
FOREST TYPES IN THE RAINIER NATIONAL PARK

G. F. ALLEN

SUPERVISOR RAINIER NATIONAL FOREST



THE forests of the Mount Rainier National Park contain few deciduous trees, but are remarkable for the variety and beauty of their conifers. The great number of species and their adaptation to the varying environment make the Park a region of peculiar interest to the botanist. The attraction of the landscape is in the main its high and bold relief as contrasted with the softer outlines of more familiar scenes about our cities and farms, but the charm is heightened by the beauty of the forest and its harmony with the topography.

The distribution of species and their mode of growth, the size of the trees and the density of the stand are determined primarily by the altitude. As the elevation increases the growing season shortens and the depth of snow and the intensity of the winter cold increase. Soil moisture, which is a factor favorable to tree growth, depends mainly upon topography, although it increases to some extent with the annual precipitation which is greater at high elevations. Generally it is insufficient to balance the increased severity of the climate, and the forest types fall naturally into altitudinal zones. The extent of the belts is modified by slope and exposure and the lines which separate them are not level or sharply defined. Trees whose natural habitat is at a low elevation ascend somewhat higher on the ridges than in the valleys, and the subalpine species descend much lower along the streams than on the ridges, which are warmed by the upward air current. The successive forest belts blend and overlap where they come together, but are

distinctive in their central areas. The composition of the evergreen forest of the Park, divided into the zones within which the species reach their best development, is as follows:

LOWER BELT

Common Name.	Botanical Name.	Distribution.
Douglas Fir.....	<i>Pseudotsuga taxifolia</i> , Britton	Abundant to 3,500 feet.
Western Red Cedar.....	<i>Thuja plicata</i> , Donn.....	Common up to 3,500 feet and is found up to 4,000 feet.
Western Hemlock.....	<i>Tsuga heterophylla</i> , Sargent	Abundant to 4,500 feet and occurs up to 5,000 feet.
Western White Pine.....	<i>Pinus monticola</i> , Douglas.....	Occurs occasionally up to 4,000 feet reaching its best development between 3,000 and 3,500.
Grand Fir.....	<i>Abies grandis</i> , Lindley.....	Common up to 4,000 feet.
Western Yew	<i>Taxus brevifolia</i> , Nuttall	Found up to 4,000 feet.

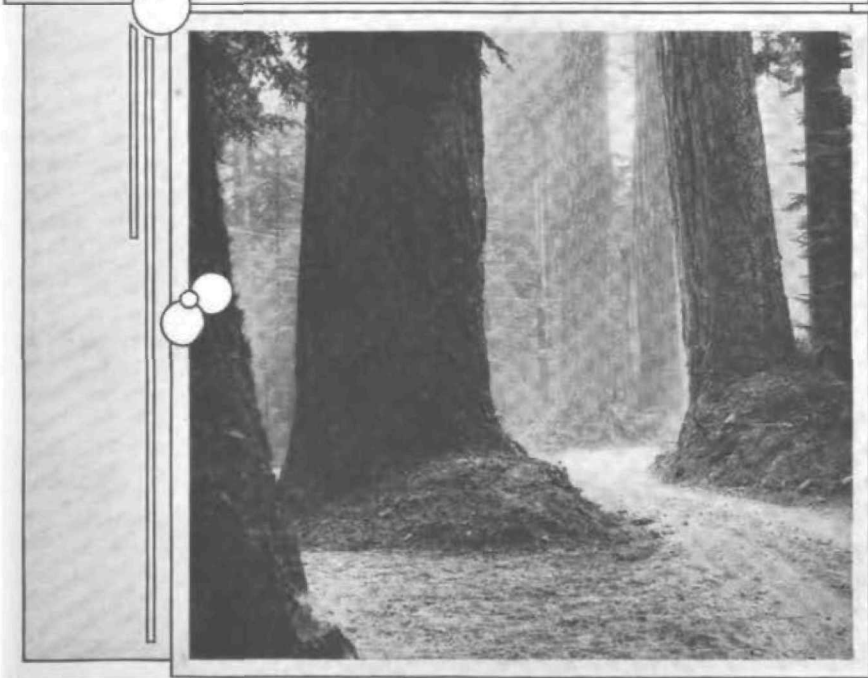
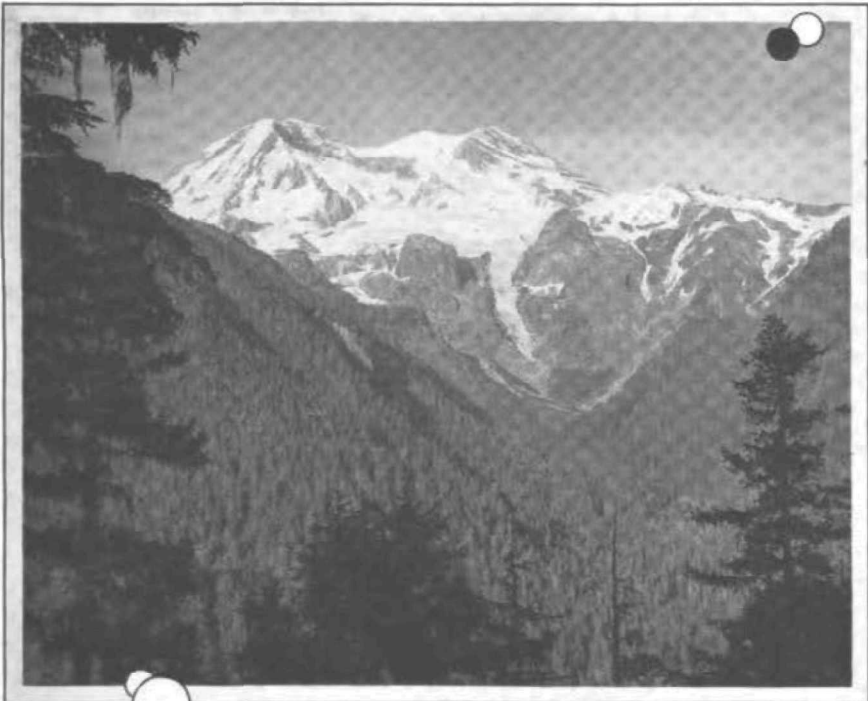
MIDDLE BELT

