Dendrochronology and Forest History

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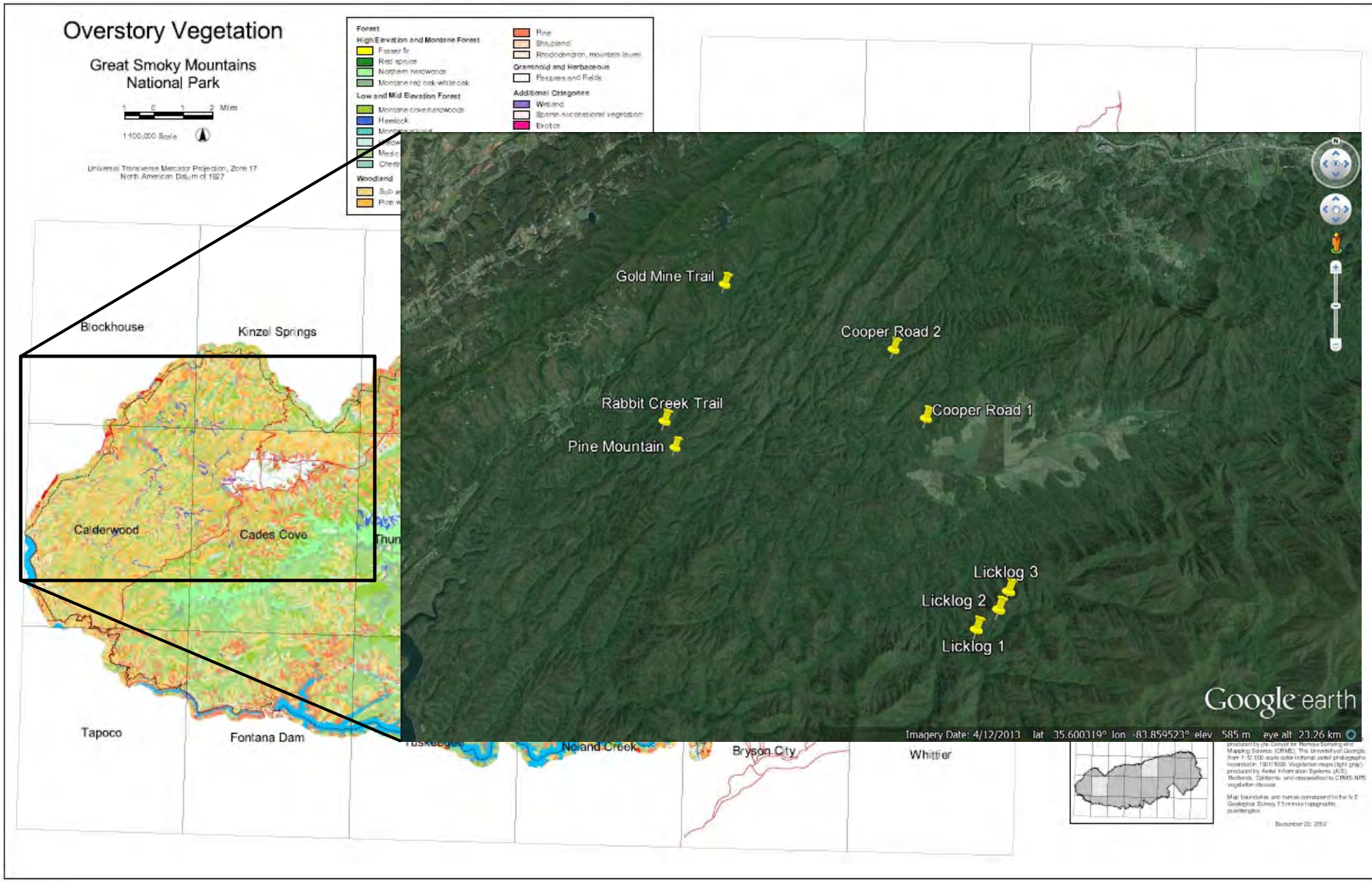
Basics of Dendrochronology

