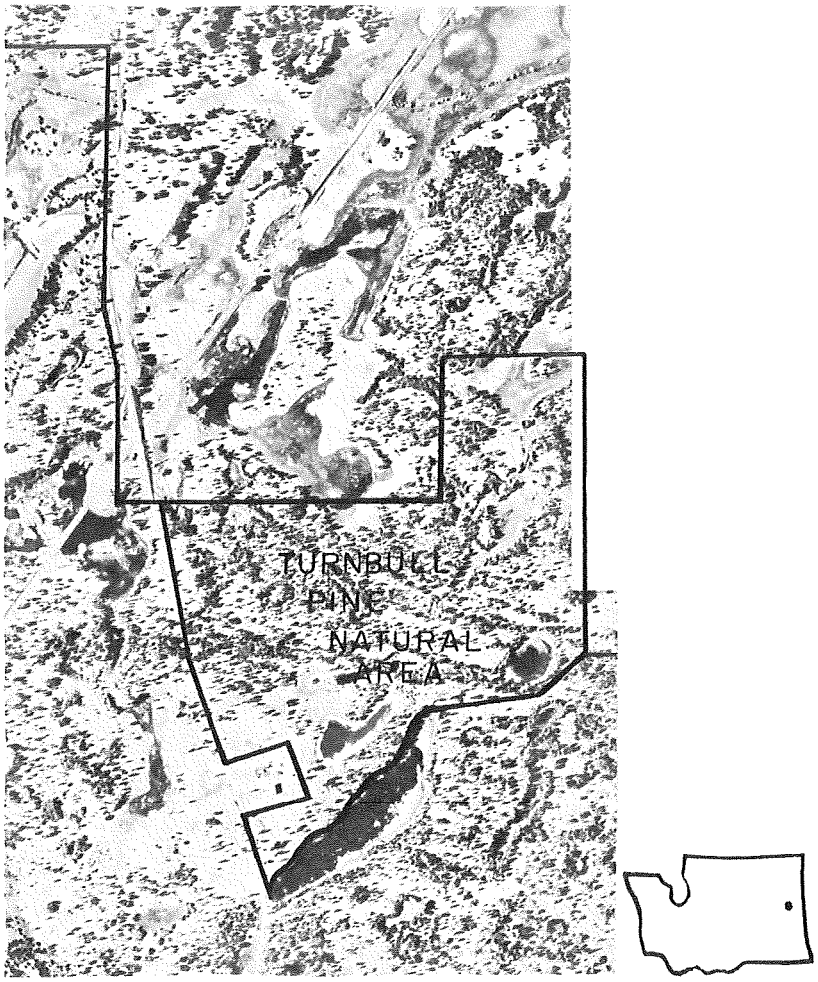
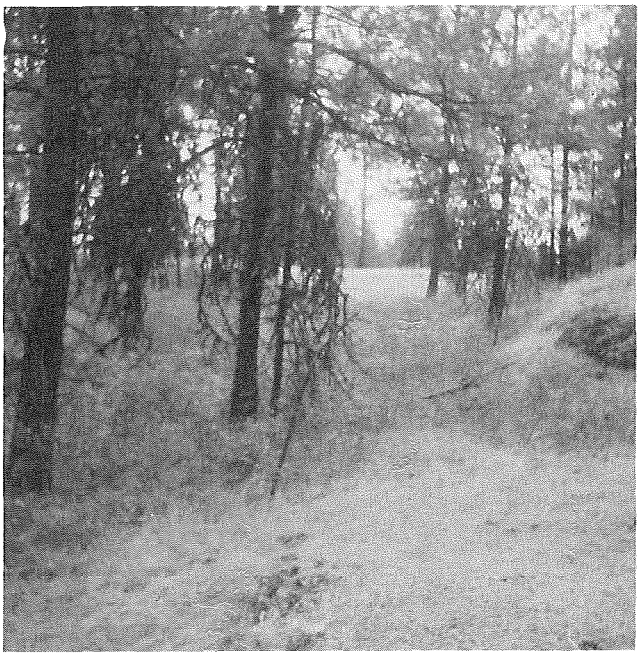
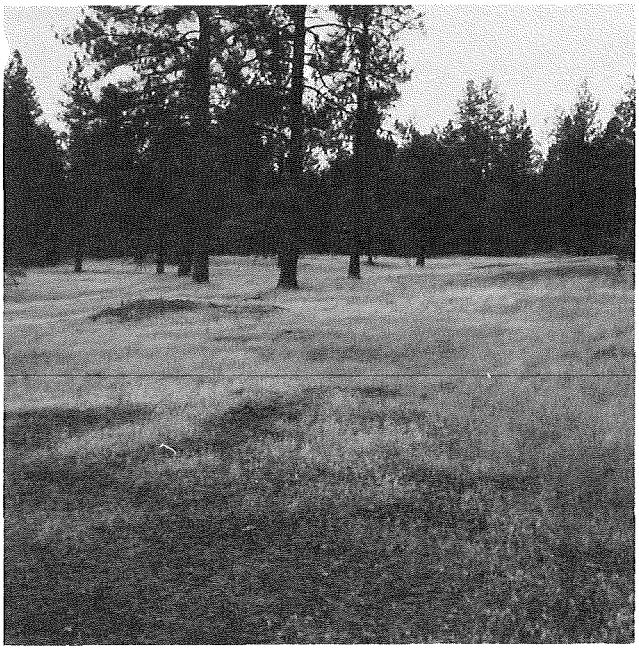


Figure TP-1.– Turnbull Pine Research Natural Area, Spokane County, Washington.

Figure TP-2.-Natural features of the Turnbull Pine Research Natural Area. Upper left: Common forest community of ponderosa pine, *Symphoricarpos albus*, and pinegrass with some Idaho fescue and elk sedge. Upper right: Dry meadow of *Agrostis alba* and *Phleum pratense* and quaking aspen meadow with *Symphoricarpos, Solidago,* and thin leaf alder. Lower left: Common community on top of gentle "biscuits," *Bromus* spp. on shallow soil. Lower right: Free water pond and adjacent tule meadow; rock rim around the pond is typical.





Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station. Portland. Oregon.

TWIN CREEK RESEARCH NATURAL AREA[1]

"Rain forest" Sitka spruce-western hemlock stands growing on terraces along the Hoh River on the western Olympic Peninsula, Washington.

The Twin Creek Research Natural Area was established in 1958 to exemplify Sitka spruce *(Picea sitchensis)* forests as they occur under the "rain forest" conditions found in river valleys on the west side of the Olympic Peninsula. The 40-ha. (l00-acre) tract is located in Jefferson County, Washington, and is administered by Olympic National Park (Port Angeles, Washington). The natural area is located in two units which occupy portions of sections 20, 21, and 29, T. 27 N., R. 10 W., Willamette meridian. Legal lines provide the boundaries. The tract is located at 47°50' N. latitude and 124 °00' W. longitude.

ACCESS AND ACCOMMODATIONS

The natural area is located a short distance from the Hoh River Road, about 23 km. (14 miles) from its junction with U.S. Highway 101. The west unit is located about 1.6 km. (1 mile) inside the park boundary and 9 km. (5.5 miles) from the visitors center at the end of the Hoh River Road. The east unit is located about 1.6 km. (1 mile) east of the west unit. There are no trails within the natural area, but cross-country travel is not too difficult because of the gentle topography.

Commercial accommodations are available in Forks or Kalaloch, along U.S. Highway 101, from 40 to 56 km. (25 to 35 miles) away. However, there is an excellent public campground at the end of the Hoh River Road and several smaller State campgrounds along the road outside the park.

ENVIRONMENT

The natural area occupies gentle topography on river terraces in the Hoh River valley. Elevations range from about 130 to 195 m. (420 to 640 ft.) in the west unit and 150 to 175 m. (500 to 580 ft.) in the east unit. Two branches of Twin Creek flow through a portion of the east unit and swampy areas are found in both units of the natural area (fig. TW-1).

The natural area is located on upper Cretaceous-lower Tertiary sedimentary rocks belonging to the Soleduck formation (Danner 1955, Huntting et al. 1961); however, bedrock is completely buried beneath depositions of alluvium and possibly some glacial drift. The valley of the Hoh River, including the natural area, has been glaciated at least three times during the Wisconsin age and at least once in pre-Wisconsin time (Crandell 1964).

A wet, mild, maritime climate prevails. Winters are mild and summers are cool with frequent cloudy days. Precipitation is heavy, but less than 10 percent falls during summer months. The following climatic data are from the Forks weather station located approximately 32 km. (20 miles) northwest of the natural area (U.S. Weather Bureau 1965):

Mean annual temperature	9.55°C. (49.2°F.)
Mean January temperature	3.72°C. (38.7°F.)
Mean July temperature	15.39°C. (59.7°F.)
Mean January minimum temperature	0.17°C. (32.3°F.)
Mean July maximum temperature	21.55°C. (70.8°F.)
Average annual precipitation	2,974 mm. (117.10 in.)
June through August precipitation	214 mm. (8.44 in.)
Average annual snowfall	348 cm. (13.7 in.)

[1] Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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Precipitation is significantly higher on the natural area itself, probably averaging about 3,600 mm. (142 in.) annually (Kirk 1966).

Soils appear to be predominantly Sols Bruns Acides. Fonda[2] has described profiles on similar terrace areas in the vicinity of the natural area and found the following sequence to be typical:

02	2 to 0 cm.	Fresh litter.
Al	Oto16cm.	Very dark grayish brown with moderate crumb structure.
B1	16 to 46 cm.	Very dark gray sand, compact breaking to single grain.
B2	46 to 57 cm.	Very dark gray sand with single grain to weak crumb structure and some clay accumulation.
C1	57 to 150 cm.	Black sands with single grain structure.
IIC2	150 cm. +	River cobbles and gravels.

BIOTA

Essentially all the forest within the natural area can be considered a mixture of SAF forest cover types 225, Sitka Spruce-Western Hemlock, and 223, Sitka Spruce, with the latter type probably dominant (Society of American Foresters 1954). They belong to Kuchler's (1964) Type 1, Spruce-Cedar-Hemlock Forest. The tracts are located within the *Picea sitchensis* Zone of Franklin and Dyrness (1969). Categorizing the area in this fashion does not do it justice, however; it is a fine example of the so-called "Olympic Rain Forest" found on major river terraces on the west side of the Olympic Peninsula (Kirk 1966).

The two units are mosaics of Sitka spruce and western hemlock *(Tsuga heterophylla)* forest of varying ages and sizes interspersed with open areas dominated by vine maple *(Acer circinatum)* and occasionally bigleaf maple *(Acer macrophyllum).* Sitka spruce and western hemlock make up about 80 and 20 percent of the stand volume, respectively. Both the spruce and hemlock are present in all size classes ranging up to a maxima of 230- to 330-cm. (90- to 130-in.) d.b.h. for spruce and 100- to 150-cm. (40- to 60-in.) d.b.h. for hemlock. Mature trees of either species obtain heights of 60 m. (200 ft.) and more. Bigleaf maple and Douglas-fir *(Pseudotsuga menziesii)* occur in more localized portions of the natural area. Bigleaf maple typically obtains diameters of 75 to 100 cm. (30 to 40 in.) b.h. and heights of 15 to 21 m. (50 to 70 ft.). Douglas-fir is largely confined to the steep terrace faces found towards the north edge of both of the units.

The forests in the natural area appear in a near climax condition. Although Sitka spruce is considered a sub-climax species in the *Picea sitchensis* Zone of Franklin and Dyrness (1969), this does not appear to be the case in this area. Spruce seedlings and saplings up to small poles are encountered throughout most of the area. Climax status is probably a partial consequence of the special conditions found in "rain forest" valleys of the western Olympic Peninsula, particularly the relatively open nature of many of the stands and selective grazing of hemlock seedlings by elk.[3] Most tree reproduction is found on rotting logs, "nurse logs," which often support hundreds of hemlock and spruce seedlings. Some of these survive, and their roots reach mineral soil. The consequences are visible throughout the natural area as lines of mature trees growing on remains of original nurse logs and in the stilted root systems of many of the spruce and hemlock.

Forest stands have relatively rich and well developed under-stories. Vine maple, *Vaccinium ovalifolium, V. parvifolium, Rubus ursinus,* and *R. spectabilis* are the most common species in the shrub layer. Vine maple is clearly the most important. Relative sparsity of *Rubus spectabilis* compared to many other coastal forest stands may be a consequence of grazing by elk. The major herbaceous species are *Oxalis oregana, Polystichum munitum., Tiarella unifoliata, Carex deweyana, Trisetum cernuum, Maianthemum bifolium* var. *kamschaticum, Rubus pedatus, Montia sibirica, Athyrium filix-femina,* and

[2] Personal communication from Dr. Richard \V. Fonda, Department of Biology, Western Washington State College, Bellingham.

[3] See footnote 2.

Gymnocarpium dryopteris. Polystichum and *Oxalis* are clearly the most important herbs.

The "rain forest" region of the western Olympic Peninsula is famous for an abundance of cryptogams, and the natural area is no exception. Mosses, liverworts, and lichens blanket the ground, downed logs, shrubs, and tree trunks. Some of the more common ground species are *Eurhynchium. oreganum, Hypnum circinale, Rhytidiadelphus loreus, Mnium menziesii, Hylocomium splendens,* and *Mnium insigne.* One of the most conspicuous epiphytes is the club moss, *Selaginella serpens,* which is particularly abundant on the maples. Other common epiphytes are *Pseudoisothecium stoloniferum, Porella navicularis, Rhytidiadelphus loreus, Radula bolanderi, Frullania nisqualensis, Scapania bolanderi,* and *Ptilidium californicum.*

The Roosevelt elk *(Cervis canadensis roosevelti)* is the most important animal present. Elk use the natural area most heavily during the winter and spring. Other mammals believed to utilize the area as residents or transients are listed in table TW-1.

Twin Creek provides some area of aquatic habitat in the east unit of the natural area. As mentioned, both units contain open swampy area, providing additional specialized habitat for a variety of plants and animals not typical of heavily forested areas. These swampy areas have standing water for at least a portion of the year.

HISTORY OF DISTURBANCE

Human disturbance appears to be very minor despite the proximity of the area to the Hoh River Road. There is no evidence of wildfires within the tract within the last several centuries.

RESEARCH

The only research known to have been conducted within the natural area are reconnaissance level examinations of the stands in connection with a study of relationships between forest communities and environmental conditions in the Hoh River Valley.[4]

The natural area appears to offer unusually good opportunities for research on: (1) successional development in coastal forests, particularly the relative successional positions of Sitka spruce and western hemlock in typical second-terrace rain forest condition; (2) effect of Roosevelt elk on community composition and forest succession; and (3) the ecology of epiphytic mosses, club mosses, liverworts, and lichens.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area include: *Topography-15'* Spruce Mountain and Mount Tom, Washington quadrangles, scale 1:62,500, issued by the U.S. Geological Survey in 1956 (Spruce Mountain quadrangle covers the west unit and Mount Tom quadrangle the east unit of the natural area) and Topographic Map of Olympic National Park and Vicinity, Washington, scale 1: 125,000, issued by the U.S. Geological Survey in 1957; and *geology-Geologic Map of Washington,* scale 1:500,000 (Huntting et al. 1961). The Superintendent, Olympic National Park (Port Angeles, Washington), can provide details on the most recent aerial photo coverage and forest type maps for the area.

[4] Research by Dr. R. W. Fonda, Department of Biology, Western Washington State College, Bellingham.

LITERATURE CITED

Crandell, Dwight R.
1964. Pleistocene glaciations of the southwestern Olympic Peninsula, Washington. U.S. Geol. Surv. Prof. Pap. 501B:B135-B139, illus.

Danner, Wilbert R.
1955. Geology of Olympic National Park. 68 p., illus. Seattle: Univ. Wash. Press.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW - 80,216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Kirk, Ruth
1966. The Olympic Rain Forest. 86 p., illus. Seattle: Univ. Wash. Press.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States--supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table TW-1. — Tentative list of mammals for Twin Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex obscurus	dusky shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Tamiasciurus douglasi	chickaree
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lutra canadensis	river otter
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis roosevelti*	Roosevelt elk
	Odocoileus h. columbianus	black-tailed deer

LEGEND

BOUNDARY, TWIN CREEK RESEARCH NATURAL AREA

SECTION LINE

STREAM

SWAMP

16 | 15
21 | 22 SECTION CORNER (T.27., R. 10 W., W.M.)

SITKA SPRUCE - WESTERN HEMLOCK FOREST

1 DOUGLAS-FIR - SITKA SPRUCE - WESTERN HEMLOCK FOREST

2 OPEN AREA

Figure TW-1.– Twin Creek Research Natural Area, Jefferson County, Washington.

