# PYRAMID LAKE RESEARCH NATURAL AREA

Supplement No. 8[1]

*Donald B. Zobel and C. Robert Wasem*[2]

The Research Natural Area described in this supplement is administered by the U.S. Department of the Interior, National Park Service. National Park Service Research Natural Areas are located within National Parks or Monuments which are administered by Superintendents. A scientist wishing to use one of these tracts should first contact the Superintendent responsible for the Park in which the Research Natural Area is located and outline his proposed research. Because of their long involvement with scientific and educational use of the National Parks and Monuments, the National Park Service has developed some standard procedures covering applications for such uses.

Eventually all research must be approved by the Park Superintendent, Director of the Region, and Chief Scientist. A resources study proposal must be prepared by the principal investigators for the above administrators' review and approval; area research biologists will assist in preparation of the proposal. Formal collecting permits are necessary within the Research Natural Areas as well as the Parks in general. There may be limitations on research activities located on Research Natural Areas within designated Wilderness Areas.

The Research Natural Area described within is a part of a Federal system of such tracts established for research and educational purposes. Each of these constitutes a site where some natural features are preserved for scientific purposes and natural processes are allowed to dominate. Their main purposes are to provide:

1. Baseline areas against which effects of human activities can be compared;
2. Sites for study of natural processes in undisturbed ecosystems; and
3. Gene pool preserves for all types of organisms, especially rare and endangered types.

The total Federal system is outlined in "A Directory of the Research Natural Areas on Federal Lands of the United States of America.''[3] Of the 64 Federal Research Natural Areas in Oregon and Washington, 45 are described in "Federal Research Natural Areas in Oregon and Washington: A Guidebook for Scientists and Educators, ..[4] along with details on management and use of such tracts; this description is the 8th supplement to that guide.

The guiding principle in management of Research Natural Areas is to prevent unnatural encroachments, activities which directly or indirectly modify ecological processes on the tracts. Logging and uncontrolled grazing are not allowed, for example, nor is public use which threatens significant impairment of scientific or educational values. Management practices necessary for maintenance of the ecosystem may be allowed.

Federal Research Natural Areas provide a uniquely valuable system of publicly owned and protected examples of undisturbed ecosystems which are available to the scientist. Scientists can conduct research with minimal

[1] Supplement No.8 to "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 (USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, 498 p., iIlus., 1972). The guidebook is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $4.90; stock number 001-001-00225-9.

[2] Donald B. Zobel is Associate Professor of Botany, Oregon State University, Corvallis. At the time of this study, he was employed by the Pacific Northwest Forest and Range Experiment Station. C. Robert Wasem is Research Biologist, North Cascades National Park, Sedro Woolley, Washington.

3 Federal Committee on Ecological Reserves. 1977. A directory of Research Natural Areas on Federal lands of the United States of America. 280 p. U.S. Dep. Agric. For. Servo

[4] See footnote 1.

interference and reasonable assurance that investments in long-term studies will not be lost to logging, land development, or similar activities. In return, the scientist wishing to use a Research Natural Area must:

2. Obtain permission from the appropriate administering agency before using the area;[5]
3. Abide by the administering agency's regulations governing the use of the natural area, including specific limitations on the type of research, sampling methods, etc., allowed; and
4. Inform the administering agency on the progress of the research, published results, and disposition of collected material.

[5] There are five agencies cooperating in this program in the Pacific Northwest: Forest Service in the U.S. Department of Agriculture; Bureau of Land Management, Fish and Wildlife Service, and the National Park Service in the U.S. Department of the Interior; and the U.S. Department of Energy.

The purposes of these limitations are simple to insure that the scientific and educational values on the tract are not impaired, to accumulate a documented body of knowledge about the tract, and to avoid conflicts between new and old studies. Research on Research Natural Areas must be essentially nondestructive in character-destructive analysis of vegetation is generally not allowed nor are studies requiring extensive modification of the forest floor, or extensive excavation of soil. Collection of plant and animal specimens should be restricted to the minimum necessary for provision of vouchers and other research needs and in no case to a degree which significantly reduces species population levels. Such collections must also be carried out in accordance with applicable State and Federal agency regulations. Within these broad guidelines, the appropriate uses of Research Natural Areas are determined on a case-by-case basis by the administering agency.

A
Wasl

# PYRAMID LAKE RESEARCH NATURAL AREA

Pyramid Lake Research Natural Area (RNA) was established by the National Park Service in 1972 to protect a small oligotrophic lake (fig. PL-1) and the surrounding habitat of the northern rough-skinned newt *(Taricha granulosa* var. *granulosa).* The area also includes a small, rapidly flowing stream and both recently disturbed and mature montane forest. The 48·ha (l19-acre) area is in the Ross Lake National Recreation Area, Whatcom County, Washington. It is located at 48°42' N. latitude and 121 °07' W.longitude.

## Access and Accommodations

Pyramid Lake RN A is approached via Washington State Highway 20, approximately 31 km (19 mil east of Marblemount or 100 km (62 mil west of Winthrop (fig. PL-2). The trail into the RNA begins 1 km (0.6 mil east of the Gorge Lake bridge and 1 km (0.6 mil west of the intersection with Diablo Dam Road. It is marked with a small sign. The trail leads 3.4 km (2.1 mil to Pyramid Lake and rises 458 m (1,500 ft). The last 1.3 km (0.8 mil of the trail is within the RNA.

Accommodations are available at the Diablo Lake Resort, about 1 km (0.6 mil north of the highway on Diablo Dam Road. A National Park Service campground is on Highway 20, 5.3 km (3.3 mil southeast of the trailhead (fig. PL·2).

