REPORT

ON THE

SILVICS OF THE BLUE MOUNTAINS (E)

NATIONAL FOREST

OREGON

By

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April 1, 1908.

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This report will of necessity deal simply with those parts of the National Forest with which I am personally familiar, which is of rather limited area, being roughly the country about Sumpter and west as far as Susanville. Of the northern part of the Forest I know nothing, nor of the high mountains in the former Baker City Forest Reserve, except what can be seen from a distance.

What notes I have been able to take without interfering with other field work have been meagre, and since I now have not access to the Supervisor's files and maps for reference, my report must be based on memory.

Topography

The rock of the region with which I am familiar is largely either granite and quartz or a coarse-textured porous basalt. This difference in formation gives rise to a striking contrast in the topography. The soft basalt is easily eroded, and when of sufficient depth and extent, has been carved into canyons. The harder quartz and granites on the other hand, give rise to rounded buttes and domes, with broad valleys and tortuous streams. This difference of configuration is very marked along the North Fork of the John Day River. At the mouth of Desolation Creek near Dale, the river flows through a basalt canyon some 1500 to 2,000 feet deep, but going up stream seven or eight miles the granitic formation is encountered, the walls of the canyon become less steep, the bottom broadens, and the river winds among rounded mountains.

The main divide has a general trend north and south, but it turns and doubles so that every aspect is presented. There is considerable variation in altitude. At Sumpter the altitude is about 4,500 feet, a few hundred feet lower at Susanville, while the highest peak in the Elkhorn Mountains, north-east of Sumpter, is over 9,000 feet above sea level.

The main divide separates the waters of the Grand Ronde, North Powder, and Burnt Rivers (tributaries of Snake River), from the waters of the several forks of John Day River. Along many or most of these streams are meadow lands most of which are patented. Upon descending from the mountains in Township 11 or 12 south, Range 36 east, one comes abruptly out of the timber into a broad level sage-brush plain — Burnt River Valley — which under irrigation has become a productive farming region. This valley extends south to the headwaters of Job Creek in Township 14 south, Range 37 east, where the timbered mountains are again encountered.

On the west side of the Forest along the Middle and North Forks, and in what is now part of the Malheur Division of the Forest, are broad stretches of level or gently sloping or rolling country, bare of arborescent flora, and covered with a sparse growth of bunch grass growing in the thin volcanic soil strewn with ferriferous porous basaltic boulders and fragments formed in situ. This is a famous cattle and horse raising country. Most of this open land, as most of the sage-brush country of the Burnt River valley, are outside the boundaries of the National Forest, and yet since portions of each type are included within the Forest they are mentioned in passing.

Climate

As might be expected, with such variations in topography there is almost every climatic variation, and to speak of the climate of the Forest as a whole would be very misleading. The length of the vegetative season is dependent not alone on the altitude but on the slope as well, and of course is subject to annual variation.

The spring of 1907 was not unusual in any way, but when in April I went to Greenhorn to measure some cordwood cut in trespass, I found it buried under seven feet of snow, the snow lay to a depth even with the lintels of the doors of the houses in the "city", and it snowed constantly the three days I was on the trip. The southern slope of the Elkhorn range was white with snow until the middle of June. During June I examined some timber for a proposed sale, north of the Columbia and Golconda mills in Township 8 south, Range 37 east, but was forced to turn back owing to the depth of snow, and I have been told of unusual winters when there was four feet of snow at Greenhorn in May. Of course it is of some of the higher altitudes I am speaking now. In Sumpter and the surrounding hills, at an altitude of about 4500 feet, the snow was all gone by May except in protected places, though even here it has snowed as late as July. Except at high altitudes the first fall frosts appear about the first or the middle of September, and the last spring frosts in May or more rarely the middle of June. However, heavy frosts are likely to occur at almost any time during the year. The growing season is therefore of short duration.

The precipitation is well distributed throughout the year with the exception of the months of July and August. During these months local thunder showers of short duration are the only rains, but these are at times severe, sometimes causing injury to agricultural crops by washing of the soil. Forest fires from lightning are not uncommon. But more destructive to agricultural interests are the summer hail storms, often accompanied by heavy wind. I have seen a storm at Sumpter in which hail-stones as large as moth-balls covered the ground and rolled into drifts in fence corners.