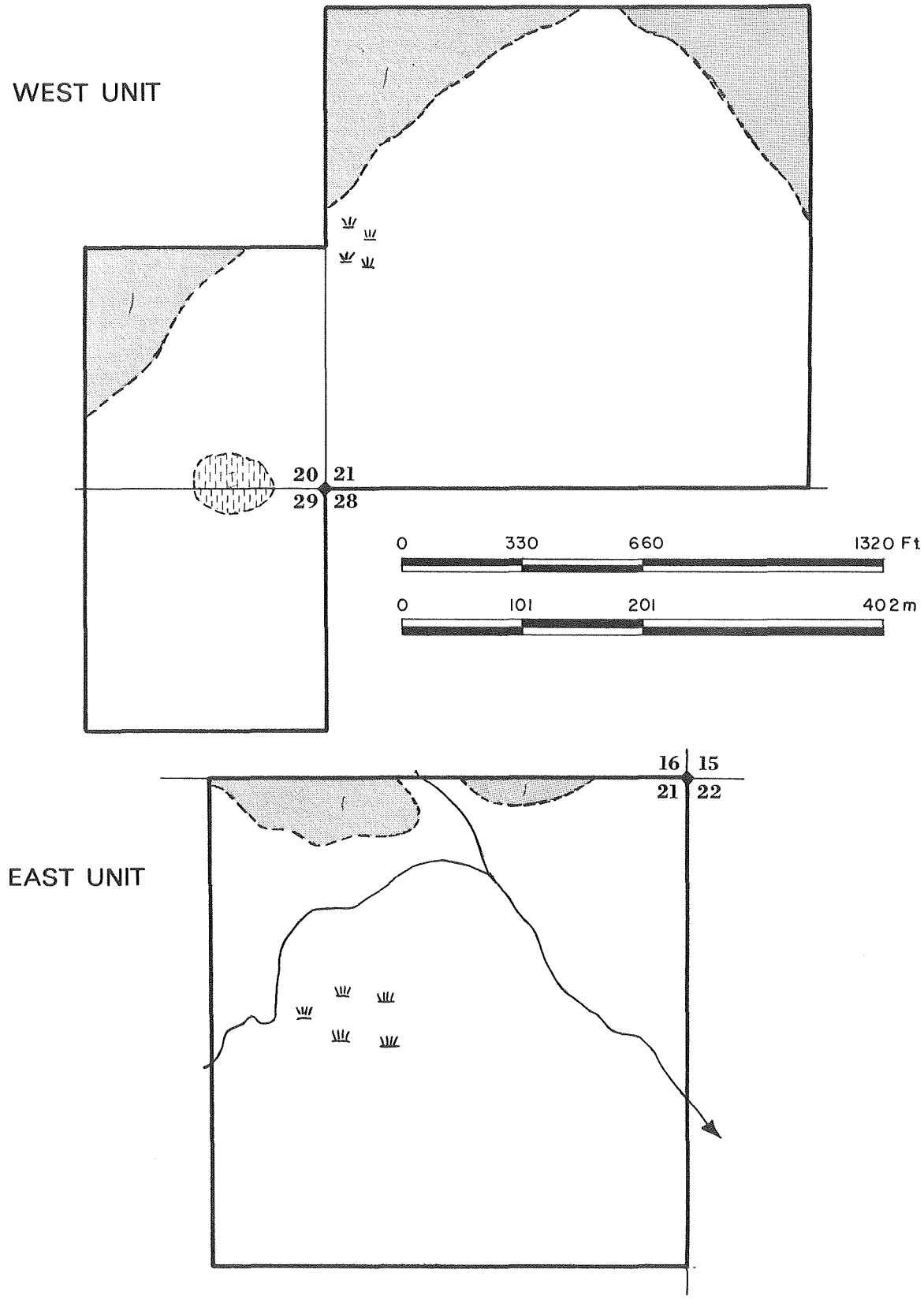
WEST UNIT
20
21
29
28
0
330
660
1320 Ft
0
101
201
402 m
16
15
21
22
EAST UNIT

Figure TW-2.- Typical forest community of bigleaf maple, Sitka spruce, and vine maple found within portions of the Twin Creek Research Natural Area; note the abundance of epiphytes on the maples.

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

WILDCAT MOUNTAIN RESEARCH NATURAL AREA [1]

Stands of noble fir and associated species on mountain slopes and ridgetops in the western Cascade Range of Oregon.

The Wildcat Mountain Research Natural Area was established on March 18, 1968, to preserve prime examples of noble fir *(Abies procera)* stands as they occur on mountain ridges in the western Cascades of Oregon. The 405-ha. (1,OOO-acre) tract is located in Linn County, Oregon, and is administered by the McKenzie Bridge Ranger District (McKenzie Bridge, Oregon), Willamette National Forest. The tract occupies portions of sections 17, 20, 21, 22, 27, and 28, T. 14 S., R. 6 E., Willamette meridian (fig. WM-1). The southern boundary is marked by Forest Road 147 and the dividing ridge between Browder and Bunchgrass Creeks (fig. WM-1). The northern boundary is based on various natural features used either directly or as control points. It lies at 44°20' N. latitude and 122°06' W. longitude.

ACCESS AND ACCOMMODATIONS

It is easiest to approach the vicinity from either the north (Albany and Sweet Home), using U.S. Highway 20, or from the south (Eugene) using U.S. Highway 126. From U.S. Highway 20, turn south just west of Tombstone Summit onto Forest Road 1345 and follow it to Forest Road 147 and the natural area. From U.S. Highway 126, turn north onto Forest Road 1645 (about 14 km. or 9 miles east of McKenzie Bridge Ranger Station). The natural area can be reached via this and Forest Road 1345 or via Forest Road 147 which leaves Forest Road 1645 about 2.4 km. (1.5 miles) north of U.S. Highway 126.

Forest Road 147 provides access to most of the southern edge of the natural area, and the abandoned Wildcat Mountain trail traverses the western half, terminating at the summit of the mountain.

ENVIRONMENT

The Wildcat Mountain Research Natural Area extends across the summit ridge of Wildcat Mountain onto the north slope of Bunchgrass Mountain (fig. WM-1). Elevations range from about 1,160 m. (3,800 ft.) in the bottom of a drainage in section 22 to 1,632 m. (5,353 ft.) at the summit of Wildcat Mountain. Several distinctive topographic units can be recognized: (1) the southwest face of Wildcat Mountain which has moderate (20- to 40-percent) slopes at its base and increasingly steeper (50- to 70-percent) gradients near the summit; (2) the north face of Wildcat Mountain which is largely steep or precipitous (50- to over 100-percent slopes) and has frequent rock outcrops; and (3) two drainages on the north slope of Bunchgrass Mountain and associated ridges which have steep (30 to 80 percent) but generally not precipitous slopes.

The natural area lies within a geologically older (Eocene to Miocene) part of the Cascade Range known as the western Cascades. A current geologic map indicates the tract is located on "volcanic rocks of the High Cascade Range" which were intruded in the Pliocene and Pleistocene, i.e., the formation

[1] Description prepared by Dr. J. F. Franklin and Dr. C. T. Dyrness, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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commonly known as the High Cascade Andesites (Peck et a1. 1964). However, recent studies indicate that" ... these areas of 'High Cascade' rocks which have been mapped within the Western Cascade Province are not to be associated in time or in place of origin with High Cascade volcanism." (Taylor 1968). Topographically the natural area is certainly consistent with the deeply eroded character of the western Cascades, and it lies several kilometers west of the recognized boundary (approximately the McKenzie River) between the western and high Cascades.

The dominant rock type is andesite. V 01canic tuffs, breccias, and possibly, intrusive plugs and dikes also occur in the area. Peck et a1. (1964) have provided some data on the lithology and petrography of the volcanic bedrock. Residual materials are covered with aeolian deposits of volcanic ash except where the ash has been removed by erosion. The source and age of the ash deposits are unknown, but there are many possible vents in adjacent parts of the high Cascades (Taylor 1968).

The wet, cool climate of the natural area is typical of subalpine areas in the Cascade Range. Precipitation is heaviest during the winter months (November through March); only 4 to 5 percent occurs during the summer (June through August). About half of the precipitation occurs as snow and accumulates in winter snowpacks which reach maximum depths of 2 to 3 m. (70 to 120 in.) between February and March. The peak of snowmelt typically occurs in May and is completed by June or early July. There are no nearby climatic stations which provide useful climatic indices for the natural area. However, headquarters of the U.S. Army Corps of Engineers' Willamette Basin Snow Laboratory was located in the pass between Squaw and Wildcat Mountains, about 1 km. (0.5 mile) west of the natural area. Between 1947 and 1951, this laboratory collected data on general climate, snow hydrology, stream-flow, etc., in the Blue River drainage. The following data are average values computed for this drainage (U.S. Army Corps of Engineers North Pacific Division 1956):

Mean annual temperature	7.2°C. (45.0°F.)
Mean January temperature	0.0°C. (32.0°F.)
Mean July temperature	16.7°C. (62.0°F.)
Average annual precipitation	3,188 mm. (125.5 in.)
June through August precipitation	127 mm. (5.0 in.)
Snowfall (water equivalent)	174 cm. (68.5 in.)

Since the mean elevation for the basin under study is 1,045 m. (3,430 ft.), temperatures are lower on the natural area and precipitation is higher; an isohyetal map suggests 3,810 to 4,065 mm. (150 to 160 in.) of annual precipitation on the natural area (U.S. Army Corps of Engineers North Pacific Division 1956). The numerous data collected at the Willamette Basin Snow Laboratory are summarized in "Snow Hydrology: Summary Report of the Snow Investigations" (U .S. Army Corps of Engineers North Pacific Division 1956) and are on file at the division office in Portland, Oregon.

Soils in the area are poorly developed Brown Podzolics. In some locations it is difficult to discern any profile development. Generally, however, the surface 15 to 30 cm. (6 to 12 in.) of soil is a weakly expressed B2ir horizon comprised of dark brown, very friable loam or sandy loam with weak subangular blocky structure. This soil material can be described as "fluffy" and is always of very low bulk density. Soil texture usually shows little variation throughout the profile. Stone content increases with depth and often reaches 50 to 60 percent by volume at 45 to 60 cm. (17.71 to 23.62 in.). Despite abundant andesite fragments in the profile these soils are apparently largely derived from aeolian deposits of volcanic ash. Forest floor thickness ranges from 4 to 8 cm. (1.5 to 3 in.) and is occasionally underlain by a very thin, discontinuous A2 horizon.

BIOTA

Approximately 288 ha. (710 acres) of the Wildcat Mountain Research Natural Area are forested. A detailed breakdown of this area by National Forest inventory type, SAF cover type (Society of American Foresters 1954), composition, and age class is provided

in table WM-1. Areas of SAF cover types can be summarized as follows: [2]

No.	*Name*	*Area*
226	Pacific Silver Fir-Hemlock (noble fir-dominated)	209 ha. (517 acres)
226	Pacific Silver Fir-Hemlock (Pacific silver fir-dominated)	38 ha. (95 acres)
205	Mountain Hemlock-Subalpine Fir	22 ha. (55 acres)
230	Douglas-Fir-Western Hemlock	17 ha. (43 acres)

There are 117 ha. (289 acres) of non-forested lands within the natural area, which include rocky cliffs, meadows of various types, and brushfields (fig. WM-2). Kuchler (1964) types represented include Silver Fir-Douglas Fir Forest (3) and Fir-Hemlock Forest (4). Most of the natural area lies within the *Abies amabilis* Zone; the *Tsuga mertensiana* Zone is represented at higher elevations (Franklin and Dyrness 1969).

The most important and nearly ubiquitous tree species in the natural area is noble fir. Pure,130-year-old stands located in the southwestern quarter and 300-year-old stands in the eastern third of the natural area provide excellent examples of this species. Pacific silver fir *(Abies amabilis),* Douglas-fir *(Pseudotsuga menziesii),* and mountain hemlock *(Tsuga mertensiana)* are common associates. Pacific silver fir is absent from the overstory in some of the pure noble fir stands but is present everywhere as seedlings and saplings; in a few stands at highest elevations Pacific silver fir and mountain hemlock are the only species present. Douglas-fir is most abundant in the drainage in section 22 and is nearly absent at higher elevations. Some of the 130year-old stands contain residual 450-year-old Douglas-fir specimens which survived the destruction of the previous stand; young, 130-year-old Douglas-firs in such stands are generally subordinate in the crown canopy to dominant noble firs.

Other tree species present within the natural area are western white pine *(Pinus monticola),* Alaska-cedar *(Chamaecyparis nootkatensis),* and western hemlock *(Tsuga heterophylla).* The pine is scattered throughout the area, but much of it is presently dead or dying from attacks by bark beetles and white pine blister rust. Alaska-cedar is generally found on rocky habitats along the ridgetops and around some meadow areas. Western hemlock is essentially confined to lower elevations.

Mensurational data have been collected only from the younger forest stands in the natural area. Dominant noble fir in the highly productive southwestern part of the natural area average 75- to 100-cm. (30- to 40-in.) d.b.h. and 50 to 55 m. (160 to 180 ft.) tall. Ring counts on roadside stumps indicate a range in age from 120 to 137 years; these data substantiate the age class recognized in the 1960 inventory. Douglas-fir of the same age in these stands average 15 to 30 cm. (6 to 12 in.) smaller in diameter and 2 to 5 m. (5 to 15 ft.) shorter than the dominant noble firs. The scattered old-growth Douglas-firs are commonly 125- to 150-cm. (50- to 60-in.) d.b.h. and about 450 years old. Dominant Pacific silver fir and mountain hemlock stands growing on poorer sites average 30- to 60-cm. (12- to 24-in.) d.b.h. and 30 to 35 m. (l00 to 120 ft.) tall at 120 to 130 years. Trees found in stands over 130 years of age are, of course, larger in size, given comparable site conditions. Maximum diameters observed to date are 186.7 cm. (73.5 in.) at b.h. for noble fir and 91.4 cm. (36.0 in.) b.h. for Pacific silver fir.

Based on size class distributions, successional trends apparently favor gradual replacement of most forest tree species by Pacific silver fir. The degree to which successional processes have advanced varies greatly, especially with stand age, but the trend in compositional changes is generally clear. For example, Pacific silver fir seedlings and saplings are abundant in many of the young (130-year-old), pure noble fir stands; but there are relatively few specimens of any

[2] Assignment of some forest stands in this area to SAF cover types was, in part, arbitrary due to inadequacies in the type definitions (Society of American Foresters 1954). Mixtures of Pacific silver fir and mountain hemlock were assigned to types 226 or 205 based on the relative importance of the two species. All areas dominated by noble fir or a mixture of Douglas-fir and noble fir were assigned to type 226.

species in intermediate size classes. In older stands, Pacific silver fir commonly dominates both seedling and intermediate size classes (fig. WM-3). Pacific silver fir seedlings and saplings are also much more abundant than those of mountain hemlock in mixed stands of these species. In general, noble fir is failing to reproduce within closed forest stands; however, seedlings are abundant on the forest floor after a good seed year and may persist for several years before dying. Mountain hemlock and Douglas-fir also appear ineffectual in reproducing themselves in forest stands.

At least four major forest communities can be recognized within the natural area based on the limited sampling thus far: *Abies procera/Clintonia uniflora, Abies procera/Achlys triphylla, Tsuga mertensiana - Abies amabilis/Xerophyllum tenax,* and *Abies amabilis/Vaccinium membranaceum - Xerophyllum* tenax.[3]

The *Abies procera/Clintonia uniflora* community is found on productive, relatively mesic sites. It is characterized by a herb-rich understory which averages 40- to 45-percent canopy coverage; in some dense stands the coverage is much less (fig. WM-3). Typical species include *Achlys triphylla, Anemone deltoidea, Chimaphila menziesii,* C. *umbellata, Clintonia uniflora, Cornus canadensis, Galiuim oreganum, Pyrola picta, P. secunda, Pteridium aquilinum, Rubus lasiococcus, Smilacina sessilifolia, Tiarella uifoliata, Viola glabella,* and *V. sempervirens. Cornus, Smilacina,* and *Clintonia* usually have the highest coverage of herbaceous species. *Vaccinium membranaceum* has high constancy, but its coverage is relatively low (1 to 15 percent).

Abies procera/Achlys triphylla communities are found on somewhat poorer sites, e.g., areas of shallower soil. Vine maple *(Acer circinatum)* is usually a conspicuous shrubby element in stands of this type. *Vaccinium membranaceum* is also present but has low coverage. The herbaceous layer can be relatively well developed and typically includes *Achlys triphylla, Pyrola secunda, Pteridium aquilinum, Smilacina sessilifolia, Galium oreganum, Viola glabella,* and *V. sempervirens.* The *Achlys* and *Smilacina* normally have the highest herbaceous coverage.

The *Tsuga mertensiana-Abies amabilis/ Xerophyllum tenax* community is typical of the poorest forested habitats, i.e., sites with the shortest, coolest growing seasons and shallow soils. Only two species are important in the understory - *Xerophyllum tenax* and *Vaccinium rnembranaceum.* The liliaceous *Xerophyllum* completely dominates with canopy coverage of up to 90 percent (fig. WM-3).

A fourth forest community, the *Abies amabilis/ Vaccinium membranaceum-Xerophyllum. tenax,* is at least sporadically represented in the natural area. It is intermediate in character between the *Tsuga-Abies/Xerophyllum* and the *Abies/Achlys* types with significant coverage of *Vaccinium membranaceum, Xerophyllum tenax,* and several herbs.

There are also a variety of non-forested communities in the Wildcat Mountain Research Natural Area. These include: (1) communities on logged and burned forest land, (2) meadows of various types, (3) shrub communities, and (4) communities associated with rock outcrops and cliffs. Small portions of areas clear-cut and broadcast burned in 1952 (in section 20) and 1967 (in sections 21 and 28) were incorporated into the natural area. The seral communities present on these areas are typical of early stages in secondary succession on forest habitats. Shrubs (e.g., *Ceanothus velutinus)* dominate on the older (more advanced) clear-cut and herbs on the other. Natural regeneration of conifers is appearing in both.

The meadow communities in the natural area can largely be related to the Wet Meadow, Mesic Meadow, and Subalpine Xeric Meadow types recognized by Hickman (1968) in comparable portions of the western Cascades. The Wet Meadow type is generally found on gentle slopes where a relatively

[3] These are vegetation units which have been recognized in a classification of forest communities in the western Cascades of Oregon. Details are available from Dr. C. T. Dyrness, U.S. Forest Service, Forestry Sciences Laboratory, Corvallis, Oregon.

deep, organic soil has developed; it is relatively rare in the natural area, occurring most frequently adjacent to Sitka alder *(Alnus sinuata.)* thickets. Typical dominants are *Veratrum viride, Senecio triangularis,* and *Valeriana sitchensis.* The Mesic Meadow type occupies habitats where moisture is typically adequate until midsummer. Dominants are *Rubus parviflorus, Pteridium aquilinum,* and *Rudbeckia occidentalis.* There are many associated herbaceous perennials, e.g., *Erigeron aliceae, Lupinus latifolius, Polygonum phytolaccaefolium, Cirsium centaurea,* and *Vicia americana* var. *truncata,* and occasional ephemeral annuals, e.g., *Gayophytum humile.* This type of meadow is probably the most extensive within the natural area. In some locations, invasion of trees, especially noble fir, is taking place; in others, there is no evidence for such successional changes, and the meadow community appears stable. Subalpine Xeric Meadows occur on sites with shallow, rocky soils where moisture becomes critical relatively early in the growing season. Representative species are *Gilia aggregata, Gayophytum diffusum.* var. *parviflorum, Orthocarpus imbricatus, Polygonum douglasii, Navarretia divaricata, Microsteris gracilis, Collinsia parviflora, Cerastium arvense,* and *Rumex acetosella.*

Wet sites adjacent to the meadows and forest, steep, north-facing slopes on Wildcat Mountain, and talus associated with rock outcrops are occupied by shrub communities. Sitka alder is the typical dominant on wetter substrates and steep north slopes forming dense thickets. Deep winter snow accumulations and extensive snow creep cause strong bowing of the 3- to 5-m.-(10- to 16-ft.-) tall alder stems. In a nearby area, the occurrence of these stands has been related to high soil water tables due to a nearly impervious subsoil[4], while in other regions they are associated with recurrent avalanches; both factors are probably operative on the natural area. Vine maple dominates the shrub communities occupying relatively dry talus; these intergrade, in some cases, with Sitka alder communities which may be found on moister portions of the same talus patch. Both types of shrub communities appear to be stable community types as there is generally no evidence of encroachment by tree species.