## Environment

The Pyramid Lake Research Natural Area lies in the eastern part of a large cirque basin which forms the north face of Pyramid Peak

**Figure PL-1.—North end of Pyramid Lake illustrating shrubby bog in upper right corner and many floating logs.**

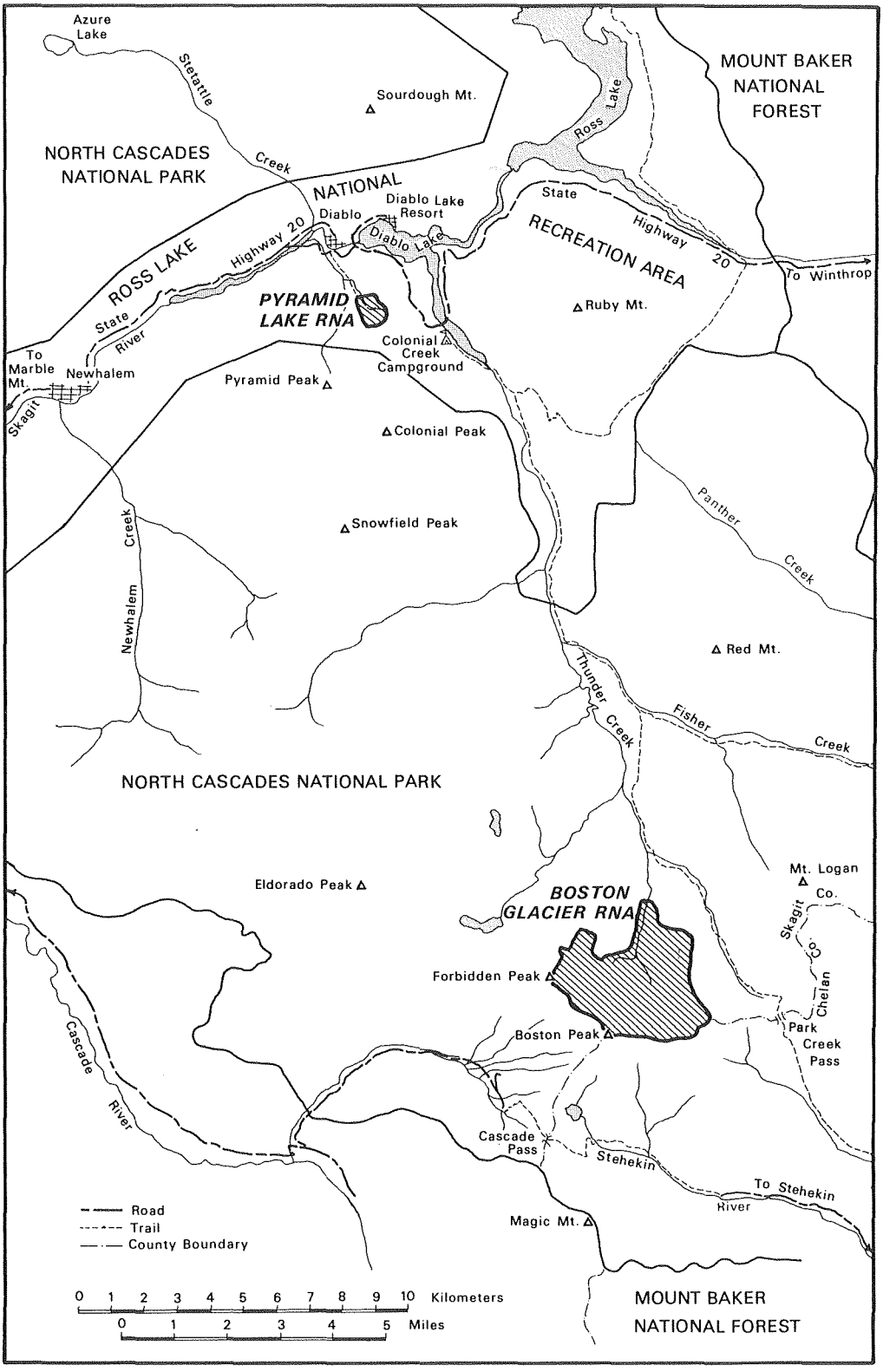



**Figure PL-2.—Location of Pyramid Lake Research Natural Area in relation to State Highway 20, Diablo Lake Resort, and Colonial Creek Campground on Diablo Lake.**

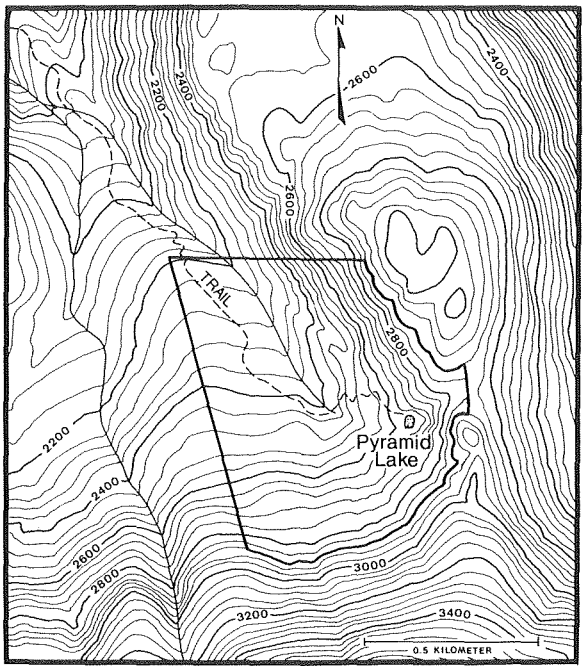



**Figure PL-3.—Pyramid Lake Research Natural Area, showing contours (in feet) and locations of lake, stream, and trail. (Redrawn from U.S. Geological Survey Ross Dam and Diablo Dam Quadrangles, Washington, 7.5 Minute Series.)**

(figs. PL-2 and PL-3). The eastern half of the area includes the lower slopes of a steep ridge with much talus and rock outcrop. Pyramid Lake is in a small, rocky basin at 802-m (2,630ft) elevation along this steep, west-facing slope. Two temporary ponds occur in the saddle northeast of the lake. The western half of the RNA is on gentler, less rocky topography, mostly a series of benches with steeper intervening slopes. It includes the drainage of the eastern fork of Pyramid Creek, a small perennial stream. There are a number of intermittent streams and small areas with seepage. Elevations range from 671 m (2,220 ft) in the northwestern corner to the 878-m (2,880-ft) contour, which forms the southern and eastern boundaries of the RNA (fig. PL-3).

This area has a wet, cool maritime climate. Climatic data are available from Diablo Dam, 2.6 km (1.6 mil northwest of Pyramid Lake (National Oceanic and Atmospheric Administration 1976). The Diablo Dam Weather Station is 520 m (1,700 ft) below the lake, in the canyon bottom along Gorge Lake (a reservoir). Annual precipitation averages 1873 mm (73.7 in); the peak is in winter. Average monthly precipitation for May through September is 100 mm or less, and total precipitation is 125 mm (4.92 in) from June through August. Average annual snowfall at Diablo Dam is 183 cm (71.9 in). Mean annual temperature is 9.2°C (48.5°F); the monthly mean is -0.2°C (31.7°F) for January and 18.3°C (64.9°F) for July. Mean maximum temperatures in July average 25.5°C (77.9°F) and mean minimums in January average -3.2°C (26.3°F).