Ten or twelve years ago a storm with the typical funnel-shaped cloud of a cyclone passed through Fox Valley, snapping large pine trees off eight or ten feet from the ground, uprooting others, and demolishing buildings in the town of Long Creek. It cut a swathe two miles wide through the forest. The storm was accompanied by hail-stones of irregular shape some of which measured 6¾ by 7¼ inches in circumference. These hail-stones unshingled houses, broke glass windows, and did considerable damage to buildings, crops, and trees, aside from the destructive force of the wind (or the vacuum).

The temperature of the region so far as I have experienced it or have been able to learn, is mild. Winter is long yet not severely cold. The summer is short, cool, and yet liable to cold waves and local storms of some violence.

The humidity is greater in the mountains than in the sage-brush plain of the Burnt River district, while very much less rain falls in the valley than across the timbered ridge to the west and north.

Economic Aspects

The principal species of value on the Forest are, in the order of their importance, yellow pine, tamarack, red or Douglas fir, white fir *(Abies grandis)*, and lodgepole pine. Engelmann spruce and western white pine, though merchantable, do not occur in sufficient quantity to be important, the white pine being rare, and the Engelmann spruce rarely occurring in extensive stands.

Many of these species grow in pure stands, while they are also mixed in differing proportions. This is discussed under **Forest Types**.

To give an estimate of the standing timber on the public land of the National Forest of any one, or all species, is exceedingly difficult, even after careful valuation surveys. Much of the land of the recent addition to the Forest (most of which is now in the Malheur division) is patented under the timber and stone act; a large part of the south central part of the Forest is occupied by mining claims, the exact location and extent of which it is next to impossible to determine owing to the confusion of records and surveys. In addition there are numerous town-sites, land grants, and homesteads which further complicate matters.

Two instances occur to me in which the presence of mining claims have complicated the sale of timber. A lumberman desired to purchase the timber in and tributary to a certain draw near Sumpter. I went with the prospective purchaser and the supervisor to look over the land. We found location notices recently posted, staking out two mining claims which extended three thousand feet directly up and down the draw. The claimants controlled all the timber not only on the claims but on the adjoining slopes as well, since the only outlet was through the draw. We believed the claims to be invalid, but were not at liberty to make the sale until this were proved, and the prospective purchaser could not wait for this process. The sale fell through.

A company proposed to construct an electric railway from Sumpter to Bourne. I attempted to estimate the timber along the right of way, but I found that nearly the entire length was taken up with placer and lode claims, some of which were valid, others probably not, but to locate them by survey, map them, report on them and have samples analysed to determine their validity, would have busied a crew of three or four men several months, while the timber involved is at best a cordwood proposition.

From these two instances it will be seen that the presence of the mining claims offer a complication in the sale of timber that is not easily dealt with.

On many of these claims wood has been cut in trespass before the creation of the Forest. The claimants have subsequently sold and moved out of the country beyond reach, and the corded wood is for the most part so rotted as to be unsalable. Very little illegal cutting has been done, however, since the Forest has been under administration.

The Baker City Lumber Company, which is affiliated with the Sumpter Valley Railway Company, is the principal timberland owner and operator in the region. They have a large band-saw mill at Baker City, and one at Austin, the terminus of their railway. They own practically all the timberland tributary to the right of way, and even, it is claimed, the ranches in the Whitney valley. It is proposed to extend the railway from Austin down the John Day River to Susanville and possibly beyond.

The cutting area of the logging operations of this company is in marked contrast to the cutting of government timber purchased under contract with the Forest Service. The area is cut clean, and brush and debris left scattered in the utmost confusion. This procedure has once or twice resulted in forest fire.

Since this company control most of the timberlands of this region outside of the National Forest boundaries, and own the railway, they are in a position to charge excessive freight rates on lumber, an opportunity which they do not neglect. The consequence is that competitors are few and sales of National Forest timber infrequent. Nearly all the timber sales of this Forest to date

have been of cordwood and mining timbers to the mines and stamp-mills situated within the Forest.

In a few years, however, the Company will have exhausted the timber on their own holdings and will either have to purchase National Forest timber or build their railway across the Forest to tap other timberlands where they can purchase stumpage. At present they are unwilling to pay over $1.50 for stumpage, but this figure is ridiculously low for any timber available to their outlet, for even the poorest grades. It would in my opinion be folly to sell any timber which is tributary to their road and mills at less than $2.25 or $2.50 unless it be inferior species such as white fir, and it may be wise to reserve most to supply local demand.

