

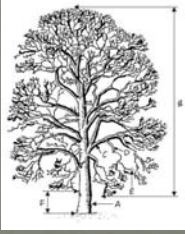
**APICAL BUD STRENGTH
TESTS AND TREE SWAY
MOVEMENTS TO EXAMINE
CROWN ABRASION**

Tyler Brannon
M.S. Candidate
Forestry, Wildlife and Fisheries

Wednesday, October 27th 2010 12:20pm Room 160 Plant Biotech Building

Tree Crowns

- Refers to leaves, stems and reproductive parts



<http://www.treetechno.co.uk/#/tree-terms/4521071322>

Tree Crowns

- Often under emphasized in forestry education.
 - Size and shape are a dynamic relationship
- Productive tissue of a tree
- One of the most easily influenced components of a tree (Larsen 2010)
- Production of photosynthate dictates shape and size of all other parts of a tree

What is Crown Abrasion/Friction?

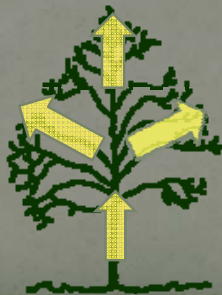
Tree crown edges impacting adjoining tree crowns with increasing force during wind sway

- Battered crowns and stems can become deformed and damaged
- Results in empty space between crowns
- Influence crown differentiation
- Stand dynamics and structure development



Crown Dynamics

- Crowns can only change in a few specific ways.



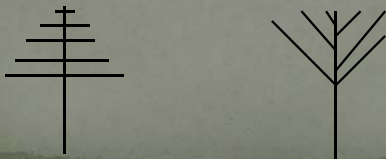
http://www.tree-scapes.co.uk/services/crown_thinning.htm

Growth Forms

- Apical Buds:
 - Preformed growth
 - All new leaf primordia are formed by or shortly after the time of rapid shoot elongation
 - Bud is set in early growing season
 - Sustained growth
 - Not all leaf primordia develop before spring
 - Development of new leaf primordia and shoot elongation occur – as long as conditions permit
 - Bud is set at the end of the growing season

Growth Forms

- Crowns:
 - Excurrent
 - Strong apical dominance (Pyramid shape)
 - Decurrent
 - Weak apical dominance (Round shape)



Effect on Stand Dynamics

- Canopy Gaps
- Inter-species competition
 - “One species terminal or lateral branches can be knocked off by tougher limbs of another species.” (Oliver and Larson 1996).
- “Development of cherrybark oak and sweet gum in mixed, even-aged bottomland stands in central Mississippi, U.S.A.” Clatterbuck and Hodges 1988.









Justification of Research

- Lack of research
 - Few studies have been done
 - Conifer emphasis
- Information missing from stand dynamic literature

Goal: To provide evidence on how crown friction/abrasion occurs and how it impacts stand development.

- Objectives
 1. Use a pendulum impact tester to determine bud strength limits.
 2. Measure and compare Crown movement during dormant and growing season using accelerometers.
 3. Conduct branch analysis for evidence of crown abrasion.

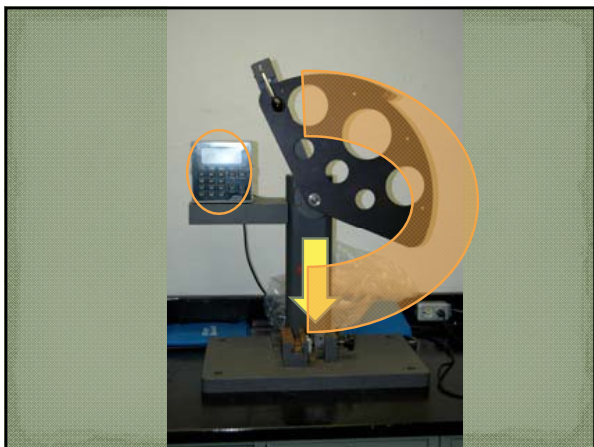
Hypotheses:

1. The preformed bud growth will require more energy to be broken than the sustained bud growth
2. Crown movements will be more rapid in the dormant season than in the growing season
3. Branch growth will not be distributed equally in crowded trees

Methods

- Use a pendulum impact tester to determine bud strength limits.
 - Tinius Olsen Impact Tester for Plastics
 - Samples will be gathered and tested within hours of collection
 - Toss Corrections for low energy





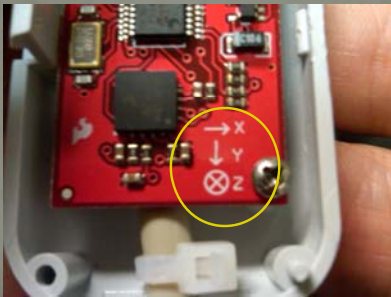
Methods

- Measure and compare Crown movement during dormant and growing season using accelerometers.
- Accelerometers
 - 3-axis
 - Records at 10 hertz
 - Records at range +/- 4 g's
- Anemometers
 - Records average wind data/minute
 - Records gust events



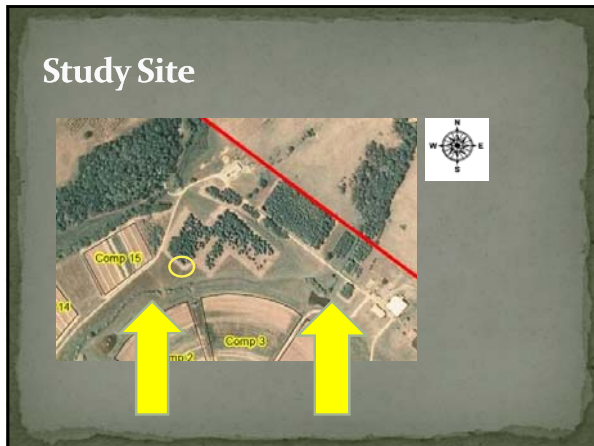
Methods

- Accelerometers



Study Site





- ### Study Site
- Nuttall oak stand
 - Chosen criteria
 - 40 feet, planted spring 1993
 - Live crown at 9 feet, branches extend 16feet
 - Symmetrical crown
 - Open to prevailing wind
 - Accessibility
 - Accelerometers
 - Placed in each 4 cardinal directions of the crown
 - 20 feet into crown
 - 2 feet from from the tip of the branch



Methods

- Conduct branch analysis for evidence of crown abrasion.
- Branch analysis
 - "Partial stem analysis"
 - Standard sampling intervals
 - Use of Dendrochronology



Analysis

- Impact tests
 - To be analyzed using ANOVA in SAS, Version 9.2
 - $\alpha = 0.05$
 - Test differences between treatments (species)
 - Test differences between treatment groups (growth forms)

Analysis

- Crown Movements
 - Regression
 - Prediction model of movement using wind speed
 - ANOVA in SAS, Version 9.2
 - $\alpha = 0.05$
 - Test differences between dormant and growing seasons

Acknowledgements

- Committee Members
 - Dr. Wayne Clatterback, UTK
 - Dr. David Harper, UTK
 - Dr. Arnold Saxton, UTK
- Tennessee Department of Forestry
 - John Conn
 - Thomas Strickland
- Many others
 - Dr. Jason Henning, UTK
 - Dr. David Larsen, University of Missouri
 - Dr. Kevin Kit, UTK

Questions?