Bedrock in the area is pre-Upper Jurassic gneiss (Huntting *et at.* 1961). There have apparently been no studies of soils in the immediate area, but Snyder and Wade (1970) describe soils from similar parent material to the west and southwest in the Mount Baker National Forest. There the soils are very gravelly loams, gravelly loams, and gravelly sandy loams, up to 1 m (3 ft) deep. They have about 40 percent rock fragments in the topsoil and 55 to 65 percent in the subsoil. Soils are well-drained, friable when moist, and non-sticky and non-plastic when wet. They have low fertility with pH 5 to 6. The 7th Approximation classification for these soils is "Typic Ferrod; coarse loamy, mixed."

Pyramid Lake has an area of 0.17 ha (0.42 acre) (fig. PL-4). It is deep for its small size,

5.

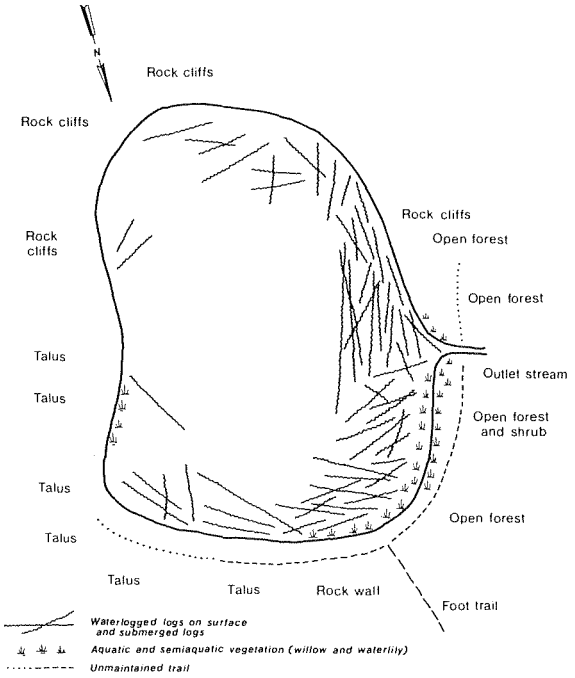



**Figure PL-4.—Pyramid Lake, shoreline conditions and location of logs in 1973.**

averaging 6.43 m (21.1 ft) for 18 soundings, with a maximum depth of 8.75 m (26.7 ft). There is no surface inlet stream, and the surface outlet stream flows only intermittently. The shoreline is occupied mainly by cliffs or talus; there is a small marsh in the northwestern corner (figs. PL-l and PL-4). Many logs are submerged or float in the lake. Oxygen is abundant for aquatic life. The lake is richer in nutrients and biota than most high-elevation lakes, but it still can be considered oligotrophic. The lake bottom is primarily silt, muck, and organic detritus; there are rocks near the shore below the talus. Most of the lake is considered to be in the littoral zone.

Detailed analyses of the lake water have given the results shown in table 1. Further chemical analysis from July 1971 samples gave the following results:[6]

| Parameter | |
|---|---|
| Conductivity | 52 micromhos |
| Chlorides | 0.73 mg/liter |
| Sulfates | 1.00 mg/liter |
| $NH_4$+ or $NH_3$ | 0.01 mg/liter |
| Fe | ⟨0.02 mg/liter |
| Na | 1.1 mg/liter |
| Mg | 0.9 mg/liter |

Contrary to the information shown on U.S. Geologic Survey topographic maps, the outlet from Pyramid Lake is not a major surface source for the east fork of Pyramid Creek. In July 1978, there was surface water only a few meters down the outlet stream and its bed was dry near its junction with the major creek. A stream which runs north-northwest was encountered about 200 m (660 ft) into the Natural Area from the western boundary near the southwest corner. It probably provides much of the flow to the creek lower in the RN A. The lower part of the stream is steep, rocky, and torrential, flowing primarily through heavy forest.

[b] Ervin Hindin, Washington State University, Pullman, personal communication, 1971.

## Biota

### Plant Communities

The forest vegetation represents the *Abies amabilis* Zone (Franklin and Dyrness 1973) well, except for the spotty importance of Alaska-cedar *(Chamaecyparis nootkatensis).* It may also be classified as forest cover type 226, Pacific Silver Fir-Hemlock (Society of American Foresters 1964) or as unit 3, Silver FirDouglas-fir Forest (Kuchler 1964). There are two major forest units in the RNA. A young, often sparse, forest occupies the steep, rocky topography in the eastern half, including the area around the lake. In contrast, the less rocky benches and gentler slopes in the western part are covered with a variable oldgrowth forest. The sharp ecotone (fig. PL-5) separating the forest types closely follows the topography. Charcoal is common in the young forest but is not apparent in the older stands.

**Table PL-1.—Analysis of water in Pyramid Lake**

| Attribute | July 7-8, 1971 | Sept. 13, 1973 |
|---|---|---|
| Secchi disc transparency (m) | 8.25 | 7.25 |
| Range of water temperature (°C) | 10.5—13.4 | 13.80—15.10 |
| Thermocline depth (m) | 3.8 | None |
| Dissolved oxygen (mg/liter) | 9.2 | 8.8 |
| pH | 7.3 | 7.4 |
| Alkalinity (mg/liter) | 36.0 | 39.0 |
| Hardness (mg/liter): | | |
| Total | 26.0 | 37.2 |
| Calcium | 20.4 | 31.6 |
| Ionizable solids (mg/liter) | 22.2 | 37.6 |
| Specific conductance (micromhos/cm) | 47.0 | 81.0 |

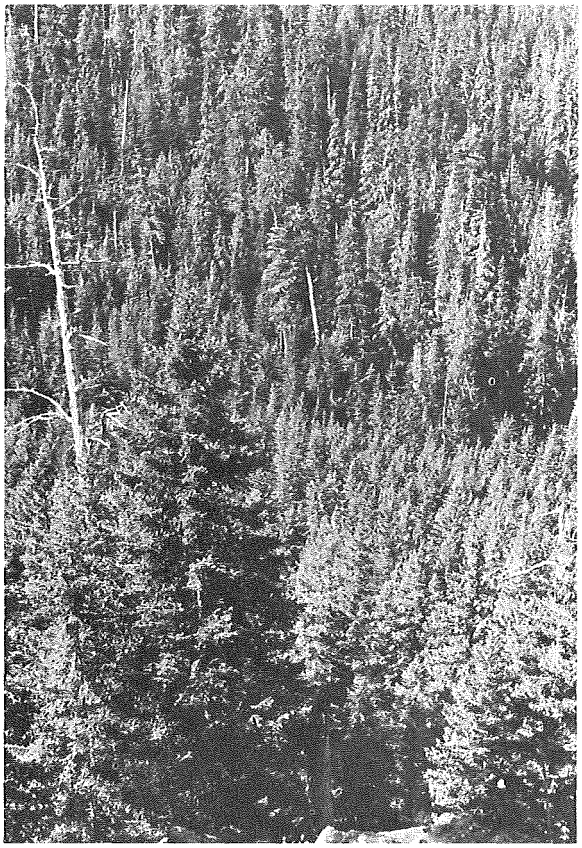


**Figure PL-5.—Ecotone between young forest (foreground) and old growth.**

Tree sizes suggest that a single fire probably resulted in establishment of the whole area of young forest; ages determined at 1.4 m (4.5 ft) on two dominant trees near the lake were 40 and 41 years in 1978.