There have been few sales except in the mining district about Sumpter. There is, however, some good yellow pine in the north available to the sawmill of La Grande. Starkey will also perhaps be a market in the future, while some saw timber cut from the National Forest has been sold in Prairie City. A large part of the Forest is netted with good roads, which will facilitate future logging operations, while the general topography lends itself to easy construction of logging roads.

Forest Types

Practically the entire Forest is forested, except for clearings, mountain parks, meadows, and a few small towns. Yellow pine is the prevalent species except at the higher altitudes where the firs and spruce become preponderant. Except in the proportion in which the several species of trees are found growing, there is little difference in types, but in this respect there is a marked variation, which has been still further modified by old cuttings. Making, then, the predominance of a species rather than the topographic variation, the criterion by which to differentiate types, we may classify the forest into the yellow pine type, the spruce type, the lodgepole pine type, the white fir type, and the mixed conifer type.

The yellow pine type.

Yellow pine occurs in nearly all soils and exposures at elevations ranging from the lowest in the National Forest up to about 5,000 feet, though individual trees occur in mixture at higher elevations. The forest floor is open, free from underbrush in any quantity, so much so that it is possible to ride in almost any direction through the forest without following trails.

The soil moisture is as a rule abundant, though the soil is well drained. This type is the most important commercially, and is found typically on the lower flats and slopes, especially of southern exposures. It varies from a pure stand of yellow pine, running as high as 20,000 feet B.M. per acre or rarely more, and gradually merges at the higher altitudes with the mixed conifer type, as the other species become more abundant and the yellow pine less numerous. The usual associates are Douglas fir, tamarack, and at higher elevations, white fir and Engelmann spruce.

The timber of this type is largely overmature and shows the effects of deterioration in stag-headedness, slow growth, and even in the attacks of fungi and insects.

In the yellow pine forests reproduction is by groups in blanks or openings in the forest. On burned areas the new growth is apt to be either white fir or lodgepole pine. Logging of yellow pine is apt to change the type to the mixed conifer type.

The spruce type.

At elevations of about 5,500 or 6,000 Engelmann spruce occasionally is found in almost pure stand in moist soil, associated with tamarack and white fir. The trees grow in close ranks, tall and rather slender, the maximum diameter as a rule not exceeding 18 or 20 inches. Undergrowth is rather rank, the amount of soil moisture compensating in some degree for the dense shade of the close canopy. This type is not common.

The lodgepole pine type.

After burns lodgepole pine often comes in pure stand, in dense thickets of limby saplings. Upon maturity such stands form closely crowded stands of poles 12 to 16 inches in diameter. This type is often found on rather dry soil. After clear-cutting on this type, sometimes no reproduction comes in, or only a few scattered white fir trees. On the other hand clear-cutting is generally the only rational method of cutting owing to strong wind, and the certainty of windfall if strips or groups be left after logging.

The white fir type.

The yellow pine type may change after logging to the mixed conifer type, the mixed conifer type after burning may change to the lodgepole pine type, while after clear-cutting the lodgepole pine type is prone to deteriorate to the white fir type. This type is found at altitudes between 5,000 and 7,000 feet, white fir *(Abies grandis)* being the principal species with others in various proportions. The underbrush of this type is usually rather dense and the forest floor moist.

The mixed conifer type.

This is the type of the northern slopes, and also the subalpine ridges and summits. All of the more common species may be found in varying mixtures, though each species is distributed according to its individual requirements, so that the type in different localities, slopes, and altitudes, may vary widely in its specific constituents. On north slopes sometimes occurs an open stand of mature tamarack with dense thickets of lodgepole pine as an understory. This is a transition from a pure stand of tamarack to the lodgepole pine type, and as such is rather different from the true mixed conifer type. The typical mixed conifer type is composed in the main of yellow pine, Douglas fir, white fir, and tamarack, with occasionally some spruce or lodgepole pine, and very rarely western white pine.

Though tamarack sometimes occurs in almost pure stand it is not considered as a special type, since it is not common, and appears to be transitory, being easily modified by art or nature into one of the types enumerated above, as for instance into the lodgepole pine type as noted above.

Yellow Pine

General Characteristics.

Root system. — Yellow pine has a deep taproot rendering the tree wind-firm in exposed situations.