- **Dendrochronology:** *dendron* = "tree" or "branch"; *chronos* = "time"; *logos* = "word" or "thought."
- **Definition**: The science that uses tree rings dated to their exact year of formation to analyze temporal and spatial patterns of processes in the physical and cultural sciences.
- **Disturbance Processes**
  - **Fire regimes**: dominate the study types conducted in the U.S.
  - **Insect dynamics**: gaining traction in eastern U.S. with EAB and HWA
  - **Tree health**: effects of silvicultural management, various diseases and cankers, air/water pollution
  - **Climate dynamics**: short-term (drought), long-term (oscillations) in background
- **Stand Inventories**
  - **Tree establishment**: single pulse, multiple pulses, evenly distributed over time?
  - **Stand composition**: transitioning of tree and shrub species over time
  - **Stand structure**: percentage of seedlings, saplings, mature trees in each species
  - **Successional trajectory**: what will be from what we had and have now

Fire History from Dendrochronology

Great Smoky Mountains National Park



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"Jeremiad"?

Me too. Me too as in those folks are a "challenge" for me. Now, maybe, I am one. But delicacy isn't a strong suit and diplomacy has never been my top trait, so, at the risk of offending at least 31.1 percent of the Volunteer State's population, Tennesseans are fat.

This came crystal clear to me when wife Diane and I tried a new-to-us restaurant, one of those all-you-can-eat deals with fried pretty-much-everything and uncountable dessert bar offerings. As I passed plates piled high by less-than-svelte folk, I wondered if "All-You-Can-Eat" somehow translates to "Death to America" in some unknown tongue.

Anyway, yes, I've dropped a third of myself in the past year and have become a bit obsessive about calories consumed, calories burned, servings of fruits, vegetables and whole grains and such. Some around me have lost weight too because my ad nauseam emphasis on "healthy eating" causes some stomachs to churn, understandably reducing appetite.

But, seriously, Tennessee caloric intake so overwhelms caloric output that 31.1 percent of Tennessee adults were obese, with a body mass index greater than 30, in 2012, ranking us in the big-bottom 10 of the United States, behind, as it were, Ohio and Iowa in obesity, tied with Michigan and barely ahead of South Carolina and Kentucky in weightiness.

Louisiana, Mississippi, Arkansas, West Virginia and Alabama took the cake (and ate it) when it comes to rotundity while Colorado had fewer really fat

'A great natural laboratory'

Fire used to restore forest in Smokies

By Morgan Simmons
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WALLAND – Whether it's the giant tulip poplars that grow in the moist coves, or the spruce-fir forests that cover the high peaks, the Great Smoky Mountains National Park is famous for its camera-friendly trees.

At the far western end of the park is where you'll find a remarkable concentration of the park's old-growth yellow pines. It's a dry, low-elevation region of the Smokies that attracts relatively few visitors. The soil here is thin and rocky; the forest doesn't have the lush, rainforest look typically seen in park calenders or coffee-tablebooks. Historically, it's where most of the park's fires have occurred.

On a recent afternoon, half-a-dozen park employees — including Pedro Ramos, the park's acting superintendent — explored a prime example of this forest type in Lynn Hollow, at the western end of the park near the Foothills Parkway. Joining them was Henri Grissino-Mayer, professor of geography at the University of Tennessee and director of the Laboratory of Tree-Ring Science. Since 2005, Grissino-Mayer and his graduate students have studied the fire history of Lynn Hollow by examining the

The crown of an old-growth short-leaf pine tree spreads out over neighboring trees in the Great Smoky Mountains National Park on Feb. 6. Because of fire suppression, the species has declined since the 1930s.