Most of the young forest is dominated by Douglas-fir *(Pseudotsuga menziesii),* but western hemlock *(Tsuga heterophylla)* and western redcedar *(Thuja plicata)* are important in the most sheltered sites on moister soils. Dominant Douglas-fir are usually 20- to 40-cm (8- to 16-in) d.b.h. Western hemlock is reproducing in the understory in the denser young forests on exposed slopes (fig. PL-6).

At the highest elevations in the young forest, lodgepole pine *(Pinus contorta)* is common; it dominates some slopes just above the boundary of the RNA. Western white pine *(Pinus monticola)* is rare. Pacific silver fir *(Abies amabilis)* is represented in the younger forest only as seedlings and Alaska-cedar only in a few shrubby clumps. The understory of this young forest varies- *Vaccinium membranaceum,*[7] *Gaultheria shallon, Salix* sp., and *Acer circinatum* are the more important shrubs; *Pteridium aquilinum, Chimaphila umbellata, Hieraceum* sp., and *Pyrola* sp., the

[7] Common names of understory plants are listed in table PL-2.

**Figure PL-6.—Dense young forest of Douglas-fir with lodgepole pine near eastern boundary.**

**Figure PL-7.—Large western redcedar (left) and Douglas-fir (right). White book on the tree trunk is 17.5 cm (6.9 in) long.**

most common herbs. On moister soils, at the base of the slope and on northern aspects, a variety of understory species more common in the old-growth forest are important. In the more open, rocky areas, *Pachistima myrsinites* and, in spots, *Arctostaphylos uva-ursi,* are important, along with a variety of herbs.

The old-growth forest presents a complex mosaic in terms of: (1) dominance in all vegetation layers, (2) the age and density of tree reproduction, and (3) the extent of recent tree mortality. The canopy is dominated by a variety of species (fig. PL-7): Douglas-fir (maximum diameter measured = 234 cm or 92 in), western red cedar (229 cm or 90 in), western hemlock (125 cm or 49 in), Pacific silver fir (108 cm or 43 in) and, in a limited area in the northwest corner, Alaska-cedar (63 cm or 25 in). Douglas-fir is rather uncommon, except on the more convex topography; large western red-cedars are most common near water and on some of the more protected benches. In some areas these two species are absent, and relatively uniform stands of western hemlock and Pacific silver fir dominate, these species being mixed in various proportions.

Small trees are mostly western hemlock and Pacific silver fir, the latter becoming more important at higher elevations. Reproduction of Alaska-cedar is usually shrub-like and seems to be significant only in parts of the northwestern section. Reproduction of western red-cedar is not common in most of the closed forest. Conifer saplings and seedlings are more dense on the steep slopes between benches than on the benches. Dense patches of conifer reproduction of uniform size occur throughout the area. These patches apparently represent local episodes of disturbance, the most recent being under dead trees in the canopy or near recent wind throws (fig. PL-8). The oldest patches are dominated by large trees of later seral species, such as western hemlock and Pacific silver fir; no Douglas-fir or western red-cedar are present. The extent and composition of the understory vary with the topography and presence of water as well as with conditions in the tree strata.

**Figure PL-8.—Moderately dense reproduction of western hemlock and Pacific silver fir in old-growth forest.**

The results of these various factors which affect forest structure and composition can best be illustrated by describing a few representative stands:

1. On the large bench· several hundred meters west of the lake, the overstory is dominated by western hemlock up to 50-cm (20-in) d.b.h.. The sparse tree reproduction is Pacific silver fir. The vascular understory is very sparse- *Vaccinium membranaceum* and *Chimaphila umbellata* are the most important species with scattered C *menziesii, V scoparium, Goodyera oblongifolia, Cornus canadensis,* and *Berberis nervosa.* Moss cover is extensive.

2. Along the gentle ridgetop west of the trail in the northern part of the RNA, western hemlock and Douglas-fir dominate. The reproduction is Pacific silver fir, western hemlock, and some western red-cedar. The most common shrubs are several *Vaccinium* spp., *Rhododendron albiflorum,* and *Gaultheria shallon. Chimaphila umbellata, Linnaea borealis, Pyrola secunda,* and *Goodyera oblongifolia* are the major herbs. Moss cover is often complete. The understory is dense only in scattered openings. There are many dead trees but no signs of fire.

3. On benches and gentle slopes near the trail, south of the stream crossing, western red-cedar is a major component of the overstory (fig. PL-9); a few exceed 2-m (6.5-ft) d.b.h. There are a few large Douglas-fir. Western hemlock and Pacific silver fir are also large (about 1 m or 3 ft). These latter two species comprise the tree reproduction. The shrub layer includes *Taxus brevifolia, Vaccinium alaskense (V ovalifolium?), V scoparium, Acer glabrum, A. circinatum, Berberis nervosa,* and, in the wettest spots, *Oplopanax horridum.* The herb layer is variable and rich, including *Asarum caudatum, Athyrium filix-femina, Blechnum spicant, Clintonia uniflora, Corallorhiza* sp., *Cornus canadensis, Disporum* sp., *Gymnocarpium dryopteris, Linnaea borealis, Pyrola asarifolia, Tiarella trifoliata, Trientalis latifolia,* and *Trillium* sp.

**Figure PL-9.—Mixed stand of western redcedar, western hemlock, and Pacific silver fir with little understory. Cedar to right of center has 49-cm (19-in) d.b.h.**

A variety of small communities add to the diversity of the Pyramid Lake Research Natural Area. These include the rock outcrops, talus (fig. PL-I0), and a variety of wet spots lakeside marsh, seeps, temporary ponds, stream-banks, and vegetation mats on floating logs are all represented.

