Requirements and Design Parameters for Lodgepole Pine Strip-thinning Equipment in British Columbia - FRDA Report 032

In British Columbia, lodgepole pine often establishes in very dense stands following wildfires or other major disturbances. Studies elsewhere suggest that reasonable growth response can be expected from thinning these stands at an early age. However, reducing the density, handling downed snags, and clearing away cut stems are problems in these stands. Where large blocks of these high density stands require thinning, mechanical methods may be more cost-effective than motor-manual methods. This paper reports on a project that arose from a joint interest by the Forest Engineering Research Institute of Canada (FERIC) and the Canadian Forestry Service (CFS) in determining the potential for developing or modifying a machine for mechanical thinning.

The objectives of the project were:

1) to prepare descriptions of lodgepole pine stands suitable for mechanical strip thinning,

2) to determine the areas of these stands available for treatment, and

3) to prepare a list of specifications for cutting attachments and carriers suitable for carrying out these treatments.

Although FERIC has monitored mechanical strip-thinning trials and requirements since 1981, neither a machine nor a method for mechanical strip thinning has yet been found that meets the operational, economic and biological requirements of industry or agency silviculturists.

The biological constraints are:

1) Ingress and low live limb development in very young stands,

2) age and density effects on crown and height development, and

3) the ability and response rate of the crop trees.

The latter two points influence the timing of treatment and therefore the size of stems severed.

Repression (also called stagnation) is a characteristic of overstocked lodgepole pine stands where height growth, as well as diameter growth and crown development are severely repressed due to the extremely high stem density and associated competition. Priorities for thinning young stands (less than 20 years) that are accessible can be easily established. Unfortunately, however, the cost and benefit trade-offs between various treatments in older stands have not yet been fully analyzed.

The study defines two age/density types of lodgepole pine as suitable for mechanical strip thinning.

Type 1 is composed of:

- stands 10 - 25 yrs old,
- 10 000 - 20 000 stems/ha (required for strip or mechanical thinning),
- 2 - 12 cm dia, and
- 3 - 7 m ht.

At 10 years of age, stands may be 10 000 to 100 000 stems/ha, 2 to 6 cm in diameter and 3 m tall. At 10 to 20 years old, stands may be 10 000 to 40 000 stems/ha, and 2 to 12 cm in diameter. At 20 to 25 years old, Type 1 stands have stems of 8 to 12 cm in diameter and up to 7 m tall.

Type 2 is composed of:

- stands 40 - 80 yrs. old,
- 3 000 - 6 000 stems/ha,
- stem diameters from 6 - 20 cm, and
- tree height from 7 - 15 m.

These Type 2 stands are considered priorities for thinning since timber supply shortages within TSA’s can be reduced if harvestable dimensions can be reached within 20 to 40 years.

Estimates of the area included within these two stand types that are treatable by mechanical methods, reasonably accessible and in good condition are as follows:

- Type 1 stands 16 600 - 25 400 ha, and
- Type 2 stands 22 000 - 23 000 ha.

The report suggests that the relatively small area defined as suitable for mechanical strip thinning does not have an equipment requirement that will attract manufacturers’ interest. Therefore, development or modification of attachments mounted on existing carriers is the likely approach.

To undertake mechanical strip thinning in Type 1 stands, it is recommended that a vertical shaft, rotary cutting head be purchased and modifications made. The cutter can be attached...
to a crawler or skidder carrier and field tests undertaken to establish whether the unit can meet the cost and biological goals. These stands should be treatable for less than $300/ha for the strip-thinning pass.

To carry out mechanical strip thinning in Type 2 stands, utilization of at least some of the cut stems is desirable. Shear, rim-driven circular-saw or scissor-type cutters are more energy efficient and require less power than other designs. Small European carriers would be suitable for working in these stands. It is recommended for these stands that a used, small-size feller forwarder be purchased and modified with Canadian attachments. Field tests should be undertaken to establish biological and cost results. Costs are estimated at approximately $400/ha, without accounting for offsetting revenue for thinnings.

Copies of this 25 page report, Requirements and design parameters for lodgepole pine strip-thinning equipment in British Columbia by I.B. Hedin, are available while supplies last, from:

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