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Diseases of Lodgepole Pine

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DISEASES are a major concern to forest managers throughout the lodgepole pine type. In many areas, diseases constitute the primary management problem.

As might be expected for a tree that has a distribution from Baja California, Mexico to the Yukon and from the Pacific to the Dakotas, the diseases of chief concern vary in different parts of the tree's range. For this reason I would like to give first a capitulation of some of the common diseases of lodgepole pine; then I will discuss those of major importance and see what can be done about controlling them.

Common Diseases of Lodgepole Pine

1. *Dwarfmistletoe*.—The dwarfmistletoe *Arceuthobium americanum* occurs essentially throughout the range of lodgepole pine, and is generally considered to be the most serious cause of disease of this tree. Principal effects of dwarfmistletoe are growth reduction and mortality. Surveys in mature stands in the central Rockies show that heavily infected stands have about half the board foot volume and twice the mortality rates of uninfected stands on the same sites (3). Recent studies in Colorado also emphasize the seriousness of dwarfmistletoe in younger stands (4). The results show that acceptable yields cannot be anticipated in stands that are infected while they are young.

2. *Decays*.—Relatively little is known of the decays in lodgepole pine on this side of the border, but the

Canadians have made detailed studies of decay in this tree in Alberta (14, 8). In Alberta, "red stain," a general term for the incipient stage of decay caused by a complex of at least 5 fungi, is the principal type of decay loss in immature stands.

The studies by Loman and Paul (8) show that the use of external indicators of decay is impractical in Alberta. They suggest, instead, the application of flat cull factors for estimating heart rot. In general, they found little decay (board foot basis) in stands under 100 years old, but in one area they found 15 percent heart rot in a stand 80 to 100 years old.

In mature and overmature stands in Colorado, decay frequently accounts for 20 to 30 percent of the gross board foot volume. Although we have no exact figures, there seems to be little doubt that *Fomes pini* is by far the most important fungus (7). This is significant from a practical standpoint because trees infected by *Fomes pini* usually form characteristic swollen knots that are reliable external indicators of decay. Other frequently encountered decays in lodgepole pine in the Central Rockies are the butt rots caused by *Polyporus circinatus* (a white pocket rot) and *Coniophora puteana* (a brown cubical rot).

Basal fire scars were found to be a principal entrance point for decay in 85-year-old stands in Alberta (13). Scar area was closely correlated with incidence of infection by decay fungi.

Although we would like to think that decays are a problem that will fade away with the harvesting of old-growth stands, the Canadian studies suggest that will not necessarily be the case.

3. *Rusts*.—Three stem rusts need to be considered in the management of lodgepole pine: comandra rust, *Cro-*

nartium comandrae; western gall rust, *Peridermium harknessii*; and stalactiform rust, *Cronartium stalactiforme*.

Comandra rust (9, 18) is by far the most serious of these three because it is common and causes high mortality and growth loss. In general, it is more abundant in the northern Rockies than in Colorado. It is most severe in areas where sage brush lands occur adjacent to lodgepole pine, because sage brush is the principal host of the *Comandra* plant, which in turn is the alternate host of the rust.

Western gall rust (16) occurs essentially throughout the range of lodgepole pine, but the main damage it causes is deformation of stems. Direct mortality is rare except in seedlings. Attempts to demonstrate an alternate host for this rust have not been successful. It can pass directly from pine to pine without an alternate host.

Stalactiform rust (9) is generally similar in appearance to comandra rust, except that (1) the cankers are much more elongate and (2) the alternate hosts are Indian paintbrush (*Castilleja*) and related plants. Although this rust can be a rapid tree-killer, it is usually not considered to be a serious problem in lodgepole pine because it is not common.

4. *Cankers*.—The only serious canker disease of lodgepole pine is *Atropellis* canker caused by *Atropellis piniphila*. This disease has been studied intensively in Alberta (6), where it is very abundant and is considered to be about as damaging as dwarfmistletoe. *Atropellis* canker has also been collected on lodgepole pine in Montana and in the Pacific Northwest, but the seriousness of the disease in the United States has not been evaluated. The disease is characterized by elongated branch and stem cankers that are accompanied by extensive resin flow. The

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wood behind the canker becomes bluish-black. The chief types of damage are deformation, growth loss, and loss of desirable pulping characteristics (bark removal difficulties and wood discoloration).

5. *Root rot*.—Root rot mortality caused by *Armillaria mellea* has been reported in young lodgepole pine (1, 19). The disease poses a serious threat to lodgepole pine regeneration, but much remains to be learned about the potential of the disease. Although *Armillaria mellea* is usually considered to be a weak pathogen that attacks declining trees, our observations in the central Rockies suggest that it causes losses in apparently vigorous young stands. Plots observed over a period of 6 years on 2 areas in northern Colorado show an annual mortality of about 1 to 2 percent of the trees in stands now 18-19 years old. The losses so far are not serious because the stands are dense, but it is not known how long this mortality will continue.

