

**LOGEPOLE PINE IN THE  
WHITMAN NATIONAL FOREST**

By

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The following discussion of lodgepole pine is based largely upon observations made during the past field season. Of necessity these have been more limited than could be desired. It is quite possible therefore that more extended observations may show that many of the conclusions presented in this report are incorrect. The conclusions put forth, however, have been reached after careful thought and are given in the hopes that, even though not entirely correct, they may provoke discussion and thus more quickly arrive at a correct solution of a most troublesome problem upon those Forests in which lodgepole pine is a strongly competing species.

### FACTORS INFLUENCING THE GROWTH OF LODGEPOLE PINE AND RELATED TREE SPECIES

The most important natural factors influencing the growth and hence the distribution of lodgepole and associated species are temperature, altitude, soil, light and moisture. Of these light and moisture are believed to be decidedly the most potent factors.

#### Temperature

Local differences in temperature apparently have little effect upon the distribution of lodgepole itself, except indirectly as these differences render other species more or less strongly competing, and as they check or prevent all tree growth. Very much the same thing can probably be said of Douglas fir, larch and white fir as of lodgepole. Yellow pine apparently prefers the somewhat warmer and Engelmann spruce distinctly cooler situations. Alpine fir is quite strongly influenced by temperature growing only at the cooler higher altitudes.

#### Altitude.

Except in the case of Alpine fir altitude probably has but little direct effect upon the growth of lodgepole or its most important associated species, except indirectly as this affects other conditions.

#### Soil.

So far as I have been able to determine, the character of the rock from which the soil is formed bears no fixed relation to the character of tree growth in this region, except as the resulting soil is more or less easily drained. The depth and fertility of the soil itself, however, influence very greatly the character of tree growth. Almost all species grow more rapidly, have better form and produce higher grades of lumber in situations where the soil is better. Better quality of soil implies not only increased fertility but depth and, perhaps more important, proper physical condition. Fine hard impermeable alluvial deposit or similar soil is poorly drained and is not considered a good forest soil, even though deep and containing large quantities of the chemical elements essential to fertility. Neither is soil in which the rock fragments are extremely large, or, where through other causes, the soil is extremely porous,

considered a good soil. Of the most important species growing in the forest yellow pine and lodgepole seem best able to thrive in poor soil conditions, while tamarack and Engelmann spruce do the least well under such conditions. The following list is given tentatively as being the approximate order in which the different tree species involved are able to grow successfully in poor soils.

1. Yellow Pine.
2. Lodgepole Pine.
3. Douglas Fir.
4. White Fir.
5. Western Larch.
6. Engelmann Spruce.

It does not necessarily follow that the reversing of this list would indicate the relative degree to which each tree profits by increased soil fertility; in fact, no tree shows greater improvement in form and quality when growing in better situations than does yellow pine and no doubt the gain is due in a small degree at least to better soil conditions. The list has been given in the order named, however, in order to give the impression that from a standpoint of soil only lodgepole is a strongly competing species, being able to flourish under conditions decidedly unfavorable to other species.

#### Light.

This no doubt is one of the strongest factors operating in the distribution of lodgepole. The following list gives the principal tree species involved approximately in the order of their tolerance:

1. Engelmann Spruce
2. White Fir.
3. Douglas Fir.
4. Lodgepole Pine.
5. Western Larch
6. Yellow Pine.

There is some doubt as to whether lodgepole is more tolerant than larch. However, there is little difference between them in this respect.

#### Moisture

In a relatively dry region such as that occupied by the Whitman this factor becomes far more important than in a humid region, such as the Pacific coast. In such well-watered regions there is sufficient moisture for almost all species; hence the growth of trees are influenced relatively more by other factors. In a dry climate such as is found upon the Whitman, however, it matters not how favorable other conditions may be, if the supply of moisture is deficient tree growth is either checked or prevented, depending upon the degree of the deficiency.

The quantity of moisture is not proportional to the amount of precipitation, although of course influenced thereby. The quantity of soil moisture is really the determining feature. This is dependent upon slope and exposure, soil drainage, relation to the topography in general, and to altitude as much as upon rainfall. Naturally creek bottoms and north slopes are moister than are exposed south slopes. Also higher altitudes, due mainly to a greater relative humidity of the atmosphere and to a lower rate of evaporation, as well as to an actually greater precipitation, are moister than low altitudes.

