

# SYMPOSIUM FIELD TOURS: OBSERVATIONS ON LODGEPOLE PINE FORESTRY IN NORTH AMERICA

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## ABSTRACT

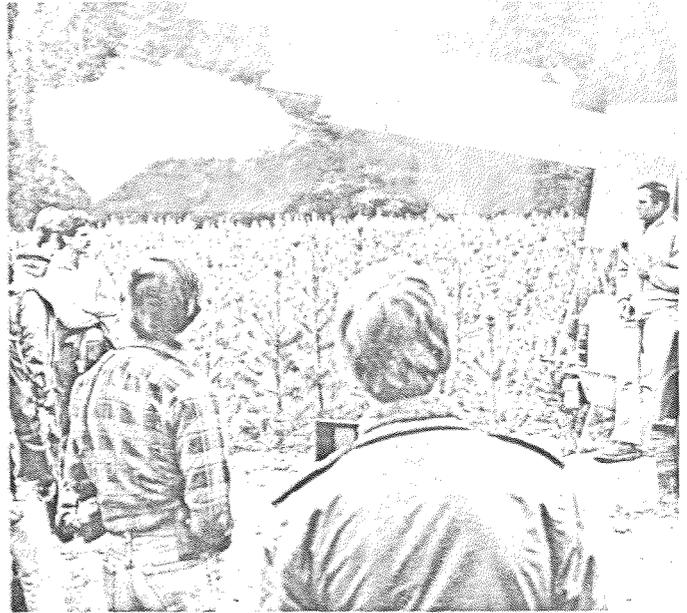
This report contains observations from symposium field tours to see genetic variation of lodgepole pine at the Priest River Experimental Forest (PREF) in northern Idaho, lodgepole pine forestry in mixed conifer forests of north-eastern Washington, and research and management in the heartland of lodgepole pine, near Hinton, Alberta.

## INTRODUCTION

Field tours for the Lodgepole Pine Symposium got off to a good start with two full bus loads of foresters and good weather. The tour visited three sites: the Priest River Experimental Forest in northern Idaho, the Colville National Forest in north-eastern Washington, and the operations of St. Regis, Ltd., in west-central Alberta.

The Priest River Experimental Forest is a 6,368-acre tract in the Idaho Panhandle National Forests located about 13 miles northeast of Priest River, Idaho. It was established in 1911 as the first center of organized forest research in the Northern Rocky Mountain Region. Since then, major contributions to knowledge have been achieved there in the fields of forest fire, forest management, forest influences, and forest pathology. The Experimental Forest is controlled and directed by the Inter-mountain Forest and Range Experiment Station specifically for research purposes. The Priest Lake Ranger District cooperates in administration and protection functions, providing a high level of fire protection, road maintenance, and timber sale administration.

The first stop on this field trip was at a 6-year-old provenance test plantation of lodgepole pine located at the PREF arboretum. The plantation contains 75 sources from southeast British Columbia to central Idaho and from low to high elevation. Jerry Rehfeldt contrasted height growth over elevation with growth over latitude. Differences in growth were three times greater for 3,300 feet elevation—the distance from arboretum to Gisborne Lookout (visible from the arboretum) than for more than 300 miles latitude from southern British Columbia to central Idaho. Jerry emphasized that seed can be transferred much farther for latitude than for elevation and that there may be some dramatic gains by moving planting stock short distances uphill from their seed origin. Studies on frost susceptibility and snow breakage are clarifying practical limits to elevational movement.



Research geneticist Jerry Rehfeldt explaining adaptive variation and seed transfer recommendations for lodgepole pine.

Ray Hoff next listed several pests that have been observed in local tests of lodgepole pine. Three of the pests were discussed in detail: needle cast, western gall rust, and pitch nodule moth. For the first two, notable genetic variability was observed both among provenances and among families within provenances. But for the pitch nodule moth, height of the trees was the overriding element responsible for the observed phenotype variation in infestation. We noted that care should be taken in tree improvement programs to reduce rather than inadvertently increase susceptibility to damaging pests.