The communities found on rock outcrops and cliffs have not been examined. The species present undoubtedly include many of those listed by Hickman (1968) for the Outcrop Ridge and Vertical Outcrop habitats recognized in his floristic study of the western Cascades. The Outcrop Ridge habitat is found on south- and west-facing slopes, where mass wasting of small fragments has produced small outcrops of barely exposed parent rock eroded parallel to the general slope of the area. Many species root in weathered cracks or pockets of finer material, including *Delphinium menziesii* var. *pyramidale, Castilleja hispida, Penstemon procerus* var. *brachyanthus, Sedum stenopetalum* and *S. divergens, Eriophyllum lanatum, Arctostaphylos nevadensis, Comandra umbellata, Lomatium martindalei, Sanicula graveolens, Eriogonum compositum, Juniperus communis, Erigeron foliosus* var. *confinis, Arenaria capillaris* var. *americana, Erysimum asperum,* and *Phacelia heterophylla.* Species such as *Saxifraga bonchialis* var. *vespertina* and *Penstemon rupicola* are typical of the exposed Vertical Outcrop habitat.

Mammals believed to utilize the natural area as residents or transients are listed in table WM-2.

The only specialized habitats known to occur on the natural area, which have not already been mentioned, are the live stream and streamside areas.

HISTORY OF DISTURBANCE

Within the core of the natural area there has been some human disturbance. Minor disturbance was associated with construction and maintenance of the Wildcat Mountain trail and fire lookout. A small forest opening was created at the mountain summit when the lookout was built. The building was

[4] Unpublished soil survey data from the H. J. Andrews Experimental Forest, on file at U.S. Forest Service, Forestry Sciences Laboratory, Corvallis, Oregon.

burned about 1966, and the cleared area now has dense tree regeneration. Sheep grazing was frequent in mountain meadows in this part of the Cascade Range into the 1930's. It has undoubtedly influenced the character of the various meadows found within the natural area.

Most human disturbance is along the southern margin of the area although it is considered minor; this area will probably also be the focus of any future problems. Two small areas (fig. WM-l) totalling about 4 ha. (10 acres) were clear-cut prior to natural area establishment. Some mortality (mostly wind-throw) is associated with the margins of these clear-cuts and of Forest Road 147, particularly immediately northwest of the Wildcat-Bunchgrass Mountain saddle. Some damage from road construction (sidecast dirt and rock) also occurred in this area.

Natural disturbances appear to be minor within the natural area since the bulk of the stands were established 130 years or more ago. The scattering of younger stands suggests some minor wildfires have occurred in the last 50 years. Dwarf mistletoe is present in noble fir in at least some of the area, and there also appear to be small scattered pockets of root rot.

RESEARC H

A number of research projects are already in progress at Wildcat Mountain Research Natural Area:

1. Cone production by noble fir has been observed annually since 1961 (Franklin 1968) and that by mountain hemlock and Pacific silver fir since 1967.[5] This study will continue until at least 1972.

2. Total amount and quality of annual seedfall has been under study since 1968, and this research will continue until at least 1972.[6] Seedtraps are located within a pure noble fir stand at about 1,340 m. (4,400 ft.) in the southwestern portion of the natural area and a mixed mountain hemlock-Pacific silver fir stand at about 1,430 m. (4,700 ft.) on the north slope of Bunchgrass Mountain (fig. WM-3) .

3. Vegetation-soil plots (10) have been taken within the natural area as part of a study of the forest communities and their environmental relationships in the central western Cascades of Oregon. These are being incorporated into the resulting classification.[7]

4. Numerous collections of soil fungi have been made within the natural area by Forest Service and Oregon State University mycologists.[8]

5. Stem analyses of noble fir and associated species have been made on specimens cut immediately adjacent to the natural area. Both the least and most productive sites are represented in these samples. The data is presently being analyzed (DeMars, Herman, and Bell 1970; Herman and DeMars 1970).

This natural area is considered an adjunct to the H. J. Andrews Experimental Forest located 8 km. (5 miles) southwest, providing additional representation of high-elevation true fir forest. The possibility exists of using comparable forest areas on the experimental forest for work involving destructive sampling or manipulation and using the natural area as a control site.

The H. J. Andrews Experimental Forest (including Wildcat Mountain Research Natural Area) is also an intensive study site for the U.S. International Biological Program's Coniferous Forest Biome Analysis of Ecosystems project. Two plots being used in this ecosystem research are located in the natural area.[9] one plot is located within a noble fir-Douglas-fir stand in the southwestern corner of the natural area and the other is located in a mountain hemlock-Pacific silver fir stand on the north slope of Bunchgrass

[5] Research by Dr. Jerry F. Franklin, U.S. Forest Service, Forestry Sciences Laboratory, Corvallis, Oregon.

[6] See footnote 5.

[7] Research by Dr. C. T. Dyrness, U.S. Forest Service, Forestry Sciences Laboratory, Corvallis, Oregon.

[8] Research by Dr. James M. Trappe, U.S. Forest Service, Forestry Sciences Laboratory, Corvallis, Oregon.

[9] For additional information, contact Dr. Jerry F. Franklin, U.S. Forest Service, Forestry Sciences Laboratory, Corvallis, Oregon.

Mountain. At present, soil and air temperatures, plant moisture stress, foliage nutrient content, and phenology are being monitored on these plots. Many additional studies are planned for 1972 and 1973. Small mammal populations are also under study within the mountain hemlock-Pacific silver fir stand.

The natural area provides a number of special research opportunities besides those possible in connection with already active research projects. These include research on: (1) the two small watersheds which occupy the eastern half of the area; (2) subalpine stands of varying age, composition, and productivity, including some of pure noble fir; (3) mountain meadows typical of those found in the western Cascades; and (4) succession on small, recently cut-over tracts incorporated within the natural area.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area are: *Topograhy-15'* Echo Mountain, Oregon quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1955; and *geology* - *Reconnaissance Geologic Map and Sections of the Westen Cascade Range/Oregon., North of Latitude* 43° *N.,* scale 1:250,000 (Peck et al. 1964), *Geologic Map of the Central Part of the High Cascade Range, Oregon* (Williams 1957), and *Geologic Map of Oregon West of the* 121*st Meridian,* scale 1: 500,000 (Peck 1961). Either the District Ranger (McKenzie Bridge Ranger District) or Forest Supervisor (Willamette National Forest, Eugene, Oregon) can provide details on the most recent aerial photo coverage and forest type maps for the area.

LITERATURE CITED

DeMars, Donald J., Francis R. Herman, and John F. Bell

1970. Preliminary site index curves for noble fir from stem analysis data. USDA Forest Servo Res. Note PNW119,9 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Franklin, Jerry F.

1968. Cone production by upper-slope conifers. USDA Forest Serv. Res. Pap. PNW-60, 21 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

_____ and C. T. Dyrness

1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Herman, Francis R., and Donald J. DeMars

1970. Techniques and problems of stem analysis of old-growth conifers in the Oregon-Washington Cascade Range. *In* J. Harry, G. Smith, and John Worrall (eds.), Tree-ring analysis with special reference to northwest America, p. 74-77, illus. Univ. Brit. Columbia Fac. For. Bull. 7.

Hickman, James Craig

1968. Disjunction and endemism in the flora of the central western Cascades of Oregon: an historical and ecological approach to plant distributions. 335 p., illus. (Ph.D. thesis, on file at Univ. Oreg., Eugene.)

Kuchler, A. W.

1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Peck, Dallas L.

1961. Geologic map of Oregon west of the 121st meridian. U.S. Geol. Surv. Misc. Geol. Invest. Map 1-325.

_____ Allan B. Griggs, Herbert G. Schlicker, Francis G. Wells, and Hollis M. Dole

1964. Geology of the central and northern parts of the Western Cascade Range in Oregon. U.S. Geol. Surv. Prof. Pap. 449, 56 p., illus.

Society of American Foresters

1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, *D.C.*

Taylor, Edward M.

1968. Roadside geology Santi am and McKenzie Pass highways, Oregon. *In* Hollis M. Dole (ed.), Andesite Conference guidebook. Oreg. Dep. Geo!. & Miner. Ind. Bull. 62: 3-33, illus.

U.S. Army Corps of Engineers North Pacific Division

1956. Snow hydrology: Summary report of the snow investigations. 437 p., illus. U.S. Army Corps of Engineers, Portland, Oreg.

Williams, Howel

1957. A geologic map of the Bend quadrangel, Oregon and a reconnaissance geologic map of the central portion of the High Cascade Mountains. Oreg. State Dep. Geol. and Min. Ind.

Table WM-1. — Area of forest types in the Wildcat Mountain Research Natural Area[1]

Forest Service inventory type[2]	Major species[3]	SAF type	Age class[4]	Area	
			Years	*Ha.*	*Acres*
Cutover	NF,DF	226	10	4.0	10
FM 1	MH, PSF	205	30	4.0	10
FM 1	PSF, MH	226	20	4.0	10
FM 1	NF	226	30	4.0	10
FM 2	PSF	226	70	2.0	5
FM 3	PSF, MH	226	120	12.2	30
FM 3	MH, PSF	205	140	18.2	45
FM 3	NF	226	70	4.0	10
FM 4	NF	226	120	8.1	20
FM 4	NF, DF	226	120	72.9	180
FM 4	NF, DF	226	300	48.6	120
FM 4	NF, PSF	226	300	36.4	90
FM 4	NF, PSF, MH	226	350	28.4	70
FM 4	PSF, MH, NF	226	350	20.2	50
D 4	DF, NF	226	120	4.0	10
D 4	DF, NF, WH	230	180	16.2	40
TOTAL				287.6	710

[1] Based on 1960 inventory of the Willamette National Forest.

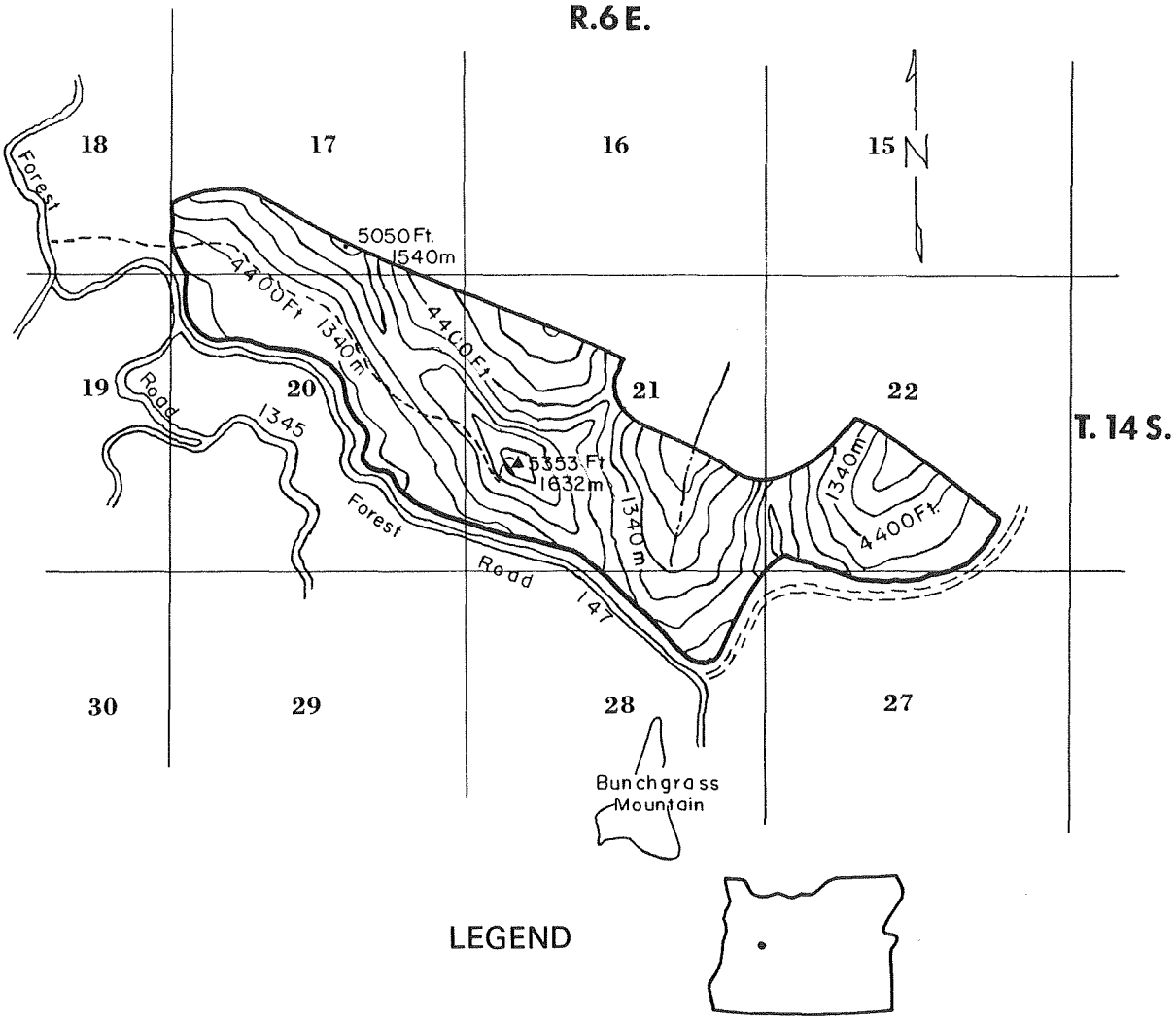
[2] Alphabetical symbols refer to forest type: FM, true fir-mountain hemlock; and D, Douglas-fir. Numeric symbols refer to size class: 1, seedlings and saplings, 0- to 5-in. d.b.h.; 2, pole timber, 5- to 11-in. d.b.h.; 3, small sawtimber, 11- to 21-in. d.b.h.; and 4, large sawtimber, 21-in. and larger d.b.h.

[3] In approximate order of importance. Abbreviations are: NF, noble fir; DF, Douglas-fir; MH, mountain hemlock; PSF, Pacific silver fir; and WH, western hemlock.

[4] Estimated age at time of 1960 inventory.

Table WM-2. — Tentative list of mammals for Wildcat Mountain Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Scapanus townsendi	Townsend mole
	Sorex bendirii	marsh shrew
	Sorex palustris	northern water shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Ochotona princeps	pika
Rodentia	*Aplodontia rufa*	mountain beaver
	Arborimus albipes	white-footed vole
	Arborimus longicaudus	red tree vole
	Clethrionomys californicus	California red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Microtus richardsoni	Richardson vole
	Microtus townsendi	Townsend vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Tamiasciurus douglasi	chickaree
	Thomomys mazama	Mazama pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Canis lupus	wolf
	Felis concolor	mountain lion or cougar
	Gulo luscus	wolverine
	Lynx rufus	bobcat
	Martes americana	marten
	Martes pennanti	fisher
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer



LEGEND

BOUNDARY, WILDCAT MOUNTAIN RESEARCH NATURAL AREA

SECTION LINE

STREAM

ROAD

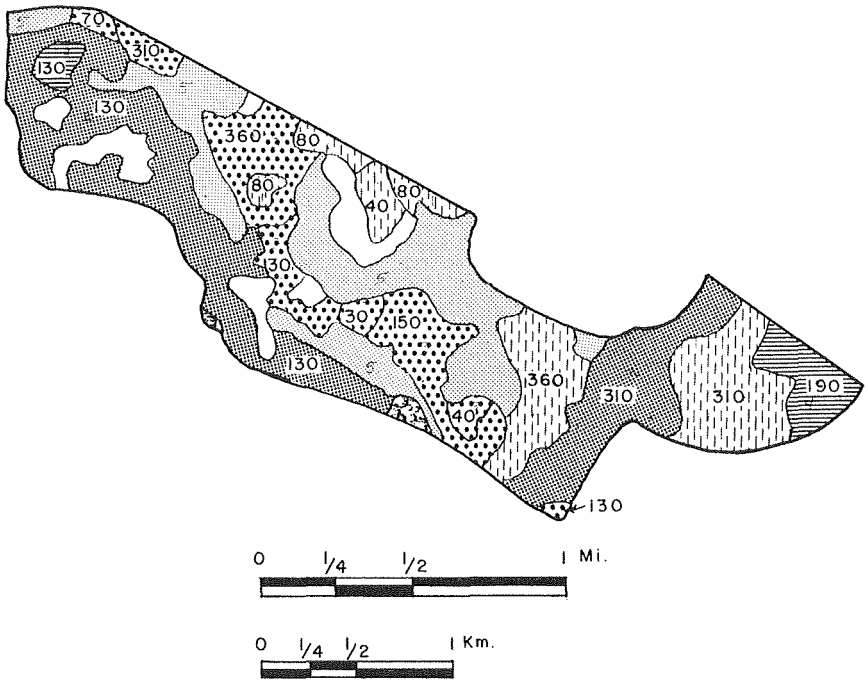
PROPOSED ROAD

TRAIL

0 1/4 1/2 1 Mi.

0 1/4 1/2 1 Km.

Figure WM-1.– Wildcat Mountain Research Natural Area, Linn County, Oregon.



LEGEND

NOBLE FIR-DOMINATED FOREST WITH PACIFIC SILVER FIR

NOBLE FIR-DOMINATED FOREST WITH DOUGLAS-FIR

MIXED FOREST OF PACIFIC SILVER FIR AND MOUNTAIN HEMLOCK

MIXED FOREST OF DOUGLAS-FIR AND NOBLE FIR

ROCKY AREAS

MOIST MEADOWS AND BRUSHFIELDS

CLEARCUT FORESTED AREAS

Figure WM-2.– Forest types and age classes in the Wildcat Mountain Research Natural Area.
(Data source: 1960 inventory, Willamette National Forest.)

Figure WM-3.-Forest communities of Wildcat Mountain Research Natural Area. Upper left: Community of *Tsuga mertensiana-Abies amabilis/Xerophyllum tenax;* the approximately 130-year-old trees average 30- to 50-cm. (12- to 24-in.) d.b.h. Upper right: Nearly pure stand of noble fir growing along Wildcat Mountain trail; these approximately 130-year-old trees average 75-cm. (30-in.) d.b.h. and 45 m. (150 ft.) tall. Lower left: Older stand (approximately 180 years) of noble fir showing abundant seedlings and saplings of Pacific silver fir, the probable climax species. Lower right: Collecting contents of seedtrap in stand of mountain hemlock and Pacific silver fir as part of long-term study of tree seeding habits on the natural area.