Of all the trees with which lodgepole is associated yellow pine certainly grows successfully with less moisture than any other tree of this region. As the quantity of soil moisture increases, however, the density of the stand and the quality of the component trees of that species improve until other more strongly competing and more tolerant trees crowd it out. At the other extreme Engelmann spruce demands a considerable and constant supply of moisture and does not grow successfully without it. White fir is perhaps next in quantity of moisture needed, but seems to demand, together with larch, Douglas fir and yellow pine, at least some degree of drainage, not doing well in situations which are poorly drained and periodically very wet. Of the other three species involved Douglas fir grows with the least moisture, while larch demands slightly more than lodgepole. Lodgepole, however, grows successfully in poorly-drained situations which may be periodically very wet and sometimes exceedingly dry. It seems to be able to endure a greater degree of drouth than any of its related species, except yellow pine, provided there is a sufficient quantity of soil moisture at some period of the year.

Granting the truth of the above points and considering only the normally-timbered belt, this region logically divides itself into three distinct classes, so far as lodgepole is concerned:

1. Situations better adapted to the growth of lodgepole pine than to any other species,—naturally producing pure stands of lodgepole pine.
2. Situations not adapted to the growth of lodgepole pine,—actually producing pure stands of yellow pine.
3. Situations adapted to the growth of lodgepole and several other species,—producing mixed conifer stands of varying composition, depending largely upon circumstances.

#### Reproduction Habits.

So much has been written regarding the habits of lodgepole in reproducing that no attempt will be made to cover that phase of the subject here, except to call attention to the fact that lodgepole cones on the Whitman apparently open immediately upon maturing. No investigation was carried on to ascertain whether or not the seeds fell immediately or whether they remained in the cones after opening.

#### Pure Stands of Lodgepole.

The most definitely defined regions producing this type of forest are the damp and poorly-drained flood plains and benches along streams. Such stream flats almost invariably produce lodgepole except at the higher altitudes, where Engelmann spruce replaces it, which

displacement is due probably to the lower temperature and to a reasonably constant supply of water at all periods, which permits the much more tolerant spruce to crowd out the lodgepole. Except at the higher altitudes, however, practically all flat and poorly-drained flood plains must always be considered as having too poor soil drainage for any species but lodgepole and must be regarded as absolute lodgepole land. As the soil becomes rockier or more rolling, hence better drained, other species appear.

Pure stands of lodgepole also occur on flat ridges and gentle slopes at high altitudes, usually over 5,000 feet, and less commonly upon steeper slopes. Just what factors operate to produce this result it is difficult to say. Apparently it is not due either to temperature nor altitude, since larch, Douglas fir and white fir all occur in other situations at as great an altitude and in regions apparently with the same temperature conditions. It also seems very doubtful if light or character of soil are the determining features. Both of these factors can be nearly duplicated in other localities. The problem seems to narrow itself down to where it appears that moisture conditions are the determining factors of the site. The exact difference is hard to tell, since it does not appear on a superficial examination that the quantity of soil moisture upon such high altitude lodgepole zones differs materially from that upon many steeper north slopes, which typically produce a forest in which other species appear. There does, however, appear to be a marked difference in underground drainage, regions occupied typically by lodgepole being more poorly drained than those occupied by other species.

It seems probable therefore that in this region other factors are so nearly balanced that some peculiar moisture condition, possibly poor drainage, results in so much more unfavorable conditions for the growth of other species that, although more tolerant, they cannot compete successfully with lodgepole.

There is therefore a fairly well defined, although not an extensive, region including nearly all flat flood plains of streams except in the higher altitudes and benches and gentle slopes at the higher altitudes which is so poorly adapted to the growth of other species that it is typically occupied by pure or nearly pure stands of lodgepole. Care must be taken not to confuse this type with regions which, through accidental means, have become occupied with pure stands of lodgepole.

It is probable that the above type of forest must always be regarded as true lodgepole land and must be managed for that species alone. While other species can grow and do appear from time to time in this region they must always be regarded as secondary.

#### Areas Not Adapted to Lodgepole.

There are large areas upon the Whitman Forest which, through a marked deficiency of soil moisture during a certain and considerable period of the year, will not grow even lodgepole pine. Such areas are occupied almost entirely by yellow pine. In some of the moister draws in this type lodgepole competes for room, but unless the situation approximates that outlined in the preceding paragraph, white fir, Douglas fir and larch, the first two more tolerant than lodgepole, compete actively and, unless influenced by artificial conditions, such as fire, successfully, with it for a place.

In this type it is self-evident that lodgepole is in no sense an important factor in the Forest.

