LOGGING AND UTILIZATION IN SPRUCE-FIR IN THE WEST¹

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Throughout the range and distribution of the spruce forests of Western North America there are several striking similarities which are characteristic of all types and which bear on the problems of management and utilization.

- (1) Spruce is generally associated with one or more of the true fir species.
- (2) Both genera are usually characterized by an all-sized stem distribution and often bear an all-aged aspect.
- (3) Spruce is the more valued species and fir, *at present*, of minor and even doubtful value.

The problem of management resolves into utilization in such a manner that a productive growing stock is left to provide future crops. As the fir component has little or no commercial value, there is a strong tendency to leave a numerous stemmed and often decadent residual stand. Such stands, even if spruce eventually outgrows the fir, are slow in development and do not make the best use of growing sites. The solutions are simple to state but difficult to achieve. Either use must be made of the fir, or its removal subsidized in the interest of silviculture.

Major markets for white spruce lumber are the eastern and mid-western states. Important but lesser markets exist in Ontario, Quebec, and the prairie provinces. These markets are of comparatively recent origin and dependent on western producers being able to supply a high-grade product to compete with other eastern and western soft-woods. The true fir, or balsam as it is generally known, tends to lower product values. As the fir is a smaller sized component of the forest, and because of species tolerance, is inclined to be more limby than spruce, the lumber produced falls into lower grades. Where products are kiln dried, segregation of logs, or lumber on the green chain, is necessary as schedules for spruce and balsam differ.

In the mature forest, fir is usually a decadent understory comprising from ten to fifteen per cent of the gross merchantable volume. Decay from disease is a hidden defect difficult or impossible to assess in cruising and not completely discernible even after falling. Such defect may occur throughout the tree or in pockets.

Western industry located in the mature spruce forest is averse to cutting balsam. The cost of handling on account of defect is high, and the return is lower on account of grade loss. The fir which is sold, probably comprising less than five per cent of any shipment, is sold as spruce. As pulp-wood the fir has considerably more value and even defective

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logs might prove of use, but to date there is not an established pulp mill in the Western Canadian spruce-fir type.

Subsidizing removal of fir is recognition of the species as a silvicultural problem. The B. C. Forest Service is commencing an experimental policy of paying for the falling of some fir stems below merchantable size, and for all those of merchantable size which do not prove fifty per cent or more useable. The smaller stems which, are prevalent on most areas, are of considerable age and in many cases defective. Their major function in the residual stand may be to retain tree cover and assist in the development of the fewer but more valuable species.

Usual logging practices in spruce-fir types do not leave areas in non-stocked condition. Uncut stands vary from all-aged stands with "J" shaped curves of stem distribution to unbalanced distributions where saplings and poles are few, and commercial size trees predominate in number and volume. Seldom, however, except in young stands of catastrophic origin, is the all-sized or all-aged character entirely lacking, and the problem of management revolves about this fact. Whether the stands are old with veterans succumbing to time, and advance growth filling the gaps, or the stands younger and more ideally distributed, the problem of management is much the same. It is to retain the best material available from the old stand for the development of the new.

A diameter limit of twelve to sixteen inches has been used widely in western spruce forests. Thirty-five to fifty larger spruce have been logged from a stand originally containing 80 to 150 spruce and 200 to 600 fir stems. The residual stand is 25 to 100 spruce and 100 to 400 fir. Tractor logging as generally practiced destroys from 20 to 70 per cent of potential residual spruce trees. Although some damage is unavoidable, the wide variation in results is dependent on the original stand, topography, season of logging, and the planning and supervision which are a part of the logging operation.

Almost without exception reproduction in spruce-fir stands is slow and difficult, and any residual seedlings, saplings, or trees, are of the utmost value in securing the second crop. The real problem is to log or harvest the commercially valuable components of old growth spruce stands and save from destruction most of the material which will be of future value.

The choice of a selection or clear cutting silvicultural system is not a pressing current issue. Such decisions may be left to the future. During the first century of harvest cuttings, the major concern is the most painless conversion from wild to managed forests. The western lumber industry operates largely in a mature spruce-fir forest, which is understocked, and over burdened with non-earning trees of relatively large size and great age. It is highly desirable to convert these areas into increment-producing forest. Where, through time, a younger understory of 0 to 12 inch d.b.h. spruce has developed in gaps and natural openings, it is also desirable to remove the older merchantable trees in such a manner as to retain the younger smaller trees for future growth. A second cut is only a step towards management, and actually constitutes a delayed yield of the existing forest.

Some of us have hopefully outlined the possibility of third and fourth cuts arising from advance growth and reproduction which will develop in cutover stands. Evidence of such a sequence exists on many horse-logged areas of Alberta and British Columbia.

The proof of such possibilities lies in the future.