The most obvious species on outcrops and talus are *Acer circinatum* and *Pachistima myrsinites,* with a few trees. Other common woody plants are *Amelanchier alnifolia, Ribes* spp., *Rubus parviflorus, Salix* sp., *Sorbus* sp., and *Vaccinium* sp. *Alnus sinuata* dominates some north-facing areas. The large variety of herbaceous species includes the ferns *Cheilanthes gracillima, Cryptogramma crispa, Cystopteris fragilis, Polypodium hesperium,* and *Polystichum lonchitis. Penstemon davidsonii* is common, as is *Agrostis scabra.*

Wet-site vegetation varies considerably. *Nuphar polysepalum* is the only floating- leaved aquatic noted. Communities associated with floating logs (fig. PL-ll) include *Carex* sp., *Drosera rotundifolia, Lycopus uniflorus,* and *Tofieldia glutinosa,* among others. The marsh at the northwestern corner of Pyramid Lake is dominated by *Spiraea douglasii; Rhododendron albiflorum, Alnus sinuata, Acer circin-*

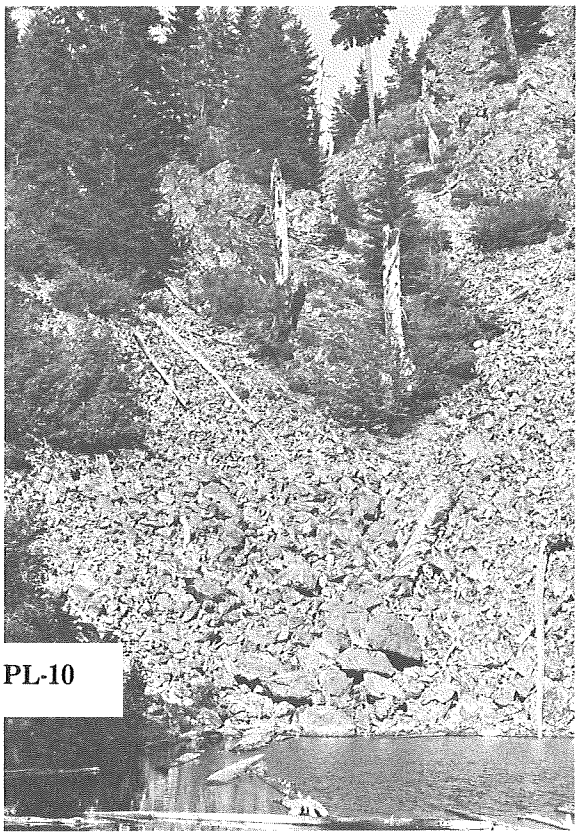


**Figure PL-10.—Talus and outcrop above Pyramid Lake.**

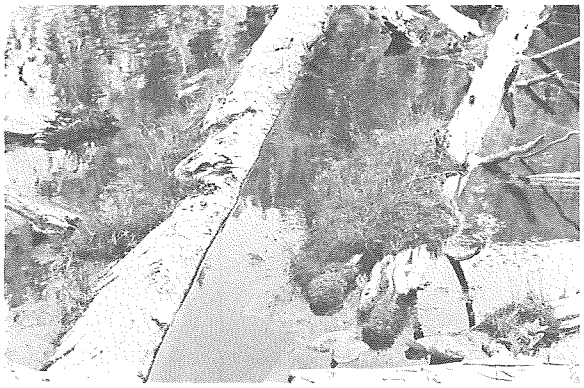


**Figure PL-11.—Floating mats of vegetation associated with logs in Pyramid Lake.**

**Figure PL-12.—Edge of boggy opening dominated by *Athyrium filix-femina*. Large trees are western redcedar.**

*atum, A. glabrum,* and *Salix* sp. are also present. The herbaceous layer includes several *Carex* spp., *Calamagrostis crassiglumis,* and *Galium* sp. There is a small mat of *Sphagnum,* and *Fontanalis antipyretica* is present. The larger pond in the saddle northeast of the lake has a wide band of *Spiraea douglasii* and *Salix* sp. on the perimeter. *Carex vesicaria* dominates the central area of the pond, which had shallow standing water in mid-July. This area is about the same size as the lake. A much smaller pond just above it is fringed by *Spiraea,* but the center was only mud in July.

Seepage areas in the forest are usually dominated by *Oplopanax horridum, Athyrium filix-femina, Tiarella trifoliata, Cornus canadensis,* and *Gymnocarpium dryopteris.* In one large, open seepage area on a flat, just west of where the creek crosses the trail, *Athyrium* is dominant (fig. PL-12); *Glyceria elata, Oplopanax* sp., *Cornus canadensis, Rubus spectabilis, Tiarella trifoliata,* and *Galium* sp. are also important. *Lysichitum americanum* is present. A temporary pond in the forest has a moss mat with a few small herbs. A hillside seep above the creek near the northern boundary has a mixed canopy of western red-cedar and Alaska-cedar, along with western hemlock and reproduction of Pacific silver fir. Besides the species mentioned above, *Equisetum arvense, Habenaria* sp., and *Listera convallarioides* occur. Several species usually grow only along open streamsides: *Actaea rubra, Adenocaulon bicolor, Stenanthium occidentale, Pamassia fimbriata,* and *Valeriana sitchensis.*

Plants identified in the Research Natural Area are listed in table PL-2.

**Table PL-2.—List of vascular plant species at Pyramid Lake Research Natural Area**

| Scientific name[1] | Habitat[2] | Common name |
|---|---|---|
| *Abies amabilis* | O Ym | Pacific silver fir |
| *Acer circinatum* | Y O W Rt Ro | vine maple |
| *Acer glabrum* var. *douglasii* | Ym Wm Om | Rocky Mountain maple |
| *Actaea rubra* | Om | baneberry |
| *Adenocaulon bicolor* | Wc | trail plant |
| *Agrostis scabra* | R | winter bentgrass |
| *Alnus rubra* | Wm | red alder |
| *Alnus sinuata* | W Y Rt | Sitka alder |
| *Amelanchier alnifolia* | W Y Ro | Saskatoon serviceberry |
| *Anaphalis margaritacea* | Wc | pearly everlasting |
| *Apocynum androsaemifolium* | Yx | spreading dogbane |
| *Arceuthobium* sp. | O | dwarf mistletoe |
| *Arctostaphylos uva-ursi* | R Yx | kinnikinnick |
| *Asarum caudatum* | Om Wc | wild ginger |