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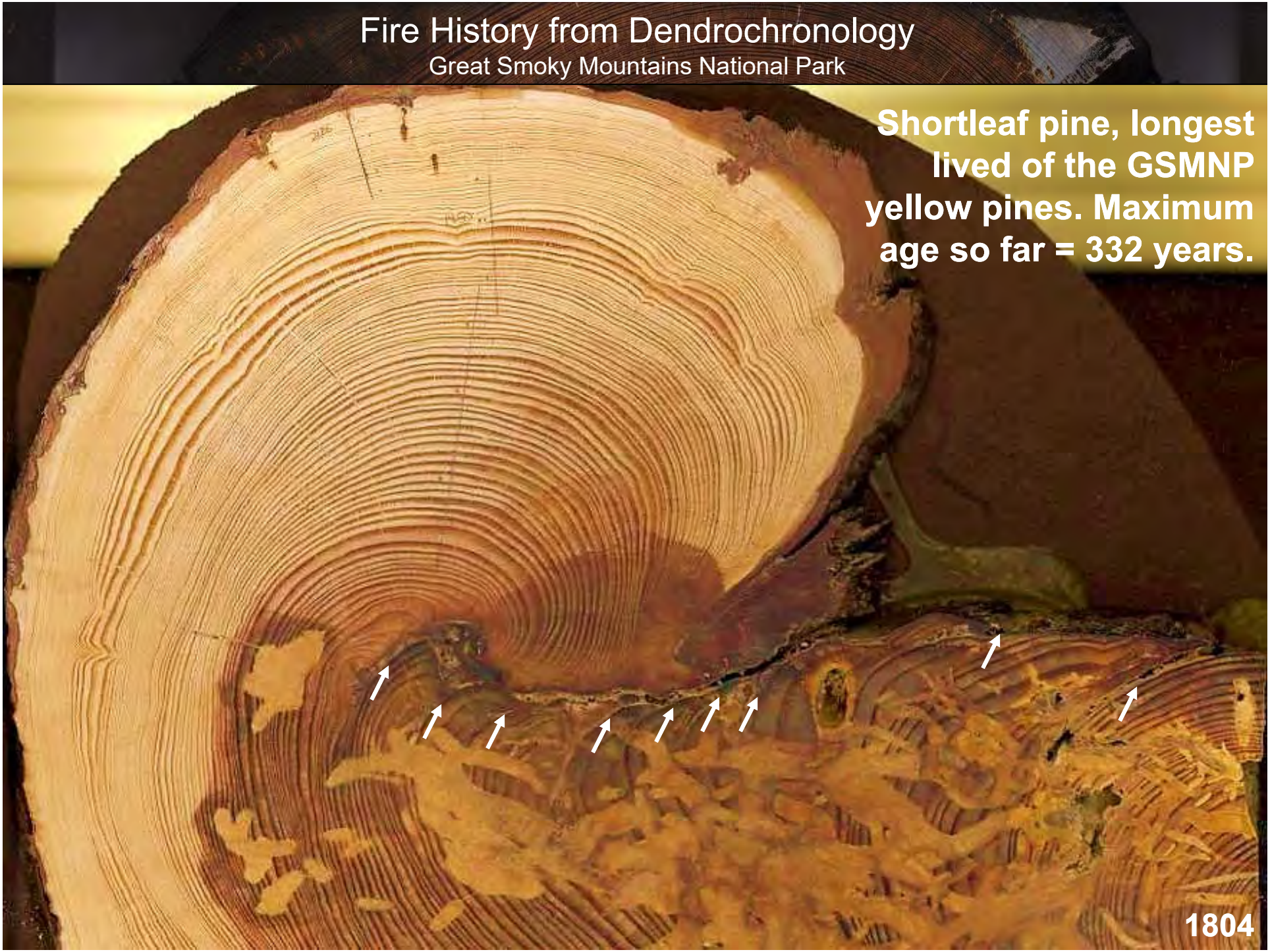
Great Smoky Mountains National Park