Lovely Fir	<i>Abies amabilis</i> , Forbes.....	Abundant from 2,500 to 5,000 feet.
Noble Fir.....	<i>Abies nobilis</i> , Lindley.....	Abundant from 3,500 to 5,000 feet.
Engelmann Spruce	<i>Picea Engelmanni</i> , Engelmann	Common on the eastern and northeastern slopes of Mount Rainier from 3,500 to 8,000 feet.
Lodgepole Pine.....	<i>Pinus contorta</i> , Loudon.....	Occasionally found up to 5,000 feet.

UPPER BELT

Mountain Hemlock.....	<i>Tsuga mertensiana</i> , Sargent	Abundant from 3,500 to 7,500 feet.
Alpine Fir	<i>Abies lasiocarpa</i> , Nuttall.....	Abundant from 4,500 to 7,500 feet.
White-bark Pine.....	<i>Pinus albicaulis</i> , Engelmann	Occasionally found from 5,000 to 7,500 feet.
Alaska Cedar.....	<i>Chamaecyparis</i> <i>nootkatensis</i> , Lamb.....	Common from 3,000 to 7,000 feet.

The dense evergreen forests characteristic of the lower western slopes of the Cascades extend into the Park in the valleys of the main and West Fork of White River, the Carbon, the Mowich, the Nisqually and the Ohanapecosh. Favored by the warm and equable temperatures and the moist, well-drained soil of the river bottoms, and protected from the wind by the enclosing ridges, the trees are perfectly proportioned and grow to a great height. The stand is close set and the tops of the mature trees form a close and continuous cover. The young growth



**NORTH PUYALLUP VALLEY
FROM REABURN POINT**

A. H. Denman
One of the deep forested valleys cut from the flanks of the mountain by glacial action. Puyallup Glacier shown at the head of the valley.

**WHERE SUMMER SUN SIFTS
THROUGH INTERLACING BOUGHS**

T. C. Smith
This group of giant firs on the government road near the Tahoma Fork is familiar to all park visitors.

in the sapling stage is abundant and vigorous. As it pushes upward the weaker individuals are crowded out in the struggle for room and light, and the stronger grow slowly with slender trunks and small crowns until a place is made for them by the decay and fall of their older brethren. Thus the forest growing naturally and untouched by fire, is of all ages, from the seedling concealed in the undergrowth to the veteran four to eight feet in diameter and perhaps four hundred years old, whose trunk, weakened by decay and age, still bravely upholds its spreading crown to the sunlight. From the lumberman's point of view, and contrasted with the vigorous and even aged stands where the trees have grown up together after a fire, the forest is over-ripe and decadent, yet it is the natural and primitive forest where decay is balanced by growth and the young take the place of the old.