### Regions Adapted to the Growth Of Both Lodgepole and Other Species.

Leaving out those regions distinctly better adapted to lodgepole than to other species and those not at all adapted to lodgepole there still remains a large area of forest, approximately from one-third to one-half of the total area, which will grow lodgepole, or any one or several of other species, depending largely upon circumstances.

This area comprises practically all north slopes, many of the higher south slopes, moist lower benches and well-drained, but moist, valleys and gulches.

The composition of the forest covering this type varies greatly, depending upon the conditions and circumstances which have obtained during the past fifty or one hundred years. Larch, Douglas fir, white fir and lodgepole are the principal species making up this stand. The more moist conditions which prevail throughout this type than in others produce a fairly dense growth both of trees and underbrush. As the weaker of these trees die, as natural pruning takes place on others and as disease and insects kill still others a quantity of highly inflammable debris accumulates, fires burn frequently through portions of this type, often killing the entire stand. In such places, lodgepole, following its well-known habits, reproduces excellently and quickly. The resulting stand is apparently a pure stand of lodgepole pine and sometimes it is actually so. A careful examination, however, will usually reveal the presence of a number of seedlings of larch, Douglas fir and white fir starting up with the lodgepole. Especially is this true of the typical north slope upon the Whitman. These trees continue to grow with the lodgepole until the latter has nearly reached the full normal height growth, when the former species begin to overtop the lodgepole. Once above the lodgepole they are relieved of what has heretofore been the greatest check upon their growth—lack of sufficient light. The tables in this respect now being turned they then shoot up rapidly and lodgepole, itself a relatively intolerant tree, is gradually crowded out. While this process is going on and as the lodgepole stand becomes less dense seedlings of Douglas and white fir, both more tolerant than lodgepole, and to a certain extent seedlings of larch, start, gradually replacing the lodgepole. Provided no artificial conditions, such as fire, insects, or felling, intervene the larch will eventually mature and be replaced by the more tolerant white and Douglas firs, the former predominating. Such extremely old north slope types are practically worthless, the white fir being so extremely defective and trees of other species too scattered to form any considerable merchantable stand. The really valuable stage of this type is reached in the younger or middle-aged stands, in which larch is still growing vigorously.

While in actual practice many interfering factors operate to break up this theoretical round of forest life, it is nevertheless true that localities are found in which almost every stage exists and there is abundant evidence to show that the lodgepole areas are the youngest and white fir thickets the oldest elements in the forest.

Granting the truth of this theory, it necessarily follows that lodgepole pine is normally but a transitory type in such situations as have already been described.

The extent to which it occurs at present seems to be dependent more upon past fire conditions than upon any other single factor. Just what place it will hold in the future will depend largely upon how successfully foresters are able to control the fire situation and to analyze actual conditions and regulate growth of lodgepole and associated species. Granting that lodgepole is a relatively undesirable tree, it is in this type of forest that the real problems of checking and regulation of its growth arise.

## M A N A G E M E N T.

### Pure Lodgepole Stands.

Granting that there are certain regions, although probably of limited area, plainly so much better adapted to lodgepole than to other species that these species cannot be expected to replace it, the problem of management is comparatively simple. The stand must be managed as a pure stand. It adapts itself readily to clear cutting.

In exploiting this forest systematically it will probably be necessary to cut everything which can be utilized, then burn the area over clean. If the areas thus cut over are small there will probably be no difficulty in securing reproduction by natural means—by seed blown from nearby trees, if enough are not already on the ground. Were it desirable to cut over large areas artificial seeding would probably be more economical than the leaving of strips of standing timber for the production of seed. Whenever a sale runs over a period of years, however, it might be possible to employ the strip method of cutting successfully. The writer has not had sufficient opportunity for observation, however, to determine to his own satisfaction these details of management; in fact they should only be decided upon after a careful examination for that purpose. It seems evident, however, that clear cutting, clean burning of all refuse and either artificial or natural reseeding to secure an even-aged stand will be the course followed in pure stands of lodgepole. While it is probable that for the present no sales will be made of such size but that natural reproduction may easily be secured, observation should be extended to show to what extent natural reproduction can safely be depended upon.

### Yellow Pine Stands.

Since this type is not adapted to the growth of lodgepole there is no real chance of lodgepole even interfering seriously with the yellow pine. In most places it will not appear at all. Along the limits of the yellow pine, however, where this species overlaps the north slope type, lodgepole takes its place as a strongly competing species. Wherever it comes in after burns it is displaced with difficulty by yellow pine; hence every precaution should be taken to prevent the entrance of this species. This can probably be done most effectually by preventing fires, by carefully piling and burning brush after timber sales, and by avoiding the removal of all seed trees in situations where lodgepole is apt to encroach upon yellow pine. It is believed that by these means lodgepole can usually be kept out of such areas. Once established, however, yellow pine, because of its intolerance, will displace it very slowly, although it will eventually do so in all cases.

