Frontline EXPRESS
Canadian Forest Service, Great Lakes Forestry Centre

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STEM ANALYSIS AND ITS USE IN FORESTRY PRACTICES

INTRODUCTION:

Trees in temperate regions undergo an annual growth cycle beginning with leaf buds opening in late spring and ending before the leaves start to fall in autumn. Growing trees respond to this cycle by producing large thin-walled cells in the spring and forming small thick-walled cells during the end of the growing season. Together, these cells form a tree ring, which is an annual increment of growth. The approximate age of a tree can be determined by counting the growth rings in the lower part of the stem. The specific years in which a tree was affected by transient factors such as fluctuations in climate and competition can also be determined. Stem analysis is a means of determining these factors and the past growth of individual trees.

METHODOLOGY:

In the field, the main stem of a tree is sectioned at the following points: 0.15m above-ground, 1.30m aboveground, and 10% height intervals along the entire stem. Stump height, interval lengths, and cutting method are also recorded. The inside and outside bark diameters for each cross-sectional sample is determined and recorded. The fresh mass of each section is determined. For each cross section, two geometric mean diameters are identified. In the lab, the discs are treated with water or ferric nitrate to increase resolution of the annual rings and to determine sapwood area. Using a computer and a scanner equipped with an image analysis system specifically designed for tree-ring measurement, the age of each cross sectional disc can be determined. Using this system, the width of each annual ring along each diameter-based radius is obtained. From this data the following growth analysis information can be determined:

- Mean radii, diameter and area for all disks,
- Tree height and volume as a function of age.

USES OF STEM ANALYSIS:

Stem analysis is a useful tool in assessing the effects of intensive forest management and silvicultural practices relating on tree growth and wood quality. The data collected are used by forest managers in improving forest productivity. Studies have shown that stem growth is reduced due to increasing competition from larger-sized trees. As a result, the distance between rings becomes smaller. With increasing density stress, stem production has a lower priority than foliage, root, and storage requirements. To overcome density stress, thinning or juvenile spacing is required in order to increase merchantable yields and attain early stand operability. Thinning or juvenile spacing is required in order to increase merchantable yields and attain early stand operability. Stem analysis can also be used to determine the patterns of spruce budworm outbreak. The outbreak is revealed by alternating wide and narrow tree rings. After a growth reduction phase, there is a growth recovery phase in which ring widths gradually return back to normal. The growth reduction phase can last from 4 to 11 years, whereas the growth recovery phase can take up to 2 to 5 years.

SOURCES OF RELEVANT INFORMATION:

Newton, P.F.; Jolliffe, P.A. 1998 Temporal size-dependent growth responses within density-stressed black spruce stands: competition processes and budwormeffects. Forest Ecology and Management. 111:1-13.

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