The soil in these river bottoms is overlaid to a depth of three to four inches or more with humus, rotten wood, twigs, and fir needles. This covering, saturated with water in the winter time, remains moist until late in summer. By the middle of August it is usually quite dry and forms a mass of combustible material to which the half-extinguished fires of careless campers often spread and smoulder slowly until fanned into flames by the rising wind. The dampness of the soil, protected by its mulch of decayed vegetation, is favorable to the growth of shrubs and perennial herbs. Salmonberry bushes grow in thickets along the streams. Vine maple, yew, willow, dogwood, elder, huckleberry, and currant bushes form a dense undergrowth which, together with the fallen timber, make travel off the trails slow and difficult. Mr. W. H. Thorn in his field notes of the survey of the Park boundary describes the timber on the west line:

"The entire line is covered with heavy forest, very large and tall, a great many trees being 6 and 8 feet in diameter, hemlock and red fir. It is difficult to get through the country on account of the fallen logs and dense brush. The forest was so thick that I could only get two angles on the main mountain."

Up to 3,000 feet the forests about Mount Rainier are composed of species common throughout the western parts of British Columbia, Washington, Oregon, and Northern California. The dominant trees are the western hemlock and the Douglas fir. The stand is usually mixed. In many places the hemlock, which germinates readily in rotten wood and humus, and is tolerant of shade, appears to be slowly supplanting the fir. It is not uncommon to see a good-sized hemlock which, having made its first growth in the decayed moss on a fallen fir, has extended its roots on either side of it into the ground in an attitude of victory over a species less fitted to survive in the struggle for existence in the mature forest. The Douglas fir not infrequently grows to a height of 250 to 270 feet. Its associate, the western hemlock, is nearly as tall. The larger hemlocks are often hollow hearted and the old firs



THE LONE
SURVIVOR

A. H. Denman

"Thy scars of winter tempest
On trunk and shattered limb
Proclaim the brave companion
Of mountain's cragged rim."
—Edmond S. Meany.

ALASKA
CEDARS

T. C. Smith

Two unusually large specimens
found in lower Ohanapcosh
Park.



are nearly all unsound although they bear little outward sign of defect. Western red cedar grows in groups along the river banks and in moist situations. It is a good-sized tree in the Park although by no means as large as at lower elevations. The grand fir, or, as it is more commonly called, the white fir, is a common tree in the bottom lands although

it forms no considerable part of the forest. It is a handsome tree distinguished by its white bark and pyramidal crown of bright shining green foliage, which give it a cheerful aspect as contrasted with the darker trunks and deep green leaves of the hemlock and Douglas fir. While these trees compose the type peculiar to the bottom lands they are not confined to it but extend to the ridges and continue to be the prevailing species up to 3,000 feet. The stand on the mountain slopes is, however, lighter and more open and the trees are smaller. Huckleberry bushes and other shrubs adapted to the drier soil of the foothills, Oregon grape, and salal take the place of the tall and dense undergrowth of the bottom lands, and the amount of fallen timber is noticeably less.

The forests of the lower elevations of the Park are of a type familiar enough to anyone who has traveled through the Pacific Northwest, but sufficiently impressive to people who see it for the first time. The rapid progress of lumbering operations indicates that not many decades will elapse before it will exist in few places which are easily accessible outside of the Park.

Between the elevations of 3,000 and 4,500 feet the general character of the forest is intermediate between that of the lowland type and the subalpine growth of the high mountains. The forest is continuous except where broken by extremely steep slopes and rocky crests where sufficient soil has not accumulated to support arborescent growth. In general there is little undergrowth. The stand is fairly close on flats, benches, and moderate slopes, and more open on exposed situations and wind-swept ridges. The prevailing trees are the amabilis and noble fir. They sometimes grow separately in pure stands, but more often are associated. At the lower limits of this type they are mixed with the Douglas fir and hemlock, while subalpine species appear at the upper limits.

The high ridges receive a heavy annual precipitation in the form of snow. The run off under the continued action of warm Chinook winds and spring rains is correspondingly rapid. The streams are the headwaters of rivers which are important sources of waterpower. Apart from their aesthetic value, the forests of the middle slopes of Mount Rainier have a direct use to the community in the protection they give to the watershed and in regulating the flow of the streams. The deep and wide-spreading root system gives stability to the loose pumice slopes and protects them from erosion while the forest and ground cover retards the surface flow so that it is absorbed by the soil and discharged gradually through the channels of the streams.

