






Effect of CO₂ on wood properties of *Liquidambar styraciflua* after 10 years of enrichment



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Introduction

FACE

- The free air CO₂ enrichment experiment on the Oak Ridge National Environmental Research Park
- The effect of CO₂ enrichment on the North American deciduous forest
- Feed backs from the forest to the atmosphere and the global carbon cycle



Physical

It is located on the Oak Ridge National Environmental Research Park in Roane County, Tenn.(35° 54' N, 84° 20'W) in southeastern United States.

Soil Type

- Silty clay loam textured and is moderately well drained
- Slightly acidic pH 5.5-6.0
- High base saturation largely dominated by exchangeable Ca
- Bulk density is 1.5 g cm⁻³
- C content is 74 mg ha⁻¹
- N content is 11mg ha⁻¹

Meteorological Description

- Climate is typical of humid southern Appalachian region
- Mean Annual Temperature – 13.9°C
- Mean Annual Precipitation – 1371mm



Oak Ridge Experiment on CO₂ Enrichment of Sweetgum



- *Liquidambar styraciflua* monoculture plantation started in 1988
- 2 elevated, 2 control plots
- Each plot is 25 m diameter with ~90 trees
- Full year of pre-treatment measurement in 1997
- CO₂ exposure (550 ppm) started spring, 1998

Rationale

- To assess the role of trees in the global cycling of carbon
- How that role will change as the atmosphere becomes progressively enriched with CO₂.

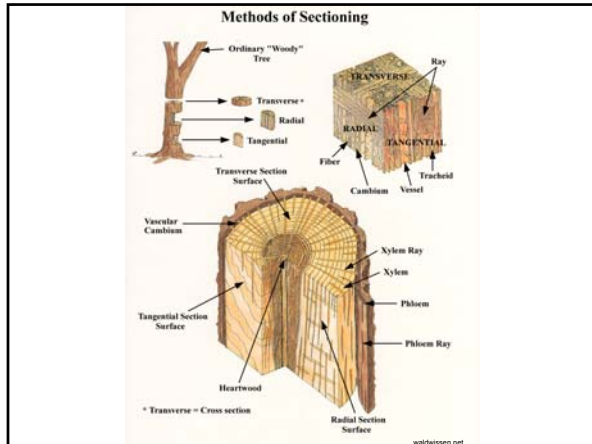
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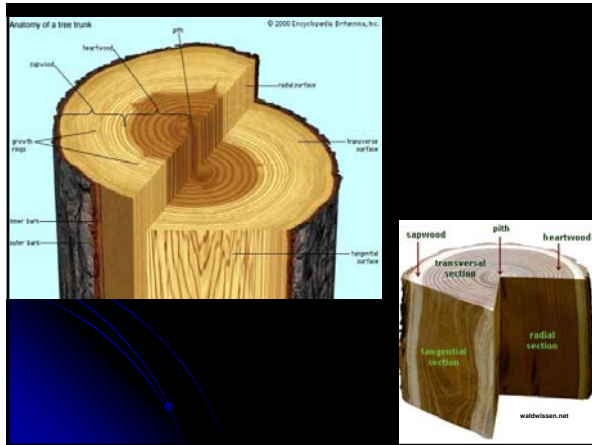
- Important in Forest Industry
- Most of the studies in seedlings
- Help dendrochronological studies to reconstruct the impact of historical increase in CO₂

Objectives

- To determine chemical properties of Sweet gum - cellulose and lignin content.
- To ascertain physical and anatomical properties of sweet gum - vessel area, vessel density, ray length and wood density.
- To determine the conducting sapwood area.

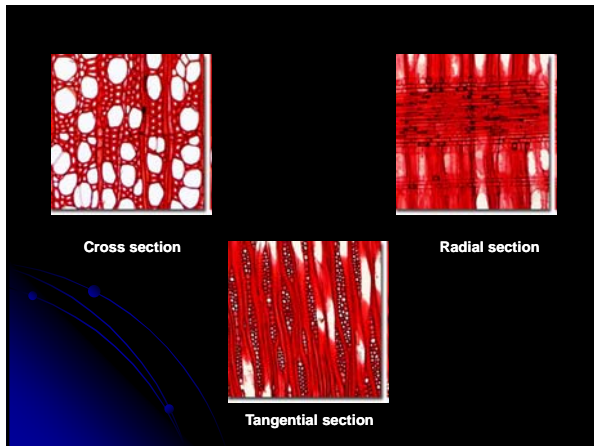
Methods

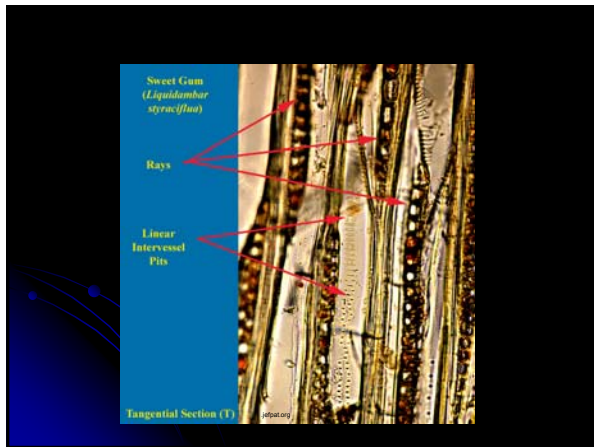


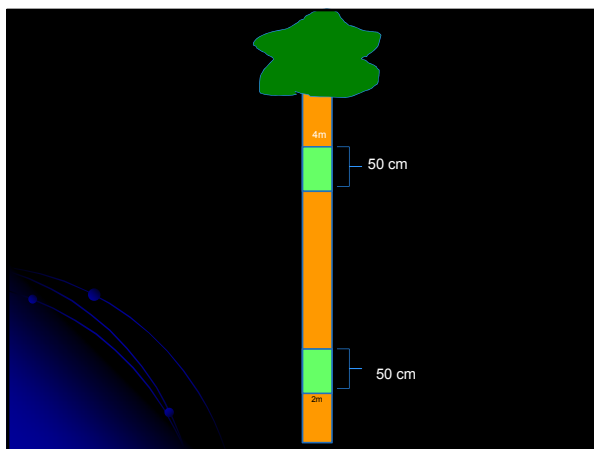


Anatomy

- 1 cm³ sample
- Boil and embed in polyethylene glycol
- 20 μm sections
- Stain with safranin
- Mount on Canada balsam
- Camera mounted on microscope
- Image J







Chemical Constituents of Wood

Wood contains three major chemical constituents: cellulose, hemicellulose, & lignin.

- Cellulose constitutes about 40 to 50% of wood & it is responsible for most wood properties.
- Hemicellulose surrounds cellulose microfibrils
- Lignin binds and provides rigidity as well as plastic nature

Chemical analyses

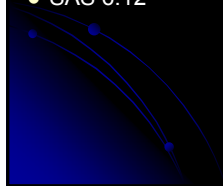
- 2g milled stem wood
- Extract in acetone(150ml) by Soxhlet method
- Alpha cellulose, gravimetric and acid soluble lignin analyzed from extractive free samples as described in NREL

Sapwood area

- Conducting sapwood area
- Freeze the wood sample
- Perfused with degassed water
- Degassed acid fuschin dye
- Fix the dye
- image J

Statistical Analysis

- Means and standard errors for each parameter
- Test for statistical difference ANOVA
- SAS 6.12



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