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972.
Pacific Northwest Forest and Range Experiment Station.
Portland, Oregon.

WILLAMETTE FLOODPLAIN RESEARCH NATURAL AREA[1]

Grassland and Oregon ash forest on wet bottom lands in Oregon's Willamette Valley.

The Willamette Floodplain Research Natural Area provides an excellent example of the grassland-forest community mosaic found on wet valley-bottom habitats or flood plains in western Oregon's Willamette Valley. Originally established on December 27, 1966, to exemplify unplowed, near-natural grasslands, it has since been relocated and enlarged to include typical flood plain forests of Oregon ash *(Fraxinus latifolia).* The 97-ha. (239-acre) tract is located in Benton County, Oregon, and is administered by the William L. Finley National Wildlife Refuge (Route 2, Box 208, Corvallis, Oregon), Bureau of Sport Fisheries and Wildlife. It occupies portions of section 28, T. 13 S., R. 5 W., Willamette meridian, at 44 °26' N. latitude and 123 °18' W. longitude (fig. WP-1).

ACCESS AND ACCOMMODATIONS

The natural area is located about 16 km. (10 miles) south of Corvallis, a short distance west of U.S. Highway 99W. A graveled all-weather road provides access to within a few hundred feet of the west boundary; from there travel is by foot cross-country and over fire trails. Cross-country travel to and through the tract (except for the crossing of Muddy Creek) is very easy because of the gentle ground. Commercial accommodations are available in Corvallis; there are no public campgrounds within the Refuge.

[1] Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

ENVIRONMENT

The Willamette Floodplain Research Natural Area is located on essentially flat topography typical of the floor of the Willamette Valley. Elevation ranges from about 82 to 88 m. (270 to 290 ft.). Gentle swales and ridges, which are most easily distinguished on aerial photographs, provide the only relief. Muddy Creek, a small, turbid, meandering, valley-bottom stream, flows through the center of the area.

The natural area is located on valley bottom alluvium consisting of unconsolidated silt sands and gravels (Vokes, Myers, and Hoover 1954). These alluvial materials belong to a group known as the Willamette silts, which are believed to be of the Wisconsin age, and to a Recent group. Piper (1942) provides additional details on these materials.

The natural area is located in western Oregon, an area of mild, moist climate. However, it is within the Willamette Valley, which is located between the Coast and Cascade Ranges, and is, therefore, subject to the somewhat warmer and drier climate typical of interior western Oregon valleys. The summer dry period is especially pronounced. Representative climatic data from the Corvallis weather station, which is about 16 km. (10 miles) north, are as follows (U.S. Weather Bureau 1965) :

Mean annual temperature	11.6°C. (53.0°F.)
Mean January temperature	4.1°C. (39.4°F.)
Mean July temperature	19.2°C. (66.6°F.)
Mean January minimum temperature	0.6°C. (33.1°F.)
Mean July maximum temperature	27.1°C. (80.8°F.)
Average annual precipitation	957 mm. (37.67 in.)
June through August precipitation	49 mm. (1.93 in.)

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According to a recent soil survey, the soil series found in the natural area are the Dayton and Woodburn silt loams and Waldo silty clay loams; the approximate percentage of the area in each series is 65, 20, and 15 percent, respectively. The grasslands occupy a mosaic of Dayton and Woodburn silt loams. The forested areas are mainly found on the Dayton series (80 percent), with some Waldo series along the western boundary. The relationships of several of these soils to geomorphic surfaces have been described by Balster and Parsons (1968). The Dayton series has been classified as a Planosol and Typic Albaqualf by the old and new soil classifications, respectively. It consists of a shallow, poorly drained silt loam over clay developed in waterdeposited silts over older underlying materials. A typical horizon sequence is as follows (the plow layer (Ap) is, of course, absent in the natural area): Dark grayish brown Ap from 0 to 20 em.; Grayish silty clay loam A2 from 20 to 38 em.; and Dark grayish clayey IIB2t from 38 to 83 em. Detailed studies have shown that the boundaries between the A2, B2, and C horizons represent depositional discontinuities (Parsons and Balster 1967). The Woodburn silt loam can be classified as a Brunizem or Aqualtic Argixeroll. The very deep moderately well-drained silt loam surface soil and silty clay loam subsoil is developed in silty alluvial deposits. A typical horizon sequence is as follows (the plow layer (Ap) is absent in the natural area): Very dark grayish brown Ap from 0 to 20 em.; Dark brown A3 from 20 to 40 em.; Dark brown B1 from 40 to 60 em.; and a dark brown silty clay loam B2t from 60 to 120 em.

BIOTA

The natural area is almost evenly divided between grassland and forest. The grasslands occupy about 50 ha. (123 acres), mostly in the eastern half of the tract. Forests, dominantly of Oregon ash, cover 47 ha. (116 acres) in the western half of the natural area. The ash forests can be related to Kuchler's (1964) Type 25, Alder-Ash Forest. The natural area is located within the Interior Valley *(Pinus - Quercus - Pseudotsuga)* Zone of Franklin and Dyrness (1969).

The grasslands found on the Willamette Floodplain Research Natural Area are probably as natural as any remaining on similar wet bottom land habitat anywhere in the Willamette Valley. These communities are a rich mixture of native and introduced species and of grasses, grasslike plants, and forbs. Typical dominants include *Carex ovales,* C. *leporina, Alopecurus geniculattus, Deschampsia caespitosa,* and *Hordeum brachyantherum.* Forbs commonly encountered include *Saxifraga integrifolia, Lomatium bradshawii, Achillea millefol1ium, Ranunculus orthorhynchus, Veronica scutellata, Potentilla gracilis, Myosotis versicolor, Sidalcia nelsoniana, Galium trifidum,* and *Hypericum perforatum.* Other species known to occur include *Sidalcia campestris, Geranium dissectum, G. molle, Collinsia parviflora, Cardamine oligosperma., Lathyrus* spp., *Ceratstium glomeratum, Plantago lanceolata, Luzula comosa, Carex lanuginosa,* C. *unilateris, Rumex acetosella, Dipsacus sylvestris, Trifolium dubium, Mimulus guttatus, Sisyrinchium angustifolium, Juncus confusus, J. bufonius, Bromus commutatus, Fragaria vesca, Geranium oreganum, Orthocarpus hispidus,* and *Epilobium glandulosum Deschampsia danthonioides* and *Plagiobothrys figuratus* are common dominants on disturbed microsites.

Some shrub and tree species are abundantly scattered through the natural area. Oregon ash, *Rosa nutkana, Spiraea douglasii, Pyrus fusca, Crataegus douglasii,* and *Amelanchier alnifolia* are among the more common. Aerial photographs (Fig. WP-1) reveal that the trees and shrubs are not uniformly distributed over the grassland; instead they appear to be densest on convex topography or microridges. Woody plants appear to be extending their range and increasing their dominance in some grassland areas, suggesting gradual successional replacement of the existing herbaceous communities by trees and shrubs (fig. WP-2). This invasion is probably a consequence of fire control programs; most natural grasslands found in the Willamette Valley are believed to have been maintained by periodic

burning. Consequently, present plans are for periodic burning of a portion of the grasslands on the natural area. Before this is attempted, burning will be tested as a management technique on a similar, nearby area.

Very little descriptive work has as yet been carried out on the forest stands. Oregon ash is the major dominant but Oregon white oak *(Quercus garryana)* becomes a co-dominant or dominant in the stands located west of Muddy Creek (fig. WP-2). The Oregon ash stands vary considerably in age and in density and composition of understory. Some of the denser young stands have essentially no ground vegetation. All of the lowland forest is, of course, subject to flooding by the overflow of Muddy Creek every winter.

Mammals which are believed to occur on the Willamette Floodplain Research Natural Area as residents or transients are listed in table WP-l. The western pond turtle *(Clemmys marmorata)* is found in Muddy Creek.

Many different bird species may be encountered within the natural area; a complete checklist of the birds for the Refuge is available at Refuge Headquarters. Among those frequenting the natural area itself are all of the water fowl which periodically feed on land, such as the dusty Canada goose *(Branta canadensis* var. *occidentalis),* for which the wildlife refuge was established, marsh hawk *(Circus cyaneus),* short-eared owl *(Asio flammeus),* red-tailed hawk *(Buteo jamaicensis),* rough-legged hawk *(Buteo lagopus),* western meadowlarks *(Sturnella neglecta),* golden-crowned sparrows *(Zonotrichia atricapilla),* northern shrike *(Lanius excubitor),* ringnecked pheasant *(Phasianus colchicus),* California quail *(Lophortyx californicus),* and bobwhite *(Colinus virginanus).* Large numbers of mallards *(Anas platyrhynchos)* are encountered along Muddy Creek at certain times of the year.

HISTORY OF DISTURBANCE

Human activities have had a significant impact on the natural area. The grasslands have never been plowed, but they were subject to heavy grazing and were probably burned periodically prior to establishment of the refuge in 1963. The grassland stand in the southwestern corner of the natural area is an abandoned field which is gradually undergoing colonization by native plants; the field was abandoned some time prior to 1964.

RESEARC H

The only research conducted thus far on the Willamette Floodplain Research Natural area is by undergraduate students in ecology and wildlife from Oregon State University; the Refuge Manager can provide details.

The natural area is a uniquely valuable research site. It is one of only two scientific reserves which includes stands of Oregon ash and provides the only protected example of semi-natural, unplowed Willamette Valley grassland. Among the many opportunities for research include studies of: (1) successional processes, particularly in connection with the burning program planned for a portion of the natural area; (2) variation in community composition in relation to microtopography (swale vs. ridge); (3) the role of various introduced plant species; (4) long-term changes in the forest-grassland boundary; and (5) aquatic and semiaquatic organisms associated with a meandering valley stream.

MAPS AND AERIAL PHOTOGRAPHS

There are no special maps of sufficient detail to be of value. Aerial photographs taken in June 1970 are available from the Agricultural Stabilization and Conservation Service, Benton County ASC Committee, P.O. Box 1027, Corvallis, Oregon. The photo providing the best coverage of the natural area is D F J 1LL-47.

LITERATURE CITED

Balster, C. A., and R. B. Parsons
1968. Geomorphology and soils, Willamette Valley, Oregon. Oreg. Agric. Exp. Stn. Spec. Rep. 265, 31 p., illus.

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Serv. Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Parsons, R. B., and C. A. Balster
1967. Dayton - a depositional planosol, Willamette Valley, Oregon. Soil Sci. Soc. Am. Proc. 31: 255-258, illus.

Piper, Arthur M.
1942. Ground-water resources of the Willamette Valley, Oregon. U.S. Geol. Surv. Water-Supply Pap. 890,194 p., illus.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Oregon. Climatography of the United States 86-31, 96 p., illus.

Vokes, H. E., D. A. Myers, and Linn Hoover
1954. Geology of the west central border area of the Willamette Valley, Oregon. U.S. Geol. Surv. Oil & Gas Invest. Map OM-150.

Table WP-1. — Tentative list of mammals for Willamette Floodplain Research Natural Area

Order	Scientific name	Common name
Marsupialia	*Didelphis marsupialis*	opossum
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus townsendi	Townsend mole
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Sylvilagus bachmani*	brush rabbit
	Sylvilagus floridanus	eastern cottontail
Rodentia	*Eutamias townsendi*	Townsend chipmunk
	Microtus canicaudus	gray-tailed vole
	Microtus townsendi	Townsend vole
	Myocastor coypus	nutria
	Neotoma fuscipes	dusky-footed wood rat
	Ondatra zibethicus	muskrat
	Peromyscus maniculatus	deer mouse
	Spermophilus beecheyi	California ground squirrel
	Thomomys bulbivorus	giant pocket gopher
Carnivora	*Canis latrans*	coyote
	Lynx rufus	bobcat
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Procyon lotor	raccoon
	Urocyon cinereoargenteus	gray fox
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Odocoileus h. columbianus*	black-tailed deer

Figure WP-1.– Aerial photograph of Willamette Floodplain Research Natural Area, Benton County, Oregon, showing boundaries, vegetative patterns, and other features.

Figure WP-2.-Natural features of Willamette Floodplain Research Natural Area. Upper left: Typical view of Muddy Creek showing streamside forest dominated by Oregon ash. Upper right: Grassland and Oregon white oak-dominated stand in southeastern corner of the natural area; note the mistletoe in the oak trees. Lower left: Portion of grassland which has been lightly invaded by shrubs and trees; invading *Crataegus* (background) and a patch of *Spiraea* (center) are visible. Lower right: Grassland area dominated by *Deschampsia caespitosa*, *Alopecurus geniculatus*, and *Carex* spp.

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

WIND RIVER RESEARCH NATURAL AREA[1]

Old-growth Douglas-fir - western hemlock stands growing in a valley in the southern Washington Cascade Range.

The Wind River Research Natural Area was established on March 28, 1934, to exemplify the old-growth Douglas-fir *(Pseudotsuga menziesii)* - western hemlock *(Tsuga heterophylla)* forests which originally covered many valleys in western Washington's Cascade Range. The 478-ha. (l,180-acre) tract is located in Skamania County, Washington, and is administered by the Wind River Ranger District (Carson, Washington), Gifford Pinchot National Forest. It is also a part of the Wind River Experimental Forest, a 4,380-ha. (10,815-acre) area maintained by the Pacific Northwest Forest and Range Experiment Station for research and demonstration of management techniques in the Douglas-fir type (U.S. Forest Service 1951). The tract occupies portions of sections 8, 17, 20, and 21, T. 4 N., R. 7 E., Willamette meridian (fig. WR-1). Boundaries are based on legal descriptions except for the southern boundary in section 20 which is 90 m. (300 ft.) north of and parallel to Trout Creek. The natural area lies at 45°49' N. latitude and 121°58' W. longitude.

ACCESS AND ACCOMMODATIONS

It is easiest to reach the natural area from the south via the Columbia River (U.S. Highway 830), Carson, and the Wind River valley, following Forest Highway 30 and Forest Road N411 to Hemlock Ranger Station (Wind River Ranger District). Just west of the ranger station turn onto Forest Road N417, which crosses the southwestern corner of the natural area about 3.2 km. (2 miles) from the station (fig. WR-1). The eastern edge of the natural area can be reached and is crossed by Forest Road N400, a low standard road which leads north from Forest Road N417 about 0.8 km. (0.5 mile) west of the ranger station.

A trail crosses section 20 and follows the northern edge of section 21, connecting Forest Roads N417 and N400 and providing access to the southern half of the natural area. The northern half is probably easiest to reach by cross-country travel from Forest Road N 46 which climbs the eastern slopes of Trout Creek Hill just west of the natural area boundary.

The nearest commercial accommodations are in Stevenson, about 24 km. (15 miles) away. However, there are several improved forest camps in adjacent portions of the Wind River valley.

ENVIRONMENT

The natural area occupies gently sloping or undulating topography on the lower slopes of the Wind River valley and Trout Creek Hill, an extinct shield volcano (fig. WR-1). Topography is somewhat steeper in the northwestern corner and at the extreme eastern edge of the natural area on the slopes of Trout Creek Hill and Bunker Hill, respectively. Portions of the area (e.g., in the NW1/4 of section 21) are nearly flat and relatively moist. There is also significant area of swamp, marsh, and open water along the western base of Bunker Hill, probably created, at least in part, by beaver *(Castor canadensis)* activity (fig. WR-2). Ele-

[1] Description prepared by Dr. J. F. Franklin, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon.

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vations range from 335 to 610 m. (1,100 to 2,000 ft.)

Bedrock in the natural area consists almost entirely of olivine basalts of Pleistocene Recent age (Wise 1970). These materials are part of the flows which originated on Trout Creek Hill. Wise (1970) has provided some petrological information on these basalts. Trout Creek Hill is surmounted by two cinder cones, and bedrock in the natural area is rarely encountered due to various surface deposits. Most of these, if not all, are composed of volcanic ejecta of unknown sources. The lower slopes of Bunker Hill, at the extreme eastern edge of the natural area, are occupied by Eocene to Oligocene andesitic to rhyodacitic pyroclastic rocks belonging to the Ohanapecosh Formation (Wise 1970).

A cool, moist climate prevails. Precipitation is seasonal, peaking during winter months and reaching lowest levels during the summer. Summer drought periods of 2 months' duration have been recorded (Steele 1952). Much of the winter precipitation occurs as snow, and at least some snow cover typically blankets the natural area during most of the winter. The following climatic data are for the Hemlock Ranger Station located about 3 km. (2 miles) southeast of the natural area and are probably quite representative of conditions there (Wind River Station in U.S. Weather Bureau 1965); additional climatic data are summarized by Steele (1952):

Mean annual temperature	8.7°C. (47.8°F.)
Mean January temperature	0.0°C. (32.0°F.)
Mean July temperature	17.5°C. (63.5°F.)
Mean January minimum temperature	−3.7°C. (25.3°F.)
Mean July maximum temperature	26.9°C. (80.5°F.)
Average annual precipitation	2,528 mm. (99.51 in.)
June through August precipitation	119 mm. (4.67 in.)
Average annual snowfall	233 cm. (91.7 in.)

Soils have not been mapped within the natural area. However, at least some profiles are similar morphologically to the Stabler shotty loam soil series described from nearby areas during a Skamania County soil survey (Anderson et al. 1956). This series was categorized as a "Brown Podzolic - Brown Lateritic" intergrade; it may better fit the Sols Bruns Acides great soil group. A typical profile located in flat topography in the eastern part of the natural area is as follows:

01	4 to 3 cm.	Undecomposed organic matter; pH 4.7.
02	3 to 0 cm.	Mainly decomposed but recognizable organic matter; pH 4.3.
A1	0 to 25 cm.	Dark brown shotty sandy loam; granular structure; abundant concretions; pH 5.3.
A3	25 to 50	Brown shotty sandy loam; weak, medium subangular blocky structure; abundant concretions; pH 5.4.
B21	50 to 74 cm.	Dark yellowish brown sandy loam; moderate medium subangular blocky structure; pH 6.3.
IIB22	74 to 81 cm.	Strong brown to yellowish brown sandy loam; massive structure; common, gravel-sized, weathered white pumice; pH 6.0.
IIIB23	81 to 132 cm.	Dark yellowish brown loam; strong coarse subangular blocky structure; common, severely-weathered, gravel-sized pumice; pH 5.9.
IIIB24	132 to 170 cm.	Yellowish red loamy sand; weak, medium subangular blocky structure; occasional, severely-weathered gravel-sized pumice; increasingly vesicular with depth; pH 6.1.
IIIB3	170 to 190 cm.+	Dark grayish brown loamy sand; massive; common, severely-weathered, gravel-sized pumice; abundant reddish brown mottles; pH 6.0.

