

**CUSUM CHARTS FOR DETECTING ONSET AND CESSATION
OF XYLEM FORMATION BASED ON AUTOMATED
DENDROMETER DATA**

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ABSTRACT

The timing and rate of xylem formation during the growing season are key processes in determining the amount and properties of wood produced. Despite the basic nature of the process, our present knowledge concerning xylem formation is surprisingly fragmentary. It has proven difficult to distinguish between the changes caused by xylem formation and those related to swelling and shrinkage of the stem. In this work we study the use of CUSUM charts [1] (cumulative sum) for automatically determining the onset and cessation date of radial increment based on automated dendrometer data. A CUSUM chart is an efficient tool for detecting small changes in the mean of a signal. We use data measured in three stands containing Scots pine and Norway spruce trees in Southern Finland during years 2001–2005 to demonstrate the performance of the method. In order to produce reliable results, one has to choose a suitable size of change, magnitude of noise, and onset or cessation levels for the radius. We compare different ways to set these parameters of the model. The quality of the results is verified by cross-validation. Once configured properly, the method produces results similar to those determined by an expert. The results are also compared to direct measurements on tracheid formation on the stems.

Keywords: CUSUM chart, stem radius, tree, growing season, dendrometer

REFERENCES

- [1] Mitra, A. (1998) *Fundamentals of Quality Control and Improvement*, 2nd ed. Prentice-Hall.

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