STAND TENDING

Stand tending practices, which include; plantation spacing, release cutting/treatments, thinning, pruning, fertilization, and drainage can be carried out from establishment to final harvest. Stand tending prescription options are outlined in regional forest management plans (five-year operating plans, annual operating plans). Pest management and forest protection are important components of any stand tending program.

Stand tending is done to accomplish one or several objectives and produce specialized products throughout the rotation period, including final harvest. The intensity of which stand tending is carried out will depend on a combination of biological, economic, and social factors. Stand tending programs depend on the inherent productivity of the site and its biological requirements for regeneration

A detailed knowledge of tree growth and stand development is fundamental for successful stand tending. Areas of uniform site types, over which tree growth follows a distinctive course, should form the units for management and silvicultural treatment

Stand tending treatments are chosen for sites which will provide adequate returns on investments, i.e. sites which have high productivity and the ability to respond to stand tending are eligible for treatment.

<u>Spacing</u>

Spacing is defined as the distance between individual trees in natural or artificial forests. Average spacing is directly related to the density of a stand, expressed as the number of stems per hectare. Optimum density (optimum spacing) is defined as the density permitting the greatest possible diameter or volume growth per tree with the minimal loss of growth per hectare. Over time, trees require more space for crown development, and consequently volume growth. The optimum density will change to accommodate tree volume growth.

Spacing/density is a form of stocking, for which standards have been designated (e.g. Stocking Standards for Manitoba).

The Manitoba stocking standards identify the density objectives, at establishment, in stems per hectare based on crop planning criteria. The densities recommended, along

with the spacing requirements to achieve these objectives, are presented by covertype as follows:

For softwood covertypes;
objective = 2500 stems/ha (softwood species only) spacing = 2.0 metres by 2.0 metres

For mixedwood covertypes;
objective = 2500 stems/ha (hardwood and softwood species) spacing = 2.0 metres by 2.0 metres

For hardwood covertypes;
objective = 6000 stems/ha (hardwood species only) spacing = 1.3 metres by 1.3 metres

Recommended spacing at establishment found in other sources (by species) are as follows: Jack pine spaced at 1736 to 3086 steins/ha or 2.4 m to 1.8 m. respectively. optimum spacing for jack pine is a function of the product objectives (pulpwood, sawlogs) and should be considered in along with site quality and economic analysis Black spruce and white spruce spaced at 2268 to 3086 stems/ha or 2.1 m to 1.8 m. respectively.

Spacing calculations for pre-commercial and commercial thinning should be based on accepted Stand Density Indices (SDI) or Spacing Factors Percent for target species.

Release

Release is freeing a tree or group of trees from immediate competition by eliminating over topping or closely surrounding vegetation. The purpose of release is to divert the resources of the site from the competing vegetation to the crop trees. Release of conifers from competing vegetation is often necessary during the critical years of establishment in order to ensure survival and improve growth rates. The type of vegetation competing for growing space varies with the degree of disturbance and soil factors, such as: texture, depth, and moisture regime. In Manitoba, glyphosate is the herbicide presently used to release suppressed conifers. Release can also be achieved by mechanical and manual methods. However, neither manual or mechanical release will eliminate root competition. Chemical release remains the most cost-effective method, with high productivity and long-term effectiveness.

Thinning

Thinning is the removal of excess trees from an overstocked stand for the purpose of providing increased growing space and lessening of the competition for the remaining trees. A detailed understanding of the management objectives and site quality are inherent characteristics of thinning treatments. Also, knowledge of local markets that

use wood products will provide the direction necessary to plan and organize local thinning programs.

Ideally, thinning should occur at the onset of crown and root competition, provided that live crown ratio is good (greater than one-third of total height) , and the species will respond to treatment. Some general rules of priority are to treat:

-plantations before natural stands
-wide crown species before narrow crown species
-intolerant before tolerant
-untreated before treated (i.e. cleaning or improvement cutting treatments)

Methods of thinning include: low thinning, crown thinning, selection thinning, mechanical thinning and free thinning. Most methods can be applied at varying intensifies to achieve management objectives. A short definition of these methods are provided below.

Low Thinning Also referred to as thinning from below. Trees are removed from the lower crown and diameter classes.

Crown Thinning Also referred to as thinning from above. Trees are removed from the middle and upper portion of the range of crown and diameter classes.

Selection Thinning Dominant trees are removed in order to stimulate the growth of the trees of the lower crown classes. If not done properly this method is similar to high-grading and stands may degenerate.

