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.

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.

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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

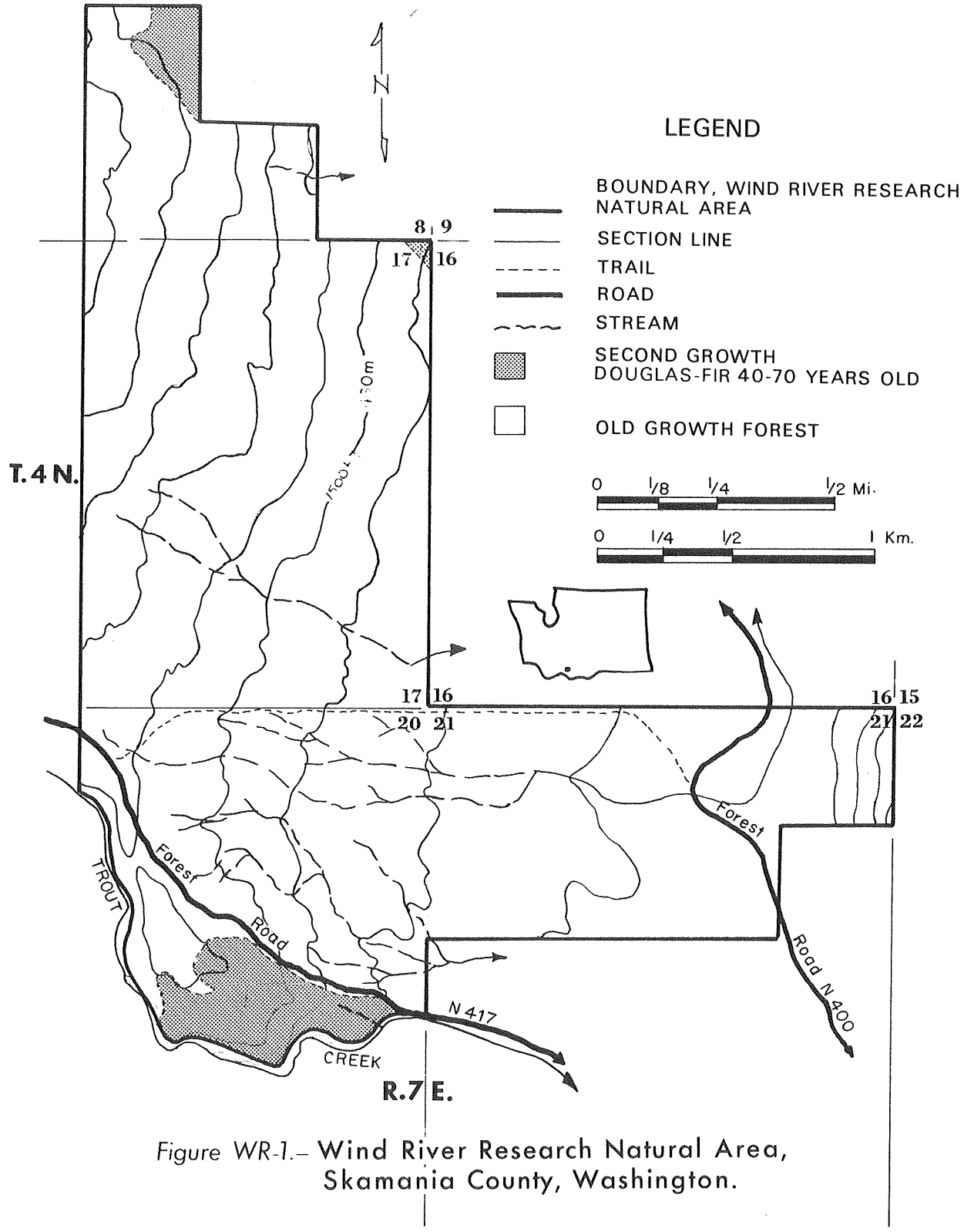
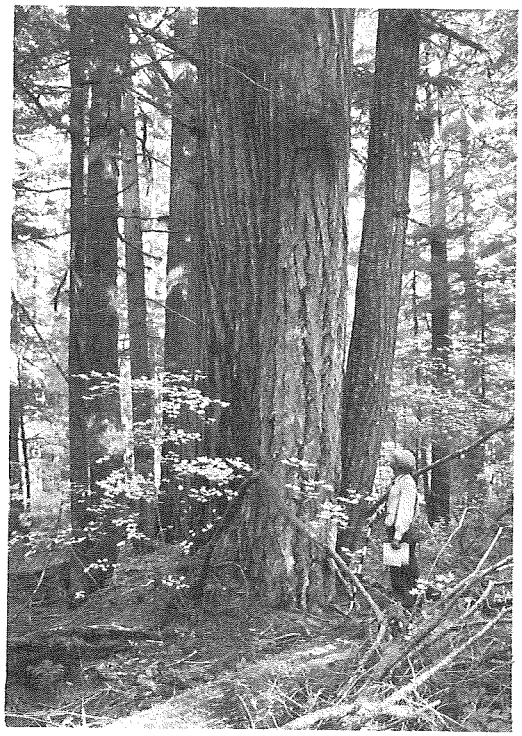


Figure WR-1.– Wind River Research Natural Area, Skamania County, Washington.

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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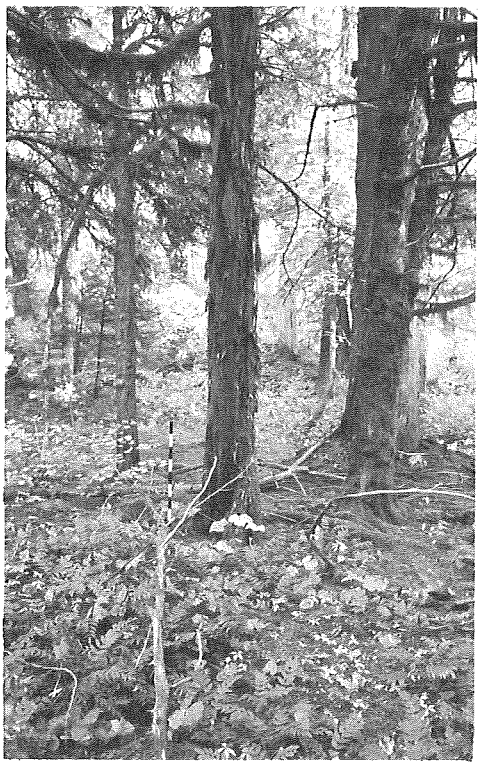

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Figure WR-2.-Features of the Wind River Research Natural Area (continued). E: Screened frames used by Leo Isaac in his 1928 study of tree seed storage in the forest floor. F: Mixed stand of Douglas-fir and western hemlock showing typical understory 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