### Mixed Conifer Stands.

It is in type of forest that the main problems in connection with the control of lodgepole present themselves.

There seems to be little questions but that of the four principal species in this type, western larch, Douglas fir, lodgepole pine, and white fir, white fir is the least desirable species and that larch and Douglas fir are usually most desirable. Lodgepole may therefore be regarded as a relatively undesirable species. Of the two most desirable species larch, while individually the most desirable from a timber standpoint, does not grow well in pure stands; hence other trees, preferably Douglas fir and a limited amount of lodgepole, must grow in mixture with it.

Just how to secure the proper mixture is difficult to decide; yet so far as lodgepole is concerned one thing seems evident,—the most of the pure or nearly pure stands of lodgepole which appear in this type follow bad burns. Where repeated fires follow each other, other species disappear almost entirely from the mixture, often forming what appears to be a permanent lodgepole type. Obviously the first requisite in preventing the spread of lodgepole at the sacrifice of other more desirable species is to prevent fires.

The aim to be sought in the management of north slope type forests is to secure a stand in which larch constitutes a sufficient per cent of the total number of trees to form approximately one-half to two-thirds the merchantable stand when mature. That such a development is possible is clearly indicated by the presence of many stands in which larch from six to twelve inches in diameter comprises as great a per cent as that given above.

It is doubtful if a selection system of cutting will prove satisfactory, since larch, itself an intolerant species, does not start so readily under other trees as do seedlings of competing species. Hence it appears that to start this species satisfactorily it must be started at least as soon as other kinds. In order to accomplish this it will probably be necessary, eventually, to cut clean, burn all debris, and make proper provision for the starting of larch and Douglas fir seedlings under the most favorable conditions. Very likely it will be necessary to resort to artificial seeding and in certain cases artificial planting of seedlings may eventually be done. The selection system of cutting would favor Douglas fir.

By proper management there appears no reason why old and nearly worthless stands mainly composed of white fir may not be replaced by more desirable species. It is also believed that throughout the greater part of this type that lodgepole need not be feared as a species which will displace more desirable sorts.

It is highly important that systematic planting and reseeding experiments be undertaken at the earliest opportunity in the north slope type of forest to determine the best methods of producing a new crop of the most desirable kind. It is in this type of forest that the most careful work is required. The securing of a seedling crop in yellow pine or lodgepole is comparatively simple, but to secure the proper proportion of larch and Douglas fir without allowing the land to be first occupied with a dense stand of lodgepole is a more difficult problem. Carefully worked out experiments along this line in typical north slope type and under conditions

similar to those under which ordinary timber sales will be made will no doubt assist in its proper solution and should certainly be undertaken.

#### GENERAL CONCLUSION.

It must be borne in mind that in considering this problem the writer has considered it mainly from an ideal standpoint. As a matter of actual fact the types or conditions already described grade into each other very perceptibly and it is often impossible to draw definite distinctions between them. However, the general conclusions reached are none the less true, even though in applying them it becomes necessary to vary the plan of management to suit locally varying conditions.

In presenting this report the writer intends it to be only a preliminary discussion of the problem, presenting a few of the essential facts that have come to his attention during the past summer.

The popular idea that prevails in the minds of many that the yellow pine type in Eastern Oregon is the only really valuable type should be dismissed wherever it exists, as untenable.

That the north slope type, where lodgepole is a most troublesome element, is capable of producing a yield of forest products, including a large per cent of saw timber of fair quality, which in annual quantity of growth per acre, though possibly not in cash value, will equal and quite probably exceed that produced upon the yellow pine type, the writer has no doubt. It appears, however, equally certain, that this condition can be produced only as a result of proper management. The working out of the details necessary in this scheme of management constitutes one of the main problems which faces the forest officers working upon the Whitman. There need be no fear, however, that lodgepole pine will seriously encroach upon other forest types if fires are not allowed to burn through those types. It is probably equally true that extremely poor north slope types now occupied mainly by either white fir or lodgepole cannot successfully be replaced by desirable species, until after they have been cut over and reseeded, probably by artificial means, to the kinds of trees wanted, and that while natural means will eventually bring about such an improvement the great gain in time resulting from the adoption of artificial means will far more than repay the additional expense necessary.

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H.I.

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