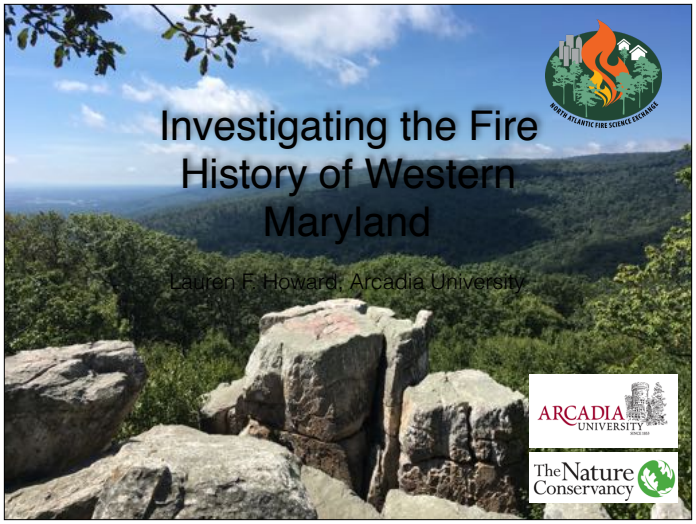


1

Why Study Fire History?

Shows that fire was an important component of the forest in the past

Provides context for how the current forest of fire-adapted species developed

Identifies range of variation in historic fire characteristics, which is useful for burn managers today

Photo: North Atlantic Fire Science Exchange

2

Why Study Fire History

🔥 Fire is misunderstood and feared

Consequences of misunderstanding can be bad

Becoming more of an issue with climate change, droughts

Eastern wildfires are becoming more like western wildfires - Gatlinburg TN, 2016

3

4

Climate Change

Increase in precipitation leads to increase in fine fuels
Increase in frequency and intensity of droughts

5

History of Catoctin Area

Area around Thurmont was Algonquin & Lenape land prior to European settlement

In the 18th Century it became Tuscarora (Iroquois Confederacy)

First German settlers 1729

Thurmont was incorporated as Mechanicstown in 1750's. Included German, Irish & enslaved African peoples

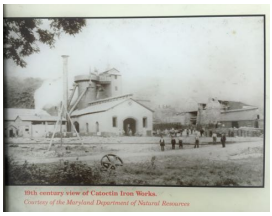
Thurmont got its name in 1894.

6

Catoctin Furnace 1774-1903

In 1873, the furnace was converted to coal

Catoctin Mountain Park was begun in 1936 by the CCC, finished 1954 & run by NPS



Fire Suppression

Weeks Act, 1924

Advances in technology after World War II

Ecological changes in former fire-adapted forests:

- Loss of reproduction of fire-adapted pine & oak species
- Mesic shade tolerant species increase

7

Pitch Pine

Chestnut Oak

Black Huckleberry

Blueberries

8

Old Pitch Pine

Old Chestnut Oak

Black Gum Midstory

Overmature Mountain Laurel & Blueberries; Much CWD

9

10

Purpose of This Study

Fire history information will aid in the design of controlled burn strategies in Maryland

The only fire history studies so far in MD are Dobey et al.'s 1987 study at Catoctin and Shumway et al.'s 2001 study at Savage Mountain.

We need more information.

11

Fire Studies from Maryland

	Dobey et al 1987	Shumway et al. 2001
Location	Catoctin Mountain	Savage Mountain
# of trees	8 pines	20 oaks
Mean Fire Interval (MFI)	5-49 years	7.6 years
Seasonality	N/A	Dormant Season
Last Fire	1936	1959

Other studies: PA: Brose et al. 2013, Marschall et al. 2016
VA: Aldrich et al 2010, 2014; Silver et al 2013
WV: Hessl et al. 2011

12

My Hypotheses

Hypothesis 1… expect frequent fire (10-20 year intervals) prior to fire suppression era, then drop off > 1930

Hypothesis 2… fire years may be correlated with drought (PDSI)

Hypothesis 3… fire adapted tree species may not have many small individuals, but mesic species might be reproducing a lot

13

My Goals

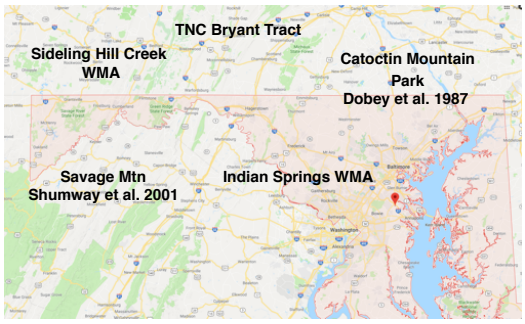
To give you a sense how fire histories are investigated and constructed!