**Table PL-2.—List of vascular plant species at Pyramid Lake Research Natural Area—Continued**

| Scientific name[1] | Habitat[2] | Common name |
|---|---|---|
| *Athyrium filix-femina* | W Om | ladyfern |
| *Berberis nervosa* | Y Om | Oregongrape |
| *Berberis* sp. | W | |
| *Blechnum spicant* | Wc Om | deer-fern |
| *Bromus* sp. | O | brome |
| *Bromus vulgaris* | Wc | Columbia brome |
| *Calamagrostis crassiglumis* | Wm | thickglume reedgrass |
| *Carex brunnescens* | Wm | brownish sedge |
| *Carex laeviculmis* | Wm | smooth-stemmed sedge |
| *Carex lenticularis* | Wm | |
| *Carex vesicaria*[3] | Wm | inflated sedge |
| *Chamaecyparis nootkatensis* | W O Ym | Alaska-cedar |
| *Cheilanthes gracillima* | R | lace-fern |
| *Chimaphila menziesii* | O | little prince's pine |
| *Chimaphila umbellata* | Y O | western prince's pine |
| *Circaea alpina* | W | alpine circaea |
| *Clintonia uniflora* | Ym Om | queencup beadlily |
| *Corallorhiza* sp. | O Ym | coralroot |
| *Cornus* sp. | W | |
| *Cornus canadensis* | Ym Om | bunchberry dogwood |
| *Cornus nuttallii* | Y | Pacific dogwood |
| *Cryptogramma crispa* | R | rock-brake |
| *Cystopteris fragilis* | R | mountain bladderfern |
| *Disporum hookeri* var. *oreganum* | Om Wc | Hooker's fairybells |
| *Drosera rotundifolia* | W L | sundew |
| *Epilobium angustifolium* | Rt Wm | fireweed |
| *Epilobium watsonii* | Rc | Watson's willow-herb |
| *Equisetum arvense* | | common horsetail |
| *Fragaria vesca* | W | western wood strawberry |
| *Galium* sp. | Om | bedstraw |
| *Galium aparine* | W Om | cleavers bedstraw |
| *Gaultheria ovatifolia* | O W Y R | slender wintergreen |
| *Gaultheria shallon* | Y O Rt | salal |
| *Glyceria elata* | Wm | tall mannagrass |
| *Goodyera oblongifolia* | O Ym | rattlesnake plantain |
| *Gymnocarpium dryopteris* | Om | oak-fern |
| *Habenaria* sp. | Wc | bog-orchid |
| *Hieraceum* sp. | Y Rt | hawkweed |
| *Holodiscus discolor* | Yx | creambush oceanspray |
| *Juniperus communis* | Ro | common juniper |
| *Linnaea borealis* | Y O | twinflower |
| *Listera convallarioides* | O Wc | broad-lipped twayblade |
| *Listera cordata* | Om | heart-leafed twayblade |
| *Lycopodium clavatum* | O | elk-moss |
| *Lycopodium* sp. | Om | clubmoss |
| *Lycopus uniflorus* | W | northern bugleweed |
| *Lysichitum americanum* | Wm | skunkcabbage |
| *Nemophila parviflora* | | small-flowered nemophila |

Table PL-2.—List of vascular plant species at Pyramid Lake Research Natural Area—Continued

| Scientific name[1] | Habitat[2] | Common name |
|---|---|---|
| *Nuphar polysepalum* | L | spatter-dock |
| *Oplopanax horridum* | Om W | devilsclub |
| *Osmorhiza chilensis* | Wc | mountain sweetroot |
| *Pachistima myrsinites* | Y W Rt | Oregon boxwood |
| *Parnassia fimbriata* var. *fimbriata* | Wc | Rockymountain parnassia |
| *Penstemon davidsonii* | Ro | Davidson penstemon |
| *Pinus contorta* | Yx | lodgepole pine |
| *Pinus monticola* | Y O | western white pine |
| *Polypodium hesperium* | Ro | polypody |
| *Polystichum lonchitis* | Rt | mountain holly-fern |
| *Polystichum munitum* | Ym Om | swordfern |
| *Populus trichocarpa* | Ym | black cottonwood |
| *Pseudotsuga menziesii* | Y O | Douglas-fir |
| *Pteridium aquilinum* ssp. *aquilinum* var. *pubescens* | W Y | bracken fern |
| *Pyrola asarifolia* | W Om Ym | large pyrola |
| *Pyrola picta* | W R Y | whitevein pyrola |
| *Pyrola secunda* | Ym O | one-sided wintergreen |
| *Rhododendron albiflorum* | W Rt O | Cascades azalea |
| *Ribes* sp. | Rt | |
| *Ribes lacustre* | Y | prickly currant |
| *Rosa gymnocarpa* | W Y | baldhip rose |
| *Rubus* sp. | | |
| *Rubus idaeus* spp. *sachalinensis* var. *sachalinensis* | R W | red raspberry |
| *Rubus parviflorus* | Rt Yx Wm | thimbleberry |
| *Rubus spectabilis* | Wm Om | salmonberry |
| *Salix* sp. | W Rt Y | willow |
| *Sambucus racemosa* | Wm | black elderberry |
| *Selaginella wallacei* | Ro | Wallace's selaginella |
| *Smilicina stellata* | Om Wc | starry solomon-plume |
| *Sorbus sitchensis* | Rt | Sitka mountain-ash |
| *Spiraea douglasii* | Wm | Douglas spiraea |
| *Stenanthium occidentale* | | stenanthium |
| *Streptopus amplexifolius* var. *americanus* | Wc | clasping-leaved twisted-stalk |
| *Taxus brevifolia* | Ym Om | western yew |
| *Thuja plicata* | Ym O | western redcedar |
| *Tiarella trifoliata* var. *trifoliata* | W | three-leaved coolwort |
| *Tiarella trifoliata* var. *unifoliata* | Rt Wc Om | western coolwort |
| *Tofieldia glutinosa* | F | tofieldia |
| *Trientalis latifolia* | Rt Om | starflower |
| *Trillium ovatum* | Om | white trillium |
| *Tsuga heterophylla* | Y O | western hemlock |
| *Tsuga mertensiana* | Y | mountain hemlock |
| *Vaccinium alaskense* | W Ym O | Alaska huckleberry |
| *Vaccinium membranaceum* | Rt Y O | big huckleberry |
| *Vaccinium ovalifolium* | O | ovalleaf huckleberry |

**Table PL-2.—List of vascular plant species at Pyramid Lake Research Natural Area—Continued**

| Scientific name[1] | Habitat[2] | Common name |
|---|---|---|
| *Vaccinium parvifolium* | O Rt Ym | red huckleberry |
| *Vaccinium scoparium* | Ym O | grouse huckleberry |
| *Valeriana sitchensis* | Wc | Sitka valerian |
| *Viola* sp. | Wm | violet |

[1]Scientific names conform to Hitchcock and Cronquist (1973).