These soils are certainly not developed primarily from residual parent materials. Volcanic ejecta appear to make up the bulk of the surface soil and have probably been deposited by both wind and water. Layering of parent materials is apparent in many profiles, including the one described above.

In general, soils become stonier, shallower, and more podzolic from east to the west, and from lower to higher elevations within the natural area.

BIOTA

For convenience all 478 ha. (1,180 acres) of the natural area can be classified as SAF cover type 230, Douglas-Fir - Western Hemlock (Society of American Foresters 1954), and Kuchler's (1964) Type 2, Cedar - Hemlock - Douglas Fir Forest. Localized areas could probably be typed as SAF type 224, Western Hemlock. Some of the swampier ground on the eastern edge of the natural area has substantial amounts of western red cedar *(Thuga plicata),* and there is some acreage of open water and marsh. The natural area is located within the *Tsuga heterophylla* Zone of Franklin and Dyrness (1969). However, it contains a surprising number of subalpine or montane *(Abies amabilis* Zone) elements, considering the low elevation it occupies; e.g., an abundance of Pacific silver fir *(Abies amabilis),* occasional noble fir *(Abies pro cera),* and the moss *Rhytidiopsis robusta.* This may be partially due to valley microclimatic influences.

Most of the natural area is occupied by 350-year-old forest stands but there are some small areas of younger age classes (fig. WR-1). Most notable is the approximately 70-year-old Douglas-fir stand located south of Forest Road N417 in section 20. This stand dates from the 1902 Yacolt Burn. Two small areas along the northeastern boundary of the natural area were accidentally logged when the adjacent, then private, forest lands were cut 50 to 60 years ago; they are now occupied by a second-growth Douglas-fir stand.

Tree species found within the natural area include Douglas-fir, western hemlock, western red-cedar, Pacific silver fir, western white pine *(Pinus monticola),* and noble fir. The relative importance of the species, in terms of stand volume, is shown in table WR-l. The exact composition of the stands varies through the natural area. In some, Douglas-fir has been completely replaced by western hemlock and Pacific silver fir, while in others the hemlock and fir have not yet attained a dominant overstory position. Western red cedar is most common in the eastern extremity of the natural area.

Stand growth and mortality in the natural area have been studied since 1947 (table WR1). Site productivity is only moderate, with an average Douglas-fir site index of 130 (a low class III) indicating Douglas-fir dominants should average 40 m. (130 ft.) in height at the index age of 100 years. The 350-year-old stand contains a total stand volume of 1,053 cu. m. per ha. (96,880 bd. ft. per acre) and is making considerable annual growth despite its advanced age (table WR-1). Most of the growth is offset by mortality in the Douglas-fir and western white pine, however. An epidemic of Douglas-fir bark beetles *(Dendroctonus pseudotsuga),* which climaxed during 1951 to 1953, and wind-throw (fig. WR-2) have been the chief causes of mortality in Douglas-fir. Mountain pine beetles *(Dendroctonus monticolae)* and white pine blister rust *(cronartium ribicola)* have practically eliminated the western white pine. Some western hemlock have been lost to windthrow and dwarf mistletoe *(Arceuthobium campylopodum)* infections.

Forest stands in the natural area are progressing toward a climax of western hemlock and Pacific silver fir, a process accelerated by heavy mortality in the Douglas-fir overstory. Although Pacific silver fir is below its normal elevational range as a climax species for this part of the Cascade Range, it is reproducing throughout most of the natural area. In many stands Pacific silver fir seedlings and saplings are as abundant as, or more so than, those of western hemlock. The growth and mortality data (table WR-1) further illustrate the course of stand succession with heavy losses of Douglas-fir and western white pine from the overstory.

Typical understory dominants vary considerably with local site conditions. Over much of the area, small trees form a second canopy level 5 to 10 m. (15 to 35 ft.) in height, made up of vine maple *(Acer circinatum),* Pacific dogwood *(Cornus nuttallii),* and Pacific yew *(Taxus brevifolia)* (fig. WR-2). A

shrub layer is typified by *Berberis nervosa, Vaccinium pnrvifolium, Gaultheri shallon, Vaccinium membraceum, Rubus ursinus,* and, in local areas, *Rhododendron macrophyllum.* Conspicuous herbs include *Clintonia uniflora, Achlys triphylla, Pteridium aquilinum, Xerophyllum tenax, Linnaea borealis, Trillium ovatum, Anemone deltoidea, Chimaphila umbellata,* and *C. menziesii.* Major mosses are *Eurhynchium oreganum, Camptothecium megaptilum.,* and *Rhytidiopsis robusta* Moister habitats have greater coverage of herbaceous species and less fertile or drier habitats greater amounts of ericads, such as *Gaultheria shallon* and *Xerophyllum tenax.* Two stands sampled during a study of forest communities in the southern Washington Cascade Range were assigned to an *Abies amabilis/Gaultheria shallon* Association (Franklin 1966); at least a part of the area could be characterized by a *Tsuga heterophylla/Acer circinatum - Berberis nervosa* Association.

Mammals believed to utilize the natural area as residents or transients are listed in Table WR-2. Some minor hunting of larger game animals occurs within the natural area.

Shelford (1963) observed that ants *(Formica rufa melnotica)* were the commonest insects on animal paths. Tenebrionid beetles *(Iphthinus serratus)* and tiger beetle larvae were also in evidence. He also collected western toads *(Bufo boreas)* and tailed frogs *(Ascaphus truei)* from the natural area.

There are no permanent streams within the natural area. The ponds and swamps at the foot of Bunker Hill provide the major areas of aquatic and semiaquatic habitat (fig. WR-2).

HISTORY OF DISTURBANCE

Human disturbance of the natural area is minor and confined to the boundaries and roadside and trailside areas. Lands on the north side of the natural area were logged 50 to 60 years ago. These have now regenerated and are occupied by young conifer forest, minimizing present edge effects. A logging railroad once crossed the extreme eastern boundary of the natural area, but the abandoned right-of-way can be located only with difficulty. Recent logging on the south side of the natural area will undoubtedly have some influence, possibly resulting in increased wind-throw within adjacent portions of the natural area.

Natural disturbances appear to be those typical of over-mature conifer forest in this region, i.e., losses to wind-throw and various pathogens mentioned earlier. Except for the small area burned in 1902, there is no evidence for wildfires within the natural area during the last 200 to 300 years.

RESEARCH

Wind River Research Natural Area has a long history of research. Many of the basic ecological studies of Douglas-fir were carried out here by Leo A. Isaac and his associates (e.g., Isaac 1940, 1943). Included were observations on natural seedfall, seed storage in the forest floor, seed germination under virgin timber, phenology, and moisture content of the forest floor. The screens used to protect seed stored in the forest floor in 1928 (Isaac 1940) were located during a reconnaissance of the area in 1969 (fig. WR-2).

The long-term study of tree growth and mortality established in 1947 and cited earlier (Steele and Worthington 1955, King 1961) is continuing. This study utilizes fifty-four 0.08-ha. (1/5-acre) growth plots, one hundred and eight 0.40-ha. (I-acre) mortality plots, and twenty-seven 0.0016-ha. (4-milacre) ground vegetation plots systematically spaced over the natural area. A re-measurement was completed in 1971 and provides 24 years of record.

Numerous observations have been made within the natural area by visiting botanists, zoologists, foresters, and soil scientists. However, these data were generally not published with specific reference to the natural area. The natural area was used as a sampling site for a study of forest communities and soils in the southern Washington Cascade Range (Franklin 1966).

Wind River Research Natural Area is a part of the Wind River Experimental Forest,

much of which is similar in forest type and environment. The possibility exists of using other parts of the experimental forest for work involving destructive sampling or manipulation and using the natural area as control site.

MAPS AND AERIAL PHOTOGRAPHS

Special maps applicable to the natural area are: *Topogmphy* 15' Wind River, Washington quadrangle, scale 1: 62,500, issued by the U.S. Geological Survey in 1957; and *geology* - *Geologic Mop of Washington,* scale 1:500,000 (Huntting et al. 1961), and *Geologic Map and Sections of the Wind River Area, Skamania County, Washington,* scale 2 in. equals 1 mile (Wise 1970). Either the District Ranger (Wind River Ranger District) or Forest Supervisor (Gifford Pinchot National Forest, Vancouver, Washington) can provide details on the most recent aerial photo coverage and forest type maps for the area.

Copies of a topographic map (scale 4 in. or 8 in. equals 1 mile, 50- or 10-foot contour intervals) for the Trout Creek Division of the Wind River Experimental Forest, including the natural area, are on file at the Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. This map was prepared by Forest Service personnel in 1934. Records of a 1934 cruise of the area, and a very generalized type map based upon it, are also on file there.

LITERATURE ITED

Anderson, A. C., Merrill Kunkle, F. E. Schlots, Don Klauss, and Clarence Lounsbury
1956. Soil survey of Skamania County, Washington. U.S. Dep. Agric. Soil Surv. Rep. Series 1940, No. 20, 92 p., ill us.

Franklin, Jerry Forest
1966. Vegetation and soils in the subalpine forests of the southern Washington Cascade Range. 132 p., illus. (Ph.D. thesis, on file at Wash. State Univ., Pullman.)

Franklin, Jerry F., and C. T. Dyrness
1969. Vegetation of Oregon and Washington. USDA Forest Servo Res. Pap. PNW-80, 216 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen
1961. Geologic map of Washington. Wash. Dep. Conserv., Div. Mines & Geol.

Isaac, Leo A.
1940. Life of seed in the forest floor. Pac. Northwest Forest & Range Exp. Stn. USDA Forest Servo Res. Note 31: 14. Portland, Oreg.

1943. Reproductive habits of Douglas Fir. 107 p., illus. Washington, D.C.: Charles Lathrop Pack Foundation.

King, James P.
1961. Growth and mortality in the Wind River Natural Area. J. For. 59: 768769, illus.

Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Shelford, Victor E.
1963. The ecology of North America. 610 p., illus. Urbana: Univ. Illinois Press.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

Steele, Robert W.
1952. Wind River climatological data 1911-1950. Pac. Northwest Forest & Range Exp. Stn. USDA Forest Serv., 21 p. Portland, Oreg.

__ __and Norman P. Worthington
1955. Increment and mortality in a virgin Douglas-fir forest. Pac. Northwest Forest & Range Exp. Sta. USDA Forest Servo Res. Note 110, 6 p., illus. Portland, Oreg.

U.S. Forest Service
1951. A guide to the Wind River Experimental Forest near Carson, Washington. Pac. Northwest Forest & Range Exp. Stn. USDA Forest Servo 20 p., illus. Portland, Oreg.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Wise, William S.
1970. Cenozoic volcanism in the Cascade Mountains of southern Washington. Wash. Dep. Conserv., Div. Mines & Geol. Bull. 60, 45 p., illus.

Table WR-1. — Inventory and annual growth and mortality within Wind River Research Natural Area[1]

Species	Inventory (1959)		Growth and mortality (1947-59)					
			Gross growth	Mortality	Net growth	Gross growth	Mortality	Net growth
	Cu. m./ha.	Bd. ft./acre	Cu. m./ha.			Bd. ft./acre		
Douglas-fir	647	63,036	1.8	3.6	−1.8	179	350	−171
Western hemlock	294	24,992	4.2	1.7	2.5	397	149	248
Pacific silver fir	63	4,024	.8	.6	.2	72	31	41
Western redcedar	42	4,145	.4	.1	.3	45	13	32
Western white pine	7	683	.2	.8	−.6	6	71	−65
TOTAL	1,053	96,880	7.4	6.7	.7	699	614	85

[1] Adapted from King (1961). Cubic volume include all trees 6.6-cm. (2.6-in.) d.b.h. and larger for entire stem. Board-foot volume (Scribner rule) includes all trees 29.5 cm. (11.6-in.) d.b.h. and larger to a 20-cm. (8-in.) top.

Table WR-2. — Tentative list of mammals for Wind River Research Natural Area

Order	Scientific name	Common name
Insectivora	*Neürotrichus gibbsi*	shrew mole
	Scapanus orarius	coast mole
	Sorex obscurus	dusky shrew
	Sorex trowbridgii	Trowbridge shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Eptesicus fuscus*	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
Rodentia	*Aplodontia rufa*	mountain beaver
	Castor canadensis	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Microtus longicaudus	long-tailed vole
	Microtus oregoni	Oregon or creeping vole
	Neotoma cinerea	bushy-tailed wood rat
	Peromyscus maniculatus	deer mouse
	Tamiasciurus douglasi	chickaree
	Thomomys talpoides	northern pocket gopher
	Zapus princeps	western jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Lynx rufus	bobcat
	Martes americana	marten
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Spilogale putorius	spotted skunk or civet cat
	Ursus americanus	black bear
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. columbianus	black-tailed deer

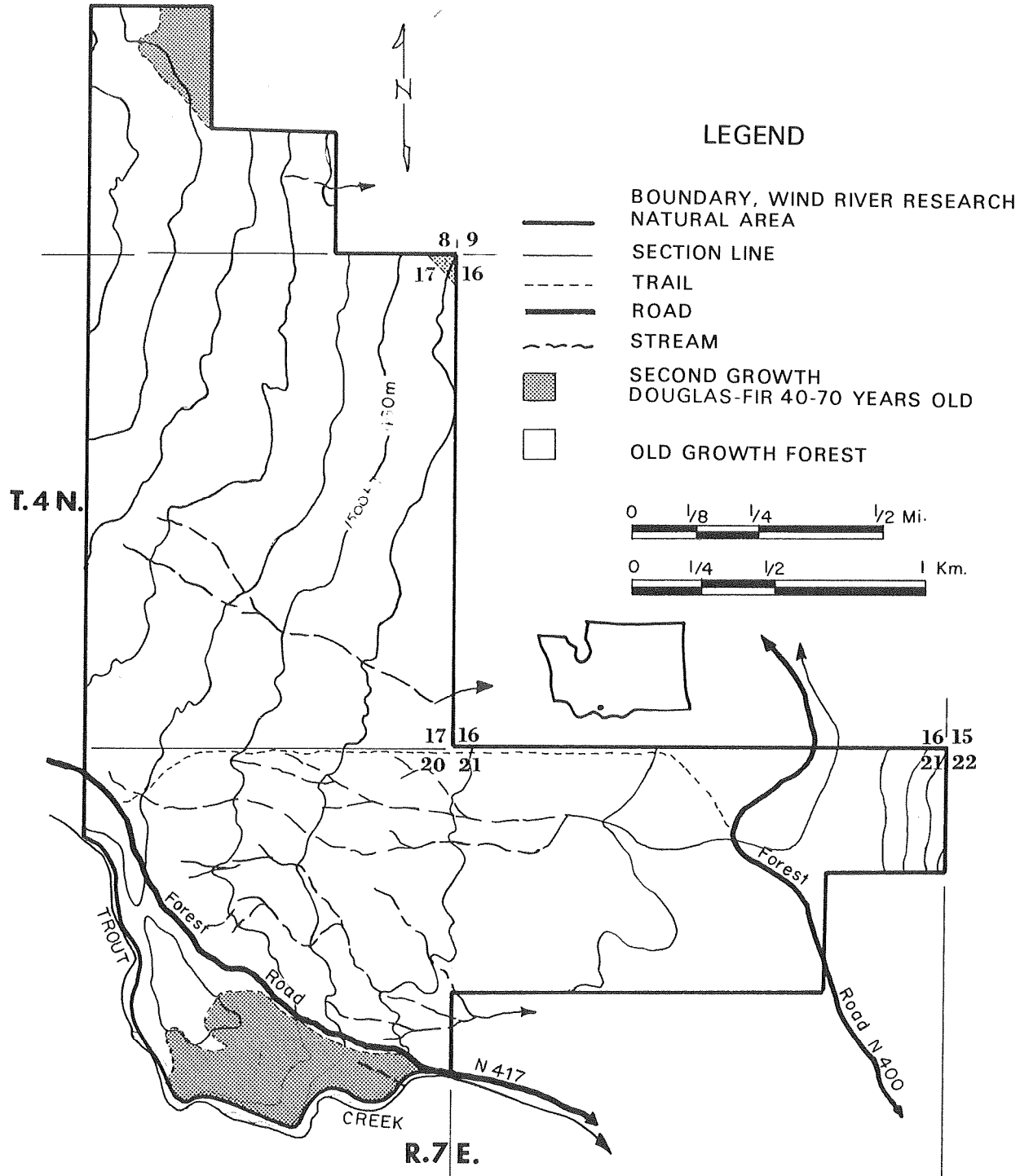
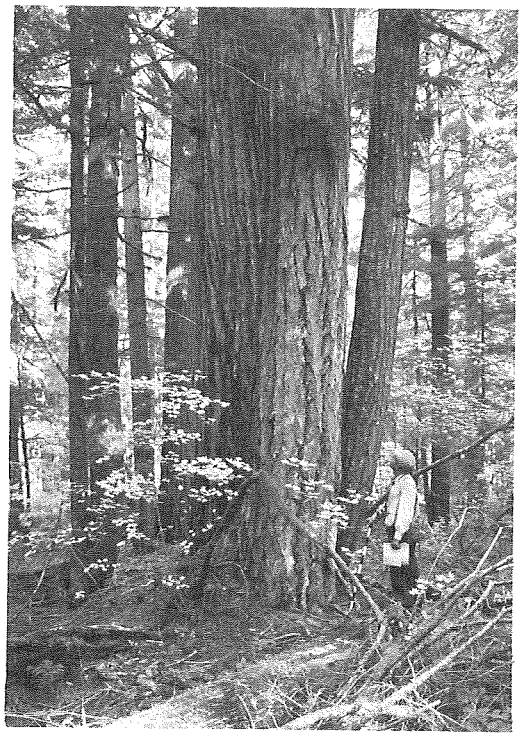


Figure WR-1.– Wind River Research Natural Area, Skamania County, Washington.