Mechanical Thinning Trees cut or retained are chosen on the basis of a predetermined spacing or pattern with little or no regard for their position in the crown canopy. Pre-dominantly used for juvenile spacing in high density even aged stands. Trees along row edges are released.

Free Thinning Cuttings designed to release crop trees without regard for their position in the crown canopy. Combination of any or all of the thinning methods

described. Designed for use in stands that are somewhat irregular in age, density, or composition.

Growth and yield data which has been collected locally may provide some information to develop yield curves for crop planning.

Thinning in the spruce, pine and fir working groups are profitable when they are done for pulpwood or high value products, and is a break even venture when done for sawlogs. Generally, thinning costs are lower when it is done between the age of 10 to 15 years, the age of maximum growth. Thinning treatments can be classified into two distinct categories, which are pre-commercial thinning and commercial thinning.

Pre-commercial thinning is the reduction of density in young stands to control stocking, prevent stagnation, improve crop tree quality and reduce rotation length. It also maintains or increases growth rate of leave trees. The trees that are removed do not yield any commercial value, and are usually left on the site to decompose. Other commonly used terminology under this classification are: juvenile spacing, sanitation spacing or brushing and weeding.

Commercial thinning is the reduction of density in stands to utilize all the merchantable material produced by the stand during the rotation and to redistribute the growth potential of the stand to optimum advantage (Smith 1962).

Pruning

The elimination of branches by the physical and biotic agencies of the environment is called natural of self-pruning. Natural pruning takes place slowly during the life of the forest crop. In artificial pruning the removal of branches from chosen portions of stems is accomplished swiftly to increase the quality and value of the crop ultimately harvested. The growth period required following pruning treatments is long, allowing the increase of stem diameter to eventually grow over cut branches. Pruning treatments ordinarily must be coupled with thinning to stimulate diameter growth and reduce the time required for branch stumps to be incorporated into the stem. Another advantage of combining pruning with thinning treatments is pruning selected crop trees can substitute for marking, as long as pruners are trained in selecting.

Plantations are not likely to produce much clear lumber without pruning because the high cost of planting usually dictates initial stand density too low for satisfactory natural pruning. In Manitoba, pruning saws and extensions are exclusively used in pruning treatments.

Fertilization

Effective and economical use of fertilizers in forestry is largely dependent on an understanding of the properties of the various fertilizer materials and their reactions in forest soils. Fertilizers are more commonly applied to forests at tine of establishment or well after crown closure.

Fertilization at time of stand establishment (usually phosphorus, potassium, or micro-nutrients) may involve a localized application made concurrently with site preparation. Fertilizer can be applied in a band down the row of seedlings, or made in a broadcast application with either air or ground equipment. It may also be used in conjunction with herbicides to minimize fertilizer stimulation of competitive ground cover vegetation. Nitrogen deficiency may not become critical until well after crown closure when much of the nitrogen becomes immobilized in the ecosystem organic matter . Therefore, nitrogen fertilizer materials are more frequently used in the fertilization of older stands. The value of growth increases is greater in older trees than in young trees and the carrying costs associated with the investment in fertilizers applied near the end of the rotation is much less than when the fertilizer is applied near time of planting.

In the primarily mixedwood part of the boreal forest (Manitoba Lowland, Aspen Parkland, and Aspen Grove forest sections) where the growing season is short and moisture often limiting, it is doubtful whether fertilization greatly improves growth. Furthermore, a good portion of any potential benefits from fertilization maybe lost due to nutrient uptake by ground vegetation. Control of ground vegetation is likely to be greater stimulus to growth than fertilization. Also, on mixedwood sites in the boreal forest, the number of years required for nutrient replacement of *N.* P and K (nitrogen, phosphorous and potassium respectively) following full tree harvesting decreases with increasing hardwood component in the harvested stand.

Drainage

Drainage is the process of downward removal of water from soil, particularly by surface and subsurface run-off and artificially by man's measures for hastening removal, e.g. by ditching. Controlled drainage for the removal of excess water may improve productivity for a particular species and affect profound changes on stand composition and regeneration. The benefits to the soil from draining wetlands are generally derived from increased rooting depth, which in turn reduces windthrow, improves soil aeration, and increases the nutrient supply.

The primary use of drainage on wetland is to increase the productive forest land base and address local wood shortages. Presently, the productive forest available to support existing wood demands are not in short supply. Wetland forests often serve as the headwaters for countless streams and lakes, as well as recharge areas for underground water reserves and as a buffer against seawater intrusion, any change in their water relations may modify the whole wetland environment, including changes in recreation values and wildlife habitat.