Next we looked at 90 families of lodgepole pine that were adjacent to the provenance test. Jerry Rehfeldt presented data on the inheritance, genetic correlations, and genetic gains for several traits. Several families were flagged with colored ribbons to illustrate the results of various selection methods. By selecting the best individuals from the best families, an 8 percent gain is possible for height growth. Unfortunately, several other traits such as crown width, branch length, and lateness of growth are highly correlated with height growth; therefore, selection just for height may lead to an undesirable tree and one that would likely be maladapted because it would grow too long into the fall. Jerry has also shown that with a selection for height, but with a 100 percent restriction for the above correlated traits, the genetic gain is 3 percent. When establishing

(including capital amortization) electricity at about 55 to 60 mills/kilowatt hour, which compares well with any contemporary competitor. Unfortunately for lodgepole pine, delivered prices for chipped material would probably have to double or triple to be profitable. Nevertheless, our group left with enhanced hope and confidence that renewable forest resources will provide a sustainable energy flow for future generations. When one hears that the world's oil reserves may last only another 35 to 90 years, advances in wood energy appear certain.

Our final stop was in Ferry County where we visited Canyon Creek Campground of the Colville National Forest. This is a nicely located and desirable recreation site in a lodgepole pine type threatened by mountain pine beetle. Robert Chicken and his associates of the Colville National Forest explained how they used crown and sapwood factors to prescribe a reduction from 180 down to 60 ft<sup>2</sup>/acre basal area to bring the stand from a dangerous risk to a safe zone. The thinned campground looks attractive, as does the adjoining half-acre clearcut. Other recent thinnings in the nearby East Portal area are also esthetically pleasing as well as helping to prevent an outbreak by the beetle otherwise sure to drastically lower recreational values. Horses were used to yard logs in this area.

Special thanks are extended to Ken Hires and Lanny Quackenbush of Washington's Department of Natural Resources and to Darrell Even, Colville National Forest, for directing the tour while in northeastern Washington.

### WEST-CENTRAL ALBERTA

The Hinton tour was designed to acquaint participants with lodgepole pine management in west-central Alberta. The primary emphases were harvesting and regeneration practices, and young stand management. This tour covered two areas of lodgepole pine forest on the leasehold (public lands with a renewable 20-year lease) of St. Regis, Ltd., with some distinct differences in growing conditions and stand composition. According to the Forest Management Agreement (FMA) with the province of Alberta, the company is obligated to "follow sound forestry practices with a view of achieving and maintaining a perpetual sustained timber yield from the productive forest land."

Large-scale logging activity in the region started 30 years ago, with the establishment of a 450-tons-per-day kraft-pulp mill in Hinton and subsequent opening of the area by the development of the all-weather road system. Before that several small portable mills operated in the area, usually near rivers and existing roads, cutting lumber, railroad ties, and pit props for a small local market. These small mills have now all but disappeared.

The entire FMA lease area lies in the eastern foothills of the Rockies. Elevation ranges from 3,000 to over 5,000 feet. Summers are short and cool; winters are long and cold. The mean

annual temperature ranges from 1° to 2°C; precipitation from 20 to 30 inches, about one-third of which is snow. July is the warmest and wettest month. The frost-free period ranges from 50 to 80 days, depending on location (elevation). Most the soils are developed from parent material of cordilleran origin. In some locations varying amounts of organic matter accumulates in forms of duff and peat.

Lodgepole pine stands now being harvested are of fire origin, fairly uniform, and cover large, continuous areas. On dry, low-quality sites, where hot fires created plentiful mineral soil seedbeds, excessive regeneration densities may have resulted in overdense stands and a reduction or complete loss of merchantable yield within the usual 80- to 90-year rotation.

Bill Mattes and Bob Udell, St. Regis, Ltd., were the guides for the first half of the tour. This 45-mile loop north of Hinton traversed new climax stands that originated after the logging of climax stands of white spruce-alpine fir over 300 years old. These decadent, overmature stands are potential habitats for a variety of pests and are stagnant in terms of wood production. Such stands are assigned high priority for removal, to be replaced by vigorous new forests. The area also supports some predominantly lodgepole pine stands that originated from fires in 1816, 1822, and 1870.