6. *Needlecasts*.—At least five species of needle-cast fungi (*Hypodermataceae*) and several other needle fungi have been reported on lodgepole pine. Two are widespread: *Hypodermella montivaga* is considered to be the most abundant in Alberta (14), while *H. concolor* is usually most common this side of the border (10). These needle-cast fungi are markedly cyclic: They may be very abundant one year and rare the next. For example, *H. concolor* reached epidemic proportions over much of the central and northern Rockies in 1963. The harmful effect of needle-cast fungi has not been assessed, but it is supposed that some loss of growth increment may occur after several years of heavy defoliation.

7. *Non-parasitic*.—Among the most striking of the non-parasitic diseases of lodgepole pine is winter drying or red belt. It is a condition usually attributed to drying out of needles during the winter by downslope westerly winds. Alternating cold and warm air layers are considered to be responsible for the condition, which results in a narrow zone of damage (5). Red belt symptoms have been noted in lodgepole pine throughout the eastern slope of the Rockies from Alberta to Colorado. The condition was widespread along the front range in Colorado and Wyoming in 1959, and in the Sangre de Cristo Mountains in southern Colorado in 1963. Mortality does not usually result directly from red belt, although trees weakened by other agencies, such as *Atropellis* canker, are frequently killed (2). The 1959 red belt caused some direct mortality in Colorado.

8. *Unknown*.—Two lodgepole pine diseases of unknown cause have been given some attention in recent years.

Parker (15) reported an unexplained disease of lodgepole pine in the interior of British Columbia. The symptoms—trunk lesions and declining tops—are quite similar to those of pole blight of western white pine, which also occurred in the same areas. The cause might well be the same as that thought to be responsible for the latter disease, a combination of shallow soils and a series of dry years.

An unusual disease that is frequently encountered in northern Wyoming and other lodgepole pine areas is what we call "nobbles" or tumors (17). These are gall-shaped swellings which may literally cover the stems. In some localities, all trees may be affected on areas of several acres. The cause of these tumors has not been determined. The distorted trees find little utility for lumber. They are widely used as curiosities and ornaments in the region.

Control of Lodgepole Pine Diseases

As utilization and economics of managing lodgepole pine change, so must our evaluation of the diseases which might be considered serious enough to warrant control action. In general, under our present conditions of extensive forest management of lodgepole pine, I would suggest the following three pathogens—dwarfmistletoe, comandra rust, and *Atropellis* canker—should receive serious attention. Of course, others that may not be considered serious now may prove to be so in the future.

Dwarfmistletoe is the chief disease enemy of lodgepole pine but, fortunately, it is one that can be controlled by silvicultural means. Clear cutting is ideally suited for control of this disease because its rate of spread is relatively limited. In fact, the major problems now present in lodgepole pine are in areas where clear cutting was not done. Partial cutting or thinning in dwarfmistletoe-infected lodgepole pine, therefore, must be avoided, unless the infection is so light that it can be taken care of in subsequent timber stand improvement work.

Dwarfmistletoe in mature or over-mature stands can be controlled by clear cutting with little modification in currently accepted silvicultural practices. Some general recommendations in this regard are: (1) clearcut patches should be as large and compact as possible, and narrow strips should be avoided, (2) boundaries should be located, wherever possible, in openings, non-susceptible types, or in healthy stands, (3) infected trees of all ages should be killed within clearcut units. Also subsequent treatment will be nec-

essary in reproduction that develops in clearcut areas adjacent to infected residual stands. This latter zone should be relatively small, about 1/2-chain wide if the residual stands are cut within about 20 years.

Comandra blister rust is a major disease in lodgepole pine in certain areas, notably in Idaho, Montana, and Wyoming. No control measures for the rust have been developed. Grubbing out or chemical treatment of *Comandra* plants, the alternate host, has been neither effective nor practical. The only present remedy is to attempt to remove as many infected trees as possible during logging or in subsequent timber stand improvement operations.

Atropellis canker is a serious disease in northern lodgepole pine stands. No practical control measures are yet available for it. The disease can be reduced to some extent by clear cutting. Because the canker often occurs in concentrated pockets, clear cutting may largely eliminate the disease in local areas (14).

Nordin (12), in a good discussion on forest pathology in relation to management of lodgepole pine in Alberta, compared the advantages and disadvantages of clear cutting versus partial cutting from the standpoint of diseases. He points out that the primary disadvantage of clear cutting is that it results in essentially pure, single-aged stands, which, in general, are most prone to pathogenic agencies. Despite this potential hazard, however, it seems that clear cutting in lodgepole pine can go a long way toward reduction of disease problems as we now know them. To be most effective, however, knowledge of distribution and abundance of diseases prior to cutting is essential. Similarly, follow-up operations to eliminate submerchantable-sized residual trees are desirable for several diseases.

This is the current state of our meager knowledge of lodgepole pine diseases. Although clearcutting now seems to be the answer to many disease problems, will this practice, in the long run, encourage other troubles? The answer to this question can be obtained only through intensified research.

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