[2] F = Floating log
L = Lake
O = Old-growth forest
R = Rocky (t = talus, o = outcrop)
W = Wet ground (m = marsh, c = creekbank)
Y = Young forest (m = mesic end, x = xeric end)

[3]*Carex arcta* (northern clustered sedge), *Carex canescens* (gray sedge), and *Carex oederi* (green sedge) were reported for Pyramid Lake in 1973 , but their presence was not confirmed.

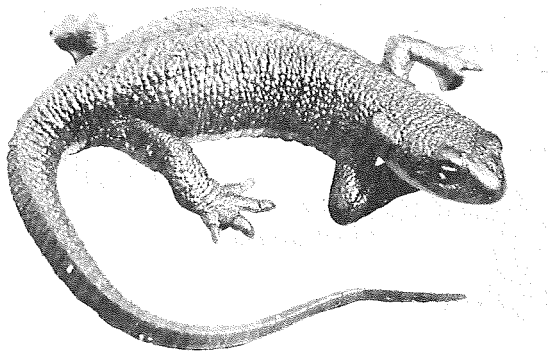


**Figure PL-13.—Northern rough-skinned newt (photo by Robert Parker Hodge).**

Fauna

Large mammals known to be present include the black bear. Columbian black-tailed deer, and coyote. Pica are common. A list of mammals and birds expected to be in the RN A has been compiled by E. R. Smith (tables PL-3 and PL-4).[8] The most obvious amphibian is the northern rough-skinned newt (fig. PL-13) seen in the lake in summer. The tailed frog *(Ascaphus truei)* occurs in the creek, and the western terrestrial garter snake *(Thamnophis elegans)* has been seen. Pyramid Lake was first planted with trout in 1936 or 1937; 1,370 cutthroat trout were added in 1948. There were still trout about 1954. but there have been none reported since at least 1966. There are probably no fish in Pyramid Creek above the highway.

[8] Smith, E. R. 1973. Pyramid Lake Research Natural Area Vertebrate Species Account. Unpubl. Report on file, Headquarters, North Cascades Complex, Sedro Woolley, Washington, 8 p.

6.

**Table PL-3.—Tentative list of mammal species**

| Order | Scientific name[1] | Common name |
|---|---|---|
| Insectivora | *Neurotrichus gibbsi* | shrew mole |
| | *Sorex bendiri* | marsh shrew |
| | *Sorex cinereus* | masked shrew |
| | **Sorex palustris* | northern water shrew |
| | *Sorex trowbridgi* | Trowbridge's shrew |
| | *Sorex vagrans* | vagrant 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 |

**Table PL-3.—Tentative list of mammal species—Continued**

| Order | Scientific name[1] | Common name |
|---|---|---|
| | *Myotis lucifugus* | little brown myotis |
| | *Myotis yumanensis* | Yuma myotis |
| Lagomorpha | *Lepus americanus* | snowshoe hare |
| | **Ochotona princeps* | pika |
| Rodentia | **Clethrionomys gapperi* | Gapper red-backed vole |
| | *Eutamias amoenus* | yellowpine chipmunk |
| | **Eutamias townsendi* | Townsend chipmunk |
| | *Glaucomys sabrinus* | northern flying squirrel |
| | *Marmota caligata* | hoary marmot |
| | *Microtus longicaudus* | long-tailed vole |
| | *Microtus oregoni* | creeping vole |
| | *Neotoma cinerea* | bushy-tailed woodrat |
| | *Ondatra zibethicus* | muskrat |
| | *Peromyscus maniculatus* | deer mouse |
| | **Tamiasciurus douglasi* | Douglas squirrel |
| | *Zapus trinotatus* | Pacific jumping mouse |
| Carnivora | *Canis latrans* | coyote |
| | *Felix concolor* | mountain lion |
| | *Lynx canadensis* | Canadian lynx |
| | *Lynx rufus* | bobcat |
| | *Martes americana* | pine martin |
| | *Mephitis mephitis* | striped skunk |
| | *Mustela ermina* | short-tailed weasel |
| | *Mustela frenata* | long-tailed weasel |
| | *Mustela vison* | mink |
| | *Procyon lotor* | raccoon |
| | **Ursus americanus* | black bear |
| Artiodactyla | **Odocoileus hemionus columbianus* | black-tailed deer |

[1]Asterisk indicates observation in the area.

**Table PL-4.—Tentative list of bird species**

| Scientific name[1] | Common name |
|---|---|
| *Accipiter cooperi* | Cooper's hawk |
| *Accipiter gentilis* | goshawk |
| *Accipiter striatus* | sharp-shinned hawk |
| *Aegolius acadicus* | saw-whet owl |
| *Asio otus* | long-eared owl |
| *Bonasa umbellus* | ruffed grouse |
| *Bubo virginianus* | great horned owl |
| *Buteo jamaicensis* | red-tailed hawk |
| *Carpodacus cassinii* | Cassins' finch |
| *Carpodacus purpureus* | purple finch |
| *Certhia familiaris* | brown creeper |
| *Chaetura vauxi* | Vaux's swift |
| *Cinclus mexicana* | dipper |
| *Colaptes auratus* | common flicker |
| *Columba fasciata* | band-tailed pigeon |