Harvesting is done in alternate blocks, generally 50 to 150 acres in size to remove 50 percent of standing timber in the first round. The residual blocks are cut 10 to 15 years later, when regeneration in the former cut blocks reaches 6 feet in height. The cutover area is scarified to reduce fire hazard and prepare a receptive seedbed. Seed may come from adjacent uncut spruce and fir stands, or from cone-bearing slash of pine. The treatment is designed to provide sufficient mineral soil seedbed for the establishment of 500 to 1,000 well-distributed seedlings per acre. Harvesting of contiguous blocks is resulting in large areas of young stands. Every area visited had been rigorously treated to obtain natural or artificial regeneration and nearly always successfully.

Stop 1 was at a vigorous spruce-pine plantation established on a level, wet site in 1974. Site preparation involved treating the cutover in 1973 with an angle blade mounted on a crawler tractor, which piled the thick duff layer in continuous rows to expose mineral soil. This operation had to be done in the early spring while the frost could still support the tractor. Planting stock used was grown in Spencer-Lemaire containers and survival was high. Spruce and pine are currently about equal in height—up to 5 to 6 feet. On the other side of the road, we observed an older (1969) plantation of lodgepole in Ontario tubes, which was thriving on a gentle seepage slope. This is one of the few sites where Ontario tubes proved successful.

Stop 2 was to view regeneration resulting from aerial seeding onto snow with helicopters in the early spring of

1970 at a rate of 16 ounces of white spruce and lodgepole pine seed per acre. The stand was logged and blade-scarified in 1969 to prepare a mineral soil seedbed. Seeding resulted in well-stocked regeneration and provided a viable alternative to planting. At present, only moist, north slopes with difficult (expensive) access for planting crews are seeded and usually at a rate of 12 to 14 ounces of seed per acre (spruce 8 to 10 ounces, pine 3 to 4 ounces).



Fourteen-year-old regeneration at Stop 2. (Photo: R. Strang)

At Stop 3 we looked at natural regeneration of lodgepole pine after harvest. Scarification equipment had exposed sufficient mineral soil and scattered the pine cones after harvesting so they opened and dispersed seed throughout the cutover area. Because this type of treatment immediately follows the harvest, no time is lost in establishing regeneration before grasses, herbs, and competing wood species invade the site.

The equipment in most frequent use for site preparation to obtain natural regeneration is a front blade-mounted triple plow on a crawler tractor of D-9 size. Barrels and chains dragged with a D-7 or D-8 size tractor are used on wet areas and on small cut blocks where the moving cost of a large cat makes the former treatment uneconomical. In contrast, site preparation for planting is mostly by Bracke; a C+H plow is used on areas with severe vegetation competition, and a C+S plow is used for winter treatment of wet areas while frozen.

At Stop 4 the group viewed the company's arboretum and test plantations. This is one of two company arboretums located at 4,500 feet (the other is at 3,600 feet), and represents high elevation sites for testing various provenances of lodgepole pine. Plantations established here in 1978 from each of eight seed zones ranging in elevation from 3,500 to over 5,000 feet show no appreciable differences in growth or other characteristics to date. This supports seed transferability without noticeable drawbacks on the FMA lease.

Also of interest were the various lodgepole and jack pine hybrid plantations established in 1972 from 10-year-old



Black spruce cutover winter treated with C+S plow. Lodgepole pine and white spruce planting will follow a year later when the ground is settled. (Photo: R. Strang)

transplants. Seed originated from Whitecourt, Alberta, and Petawawa, Ontario, respectively. The hybrids were produced at the Petawawa Forest Experiment Station. So far, the performance of the hybrids is much poorer than that of the local lodgepole pine, except in branch growth, in which respect they resemble jack pine.

On the morning of the second day, the group headed south of Hinton into the heart of pine country with tour guides Jack Wright, St. Regis, Ltd., and Imre Bella and Bill Ives, Canadian Forestry Service, Edmonton. We traveled through an area that was logged in the last 10 years and has larger cut blocks (150 to 300 acres). We saw some 100-year-old pine stands that when harvested yield 40 or more cunits of wood per acre. But in the same stand, some dense patches contain virtually no merchantable stems. A site preparation treatment with drags used after logging in the early 1970's resulted in considerable overstocking of new stands. St. Regis, Ltd., has an ongoing program of precommercial thinning to reduce stand density to around 800 stems per acre. This effort is concentrated on stands that are adjacent to roads and close to the mill. Some precommercial thinning has also been done in young, overdense, fire-origin stands, but this program was terminated because of excessive cost.