A large part of the area above the 4,500-foot contour consists of open grassy parks, rocky and barren summits, snow fields, and glaciers. Tracts of dense subalpine forest occur in sheltered locations, but they are nowhere very extensive and their continuity is broken by open swamp glades and meadows and small bodies of standing water. The steep

upper slopes of the spurs diverging from the main ridges are frequently covered with a stunted scraggy growth of low trees firmly rooted in the crevices between the rocks. The most beautiful of the alpine trees are about the mountain parks. Growing in scattered groves and standing in groups or singly in the open grass land and on the margin of the lakes, they produce a peculiarly pleasing landscape effect which agreeably relieves the traveler from the extended outlook to the snow-fields of the mountain and broken ridges about it.

At the lower levels of the subalpine forest the average height of the largest trees is from 50 to 60 feet. The size diminishes rapidly as the elevation increases. The trees are dwarfed by the cold and their trunks are bent and twisted by the wind. Small patches of low, weather-beaten, and stunted mountain hemlock, Alpine fir, and white-bark pine occur up to 7,000 feet. A few diminutive mountain hemlocks grow above this elevation. The trunks are quite prostrate and the crowns are flattened mats of branches lying close to the ground. The extreme limit of tree growth on Mount Rainier is about 7,600 feet. There is no distinct timber line.

In the subalpine forest the species about the base of the mountain are replaced by others better adapted to withstand the pressure of the snow and the violence of the storms, and which are found only at a considerable elevation above sea level or in high northern latitudes. The trees, adapted to withstand the pressure of the snow and the violence of the winter storms, are short with rapidly tapering trunks and heavy branches which, where they stand in the open, often reach to the ground. The mountain hemlock, relying on the strength of its short, thick, and unyielding limbs, opposes them to the full force of the winter wind and the crushing weight of the frozen snow. Its trunk is often bent and twisted and the top broken, but it is successful in holding its own in the most exposed situations. The Engelmann spruce and the amabilis and alpine fir bear pyramidal crowns broad at the base and contracting toward the top where they become slender spires which terminate in pointed tops. The branches, which in summer turn downward and outward in long graceful curves, bend under the weight of the snow, are compressed toward the trunk and supported by it and by each other. The flexible tops are bent down, but spring up when the snow melts.

At an elevation of over 4,500 feet trees grow very slowly and the reproduction is deficient. There have been no large recent burns, but many of the beautiful Alpine groves have been destroyed by fires started by the early visitors to the mountains over twenty years ago. There has been little change in these burns. The dead trees are still standing and even the smaller limbs seem still sound and strong. The bark has fallen and the trunks and branches are bare and white. Only a few very small trees have sprung up.

There are several large burns on the middle slopes of the mountain which date back to the time when they were the hunting groves

of the Indians. Most of the fire-killed timber has fallen and is in all stages of decay. The second growth has sprung up in places, and in damp sections the young trees are twelve to fourteen inches in diameter. The hillsides have probably burned over repeatedly and the ground is covered with a vigorous growth of huckleberry brush, grasses, and flowering plants. The fire season in the high mountains of the Park is much shorter than in forests at low elevations and the risk is reduced to a minimum by the watchfulness of the Park rangers. Still a serious fire may occur any year. The ground cover becomes quite dry in August and the subalpine forest is in one way peculiarly exposed to fire. The resin pockets in the bark at the base of the trees blaze fiercely when kindled by a ground fire and the flames springing into the drooping branches start crown fires which sweep from tree to tree and are very difficult to control.

There are few species of deciduous trees in the Park. They are most abundant in moist situations. The red alder is common near the banks of the streams. The black cottonwood occurs associated with cedar and hemlock in alluvial bottoms, or forms little groves on sandy river bars. The leaves twinkle and turn in the lightest winds, exposing alternately the deep lustrous green of the upper surface and the silvery white of the under side. The vine maple forms a large part of the undergrowth in the valleys. The broad-leaf maple in the Park is a low short-stemmed branching tree which occurs sparingly at elevations under 3,000 feet. In number and volume the broad-leaved trees are a negligible component of the forest. Yet they are common enough to diversify and lighten the somewhat monotonous and somber effect of the conifers. They are most noticeable on clear days in the winter when the sun, elsewhere shaded by the evergreens, shines upon the snow through the leafless branches, and in the autumn when the foliage of the cottonwoods is brown and yellow and the vine maple bushes are scarlet.



H. B. Hinman

CAMP ROBBER