Stem and crown. — In early youth the last two years growth of the stem is covered by needles, the needles on the lower part of the stem falling off, leaving the stem roughened by the presence of the bracts of the primary leaves. The crown in early youth extends to the ground and is irregular in outline, but later in life it comes to occupy only the upper half or third, or even less of the tree, according to whether it is in forest or partially open stand. The crown of mature trees is cylindrical or of a lengthened conical outline, not broad, perhaps 20 feet broad, and long, with the leaves tufted at the ends of the branches. The bole tapers rather more than that of tamarack or lodgepole pine. At low elevations and where it comes up in old fields, yellow pine is short and scrubby.

Bark. — The bark in youth is black becoming rough early. In older trees it is yellow with deep longitudinal and diagonal fissures dividing the surface into polygonal plates, composed of thin lamellae which exfoliate in small particles with irregular outline. The bark is always relatively thick, though the thickness is very variable in trees of equal age. The color also varies somewhat. Rather large trees may preserve the black, rough appearance that is characteristic of early life, while sometimes a smaller tree may have the smooth, fissured, yellow bark. The fissures of the yellow-barked trees are black like the younger trees and the bark does not exfoliate from them. In these younger black barked trees, the bark, being not so old, is thinner and has resin ducts running through it; while in the older trees the outer bark has become dead and no resin flows through it. It consequently is looser and peels off in scales more readily.

Self-pruning. — In thick, even-aged, pure stands the lower branches persist and live till the trees attain an age of from 10 to 15 years with a height of about 7 feet. At this stage the lower branches die for a distance of about one third the total height from the ground, though the dead branches are not sloughed for a few years longer. They gradually disappear, however, and in forest grown trees it is not unusual for trees to be clear of branches for four-fifths of the total height. In close stand, however, the trees are tall and spindling.

Site requirements.

Topographic situation. — The yellow pine attains its best development in flats and bottoms with deep rich soil, and is often the only tree growth on canyon slopes especially on southern slopes at altitudes up to 5,000 feet.

Soil. — The species is not fastidious in regard to soil. It prefers a fresh but well-drained soil of some depth, though it will grow on the rocky, thin soil of the slopes.

Exposure. — Owing to its deep taproot it often stands firm on exposed situations. A lone yellow pine is often seen standing on a slope bare of everything but loose rocks and meagre grass.

Altitude. — Its altitudinal range within the Forest is from the lowest (about 4,000) to about 5,500.

Gradient. — It grows on steep slopes as well as on flats.

Tolerance.

Yellow pine is intolerant of shade throughout life. It will, however, stand shading at the side in early youth provided its top is free. In later life it demands a certain amount of side light as well. On slopes the tree requires more light than it does in the deeper, moister soil of the flat or bot-

tom. When shaded by dominant trees the suppressed tree dies. It does not seem to be able to continue to live under shade, and when the dominant tree is removed by wind, fire, or logging, it is not often that the suppressed tree regains its vigor. A mature tree can live when shaded at the side, but it will grow in height in its endeavor to keep its top in the light, while diameter growth is retarded causing a long, spindling development.

Reproduction.

Seeds are not borne in large quantities every year, but the occurrence of a "seed year" or a year when seed are more abundantly borne is rendered less conspicuous than in some other species because of the fact that different years do not present so very marked a contrast in this particular. More seed are borne on trees that get full side light and that stand in deep, fertile, fresh soil, than on trees in the interior of a forest or on shallow, dry soil. It takes two years for the cones to mature and the seed are scattered in the fall. The wind is the principal agent of dissemination, while on hill slopes gravity plays an important part in scattering the seed as the cones roll down for a considerable distance from the parent trees. Two seed trees would seem to be sufficient to seed an acre if they are well separated, and on slopes it would be advisable to leave trees near the top of the slope for seeding, for the reason indicated above.

The conditions most favorable to germination are a porous, well-drained, loamy, clay soil with but little humus. The principal deciding factor, however, is the abundance or lack of light. Partial shade from brakes or other underbrush, if not too heavy, seems to be an advantage to the seedlings for the first year or two, but unless the shade is very light the seed will not germinate; or if they do the seedlings will live but a short time. In openings in a broken stand of yellow pine, seedlings come in thickly, but under the shade of the parent trees, even though the shade be not heavy, no reproduction occurs.

Relations with other species.