Walk you through field and laboratory methods

Crossdating and analysis

What you can get with fire history data

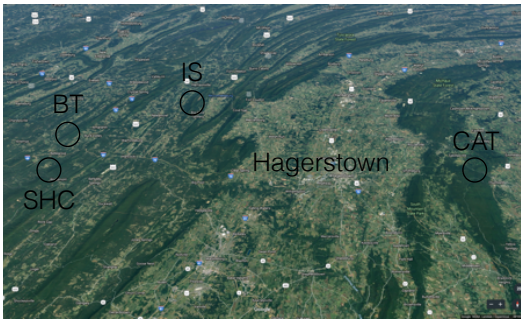
14



Locations of 4 Study Areas in MD

The goal was to cover western part of the state to the east of Shumway et al.'s 2001 study of Savage Mountain.

15



Locations of 4 Study Areas in MD

Study areas were in the Ridge & Valley region, east of the Allegheny Front at Cumberland.

Imagery: Google Earth

16

Catoctin Park

We looked for evidence of fire on piney west- and south-facing slopes.

Imagery: Google Earth

17

Field Work

Located all fire scarred trees in a 1 square km area on south- or west-facing slopes

- GPS, aspect, dbh, species ID
- Collected section or partial section

Characterized vegetation in 2, 500-m^2 circular plots

- Cored all trees > 4" dbh for age structure

18

19

Recorder Trees

- Survive surface fires
- Heal afterwards
- Are likely to scar again
- This one shows 7 fires
- Likely more scars internal

20

Laboratory Analysis

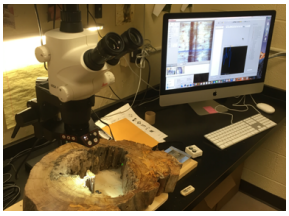
Sand cross sections smooth with multiple grades of sandpaper to 400-600 grit

Measure annual ring widths using a Velmex stage, microscope, and computer

Cross-date samples to check for missing or false rings

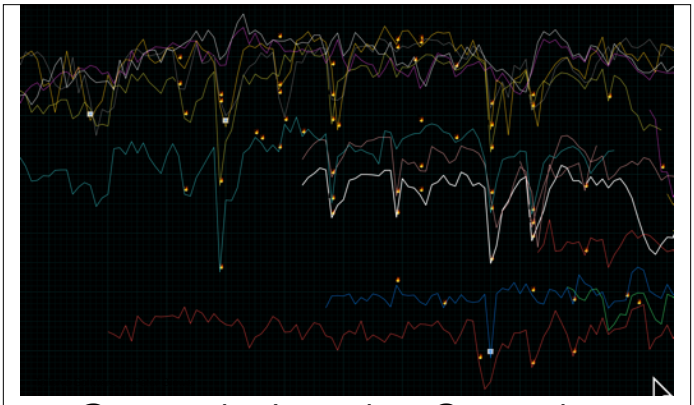
Identify years and seasons of fire scars on the samples

21



22

23

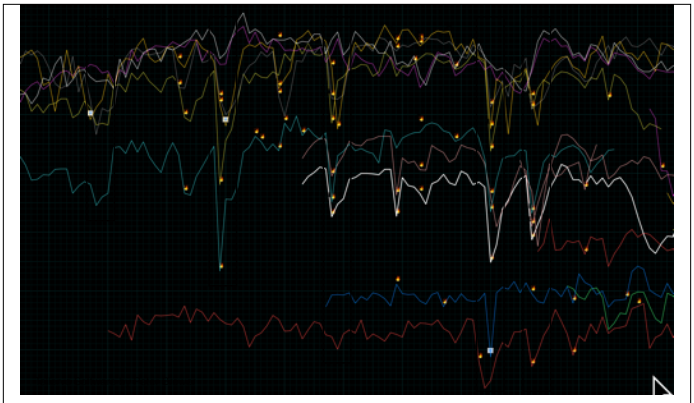


Crossdating the Samples

Radial Growth Plots showing wide and narrow rings on a timeline
Fire scars are the flame icons 🔥

