Vegetation Response to Tornado Disturbance and Subsequent Salvage Logging in an East Tennessee Oak-Hickory Forest; 14 Years Post-Disturbance

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Introduction

- Background Information
- Justification for Research
- Objectives
- Design and Methods

Background Information

- February 21, 1993: F3 tornado hits Oak Ridge, TN
  - Path length: 10 miles
- UT Forest Resources Research and Education Center (FRREC)
  - 352 total acres damaged
  - **249 acres heavily damaged**

Background Information

Background Information

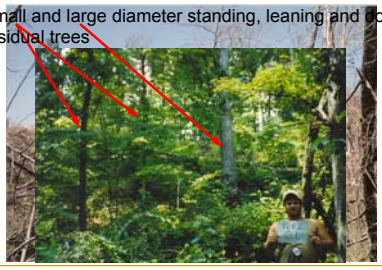
- Wind is one of the main causes of large-scale disturbance (Canham and Loucks, 1984)
- Large scale wind disturbance = long term effects on stand composition (Clinton and Baker, 2000)

Background Information

- Late spring '93 **salvage harvest** begins
  - Standing, leaning and downed merchantable timber harvested
  - Unmerchantable, small diameter timber left standing, leaning, and on the ground

Background Information

- 2 tornado areas left **unharvested**
  - Large gaps; large amounts of woody debris
  - Small and large diameter standing, leaning and downed residual trees



Background Information

- **Slashing** in 2 areas following salvage
  - Cut all leaning and standing tree > 2" DBH
  - All harvested timber were left on the ground

Background Information

- **Clearcut harvested in summer of 1989**
  - Part of mixed pine-hardwood planting/site prep. study

Background Information

Treatment Summary:

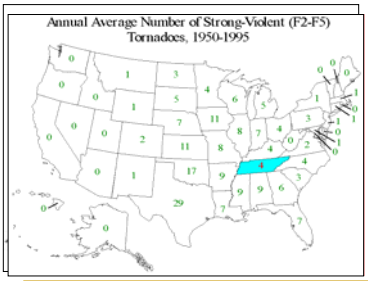
- Tornado disturbance only (T)
- Salvage harvest (S)
- Salvage harvest, then slashed (S/S)
- Clearcut (CC)
  - From separate study 3 years prior to tornado

Background Information

- Summer 1993, Karen Andreadis begins thesis project on mammal communities
  - tornado disturbance vs. clearcut
- In 1994, Chris Newbold begins thesis project on bird communities.
  - tornado disturbance vs. salvage vs. clearcut
  - extensive vegetation data collected

Background Information

Tornadoes in East TN are relatively infrequent



Tornadoes documented since 1950

- East TN:
  - 140 total
  - 56 strong-violent
- Anderson County:
  - 5 total
  - 1 strong-violent (2/23/93)

http://www.ncdc.noaa.gov/oa/climate/severeweather/tornadoes.html#history

Justification for Research

- Nature of large-scale wind disturbance makes it difficult to study
- Little research is available more than 10 years post-disturbance.
- VERY little work looks at salvage harvests.

Objectives

- Compare stand characteristics between treatments.
  - species composition, diversity, stocking, structure
- Compare coarse woody debris (CWD) loads between treatments.
  - density, % cover, volume
- Compare natural and anthropogenic disturbances (clearcut vs. tornado disturbance).
- Examine successional trends by comparing Chris Newbold's data to mine
  - (tornado- and salvage-areas only)

Hypotheses

H_O: all treatments are similar
H_A: all treatments are not similar

…for the following:

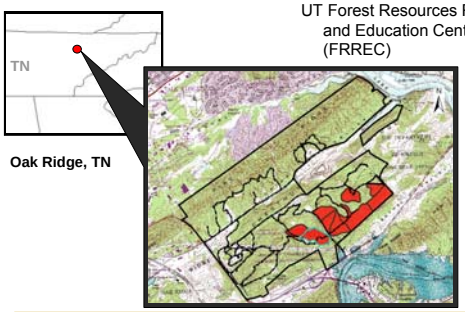
- Cluster analysis
- Diversity (Shannon's H)
- Diameter distribution
- Stem densities
- CWD volume, % cover, and density

Expectations

- Diversity (using Shannon's H')
  - Herbaceous and woody vegetation will be similar between all treatments
- Stem Density (stems per acre)
  - All treatments will have different densities
- Diameter Distribution
  - T ≠ S ≠ S/S, CC
  - S/S and CC will have similar distributions but at different diameters
- CWD
  - All treatments will have different volumes, densities and % coverages