Figure WR-2.-Features of the Wind River Research Natural Area. A: Wind-thrown old-growth Douglas-fir; substantial and continuing mortality of Douglas-fir is taking place due to insects, disease, and wind. B: Cluster of typical old-growth Douglas-fir trees. C: Pacific yew is one of several conspicuous subordinate trees found within the natural area. D: Fine stand of old-growth Douglas-firs along Forest Road N400.

A



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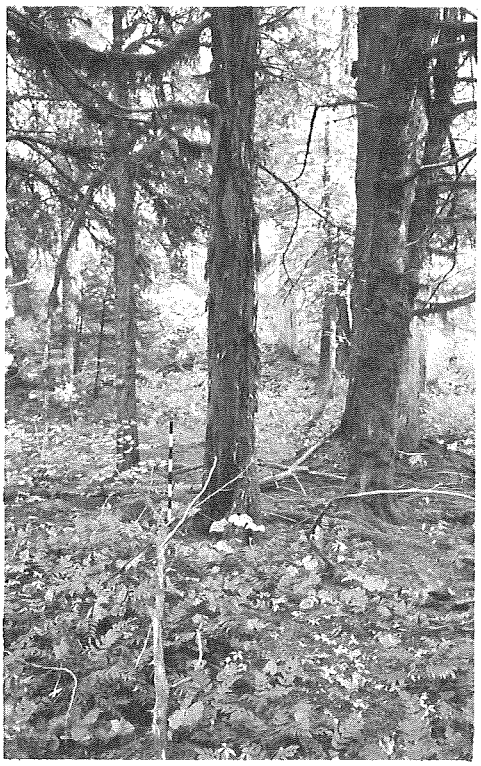

D

Figure WR-2.-Features of the Wind River Research Natural Area (continued). E: Screened frames used by Leo Isaac in his 1928 study of tree seed storage in the forest floor. F: Mixed stand of Douglas-fir and western hemlock showing typical understory dominants-vine maple and *Berberis nervosa;* note the Pacific silver fir sapling in the center of the picture. G: Swampy area at the foot of Bunker Hill which was probably created, at least in part, by beaver activity; the dead trees are mostly western red-cedar. H: Small pond, marsh, and swamp at the foot of Bunker Hill at the eastern edge of the natural area.

E

F

G

H

Federal Research Natural Areas in Oregon and Washington A Guidebook for Scientists and Educators. 1972. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

WOLF CREEK RESEARCH NATURAL AREA[1]

Bitterbrush - bunchgrass communities on granitic soils located along the lower east slope of the northern Washington Cascade Range.

The Wolf Creek Research Natural Area was established February 1969 as an example of the bitterbrush *(Purshia tridentata)* bunchgrass vegetation which occurs on granitic soils at low elevations on the east slope of the Washington Cascades. This vegetation type is important as winter range for big game animals. The 61-ha. (150-acre) tract is located in Okanogan County, Washington, and is administered by the Winthrop Ranger District (Winthrop, Washington), Okanogan National Forest. It is rectangular in shape; the east, north, and west edges are partly fenced and follow surveyed section lines and its south edge borders Wolf Creek (fig. WW-1). It is located in the N1/2 of section 1, T. 34 N., R. 20 E., Willamette meridian, at 48°30' N. latitude and 120°15' W. longitude.

ACCESS AND ACCOMMODATIONS

A blacktop and gravel road terminates approximately 0.4 km. (0.25 mile) from the area adjacent to a ranch headquarters and about 8 km. (5 miles) west of Winthrop, Washington. Wolf Creek Trail, which starts at the road end, bisects the lower third of the natural area. Directions should be obtained at the Winthrop Ranger Station. Access is excellent during summer and often easy during the winter due to limited snow accumulations. Public accommodations are available in Winthrop.

[1] Description prepared by Dr. F. C. Hall, U.S. Department of Agriculture, Forest Service, Region 6, Portland, Oregon.

ENVIRONMENT

The Wolf Creek Research Natural Area is located in steep rolling foothills of the Cascade Range. It ranges in elevation from 792 to 975 m. (2,600 to 3,200 ft.). Topography varies from gentle and rolling to steep; between the ridgetop at the north boundary and steep slopes adjacent to Wolf Creek along the south boundary are a series of small benches. Slope direction is southerly. Most of the parent rocks are granite or granodiorite with some sedimentary types at lower elevations.

A largely continental climate prevails. Most precipitation occurs as snow during the cool, cloudy winters. Summers are warm, low in precipitation, and largely cloudless. Two to 3 months of drought are common. Climatic data from Winthrop, located in a valley 8 km. (5 miles) to the southeast, are as follows (U.S. Weather Bureau 1965):

Mean annual temperature	7.1°C. (44.8°F.)
Mean January temperature	-7.5°C. (18.4°F.)
Mean July temperature	20.1°C. (68.2°F.)
Mean January minimum temperature	-13.1°C. (8.4°F.)
Mean July maximum temperature	30.5°C. (87.0°F.)
Average annual precipitation	368 mm. (14.5 in.)
June through August precipitation	58 mm. (2.3 in.)

Soils in the area have not been mapped. Cursory examination suggests they are generally colluvial Regosols (Entisols) with little profile development. Sand to pea-size granitic gravel is common, some aerially deposited volcanic ash is present, and the soils generally have a sandy loam to loam texture. The small areas of forest appear to occur on Gray Wooded soil types.

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BIOTA

Estimated areas by major community types are:

Name	*Area*
Purshia tridentata/Agropyron inerme - Festuca idahoensis	32 ha. (80 acres)
Pinus ponderosa/Purshia tridentata/Festuca idahoensis	16 ha. (40 acres)
Pinus ponderosa - Pseudotsuga menziesii/Symphoricarpos albus/ Agropyron inerme	8 ha. (20 acres)

The *Purshia/Agropyron. - Festuca* community type could probably be assigned to Kuchler's (1964) Type 55, Sagebrush Steppe. The *Pinus/ Purshia/Agropyron* community type is assignable to SAF cover type 237, Interior Ponderosa Pine (Society of American Foresters 1954), and Kuchler's Type 10, Ponderosa Shrub Forest. *Pinus -pseudotsuga/Symphoricarpos/Agropyron* communities could be assigned to SAF forest cover type 214, Ponderosa Pine - Larch - Douglas-Fir, and Kuchler's Type 12, Douglas Fir Forest. The area falls within a forested zone but is largely devoid of trees due to soil factors and slope aspect.

The *Purshia tridentata/Agropyron inerme Festuca idahoensis* stands are characteristically dominated by beardless bluebunch wheatgrass *(Agropyron inerme)* and bitterbrush with some Idaho fescue *(Festuca idahoensis), Balsamorhiza sigittata,* Sandberg bluegrass *(Poa sandbergii),* and very scattered ponderosa pine *(Pinus ponderosa)* (fig. WW -2). This community type occurs from reasonably level benches to steep southerly slopes, some of which exceed 100 percent. The type can be related to either the *Purshia/ Festuca* or *Purshia/Agropyron* types described by Daubenmire (1970).

The *Pinus ponderosa/Purshia tridentata/ Festuca idahoensis* community is a very open type characterized by a 15- to 25- percent crown cover of ponderosa pine and a shift in understory dominance from beardless bluebunch wheatgrass to Idaho fescue (fig. WW -2). This community is characteristic of gentler slopes on upper portions of the tract. Pine growth is slow, even in saplings and poles (fig. WW -2), suggesting limited forest productivity and savanna conditions (Daubenmire 1970).

The forest community of ponderosa pine and Douglas-fir *(Pseudotsuga menziesii)* seems reasonably representative of climatic climax plant community potentials in this area. The stands have overstories dominated by ponderosa pine, but tree reproduction is mostly Douglas-fir. Ground vegetation is co-dominated by *Symphoricarpos albus* and beardless bluebunch wheatgrass. Numerous ponderosa pine are fire-scarred at their bases. Moderately low basal areas (20.5 sq. m. per ha. or 80 sq. ft. per acre) and slow diameter growth of trees suggest limited forest growth potential.

The area is important winter range for mule deer *(Odocoileus hemionus).* In general they move off the tract sufficiently early in the spring to prevent grazing damage to grasses. Other mammals believed to utilize the tract as residents or transients are listed in table WW -1.

HISTORY OF DISTURBANCE

Fire scars on ponderosa pine indicate ground fires periodically burned the area prior to initiation of fire control programs in 1910. Lack of dominant old-growth fir in the forest area further suggests all portions of the tract have burned at some time. Sufficient grass volume is present on the grassland to carry a fire so one should assume it has burned.

The Wolf Creek Research Natural Area has been used as livestock range since about 1900, primarily for cattle. Heavy overgrazing occurred in the late 1930's and early 1940's and caused a change of vegetation composition. However, in 1948, initiation of the grazing season was changed to June 1, by which time native forage has dried sufficiently that it is low in livestock palatability and is not damaged by light use. Presently, livestock pass through the area annually on their way to higher elevation ranges. Vegetative indicators suggest that an upward trend in range condition has persisted over the past 15 years.

Some trees were removed from east portions of the area 5 to 8 years ago, and logging has recently taken place adjacent to and above the area on State-owned land. No further

logging will be allowed, and timber harvest on adjacent lands should have no impact on the bitterbrush - wheatgrass communities.

RESEARCH

No research is known to be in progress on the Wolf Creek Research Natural Area. The area provides interesting opportunities to study: (1) effects of winter-game use on palatable shrub-bunchgrass vegetation; and (2) biomass productivity in relation to soils and topography in three closely related and intergrading plant communities developed under a single macroclimate.

MAPS AND AERIAL PHOTOGRAPHS

No special topographic or geologic maps are available for the natural area which are sufficiently detailed to be useful. Either the District Ranger (Winthrop Ranger District) or Forest Supervisor (Okanogan National Forest, Okanogan, Washington) can provide details on the most recent aerial photo coverage of the area.

LITERATURE CITED

Daubenmire, R.
1970. Steppe vegetation of Washington. Wash. Agric. Exp. Stn. Tech. Bull. 62, 131 p., illus.

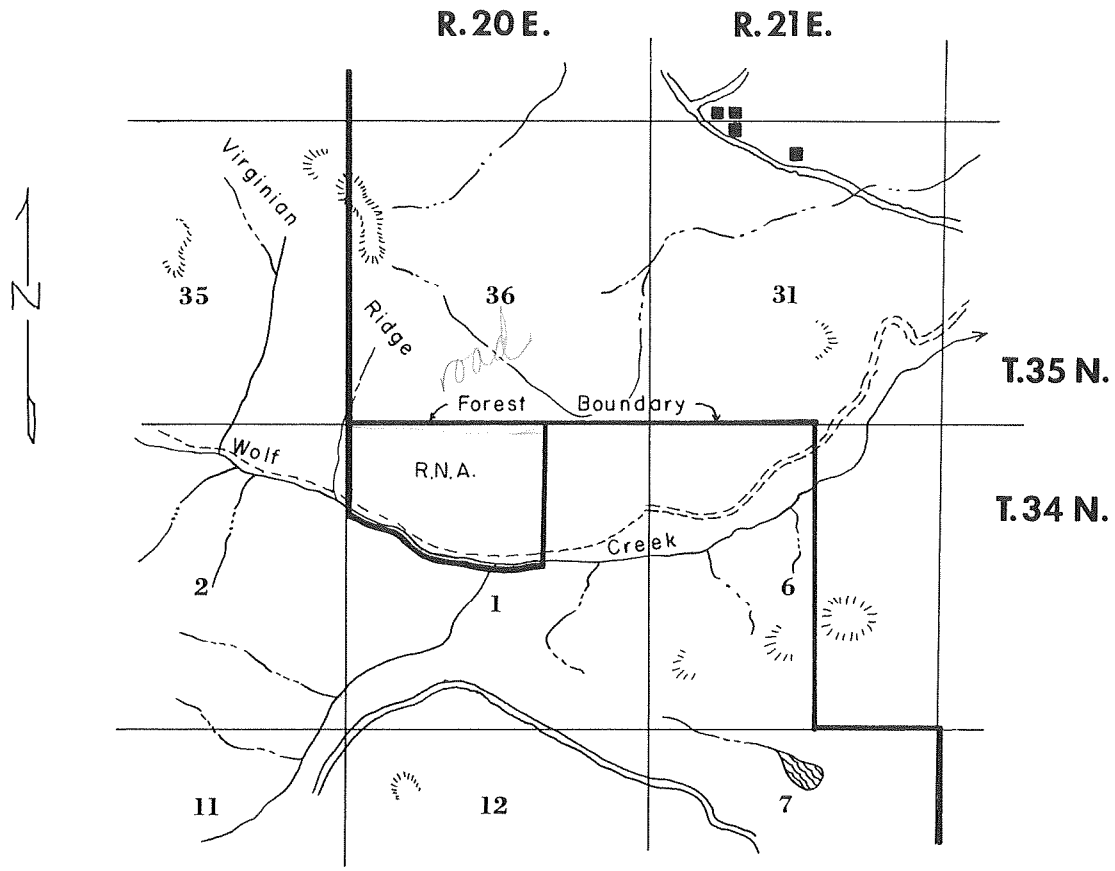
Kuchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

U.S. Weather Bureau
1965. Climatic summary of the United States - supplement for 1951 through 1960, Washington. Climatography of the United States 86-39, 92 p., illus.

Table WW-1. — Tentative list of mammals for Wolf Creek Research Natural Area

Order	Scientific name	Common name
Insectivora	*Sorex cinereus*	masked shrew
	Sorex obscurus	dusky shrew
	Sorex palustris	northern water shrew
	Sorex vagrans	wandering shrew
Chiroptera	*Antrozous pallidus*	pallid bat
	Eptesicus fuscus	big brown bat
	Lasionycteris noctivagans	silver-haired bat
	Lasiurus borealis	red bat
	Lasiurus cinereus	hoary bat
	Myotis californicus	California myotis
	Myotis evotis	long-eared myotis
	Myotis lucifugus	little brown myotis
	Myotis thysanodes	fringed myotis
	Myotis volans	long-legged myotis
	Myotis yumanensis	Yuma myotis
	Plecotus townsendi	Townsend big-eared bat
Lagomorpha	*Lepus americanus*	snowshoe hare
	Lepus californicus	black-tailed jack rabbit
	Lepus townsendi	white-tailed jack rabbit
	Ochotona princeps	pika
	Sylvilagus nuttalli	mountain cottontail
Rodentia	*Castor canadensis*	beaver
	Clethrionomys gapperi	Gapper red-backed vole
	Erethizon dorsatum	porcupine
	Eutamias amoenus	yellow-pine chipmunk
	Eutamias townsendi	Townsend chipmunk
	Glaucomys sabrinus	northern flying squirrel
	Marmota flaviventris	yellow-bellied marmot
	Microtus longicaudus	long-tailed vole
	Microtus montanus	mountain vole
	Microtus oregoni	Oregon or creeping vole
	Microtus richardsoni	Richardson vole
	Neotoma cinerea	bushy-tailed wood rat
	Perognathus parvus	Great Basin pocket mouse
	Peromyscus maniculatus	deer mouse
	Phenacomys intermedius	heather vole
	Spermophilus saturatus	Cascades mantled ground squirrel
	Tamiasciurus douglasi	chickaree
	Thomomys talpoides	northern pocket gopher
	Zapus princeps	western jumping mouse
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	coyote
	Felis concolor	mountain lion or cougar
	Gulo luscus	wolverine
	Lynx canadensis	Canadian lynx
	Lynx rufus	bobcat
	Martes americana	marten
	Mephitis mephitis	striped skunk
	Mustela erminea	short-tailed weasel or ermine
	Mustela frenata	long-tailed weasel
	Mustela vison	mink
	Procyon lotor	raccoon
	Taxidea taxus	badger
	Ursus americanus	black bear
	Vulpes fulva	red fox
Artiodactyla	*Cervus canadensis*	wapiti or elk
	Odocoileus h. hemionus	mule deer



LEGEND

BOUNDARY, WOLF CREEK RESEARCH NATURAL AREA

ROADS

SECTION LINE

STREAMS

TRAIL

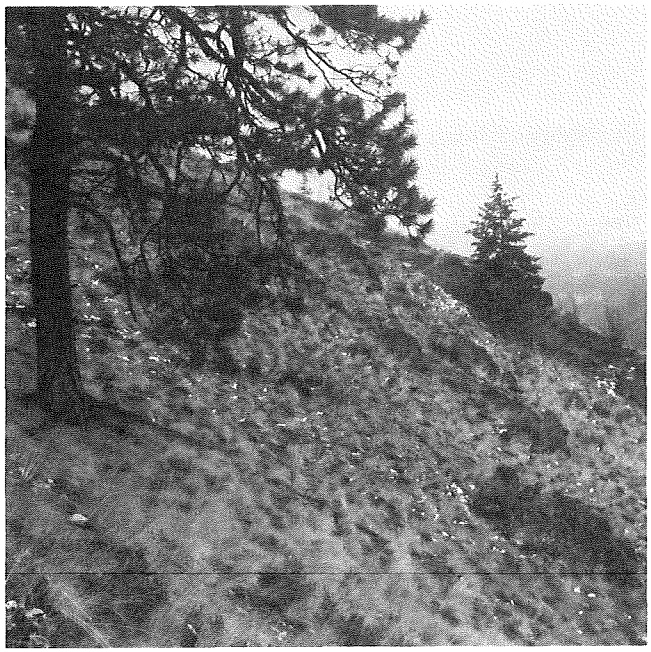
BUILDINGS

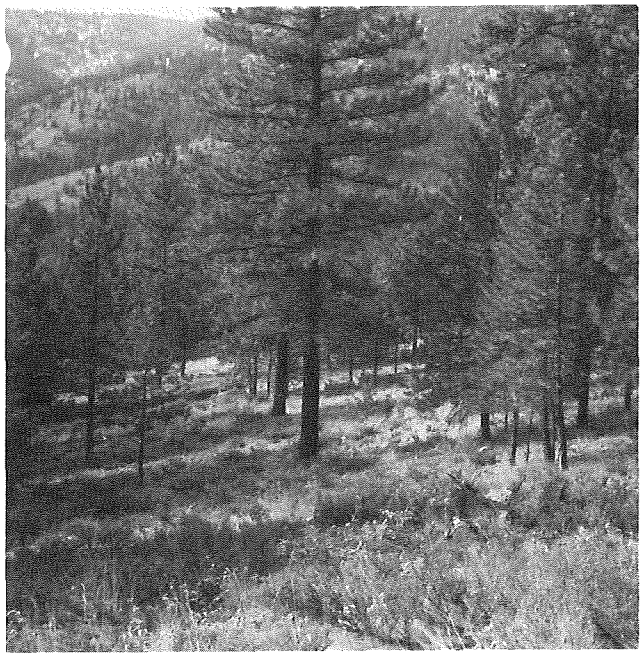
0 1/4 1/2 1 Mi.