24

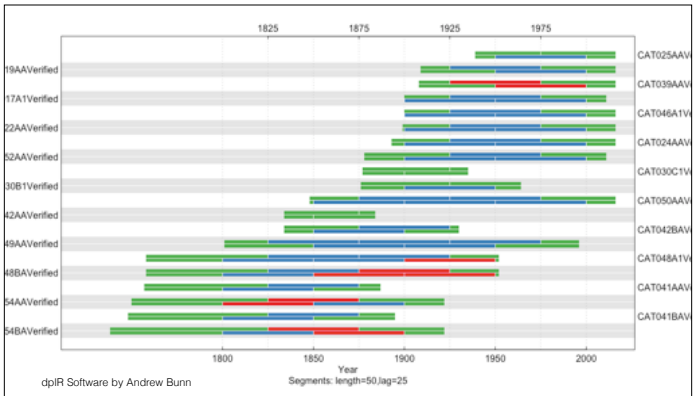
25



Crossdating the Samples

Radial Growth Plots showing wide and narrow rings on a timeline
Fire scars are the flame icons 🔥

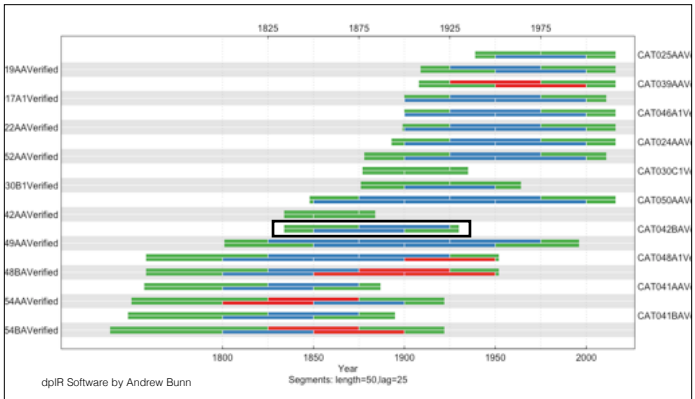
26



Crossdating the Samples

Series Intercorrelation of > 0.32 is significant
dplR, the R version of COFECHA, is analyzing 50 year segments

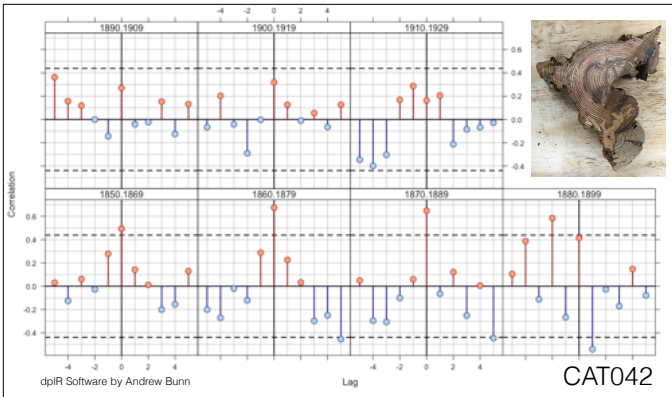
27



Crossdating the Samples

Series Intercorrelation of > 0.32 is significant
dplR, the R version of COFECHA, is analyzing 50 year segments

28



CAT042

Crossdating the Samples

The highest position is the best numerical correlation

dplR, the R version of COFECHA, is analyzing 20 year segments

29

Crossdating allows you to:

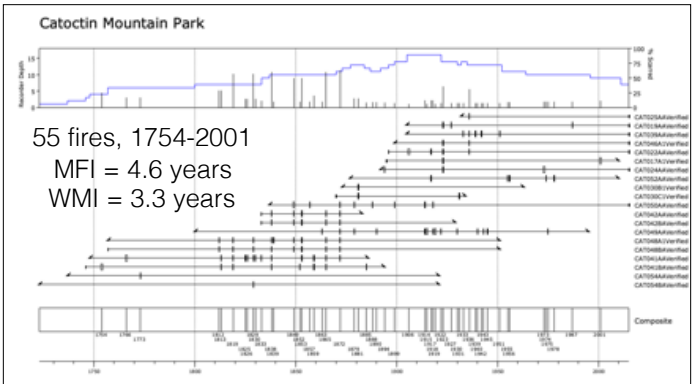
Check for dating errors.