Table PL-4.—Tentative list of bird species—Continued

| Scientific name[1] | Common name |
|---|---|
| *Contopus sordidulus* | western wood peewee |
| **Corvus brachyrhynchos* | common crow |
| **Corvus corax* | common raven |
| **Cyanocitta stelleri* | Steller's jay |
| *Dendragapus obscurus* | blue grouse |
| *Dendroica coronata* | myrtle warbler |
| *Dendroica petechia* | yellow warbler |
| **Dryocopus pileatus* | pileated woodpecker |
| *Empidonax* sp. | Empidonax flycatchers |
| *Falco columbarius* | black merlin |
| *Falco sparverius* | American kestrel |
| *Glaucidium gnoma* | pygmy owl |
| *Hesperiphona vespertina* | evening grosbeak |
| *Hylocichla guttata* | hermit thrush |
| *Hylocichla ustulata* | Swainson's thrush |
| **Ixoreus naevius* | varied thrush |
| **Junco hyemalis* | dark-eyed junco |
| *Loxia curvirostra* | red crossbill |
| *Melospiza melodia* | song sparrow |
| *Nucifraga columbiana* | Clark's nutcracker |
| *Nuttallornis borealis* | olive-sided flycatcher |
| *Oporornis tolmiei* | MacGillivray's warbler |
| *Otus asio* | screech owl |
| *Passerella iliaca* | fox sparrow |
| *Perisoreus canadensis* | gray jay |
| *Picoides pubescens* | downy woodpecker |
| *Picoides villosus* | hairy woodpecker |
| *Pinicola enucleator* | pine grosbeak |
| *Piranga ludoviciana* | western tanager |
| *Regulus calendula* | ruby-crowned kinglet |
| *Regulus satrapa* | golden-crowned kinglet |
| *Selasphorus rufus* | rufous hummingbird |
| *Sitta canadensis* | red-breasted nuthatch |
| *Sitta carolinensis* | white-breasted nuthatch |
| **Sphyrapicus varius* | red-breasted sapsucker |
| *Spizella passerina* | chipping sparrow |
| *Stellula calliope* | calliope hummingbird |
| *Troglodytes troglodytes* | winter wren |
| *Turdus migratorius* | robin |
| *Vermivora celata* | orange-crowned warbler |
| *Vermivora ruficapilla* | Nashville warbler |
| *Vireo huttoni* | Hutton's vireo |
| *Vireo solitarius* | solitary vireo |
| *Wilsonia pusilla* | Wilson's warbler |
| *Zonotrichia atricapilla* | golden-crowned sparrow |
| *Zonotrichia leucophrys* | white-crowned sparrow |

[1]Asterisk indicates observation in the area.

## History of Disturbance

The major disturbance affecting the area was a fire that occurred 45-50 years ago, initiating the young forest in the eastern half of the area. No evidence of fire was found in the old-growth forest away from the ecotone. The spotty pattern of dead trees and tree regeneration indicates local episodes of tree death, perhaps caused by disease or insects. Dwarf mistletoe *(Arceuthobium* sp.) infection of western hemlock is severe throughout much of the old-growth forest. Windthrow is usually of single scattered trees except in one wet area (fig. PL-12) where several large trees recently fell.

Human disturbance has been minor, localized along the trail and at the south end of the lake, where there was some trampling and litter. Mountain climbers use the trail to the lake and then continue up slope west of the lake. There is trail flagging above the lake but no sign of disturbance along it. Camping in the area is not permitted, but day use is probably moderate because the trail head is on a main highway. Trappers used the area in the past; an old trap nailed to a tree and some nearby litter were found in the old-growth forest.

## Research

Pyramid Lake was sampled for water quality and aquatic biota by National Park Service personnel in 1971 and 1973. Trapping and observations of vertebrates were done on September 11-12, 1973 (see footnote 8). No research is presently known to be underway.

The aquatic habitat probably has the most potential for research, since the lake is an easily accessible example of a small, deep mountain lake. The diverse tract of old-growth forest, on a variety of wet to moderate habitats, is of interest, especially in terms of the dynamics of tree replacement after the pioneer canopy disappears. The substrate, gneiss, presents a contrast to the sedimentary and granitic rock in other Research Natural Areas in the North Cascades which also support forests of the *Abies amabilis* Zone (for example, the North Fork Nooksack and Lake Twentytwo Research Natural Areas).

## Maps and Aerial Photographs

Maps applicable to the area include:

*Topography* - 7.5' Diablo Dam and Ross Dam, Washington quadrangles, scale 1:24,000, issued by the U.S. Geological Survey in 1963; and *geology* - *Geologic Map of Washington,* scale 1:500,000 (Huntting *et al.* 1961). Information on the most recent aerial photography is available at the North Cascades National Park Service Complex headquarters, Sedro Woolley, Washington.

## LITERATURE CITED


Franklin, Jerry F., and C. T. Dyrness.
1973. Natural vegetation of Oregon and Washington. USDA For. Servo Gen. Tech. Rep. PNW-8, 417 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Hitchcock, C. L., and A. Cronquist.
1973. Flora of the Pacific Northwest. 730 p. Univ. Wash. Press, Seattle.

Huntting, Marshall T., W. A. G. Bennett, Vaughan E. Livingston, Jr., and Wayne S. Moen.
1961. Geologic map of Washington. Scale 1:500,000. Wash. Dep. Conserv., Div. Mines and Geol., Olympia.

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.

National Oceanic and Atmospheric Administration, Environmental Data Service.
1976. Climatological data: Annual summary, Washington. Vol. 80, No. 13, Natl. Clim. Cent., Asheville, N.C.

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

Society of American Foresters.
1964. Forest cover types of North America (exclusive of Mexico). 67 p., illus. Washington, D.C.




GPO 989-176

The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

Within this overall mission, the Station conducts and stimulates research to facilitate and to accelerate progress toward the following goals:

1. Providing safe and efficient technology for inventory, protection, and use of resources.

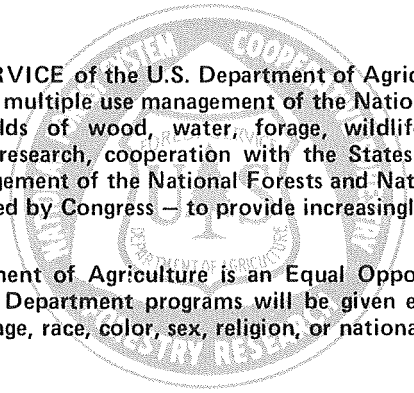
2. Developing and evaluating alternative methods and levels of resource management.

3. Achieving optimum sustained resource productivity consistent with maintaining a high quality forest environment.

The area of research encompasses Oregon, Washington, Alaska, and, in some cases, California, Hawaii, the Western States, and the Nation. Results of the research are made available promptly. Project headquarters are at:

Anchorage, Alaska
Fairbanks, Alaska
Juneau, Alaska
Bend, Oregon
Corvallis, Oregon
La Grande, Oregon
Portland, Oregon
Olympia, Washington
Seattle, Washington
Wenatchee, Washington

*Mailing address: Pacific Northwest Forest and Range Experiment Station*
*809 N.E. 6th Ave.*
*Portland, Oregon 97232*



The FOREST SERVICE of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.

The U.S. Department of Agriculture is an Equal Opportunity Employer. Applicants for all Department programs will be given equal consideration without regard to age, race, color, sex, religion, or national origin.