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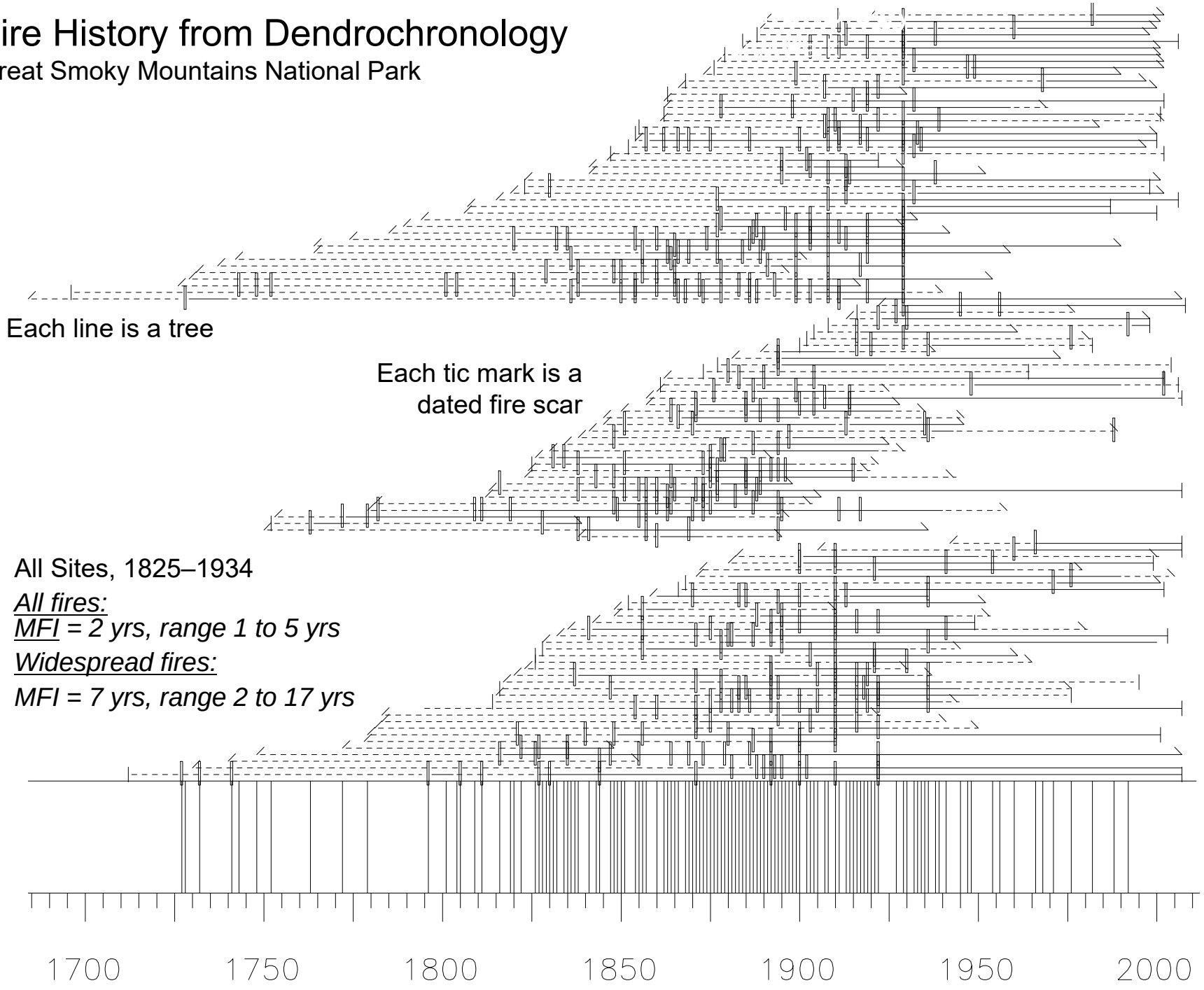