The common associations of yellow pine are Douglas fir, white fire, and tamarack. Along streams it is found with cottonwood, mountain maple, and sometimes Engelmann spruce. Douglas fir and white fir, since they cast a dense shade, make it impossible for such an intolerant species as yellow pine to grow where many of these species are found, while since both these species are more tolerant of shade they usually get the better of yellow pine when there is competition for growing space. If, however, yellow pine gets a start before the firs, they may help it by causing side shade, to prune itself of branches early, and since the yellow pine is faster of growth it can remain dominant.

It would seem to be inadvisable to log yellow pine alone where it occurs in mixture with other conifers, such as Douglas fir and white fir. Wherever practicable these species should be taken with the pine, for otherwise there is danger that they will ultimately ruin the chances of seeding of the more valuable yellow pine.

Fire.

Fire often does great damage to young yellow pine. The fires on this Forest are almost entirely surface fires which rapidly run over the ground; and since the yellow pine forests are open with long grass often as a forest floor the young trees are scorched and die, being very susceptible to the heat. After maturity, however, the trees are not damaged greatly unless covered with dry hanging moss.

In mixed forest, fires are liable to bring in lodgepole pine which tends to supplant the more valuable yellow pine, thus injuring the commercial value of the forest.

Lodgepole Pine

General Characteristics.

Lodgepole pine, locally known as black pine, has no tap root. The surface roots extend into the soil to a depth of about 2 feet in mature trees with a lateral extent of 5 or 6 feet. For this reason as was said in the discussion on the lodgepole pine type, a pure stand of lodgepole pine, when logged is extremely liable to windfall unless great precaution is taken. The trees on the edge of a patch of lodgepole left after cutting are almost certain to be windthrown.

Stem and crown. — In youth the stem is clothed with branches from the ground upward even in dense thickets, while the branchlets are covered with leaves. As the young trees crowd each other in their growth, the lower branches are pruned naturally and the crown comes to occupy only the upper half or third of the stem. The stem at all ages is cylindrical as compared with other species.

Self pruning. — The young trees stand in close pure stand until 20 feet tall with very little or no "natural pruning". In maturity pruning has advanced until the canopy occupies only the top third of the bole, but frequently dead branches remain to within a short distance of the ground. The knots thus caused do not injure the timber since the species is never used for saw material, being used for little else than fuel and fence poles.

Site requirements.

Topographic situation. — The lodgepole pine is found at the higher altitudes on relatively flat country.

Soil. — It grows in a dry or clay loam and does not require much soil moisture.

Exposure. — It does not grow in very exposed situations, that is not on steep slopes, since the shallow root system predisposes it to windfall, but on level land it is found in pure stand, even when the country is exposed to high winds. It is never found, however, in the open occurring individually as does the yellow pine.

Tolerance of shade.

In youth lodgepole pine is tolerant of shade growing in pure stand where it gets overhead light but no side light. In such situations even the lower branches persist and live, indicating that side light is not essential. In mixed stands, however, when shaded by older or faster growing species it can not grow.

In later years it is able to stand some shade, but is comparatively intolerant though not to as great a degree as yellow pine or tamarack.

Relations with other species.

Lodgepole pine is found characteristically in pure even-aged stands, but even in this occurrence tamarack is not infrequently found scattered through the stand. Other species with which it is found in mixture are white fir and Douglas fir in the mixed conifer type.

Enemies.

It is reported by one of the rangers that in the northern part of the National Forest an insect disease is playing havoc with the lodgepole pine. The insect bores under the bark, until the tree is girdled and dies. An area covering about a section of land has been wasted in this way during the past year and the destruction is spreading fast. As yet the insect seems to confine its attention to this species alone, but it is possible that it may spread to others when it has exhausted all the lodgepole in its path. I have not seen this disease or the insect that causes it, so can give no definite report upon it.

Tamarack

General Characteristics.

Tamarack has a loose, open crown wider generally than spruce, but not so wide as Douglas fir. The spread of the crown is about 18 feet on a tree 100 feet tall. The branches curve slightly upward. The bole is usually markedly cylindrical and tall. The bark is similar in general appearance to that of yellow pine, but is smoother and thinner. It clears itself readily of branches.

Topographic distribution. — Tamarack occurs on almost all sites at almost all altitudes. It is found associated with lodgepole pine on the flats at higher elevations, and is in the yellow pine forests of the lower altitudes on flats, in bottoms, and especially on sunny slopes, with southern exposure.

Tolerance of shade.