(T = tornado; S = salvage; S/S = salvage/slash; CC; clearcut)

Methods – Study Site



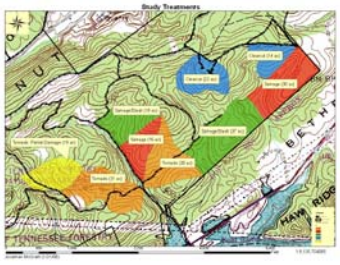
UT Forest Resources Research and Education Center (FRREC)

Experimental Design

Complete Randomized Block Design

- 4 treatments
- 2 blocks per treatment

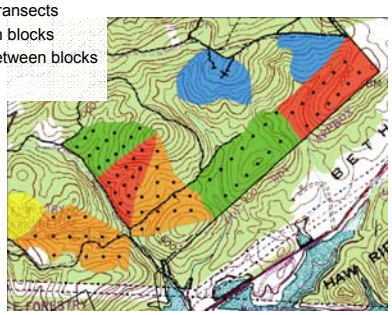
- **Tornado**
  - 31, 28 ac.
- **Salvage**
  - 16, 30 ac.
- **Salvage/Slash**
  - 19, 37 ac.
- **Clearcut**
  - 5 1-ac. blocks



Plot Layout

- Plots laid out along transects
- Spaced evenly within blocks
- Spaced differently between blocks
  - Variable block size

Trtmt. Block	# Plots
T1	14
T2	13
S1	13
S2	12
SS1	12
SS2	13



(Clearcut block layout yet to be determined)

Methods – Vegetation

Overstory Plot

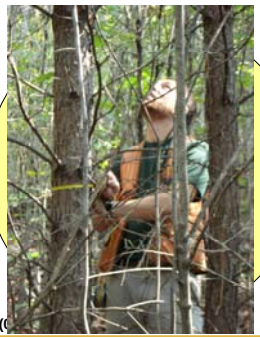
- Percent Slope, Aspect, Slope Position
- Trees ≥ 4.5" DBH
  - DBH (1" classes)
  - Species

Overstory: 0.1 ac. (0.04 HA)

Methods – Vegetation

Midstory Plot

- Trees 1.5" to 4.4" DBH
  - DBH (1" classes)
  - Species

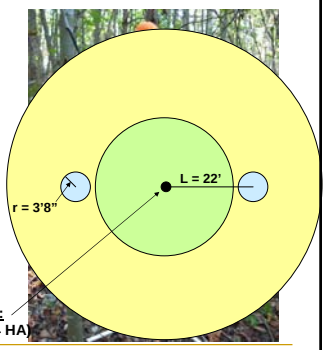


Midstory: 0.02 ac. (

Methods – Vegetation

Understory Plot

- Trees < 1.5” DBH, Ht. ≥ 4’)
  - species
- Woody plants < 4’:
  - species presence
- Herbaceous plants:
  - species (spp. groups) presence

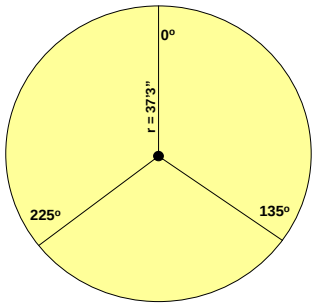


Methods – CWD

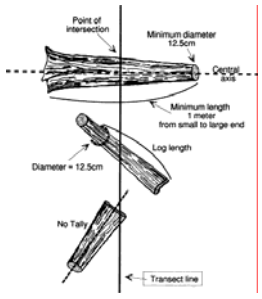
Line Intersect Method (Waddell 2002)

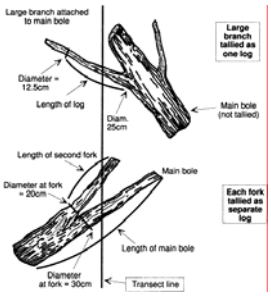
- Min. diameter = 5” (12.5cm)
- Min. length = 3.3’ (1m)

Measure diameter at large and small end and log length



Methods – CWD





Methods – CWD

From DeVries, 1974

- Volume of a log
  - $V_{ft} = [(\pi/8)(D_S^2 + D_L^2)l]/144$
- Volume per acre
  - $V_{ft}/ac. = (\pi/2L)(V_{ft}/l_t)f$
- Density
  - $Logs/ac. = (\pi/2L)(1/l_t)f$
- Percent cover
  - $\% Cover = 0.25\pi(D_S + D_L)/L$

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