0 1/4 1/2 1 Km.

Figure WW-1.– Wolf Creek Research Natural Area, Okanogan County, Washington.

Figure WW-2.-Communities of Wolf Creek Research Natural Area. Upper left: Community of bitterbrush and beardless bluebunch wheatgrass with occasional ponderosa pine and forbs growing on a bench. Upper right: Community dominated by beardless bluebunch wheatgrass with some bitterbrush and occasional ponderosa pine growing on steep south slope. Lower left: Open ponderosa pine/bitterbrush/Idaho fescue community growing on an upper slope bench. Lower right: This ponderosa pine-Douglas-fir community growing on deeper soil and steep slopes probably represents the typical zonal forest community.





APPENDIX I
Examples of Federal Agency Regulations Governing Establishment and Use of Research Natural Areas

Section 251.23 of Title 36, Code of Federal Regulations, which provides the authority for establishment of Research Natural Areas and other experimental areas on National Forest lands, reads as follows:

The Chief of the Forest Service shall establish and permanently record a series of areas on National Forest land to be known as experimental forests or experimental ranges, sufficient in number and size to provide adequately for the research necessary to serve as a basis for the management of forest and range land in each forest region. Also, when appropriate, the Chief shall establish a series of research natural areas, sufficient in number and size to illustrate adequately or typify for research or educational purposes, the important forest and range types in each forest region, as well as other plant communities that have special or unique characteristics of scientific interest and importance. Research Natural Areas will be retained in a virgin or unmodified condition except where measures are required to maintain a plant community which the area is intended to represent. Within areas designated by this regulation, occupancy under a special-use permit shall not be allowed, nor the construction of permanent improvements permitted except improvements required in connection with their experimental use, unless authorized by the Chief of the Forest Service.

U.S. Forest Service regulations governing the management and use of Research Natural Areas (from USDA Forest Service Manual, Section 4063, as of February, 1971) are as follows:

POLICY

The Forest Service will cooperate with other public agencies and such private and professional organizations as The Nature Conservancy, Society of American Foresters, Society for Range Management, and Ecological Society of America, to establish and maintain an adequate number and variety of research natural areas. The use of Forest Service research natural areas by scientists within and outside the Forest Service, and use for certain educational purposes is encouraged.

Research natural areas should represent as many as possible of the major, natural timber types or other plant communities in unmodified condition. Other forest or range conditions that have special or unique characteristics of scientific or educational interest, such as outliers of grass or timber types, unique bog associations, or unusual combinations of flora may also be set aside. To whatever extent is feasible, animal life also should be present in unmodified condition.

As a general guide, these areas should show evidence of no major disturbance by man, such as timber cutting, for at least the past 50 years. On rare occasions, however, in a valuable plant community that should be preserved, the most suitable area that approaches these conditions should be selected. Certain valuable second-growth timber types may also be preserved as research natural areas if sufficient need can be shown.

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RESPONSIBILITY

Selection and establishment of research natural areas on National Forest land may be initiated either in the research or National Forest resource management organization. Forest Supervisors and research project leaders are responsible for proposing establishment, and district rangers for protection. The scientific and educational uses made of natural areas by Forest Service and other scientists will normally be a research responsibility.

SIZE

Research natural areas should be large enough to provide essentially unmodified conditions in their interior portions - usually over 300 acres. Exceptions to the usual minimum of 300 acres should be limited to truly outstanding cases. Seldom can tracts smaller than 300 acres be expected to maintain essentially unmodified conditions unless they are buffered by scenic or other areas that are maintained in relatively unmodified conditions.

PROTECTION AND MANAGEMENT

A research natural area must be protected against activities which directly or indirectly modify ecological processes if the area is to be of value for observation and research on plant and animal succession, habitat requirements of species, insect and fungus depredations, soil microbiology, phenology, and related phenomena. Logging activities and uncontrolled grazing by domestic livestock are not permitted. The criterion for management of research natural areas is for protection against unnatural encroachments.

IDENTIFICATION

Research natural areas should be identified in the administrative records as to location, purpose, and objectives, and the boundary marked in the field. Signs which would tend to attract sightseers, recreationists, and casual visitors should be avoided. However, if roads or trails pass along the boundary or through the research natural area, limited posting may be needed to protect the area.

FENCES

Research natural area boundaries need not be fenced unless necessary for protection against livestock or excessive human use.

PUBLICITY

Publicity is generally limited to professional groups at either national, State, or university levels and mainly to inform scientists and educators of the location, vegetation types, and administering agency in order to make the fullest proper use of the research natural areas. Other publicity should be avoided.

PHYSICAL IMPROVEMENTS

Generally speaking no physical improvements such as roads, trails, fences, or buildings should be permitted within a research natural area. Temporary facilities needed for research, such as instrument shelters, may be installed with the approval of the Station Director. Except as essential to fire protection of adjoining lands, no buildings, roads, or trails should be permitted at or on the boundaries of a research natural area.

PROTECTION

Fires within a research natural area should be extinguished as quickly as possible, but no cleanup, fire hazard reduction, or reforestation should be undertaken.

No control of insects or disease should be instituted unless the infestation or infection threatens adjacent forests or will drastically alter the natural ecological processes within; for example, white pine blister rust. Insect or disease-killed trees are a part of the natural forest and should not be felled or removed.

PUBLIC USE

Picnicking, camping, collecting plants, gathering nuts and herbs, picking berries, and other public uses which contribute to modification of a research natural area should be

discouraged or expressly prohibited if such uses threaten serious impairment of research or educational value. Hunting, fishing, and trapping should be prohibited only if the removal of game, fish, and fur-bearers is likely to be on a scale sufficient to affect the biotic communities.

SCIENTIFIC AND EDUCATIONAL USE

The Forest Service encourages use of research natural areas by responsible scientists and educators. Generally the educational use should be at the upper classman or graduate college level. Research on natural areas will be essentially nondestructive in nature. Studies that require timber felling, seedbed modification, or extensive soil excavation should be done on the experimental forests and ranges, or similar areas.

Because of the fragile character of most research natural areas, cooperative agreements will normally be prepared between the Forest Service and non-Forest Service scientists outlining briefly the mechanics of field research and the limitations thereto. Forest Service scientists should cooperate in the research whenever possible in order to derive the greater benefit from the work.

VEGETATION MANAGEMENT

Station Directors may authorize such management practices as are necessary to preserve some representation of the vegetation for which the natural area was created originally, including *Ribes* eradication in white pine types, control of excessive animal populations, or prescribed burning or grazing to maintain a grass community. Only tried and reliable techniques will be used, and then only where the vegetative type would otherwise be lost without management. The criterion here is that the management must provide a closer approximation of the vegetation and the processes governing the vegetation than would be possible without management. If doubt exists about the need for vegetation management or the reliability of the techniques, then nothing should be done. Where management practices are necessary a portion of natural areas should be kept untreated as a "green check."

MINERAL ENTRY

Research natural areas should be withdrawn from mineral entry.

APPENDIX II
Index to Research Natural Areas
By Forest Cover and Vegetation Types

Research Natural Areas described in this guidebook are indexed here according to the forest cover and vegetation types described by the Society of American Foresters (1954) and Küchler (1964), respectively. The areas are coded here according to the listing provided in table 1 and on the back cover of this report.

Type No.	Type name	Area in which type exists
SAF-205	Mountain Hemlock - Subalpine Fir *Tsuga mertensiana - Abies lasiocarpa*	BU, GL, OR, WM
SAF-206	Engelmann Spruce - Subalpine Fir *Picea engelmannii - Abies lasiocarpa*	GL
SAF-207	Red Fir *Abies magnifica*	AC, BP
SAF-208	Whitebark Pine *Pinus albicaulis*	
SAF-210	Interior Douglas-Fir *Pseudotsuga menziesii*	PB
SAF-211	White Fir *Abies concolor*	AC, BP
SAF-212	Larch - Douglas-Fir *Larix occidentalis - Pseudotsuga menziesii*	BB
SAF-213	Grand Fir - Larch - Douglas-Fir *Abies grandis - Larix occidentalis - Pseudotsuga menziesii*	OD, PE
SAF-214	Ponderosa Pine - Larch - Douglas-Fir *Pinus ponderosa - Larix occidentalis - Pseudotsuga menziesii*	BB, ME, MI, ML, PE, RC, WW
SAF-215	Western White Pine *Pinus monticola*	RC
SAF-217	Aspen *Populus tremuloides*	PN, TP
SAF-218	Lodgepole Pine *Pinus contorta*	BB, PJ, PR

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SAF-221	Red Alder *Alnus rubra*	CF, DP, LA, LC, NF
SAF-222	Black Cottonwood - Willow *Populus trichocarpa* - *Salix* spp.	PO
SAF-223	Sitka Spruce *Picea sitchensis*	NC, TW
SAF-224	Western Hemlock *Tsuga heterophylla*	DP, HA, HI, LC, NC, NF, QU, WR
SAF-225	Sitka Spruce - Western Hemlock *Picea sitchensis* - *Tsuga heterophylla*	DP, HI, LC, NC, QU
SAF-226	Pacific Silver Fir - Hemlock *Abies amabilis* - *Tsuga* spp.	BR, BU, HA, LA, NF, SR, WM
SAF-227	Western Redcedar - Western Hemlock *Thuja plicata* - *Tsuga heterophylla*	LA, LC, NF, QU
SAF-228	Western Redcedar *Thuja plicata*	CF
SAF-229	Pacific Douglas-Fir *Pseudotsuga menziesii*	BA, CF, JC, WH, WR
SAF-230	Douglas-Fir - Western Hemlock *Pseudotsuga menziesii* - *Tsuga heterophylla*	BA, CF, CH, LC, NF, QU, TW, WM, WR
SAF-231	Port-Orford Cedar - Douglas-Fir *Chamaecyparis lawsoniana* - *Pseudotsuga menziesii*	BP, CO, PO
SAF-232	Redwood *Sequoia sempervirens*	WH
SAF-233	Oregon White Oak *Quercus garryana*	MA, ML, PI
SAF-234	Oak - Madrone *Quercus* - *Arbutus menziesii*	AS, PO
SAF-237	Interior Ponderosa Pine *Pinus ponderosa*	BJ, CC, GM, LO, ME, MI, OD, PN, PR, TP, WW
SAF-238	Western Juniper *Juniperus occidentalis*	GM, HR, LO, OD
SAF-243	Ponderosa Pine - Sugar Pine - Fir *Pinus ponderosa* - *P. lambertiana* - *Abies* spp.	AC, AS, BP, PR
SAF-244	Pacific Ponderosa Pine - Douglas-Fir *Pinus ponderosa* - *Pseudotsuga menziesii*	AS
SAF-245	Pacific Ponderosa Pine *Pinus ponderosa*	AS
SAF-246	California Black Oak *Quercus kelloggii*	

SAF-247	Jeffrey Pine *Pinus jeffreyi*	
SAF-248	Knobcone Pine *Pinus attenuata*	
K-1	Spruce - Cedar - Hemlock Forest *Picea - Thuja - Tsuga*	DP, HI, JC, NC, QU, TW
K-2	Cedar - Hemlock - Douglas Fir Forest *Thuja - Tsuga - Pseudotsuga*	BA, CF, CH, CO, LA, LC, NF, PO, WH, WR
K-3	Silver Fir - Douglas Fir Forest *Abies - Pseudotsuga*	BR, BU, HA, LA, LC, NF, OR, SR, WM
K-4	Fir - Hemlock Forest *Abies - Tsuga*	BR, BU, GL, LA, NF, OR, SR, WM
K-5	Mixed Conifer Forest *Abies - Pinus - Pseudotsuga*	AC, AS, BP, PR
K-6	Redwood Forest *Sequoia - Pseudotsuga*	WH
K-7	Red Fir Forest *Abies*	AC
K-10	Ponderosa Shrub Forest *Pinus*	AS, BJ, CC, GM, LO, MI, PR, WW
K-11	Western Ponderosa Forest *Pinus*	CC, ME, OD, PN, RC, TP
K-12	Douglas Fir Forest *Pseudotsuga*	AC, AS, BB, ME, MI, ML, PE, RC, WW
K-13	Cedar - Hemlock - Pine Forest *Thuja - Tsuga - Pinus*	
K-14	Grand Fir - Douglas Fir Forest *Abies - Pseudotsuga*	GM, OD, OR, PB, PE, RC
K-15	Western Spruce - Fir Forest *Picea - Abies*	GL
K-24	Juniper Steppe Woodland *Juniperus - Artemisia - Agropyron*	GM, HR, LO, OD
K-25	Alder - Ash Forest *Alnus - Fraxinus*	CF, DP, LA, LC, MA, WP
K-26	Oregon Oakwoods *Quercus*	MA, ML, PI
K-29	California Mixed Evergreen Forest *Quercus - Arbutus - Pseudotsuga*	AS, MY
K-33	Chaparral *Adenostoma - Arctostaphylos - Ceanothus*	AC, AS

K-34	Montane Chaparral *Arctostaphylos - Castanopsis - Ceanothus*	AC, AS, BP
K-38	Great Basin Sagebrush *Artemisia*	LO, RH
K-40	Saltbush - Greasewood *Atriplex - Sarcobatus*	RH
K-49	Tule Marshes *Scirpus - Typha*	PN, TP
K-50	Fescue - Wheatgrass *Festuca - Agropyron*	TP
K-51	Wheatgrass - Bluegrass *Agropyron - Poa*	PB, RC, RH, TP
K-52	Alpine Meadows and Barren *Agrostis, Carex, Festuca, Poa*	BU, LA, NF, OR
K-55	Sagebrush Steppe *Artemisia - Agropyron*	ME, RH, WW

LITERATURE CITED

Küchler, A. W.
1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Publ. 36, various paging, illus.

Society of American Foresters
1954. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.

APPENDIX III
Index to Research Natural Areas by Tree And Important Range Plant Species

Research Natural Areas described in this guidebook are indexed here according to species of tree and selected important range plants present there. The areas are coded here according to the listings provided in table 1 and on the back cover of this report. Plants are arranged alphabetically by scientific name. A species, when present in small quantities, may be indexed for a Research Natural Area but not appear in the text writeup; indexing is based on field notes or other documentation in such cases.

Plant	Area in which type exists
Abies amabilis Pacific silver fir	BA, BR, BU, CF, GL, HA, HI, LA, LC, NF, OR, QU, SR, WM, WR
Abies concolor White fir	AC, AS, BP, GM, OR, PR
Abies grandis Grand fir	CC, CO, MA, ME, MI, ML, OD, OR, PB, PE, PI, PO, RC
Abies lasiocarpa Subalpine fir	AC, BU, GL, OR, WM
Abies magnifica var. *shastensis* Shasta red fir	AC, BP, GL
Abies procera Noble fir	BR, BU, OR, SR, WM, WR
Acer circinatum Vine maple	AC, AS, BA, BR, BU, CF, CH, CO, HA, HI, JC, LA, LC, MY, NF, OR, PE, PO, QU, TW, WM, WR
Acer glabrum Douglas maple	BB, BP
Acer macrophyllum Bigleaf maple	AC, AS, CF, CH, HI, JC, LA, LC, MA, MY, PI, PO, TW, WP
Agropyron spicatum Bluebunch wheatgrass	BB, CC, HR, LO, ME, ML, PB, RC, RH, TP
Agropyron inerme Beardless bluebunch wheatgrass	WW
Alnus rhombifolia White alder	AS, MY

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Alnus rubra Red alder	CF, CH, CO, DP, HI, LA, LC, NC, NF, PO, QU, WP, WR
Alnus sinuata Sitka alder	AC, BU, GL, LA, NF, OR, WM
Arbutus menziesii Pacific madrone	AC, AS, CO, MA, PO
Arctostaphylos patula[1] Green manzanita	AC, BP, GM, MI, PR
Arctostaphylos viscida White-leaved manzanita	AS
Artemisia arbuscula Low sagebrush	GM
Artemisia rigida Stiff sagebrush	ME, RH
Artemisia tridentata Big sagebrush	GM, HR, LO, RH
Bromus tectorum Cheatgrass brome	CC, ML, PB, PN, RH, TP
Calamagrostis rubescens Pinegrass	BB, CC, ME, OD, PB, PE, PN, TP
Carex geyeri Elk sedge	BB, CC, ME, ML, OD, PB, TP
Carex rossii Ross sedge	BJ, GM, MI, PR
Castanopsis chrysophylla Golden chinkapin	AC, AS, BP, CH, CO, PO, WH
Ceanothus velutinus Snowbrush ceanothus	AC, AS, BP, CC, MI, PE, PR, WM
Cercocarpus betuloides Birchleaf mountainmahogany	AS
Cercocarpus ledifolius Curlleaf mountainmahogany	CC, GM
Chamaecyparis lawsoniana Port-Orford - cedar	BP, CO, PO
Chamaecyparis nootkatensis Alaska-cedar	BU, LA, NF, OR, WM
Cornus nuttallii Pacific dogwood	AC, BA, CF, PI, PO
Festuca idahoensis Idaho fescue	BB, GM, HR, LO, ML, OD, PB, PN, PR, RC, RH, TP, WW

Festuca viridula Green fescue	BU
Fraxinus latifolia Oregon ash	MA, MY, PO, WP
Grayia spinosa Spiny hopsage	RH
Juniperus occidentalis Western juniper	CC, GM, HR, LO, OD
Koeleria cristata Prairie junegrass	CC, HR, PN, TP
Larix occidentalis Western larch	BB, ME, MI, ML, OD, PE, RC
Libocedrus decurrens Incense - cedar	AC, AS, BP, MI, MY, PE
Lithocarpus densiflorus Tanoak	CO, PO, WH
Picea engelmannii Engelmann spruce	GL
Picea sitchensis Sitka spruce	DP, HI, JC, LA, LC, NC, QU, TW
Pinus albicaulis Whitebark pine	BU
Pinus attenuata Knobcone pine	BP, WH
Pinus contorta Lodgepole pine	BB, BJ, GL, PR, SR
Pinus lambertiana Sugar pine	AC, AS, BP, CO, PO, PR
Pinus monticola Western white pine	AC, BA, BP, CF, GL, OR, PO, RC, WM, WR
Pinus ponderosa Ponderosa pine	AC, AS, BB, BJ, CC, GM, LO, ME, MI, ML, OD, PB, PE, PN, PR, RC, TP, WW
Poa sandbergii Sandberg bluegrass	CC, GM, ME, ML, PB, PN, RH, TP, WW
Poa secunda	(see *Poa sandbergii*)
Populus tremuloides Quaking aspen	PN, TP
Populus trichocarpa Black cottonwood	CF, LC, NF

Pseudotsuga menziesii Douglas-fir	AC, AS, BA, BB, BP, BR, BU, CC, CF, CO, GL, HA, HI, JC, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PO, QU, RC, SR, TW, WH, WM, WP, WR, WW
Purshia tridentata Bitterbrush	BJ, GM, HR, LO, MI, ML, PR, WW
Quercus chrysolepis Canyon live oak	BP, PO
Quercus garryana Oregon white oak	AC, AS, MA, ML, MY, PI, WP
Quercus kelloggii California black oak	AS
Quercus sadleriana Sadler oak	
Quercus vaccinifolia Huckleberry oak	BP
Sequoia sempervirens Coast redwood	WH
Sitanion hystrix Bottlebrush squirrel tail	BJ, HR, LO, ME, MI, PR
Stipa occidentalis Western needlegrass	BJ, MI, ML, PN, PR
Taxus brevifolia Pacific yew	AC, AS, BA, BP, CF, CO, LC, MA, NF, PO, RC, WM, WR
Thuja plicata Western redcedar	BA, CF, HA, HI, JC, LA, LC, MY, NF, PO, QU, WR
Tsuga heterophylla Western hemlock	AC, BA, BR, BU, CF, CO, DP, HA, HI, JC, LA, LC, NC, NF, OR, PO, QU, SR, TW, WH, WM, WR
Tsuga mertensiana Mountain hemlock	AC, BR, BU, GL, LA, NF, OR, SR, WM
Umbellularia californica California laurel	MY, PO, WH

[1] Includes *Arctostaphylos parryana.*

APPENDIX IV
Index to Research Natural Areas by Species of Mammals

Research Natural Areas described in this guidebook are indexed here according to the species of mammals which are believed to utilize the tracts either as residents or transients. Because of the general absence of field collections and observations, assignments of mammals to Research Natural Areas should be considered tentative. The areas are coded here according to the listings provided in table 1 and on the back cover of this report. Mammals are grouped by order and arranged alphabetically by scientific name within the orders.