Tamarack must be classed as intolerant throughout life. Its rapid rate of growth, however, compensates in a measure for its inability to bear shade. It is not uncommon to find a stand of lodgepole pine or mixed conifers with tamaracks towering above the other trees where they get plenty of light. In such stands, however, the dense shading of the ground by the other species makes reproduction of tamarack impossible.

Injuries.

Tamarack suffers less from injuries of all kinds than almost any other tree of the region. It is relatively free from insect attacks, and lives to an old age in a healthy condition. The wood is sometimes rotted by the action of fungus.

Engelmann Spruce

General Characteristics.

The crown is very narrow and spike-shaped, but it often extends down the trunk one-half or even two-thirds its length even in fairly dense stands. The stem is for this reason generally knotty, since the species does not easily prune itself of branches.

Site Requirements.

Engelmann spruce is a tree of the higher altitudes, but since it requires a certain degree of soil moisture it is not found abundantly, and only in a stunted growth, on exposed ridges, while it does occur along waterways at the lower altitudes of the National Forest — that is as low as about 4,800 feet.

Tolerance of shade.

It is one of the most tolerant trees of the Forest. It readily germinates and grows under the shade of firs and pines providing it has sufficient soil moisture.

Douglas Fir

General Characteristics.

Douglas fir, or as it is invariably called locally, red fir, has rather a wide crown as compared with spruce, tamarack, or lodgepole pine. Unless in mixture with pines in rather dense stand, the dead branches may persist on the lower bole indefinitely. A root-swelling is often present extending several feet from the ground. The bark is corky, dark, and deeply fissured, and on large trees is often 3 inches thick. The resistance to fire from this cause is considerable, pines often being injured owing to the more inflammable nature of their bark, though thick, when old Douglas fir trees are unscathed.

Site Requirements.

Douglas fir is found in almost all soils and situations, though it seems to do best on northern and eastern slopes and canyon bottoms. It often forms a considerable proportion of the stand in mixed conifer forests.

Light Requirements.

Douglas fir is rather intolerant of shade. But little reproduction occurs under close shade, and the lower limbs of the mature trees though still persistent rapidly die from want of light.

White Fir

White fir *(Abies grandis)* has a deep tap-root. The branches droop and the crown is rather wide especially in young trees, but in older trees it is relatively narrow since the crown does not increase so much in spread with the growth of the tree.

This species forms a considerable proportion of the mixed conifer type at the higher altitudes, and in some cases forms a type apart. It does well on dryer soil than many of its associates, and occurs on fairly steep slopes generally on cool northern exposures, and on mountain ridges as well as canyon bottoms.

White fir is more tolerant of shade than the pines although scarcely so shade-enduring as Engelmann spruce.

This fir frequently comes in on cut-over slopes and ridges when tamarack, or lodgepole pine are

removed, and successfully competes with second growth tamarack. This is due largely to the fact that the seedlings can stand a greater degree of shading than can the tamarack.

This species is of very little value commercially. Mature trees are almost invariably affected with rot, which often extends through the heart of the trunk for a distance of 30 or 40 feet from the ground. So prevalent is this defect that lumbermen can with difficulty be induced to cut them, and indeed it is a waste of time to handle the tree, except in some unusual conditions. The wood checks badly, decays rapidly when piled in cordwood on the ground, and gives but little heat as firewood.

It is but a "weed tree" and as such should be removed as much as possible in all logging operations in order to give way for better species.

Other Species

The western white pine *(Pinus monticola)* can not be considered as a merchantable species, for although it is of sufficient size and value it is exceedingly rare, and grows in inaccessible localities. I was told of a few trees which grew on a high mountain slope near Susanville, and found the trees after minute directions. They stood in a dense mixed stand of conifers with thick underbrush, and abundant soil moisture. The species with which it was associated were Engelmann spruce, white fir, and Douglas fir. I sent samples of the cones and foliage to the Dendrologist for identification. This is the only place in which I have seen or heard of the species in this Forest.

On rocky points and scab lands juniper occurs. This is not a commercial tree. It is, however, used to some extent locally for fence posts for which it is as well adapted as its eastern relative.

Mountain mahogany and yew are occasionally found as trees, but they are unimportant, and usually occur simply as scrubby low-growing forms.

Along waterways cottonwoods and other broad-leaved species occur, but never in sufficient number or size to be merchantable.

General Silvical Notes

Tolerance of Shade.

The most important species of the Forest in the order of their tolerance.