We stopped to view a spacing study reported in the Symposium by Wayne Johnstone. Plots were established in 1963 by the CFS in lodgepole pine regeneration that became established after a large fire 7 years earlier. Five spacings (200, 400, 800, 1,600, and 3,200 stems/acre) were replicated twice on three sites (good, medium, and poor). Twenty years after treatment the most dramatic and consistent response, both in diameter and height growth, occurred on poor sites. Optimum spacing, with an eye to merchantable yield at harvest, is around 800 to 1,000 stems per acre. The influence of spacing in thinned plots on height increment and mean height was relatively small and inconsistent. Height growth was generally best at

intermediate spacing. Irregular mortality from various causes emerged as a problem between ages 15 and 25 years.

The last stop of the morning was at another CFS study: early stand dynamics of lodgepole pine. The objective of this study is to determine the causes and the amount of mortality between stand establishment and age 30 years, both in thinned and unthinned stands. Numerous insect, disease, and animal damage problems are prevalent and additional information is prerequisite to intelligent management of lodgepole pine.

Although St. Regis, Ltd., is entitled to planting stock from the AFS, they have opted to grow their own seedlings in a greenhouse built for this purpose in 1980. In turn, the company is reimbursed for their seedlings at AFS seedling production cost. This greenhouse can produce one million container seedlings per crop, and up to three crops per year. Most of the second crop and all of the third, is overwintered in cold frames. The seedlings are grown in 2.5 inch<sup>3</sup> Spencer-Lemaire-Ferdinand containers of 102 plants per tray. These containers are designed with vertical ribs to promote downward root growth. When the roots reach the bottom, air pruning enhances lateral growth, which helps to bind the root ball. The seedlings are grown in the greenhouse for 4 to 8 weeks, depending on the crop, then transferred to cold frames for hardening off. The greenhouse is about 3 feet higher than the cold frame area, facilitating seedling transfer by a gravity-feed roller system. Fertilizers are injected into the watering lines for use both in the greenhouse and in the cold frames.

Nearly 30 people from Alberta, British Columbia, Ontario, the United States, and Sweden participated in what most found to be an informative and interesting field tour. For this, thanks are due to Jack Wright and his staff at St. Regis, Ltd., who helped in organizing and running the tours, and to Bernie Simpson, AFS, for the good meals and lodging.

### CONCLUSIONS

Interest in lodgepole pine has grown considerably since our first international symposium in 1973. This can be seen by the makeup of symposium participants. Not only were there more of us, even requiring duplicate sessions across the border, but practicing foresters made up a much larger portion of the attendance. Information from scientists is being used, and ideas and innovations are flowing freely in both directions.

Canada now includes lodgepole pine among its top timber species, accounting for more than 10 percent of its total harvest. Large clearcuts, intensive site preparation by mechanical means, and natural regeneration and planting to bring about quick

reforestation are commonplace. Information on optimal spacing levels, genetic improvement, and pest control is being accumulated to increase productivity in second-growth forests.

Lodgepole pine management in the United States varies more than in Canada. In the United States, clearcuts are much smaller, broadcast burning is often used in site preparation, and there is more reliance on natural regeneration. Mountain pine beetle and dwarf mistletoe continue to influence management practices over large areas, but we are now smarter on how to minimize their impacts through silviculture. A significant portion of Rocky Mountain lodgepole pine forests are being saved from harvesting through creation of wilderness, and much of the remaining resource carries at least moderate harvesting constraints to protect environmental and social concerns.

Harvesting technology for small timber, efficient utilization, innovative new products, and development of additional markets seem to be key considerations for the future of lodgepole pine as a timber resource. Strong firewood demands, such as we saw near Spokane, were not predicted a decade ago; nor did we foresee the growing interest in flakeboards. Advanced energy production technology and ideas for high-value products such as fabricated trusses are beginning to flow from creative minds. And 10 years ago we did not have the results of plantings in Sweden; intensive forestry and more progressive economics seem so much more possible after hearing of lodgepole's success from Stig Hagner. Surely those of us with "contortaitis" can look forward to another exciting decade.

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# LOGEPOLE PINE THE SPECIES AND ITS MANAGEMENT

## SYMPOSIUM PROCEEDINGS

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