Where an understory of younger, smaller spruce does not exist, the practice of selective logging is a gamble. The manager is laying a wager of road expense and liquidation value on the chances of added recovery at future date from trees which are already advanced in age. The wagerer risks loss through windthrow and other natural hazard and must be assured of a secure forest land tenure. As a forester he may hope or have reason to expect reproduction in the interim between cuts. Evidence of successful partial cuts in this type of forest is not available.

Clear cutting of all merchantable stems may be desirable. There is little or no evidence available to indicate possibility of early regeneration of the forest, and planting may be required. Little or no planting has been carried out in western spruce-fir forests.

In view of the hazards of carrying what might be termed risk trees towards a second cut, the middle way between light selection and heavy liquidation may be the most satisfactory approach to utilization of spruce-fir forests. Depending partly on market requirements and the economics of logging, the industrial forester may vary cuts to suit specific conditions, and will make successful use of the forest, provided logging damage is kept to a minimum. This statement is almost universally applicable in the western spruce-fir forest, as unwarranted destruction creates the most serious problems of future management.

Tree marking has been used more and more in the western spruce-fir forest to select trees for cutting and to leave a well spaced and presumably healthy reserve stand. In practice successful marking is limited by numerous factors. A commercial operator needs a minimum volume for successful operation. In western Canada, where little timber is held under private ownership, improvements must be written off against the current operation. Roads especially are expensive and the logger will aim at the removal of maximum values. Under the long term tenures becoming increasingly available, there is more incentive to build roads which may be used periodically for the removal of lighter cuts, and the practice may be financially sound. Windthrow, which is a factor to be reckoned with in most spruce-fir forests, must be carefully gauged before successful marking can be achieved. Marking is an approach to harvesting which must be used discreetly by foresters who understand the type in which they are working. Indiscriminate use of marking can produce most unsatisfactory results and highly unfavorable publicity for silvicultural measures generally.

Over most of western North America tractor logging is the accepted and most common commercial practice. Tractor sizes vary, but the relatively large machines such as the D7, TD 18, and HD 15 have preference in the British Columbia industry. Major reasons for this seemingly heavily

powered equipment is their versatility for bunching logs, roading with or without pans or arches, and building logging roads. Heavy windfall and stubborn clay soils make heavier equipment almost standard. Smaller companies may use one or two machines for all purposes. Larger companies prefer the large machine for sustaining production. Heavy snow fall in much of the western spruce-fir forest is a handicap to logging which can only be overcome efficiently by larger equipment.

Log lengths vary. In British Columbia and Alberta tree length skidding is a common and expanding practice. Trees are felled and partially limbed and the whole useable length is skidded to the sawmill, or to a landing from which trees or logs in varying lengths are trucked to the mill. The practice is economically sound and easily adaptable to a wide range of conditions, but in its early use has run counter to silvicultural objectives. Actually abuse rather than proper use has lead to criticism and even curtailment of the method.

Where woods organization is adequate tree length skidding is not unduly destructive. Carefully planned and well supervised operation is both silviculturally and economically. Planning makes best use of terrain to aid timber removal. Logs or trees flow over the easiest routes. Falling is systematized so that trees are well angled to carefully laid out skid roads, and trees come out with a minimum of effort and damage. Destruction of residual trees is pretty well limited to skid roads and haul roads. On these the soil and debris is usually so well churned that a receptive medium is provided for seed germination and seedling survival. In contrast to any helter skelter performance, such organization has proven cheap and sound forest management.

In steep mountainous terrain truck and tractor logging is limited, and spruce volumes as a rule do not lend themselves to any form of West Coast high-lead operation. A European system known as the Wyssen Skyline-crane is at present under experimentation. It consists of a skyline and carriage with special braking features which adapt to steep down-hill operation. The first season of test at Spillimacheen, British Columbia, has proven successful and logs have been handled at very favorable costs from a plateau which hitherto had been considered inaccessible.

In the field of utilization the ground has hardly been broken. Introduction of dry kilns in the western spruce-fir operations has produced a higher grade of products with wider marketability, but little prospect is indicated for wide spread economic disposal of sawdust, shaving, or slab wood.

In Prince George, British Columbia, a newly organized company is producing and experimenting in building with a patented construction medium composed mainly of cement and planer shavings. The product is a building block or panel which may be sawn, nailed, or welded to concrete. The material has proven in tests to be strong, to have excellent insulation properties and is almost sound proof. It can be plastered inside and stuccoed outside and is used from the basement to roof for inside and outside covering of walls. Its expansion coefficient is low.

The product is illustrative of secondary uses which in time will be affiliated with the lumber industry but which have been relatively slow in development.

In spite of the fact that the west contains the last great stand of mature spruce-fir, transportation costs and distance to markets have slowed the development of a pulp industry. Several companies have entered the field in recent years and others are in the process of becoming established. None as yet is producing. Pulp manufacture with its variety of end products will help to stabilize and vary the expanding industry of the western spruce-fir type.