1. Engelmann spruce
2. White fir
3. Red fir
4. Lodgepole pine
5. Yellow pine
6. Tamarack

Demands upon Soil and Moisture.

The most important species on the Forest in the order of their demand upon moisture and quality of soil.

1. Engelmann spruce
2. Tamarack
3. Yellow pine
4. Douglas fir
5. White fir
6. Lodgepole pine

Altitudinal Range of Several Species within the Blue Mts. (E) National Forest.

Species	Lower limit (Feet)	Upper limit (Feet)
Western white pine	6,000	?
Yellow pine	4,000	5,500
Lodgepole pine	4,500	?
Tamarack	4,000	5,500
Engelmann spruce	4,800	?
Douglas fir	4,000	?
White fir	5,500	?

Forest Enemies

Fire.

No serious forest fires have occurred on the area now included in the Blue Mountains (East) National Forest for several years. During the dry summer and fall months, however, surface fires which usually do not cover a large area are more or less frequent. These fires, caused by lightning, locomotives, or carelessness, run over the ground burning the litter and any dead timber standing and down, but unless there is a tangle of dead and down timber they rarely do serious damage to timber trees. In several localities there are tangles of dead and down material covering several acres, with young growth growing through it. Such spots are a fire menace, but as a rule the dead and down material is too far from where it could be used to be given under free use regulations, or otherwise disposed of, while as a rule it is too unsound to be of any value.

Red or Douglas fir is perhaps the most fire-resisting species on the National Forest, though the ordinary surface fires do but little damage to mature yellow pine unless they by constant repetition so scar the tree as to leave the wood unprotected to fungus spores.

The worst effects from fires upon slopes is the destruction or injury to the forest floor. The humus is burned off leaving a shallow soil unprotected from erosion. Rocks and burning logs are often loosened by the heat and roll down the steep slopes doing further damage by spreading the fire. The soil is left dry and is destroyed in patches furnishing but a poor seed bed for further restocking.

Insects.

The borer which injures lodgepole pine has been mentioned in the discussion on this species. The yellow pine bark borer *(Dendroctonus)* has caused some injury to yellow pine, but this injury is not extensive.

There is an insect which forms a gall on the twigs of the Engelmann spruce. Though common, it does no damage to the timber so far as I have been able to discover.

Plant attacks.

In the region about Susanville I found a mistletoe very prevalent upon the yellow pine. It attacks trees less than five feet tall, and works upon mature trees also. When the seeds of this species are ripe they are enclosed in a sac of fluid under pressure, and upon friction or shaking of the branch upon which they grow the seed are ejected with violence and shot considerable distance. The viscid fluid with which they are surrounded enables them to find lodgement on the bark or wherever they happen to alight, and in this manner the species is disseminated.

This mistletoe produces a curious deformation of the limbs of the pine, which becomes knotted and twisted in grotesque figures, and apparently the parasite saps the tree, for I have found trees dead from no other apparent cause. So far as my observations have carried me, it attacks only the yellow pine. This is probably the *Razoumofska campylopoda* (Engelm.), though I have not determined definitely.

The rot in white fir trees caused by a conch has been discussed under that species.

Atmospheric Agencies.

These have been considered under "Climate".

A List of the Trees of the Blue Mountains (E) National Forest Oregon

Common name	Local name	Scientific name
Western white pine	White pine	*Pinus monticola* Dougl.
Western yellow pine	Yellow or bull pine	*Pinus ponderosa* Laws.
Lodgepole pine	Black pine	*Pinus murryana* "Oreg. Com."
Western larch	Tamarack	*Larix occidentalis* Nutt.
Engelmann spruce	Spruce	*Picea engelmanni* Engelm.
Douglas fir	Red fir	*Pseudotsuga taxifolia* (Law.) Britton
Lowland fir	White fir	*Abies grandis* Lindl.
?White fir	White fir	*Abies concolor* (Gord.) Parry
Pacific yew	Yew	*Taxus brevifolia* Nutt.
Juniper	Juniper	*Juniperus occidentalis* (Hook.)
Willow	Willow	*Salix* (spec.)
Aspen	Quaking asp	*Populus tremuloides* Michx.
Black cottonwood	Cottonwood	*Populus trichocarpa* Torr. and Gr.
Paperleaf alder	Alder	*Alnus tenuifolia* Nutt.
Black haw	Haw	*Crataegus douglasii* Lindl
Mountain mahogany	Mahogany	*Cercocarpus parvifolius* Nutt.