Order and species	Area in which type exists
Marsupialia:	
Didelphis marsupialis Opossum	MA, NC, PI, WP
Insectivora:	
Microsorex hoyi Pigmy shrew	BB
Neürotrichus gibbsi Shrew mole	AC, AS, BP, BR, BU, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, MA, ME, ML, MY, NC, NF, OR, PE, PI, PO, QU, SR, TW, WH, WM, WP, WR
Scapanus latimanus Broad-footed mole	AS, BJ, BP, GM
Scapanus orarius Coast mole	BR, BU, CC, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PO, QU, RC, SR, TW, WH, WM, WR
Scapanus townsendi Townsend mole	AC, BP, BR, BU, DP, HA, JC, LA, LC, MA, MY, NC, NF, PE, PI, QU, TW, WM, WP
Sorex bendirii Marsh shrew	AC, BP, BR, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, ML, NC, NF, OR, PE, PO, QU, TW, WH, WM
Sorex cinereus Masked shrew	BB, BU, LA, LC, ME, NF, WW
Sorex merriami Merriam shrew	GM, HR, PB
Sorex obscurus Dusky shrew	BB, BU, CF, DP, HA, HI, JC, LA, LC, ME, ML, NF, OD, PE, QU, SR, TW, WR, WW

[1] Bagby and Lost Forest Research Natural Areas are not included in the appendix because of insufficient information.

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Sorex pacificus Pacific shrew	CH, CO, MY, PO, WH
Sorex palustris Northern water shrew	AC, BR, BU, CC, GL, LA, LC, MI, ML, NF, OD, OR, PB, PE, PR, RC, WN, WW
Sorex preblei Preble shrew	CC, OD, PB, RC
Sorex trigonirostris Ashland shrew	
Sorex trowbridgii Trowbridge shrew	AC, AS, BP, BR, BU, CF, CH, CO, GL, HA, HI, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OR, PE, PI, PO, QU, SR, TW, WH, WM, WR
Sorex vagrans Wandering shrew	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, ML, NC, NF, OD, OR, PB, PE, PI, PN, PO, PR, QU, RC, RH, SR, TP, TW, WH, WM, WP, WR, WW
Sorex yaquinae Yaquina shrew	NC
Chiroptera:	
Antrozous pallidus Pallid bat	AC, AS, BJ, BP, CC, CH, CO, GL, GM, HR, MA, ME, MY, NC, OD, PB, PI, PO, WH, WP, WW
Eptesicus fuscus Big brown bat	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PN, PO, PR, QU, RC, RH, SR, TP, TW, WH, WM, WP, WR, WW
Lasionycteris noctivagans Silver-haired bat	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PN, PO, PR, QU, RC, RH, SR, TP, TW, WH, WM, WP, WR, WW
Lasiurus borealis Red bat	AC, AS, BJ, BP, BR, CH, CO, GL, GM, HA, HR, MA, ME, MI, MY, NC, OR, PE, PI, PO, PR, WH, WM, WP, WW
Lasiurus cinereus Hoary bat	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PN, PO, PR, QU, RC, RH, SR, TP, TW, WH, WM, WP, WR, WW
Myotis californicus California myotis	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PN, PO, PR, QU, RC, RH, SR, TP, TW, WH, WM, WP, WR, WW

Myotis evotis Long-eared myotis	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, MY, NC, NF, OD, OR, PB, PE, PI, PO, PR, QU, RC, RH, SR, TW, WH, WM, WP, WR, WW
Myotis keeni Keen myotis	LC, NF
Myotis lucifugus Little brown myotis	AC, AS, BB, BJ, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PN, PO, PR, QU, RC, RH, SR, TP, TW, WH, WM, WP, WR, WW
Myotis subulatus Small-footed myotis	CC, HR, OD, PB, PN, RC, TP
Myotis thysanodes Fringed myotis	AC, AS, BJ, BP, BR, CC, CH, CO, GL, GM, HR, MA, ME, MI, MY, NC, OD, OR, PB, PE, PI, PO, PR, RC, WH, WM, WP, WW
Myotis volans Long-legged myotis	AC, AS, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, MY, NC, NF, OD, OR, PB, PE, PI, PO, PR, QU, RC, RH, SR, TW, WH, WM, WP, WR, WW
Myotis yumanensis Yuma myotis	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, MY, NC, NF, OD, OR, PB, PE, PI, PN, PO, PR, QU, RC, RH, SR, TP, TW, WH, WM, WP, WR, WW
Pipistrellus hesperus Western pipistrel	CC, HR, OD, PB, PN, TP
Plecotus townsendi Townsend big-eared bat	AC, AS, BJ, BP, BR, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PN, PO, PR, QU, RC, RH, SR, TP, TW, WH, WM, WP, WR, WW
Tadarida brasiliensis Brazilian free-tailed bat	AS, WH
Lagomorpha:	
Lepus americanus Snowshoe hare	AC, AS, BB, BP, BR, BU, CC, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, ME, MI, ML, NC, NF, OD, OR, PB, PE, PO, QU, RC, SR, TW, WM, WR, WW
Lepus californicus Black-tailed jack rabbit	AS, BJ, GM, HR, ME, PB, PN, PR, RH, TP, WW
Lepus townsendi White-tailed jack rabbit	ME, WW
Ochotona princeps Pika	AC, BR, BU, LA, ME, MI, NF, OR, PE, WM, WW

Sylvilagus bachmani Brush rabbit	AS, CH, MA, MY, NC, WH, WP
Sylvilagus floridanus Eastern cottontail	MA, WP
Sylvilagus idahoensis Pigmy rabbit	HR
Sylvilagus nuttalli Mountain cottontail	BB, BJ, GM, HR, ME, PB, PN, PR, RC, TP, WW

Rodentia:

Aplodontia rufa Mountain beaver	AC, AS, BP, BR, BU, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, ML, MY, NC, NF, OR, PE, PO, QU, SR, TW, WH, WM, WR
Arborimus albipes White-footed vole	BR, CH, CO, NC, PO, WH, WM
Arborimus longicaudus Red tree vole	AC, BP, BR, CH, CO, GL, MA, NC, OR, PE, PO, WH, WM
Castor canadensis Beaver	BU, CC, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, MY, NF, OD, PE, PO, PR, QU, RC, TW, WR, WW
Clethrionomys californicus California red-backed vole	AC, BP, BR, CH, CO, GL, MI, ML, MY, NC, OR, PE, PO, WH, WM
Clethrionomys gapperi Gapper red-backed vole	BB, BU, CC, CF, DP, HA, HI, JC, LA, LC, ME, NF, OD, PB, QU, RC, SR, TW, WR, WW
Dipodomys heermanni Heermann kangaroo rat	
Dipodomys ordi Ord kangaroo rat	HR
Erethizon dorsatum Porcupine	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, GL, GM, HR, ME, MI, ML, NC, NF, OD, OR, PB, PE, PN, PO, PR, RC, SR, TP, WH, WM, WR, WW
Eutamias amoenus Yellow-pine chipmunk	AC, AS, BB, BJ, BP, BR, BU, CC, GL, GM, HI, LA, ME, MI, ML, NF, OD, OR, PB, PE, PN, PR, RC, SR, TP, WM, WW
Eutamias minimus Least chipmunk	HR, RH
Eutamias ruficaudus Red-tailed chipmunk	BB
Eutamias townsendi Townsend chipmunk	AC, AS, BP, BR, BU, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OR, PE, PI, PO, QU, SR, TW, WH, WM, WP, WR, WW

Glaucomys sabrinus Northern flying squirrel	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OR, PB, PE, PI, PN, PO, PR, QU, RC, SR, TP, TW, WH, WM, WR, WW
Lagurus curtatus Sage vole	GM, HR, RH
Marmota caligata Hoary marmot	BU, NF
Marmota flaviventris Yellow-bellied marmot	BB, CC, HR, ML, OD, PN, TP, WW
Microtus californicus California vole	AS
Microtus canicaudus Gray-tailed vole	MA, PI, WP
Microtus longicaudus Long-tailed vole	AC, BB, BR, BU, CC, CF, CH, DP, GL, HA, HI, HR, JC, LA, LC, ME, MI, ML, NC, NF, OD, OR, PB, PE, PN, PO, PR, QU, RC, SR, TP, TW, WH, WM, WR, WW
Microtus montanus Mountain vole	CC, GM, HR, ME, OD, PB, PN, PR, RC, TP, WW
Microtus oregoni Oregon or creeping vole	AC, BP, BR, BU, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OR, PE, PI, PO, QU, SR, TW, WH, WM, WR, WW
Microtus pennsylvanicus Meadow vole	BB, PN, TP
Microtus richardsoni Richardson vole	AC, BR, BU, CC, GL, LA, LC, NF, OD, OR, PB, RC, WM, WW
Microtus townsendi Townsend vole	AC, BP, BR, CH, DP, GL, HA, JC, LC, MA, MY, OR, PE, PI, PO, QU, TW, WH, WM, WP
Myocastor coypus Nutria	WP
Neotoma cinerea Bushy-tailed wood rat	AC, BB, BJ, BP, BR, BU, CC, CF, CH, DP, GL, GM, HA, HI, HR, JC, LA, LC, ME, MI, ML, NC, NF, OD, OR, PB, PE, PN, PO, PR, QU, RC, SR, TP, TW, WM, WR, WW
Neotoma fuscipes Dusky-footed wood rat	AS, CH, GM, MA, MY, PI, PO, WH, WP
Ondatra zibethicus Muskrat	DP, MY, NF, TP, WP
Onychomys leucogaster Northern grasshopper mouse	HR, PN, RH, TP

Perognathus parvus Great Basin pocket mouse	HR, ME, PN, RH, TP, WW
Peromyscus maniculatus Deer mouse	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PN, PO, PR, QU, RC, RH, SR, TP, TW, WH, WM, WP, WR, WW
Phenacomys intermedius Heather vole	AC, BR, BU, CC, GL, HI, LA, MI, NF, OD, OR, PB, PE, RC, SR, WM, WW
Reithrodontomys megalotis Western harvest mouse	HR, PN, RH, TP
Sciurus griseus Western gray squirrel	AS, BJ, GM, MA, ME, MI, ML, MY, PE, PI, PR, WH
Spermophilus beecheyi California ground squirrel	AS, CH, HR, MA, PI, PO, WH, WP
Spermophilus beldingi Belding ground squirrel	BJ, CC, HR, OD
Spermophilus columbianus Columbian ground squirrel	BB, CC, PB, PN, RC, TP
Spermophilus lateralis Mantled ground squirrel	AC, AS, BB, BJ, BP, CC, GL, GM, MI, ML, OD, PB, PE, PR, RC
Spermophilus saturatus Cascades mantled ground squirrel	BU, LA, ME, SR, WW
Spermophilus townsendi Townsend ground squirrel	HR, ME, RH
Spermophilus washingtoni Washington ground squirrel	
Synaptomys borealis Northern bog vole	NF
Tamiasciurus douglasi Chickaree	AC, AS, BJ, BP, BR, BU, CF, CH, CO, DP, GL, GM, HA, HI, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PE, PI, PO, PR, QU, SR, TW, WH, WM, WR, WW
Tamiasciurus hudsonicus Red squirrel	BB, CC, PB, PN, RC, TP
Thomomys bottae Valley pocket gopher	AS
Thomomys bulbivorus Giant pocket gopher	MA, PI, WP
Thomomys mazama Mazama pocket gopher	AC, AS, BJ, BP, GL, MI, ML, NC, OR, PE, PR, WM

Thomomys talpoides Northern pocket gopher	BB, BU, CC, HR, ME, OD, PB, PN, RC, RH, SR, TP, WR, WW
Thomomys townsendi Townsend pocket gopher	
Zapus princeps Western jumping mouse	BB, BU, CC, CF, OD, PB, WR, WW
Zapus trinotatus Pacific jumping mouse	AC, BP, BR, CH, CO, DP, GL, HA, HI, JC, LA, LC, MI, ML, NC, NF, OR, PE, PO, PR, QU, RC, SR, TW, WH, WM, WW
Carnivora:	
Bassariscus astutus Ringtail or miner's cat	AS, BP, CH, CO, MY, PO, WH
Canis latrans Coyote	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PN, PO, PR, QU, RC, RH, SR, TP, TW, WH, WM, WP, WR, WW
Canis lupus Wolf	AC, BP, BR, GL, OR, WM
Felis concolor Mountain lion or cougar	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, JC, LA, LC, ME, MI, ML, MY, NF, OD, OR, PB, PE, PO, PR, QU, RC, SR, TW, WH, WM, WR, WW
Gulo luscus Wolverine	AC, BP, BR, GL, NF, OR, WM, WW
Lutra canadensis River otter	BU, CF, CO, DP, HA, HI, JC, LA, MY, NF, PE, PO, PR, QU, TW
Lynx canadensis Canadian lynx	BB, CC, OD, PB, WW
Lynx rufus Bobcat	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PN, PO, PR, QU, RC, RH, SR, TP, TW, WH, WM, WP, WR, WW
Martes americana Marten	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, GL, GM, HA, HI, JC, LA, LC, ME, MI, NC, NF, OD, OR, PB, PE, PO, PR, QU, RC, SR, TW, WH, WM, WR, WW
Martes pennanti Fisher	AC, AS, BP, BR, CC, GL, HA, HI, JC, MI, OD, OR, PB, PE, QU, TW, WM
Mephitis mephitis Striped skunk	AS, BJ, CC, DP, GM, HA, HR, JC, MA, NC, OD, PB, PI, PN, PR, QU, TP, TW, WP, WR, WW

Mustela erminea Short-tailed weasel or ermine	AC, AS, BB, BP, BR, BU, CC, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PO, QU, RC, SR, TW, WH, WM, WP, WR, WW
Mustela frenata Long-tailed weasel	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PN, PO, PR, QU, RC, SR, TP, TW, WH, WM, WR, WW
Mustela vison Mink	AC, BP, BR, BU, CC, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, MA, MI, MY, NC, NF, OD, OR, PB, PE, PI, PO, PR, QU, RC, TW, WH, WM, WW
Procyon lotor Raccoon	AC, BP, BR, CC, CH, CO, DP, GL, HA, HI, JC, MA, MY, NC, NF, OD, OR, PB, PE, PI, PO, PR, QU, TW, WH, WM, WP, WW
Spilogale putorius Spotted skunk or civet cat	AC, AS, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, HR, JC, LA, LC, MA, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PO, PR, QU, SR, TW, WH, WM, WR
Taxidea taxus Badger	AS, BB, BJ, CC, GL, GM, HR, ME, MI, OD, PB, PN, PR, RH, TP, WW
Urocyon cinereoargenteus Gray fox	AC, AS, BJ, GL, GM, HR, MA, NC, PE, PI, PR, WP
Ursus americanus Black bear	AC, AS, BB, BJ, BP, BR, BU, CC, CF, CH, CO, DP, GL, GM, HA, HI, JC, LA, LC, MA, ME, MI, ML, MY, NC, NF, OD, OR, PB, PE, PI, PO, PR, QU, RC, SR, TW, WH, WM, WP, WR, WW
Vulpes fulva Red fox	AC, AS, BJ, BP, BR, BU, CC, GL, GM, HR, LA, MA, ME, MI, NC, NF, OD, PE, PI, PR, SR, WM, WP, WW
Artiodactyla:	
Alces alces Moose	BB
Cervus canadensis[2] Elk or wapiti	AC, BB, BP, BR, BU, CC, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, ME, MI, ML, NF, OD, OR, PB, PE, PO, PR, QU, RC, SR, TW, WM, WR, WW
Odocoileus h. columbianus Black-tailed deer	AS, BP, BU, CF, CH, CO, DP, GL, HA, HI, JC, LA, LC, MA, MY, NC, NF, PI, PO, QU, SR, TW, WP, WR
Odocoileus h. hemionus Mule deer	AC, BB, BJ, BR, CC, GL, GM, HR, ME, MI, ML, OD, OR, PB, PE, PR, RC, RH, WM, WW

[2] Including *Cervus canadensis* var. *roosevelti*, Roosevelt elk.

Odocoileus virginianus White-tailed deer	BB, PN, TP
Oreamnos americanus Mountain goat	BU, LA, NF

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