Place floating samples on the timeline with statistical confidence.

Make sure every ring is assigned to its actual calendar year so that we can **date fire scars.**

I missed this micro-ring the first time!

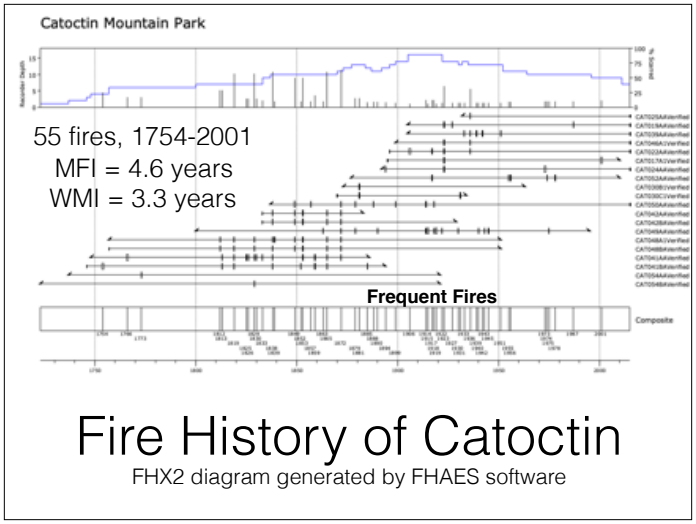
30



Fire History of Catoctin

FHX2 diagram generated by FHAES software

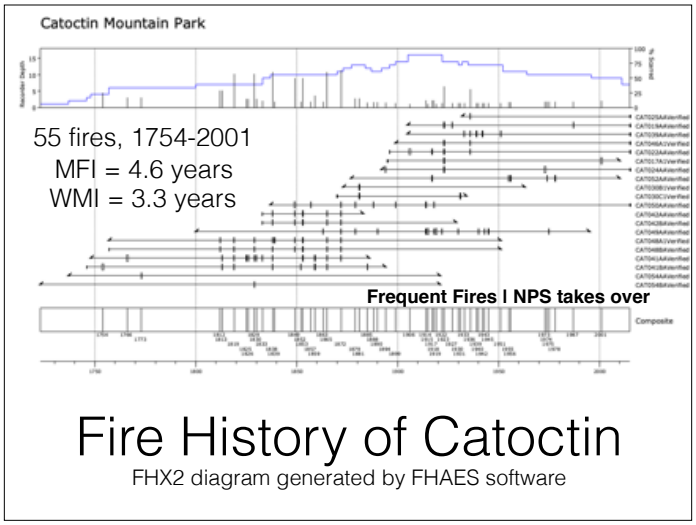
31



Fire History of Catoctin

FHX2 diagram generated by FHAES software

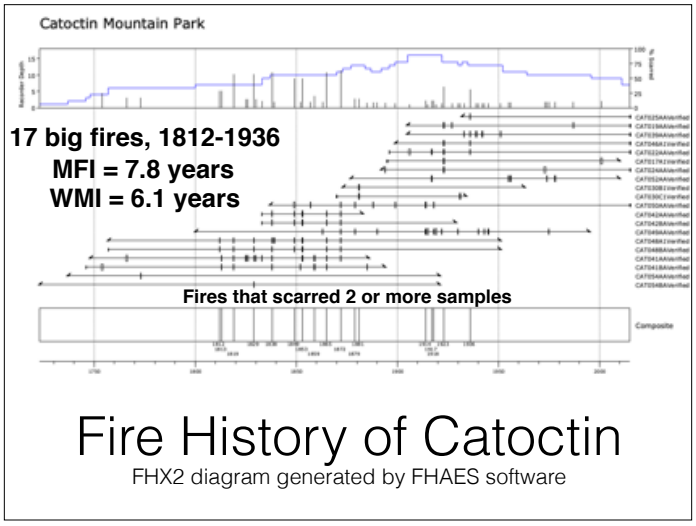
32



Fire History of Catoctin

FHX2 diagram generated by FHAES software

33



Fire History of Catoctin

FHX2 diagram generated by FHAES software

34

Newsworthy Fires

Archive research by Gabe Cahalan at the Maryland Nature Conservancy found newspaper articles confirming dates of wildfires in the Catoctin Area.

