

# CONTROLLING VARIABILITY IN THE PULP AND PAPER INDUSTRY

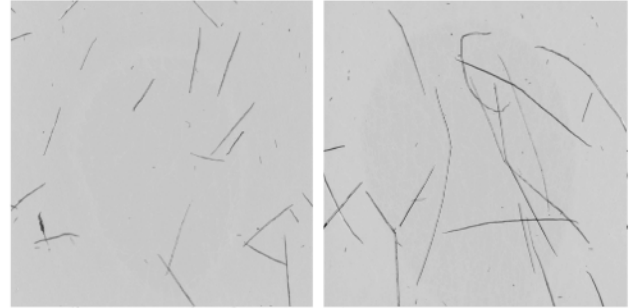
A McIntire-Stennis supported project in support of the forest industry



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Businesses have invested millions of dollars to better control variation during manufacturing, including employing Six Sigma and other approaches. For the forest products industry, much of the variability is from the wood itself due to its biological nature. One of the major consumers of wood is the pulp and paper industry. The properties of finished pulp depend on the anatomical characteristics, to which the tracheid is the basic building block of wood for softwoods. Tracheids resemble drinking straws and in young trees (<5 years) they are short with thin cell walls and small diameters, whereas tracheids in old trees (>20 years) are much stronger due to their greater length, thick cell walls, and large diameters. Here we characterized the tracheid properties of plantation loblolly pine from across the growing region. Samples were pulped and the dimensions of the tracheids measured using an automated microscope. Models have been developed to explain the changes that occur in tracheid properties over time and across the growing region.

## Variation in loblolly pine tracheid length



Juvenile Tracheids ~1.5 mm

Mature Tracheids ~4.5 mm

## COLLABORATION

We are collaborating with the forest industry including members of the Wood Quality Consortium, scientists at the USDA Forest Service Forest Products Laboratory, and scientists at other universities.



Tracheid lengths in older trees are 4 times the length of tracheids in younger trees. By understanding wood anatomy, the pulp and paper industry can better control their process variation.

## About McIntire-Stennis

The McIntire-Stennis program, a unique federal-state partnership, cultivates and delivers forestry and natural resource innovations for a better future. By advancing research and education that increases the understanding of emerging challenges and fosters the development of relevant solutions, the McIntire-Stennis program has ensured healthy resilient forests and communities and an exceptional natural resources workforce since 1962.



## IMPACT

Tracheid length and width vary significantly across the southeast by physiographic region.



This work will be integrated into two distinct models in the future: 1) growth and yield models for wood growers, and 2) procurement models for wood buyers.



Pulp and paper facilities are increasingly deploying automated fiber monitoring instruments to better understand raw material properties.



This work combined with online monitoring efforts will allow the pulp and paper industry to reduce manufacturing variation.