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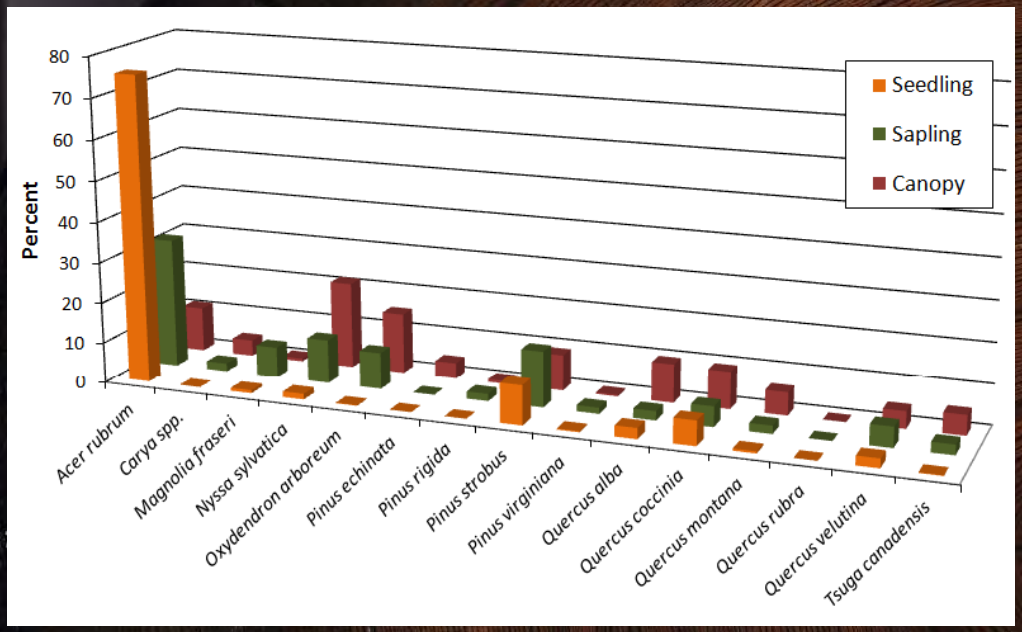

Fire-intolerant tree species are becoming dominant:

- Red maple
- Eastern white pine
- Black gum
- Eastern hemlock

Biggest take-home message:
Our yellow pines are not regenerating.

- Although "mesophication" is occurring, the proliferation of ericaceous shrubs is staggering such that any future wildfire could be catastrophic.
- Clear shift from yellow pine/oak dominated fire tolerant stands to fire-intolerant, shade-tolerant hardwood and conifer species.
- Fires are less common today, causing more fuels to build up, aided by southern pine beetle devastation, continuing the downward spiral, until some environmental threshold will be reached.
- Restoration will be difficult to achieve. How do we remove an entire understory and dense ericaceous shrubs? Re-introduction of fire could be detrimental rather than beneficial.

The take-home message about fire in the Appalachians…

- Fire was once a dominant disturbance process up until ca. 1925 to 1945.
- Climate itself cannot have been the primary ignition source of fire post-1800, nor the primary cause of fire cessation post-1925.
- If it was, then fires caused by lightning would be igniting today.
- So, what's different today?
- Most fires found in the tree-ring record were likely caused by human ignitions.
- Human ignitions were removed ca. 1925 to 1945 with establishment of national forests and national parks.

- It's possible that today's forests in the pine/mixed hardwood stands of the southern Appalachians are simply reverting back to the original fire regime that existed before human ignitions became common.
- Many eastern forests are thought to be undergoing "mesophication," fire-intolerant tree species are becoming more common.
- Soil charcoal study shows presence of mesic conifer charcoal in areas currently dominated by yellow pines, suggesting that "the current period of mesophication may not be unique in this ecosystem" (Underwood 2013).


Thank you!