April 1923, for example, was a big fire! (5 trees, D)

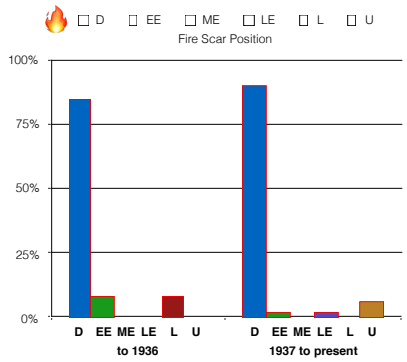
Seasonality of scars vary depending on what month the fire happened. For example a March fire can register as dormant or earlywood in MD.

35

Seasonality of Historic Burns

Dormant season burns (after leaf-fall or before leaf-out) accounted for 85% and 90% of burns before & after 1937, respectively. ——>

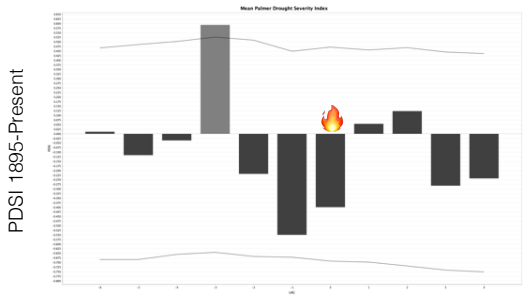
At Catoctin, 89 of 100 (89%) fire scars examined so far were dormant season burns.



36

Fires and Drought

Superposed Epoch Analysis



- Significantly wet year 3 years prior to fire
- Fires occur in dry years, but not significant

Increase in Mesic Understory with fewer fires today?

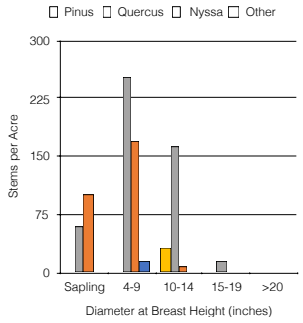
37

Lack of pine reproduction in the small size class

Abundance of black gum in the small size class

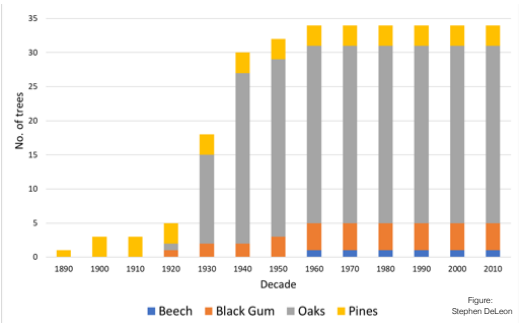
Oaks are well represented in the small and medium size classes, but have few new saplings

Data from 2, 500 m2 plots —>



Forest Composition from Increment Cores

38



Pines established around the turn of the century
Oaks and black gums established in the 1930-40's
The forest has remained relatively unchanged since 1960!

Major Conclusions

39

Pre-European fire regime was not recorded by the trees I have. I got back to the 1750's with a few trees.

Fire was frequent in the 19th & 1st half of the 20th centuries, which is consistent with the charcoal iron industry that began operating in 1774.

Few fires after 1950's at Catoctin; last big one was in 1936 just before Catoctin became a park.

Most fires occurred in the Dormant Season (between annual growth rings). This is consistent with other Appalachian fire history studies.

Fires occurred 3 years after significantly wet years and during drier years.

Forest succession has frozen since the 1960's with little regeneration. Midstory black gums and oaks are just as old as canopy oaks.

What is the future role of fire at Catoctin?

Fire History Studies like this provide historical context for burn prescriptions today.

Catoctin's oaks and pines are fire-adapted and arose during a time period with frequent 🔥.

However, controlled burning may not be enough to get pine & oak regeneration today without other management.

What do you notice? —->

40

Acknowledgements

The Nature Conservancy (Gabe Cahalan, Deborah Landau, and an anonymous donor)

Major funding for the project

Catoctin Mountain Park & the National Park Service (Lindsey Donaldson, Becky Loncosky)

Maryland Department of Natural Resources (Donald Rohrback)

Arcadia University

Undergraduates (Dani, Nate, Krystal, Kristyn, Baaqeyah, Hope, Stephen, Tori, Emilee, Nina)

Instructional Technology Grant

Faculty Development Grants

Summer Research Fellowships

Office of Sponsored Research & Programs

Joy Howard

Thank you!

41