

Fire and oak as keystone process-
genus in the eastern US

or



to Novel Ecosystems

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Forest composition greatly varied during last 10-12K yr in eastern US.

Long running debate - climate change vs. disturbance

At some point, Native American land-use (fire) became keystone process

To what extent did NA manage eastern forests: which ones, how and why?

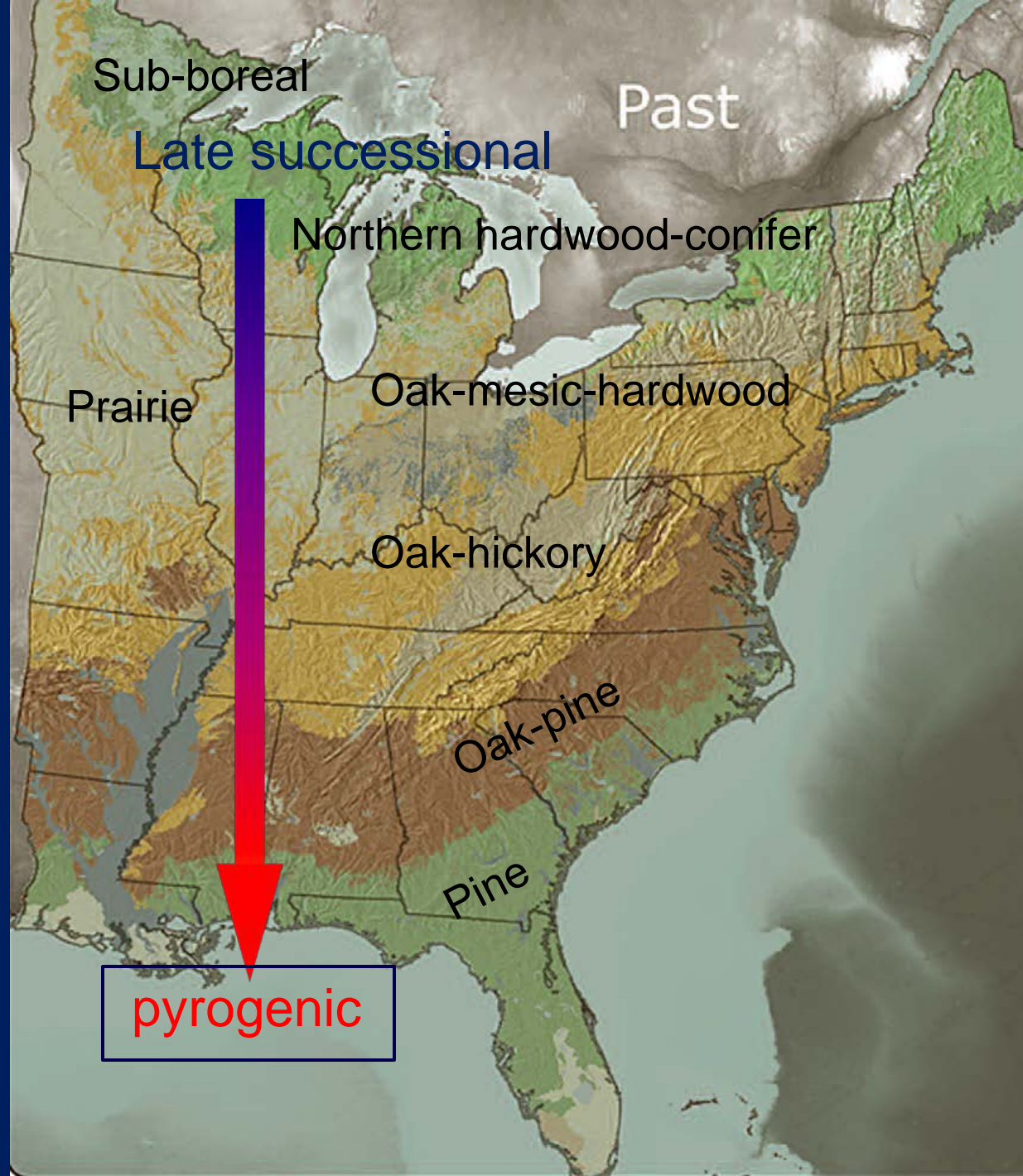
Fire-oak in eastern US are **keystone** process-genus.

~100 bird-mammals spp. depend on oaks as a major food source

Oak forests should be preserved; not accept **novel (invasive) ecosystems** that have no historical precedent

Talk themes:

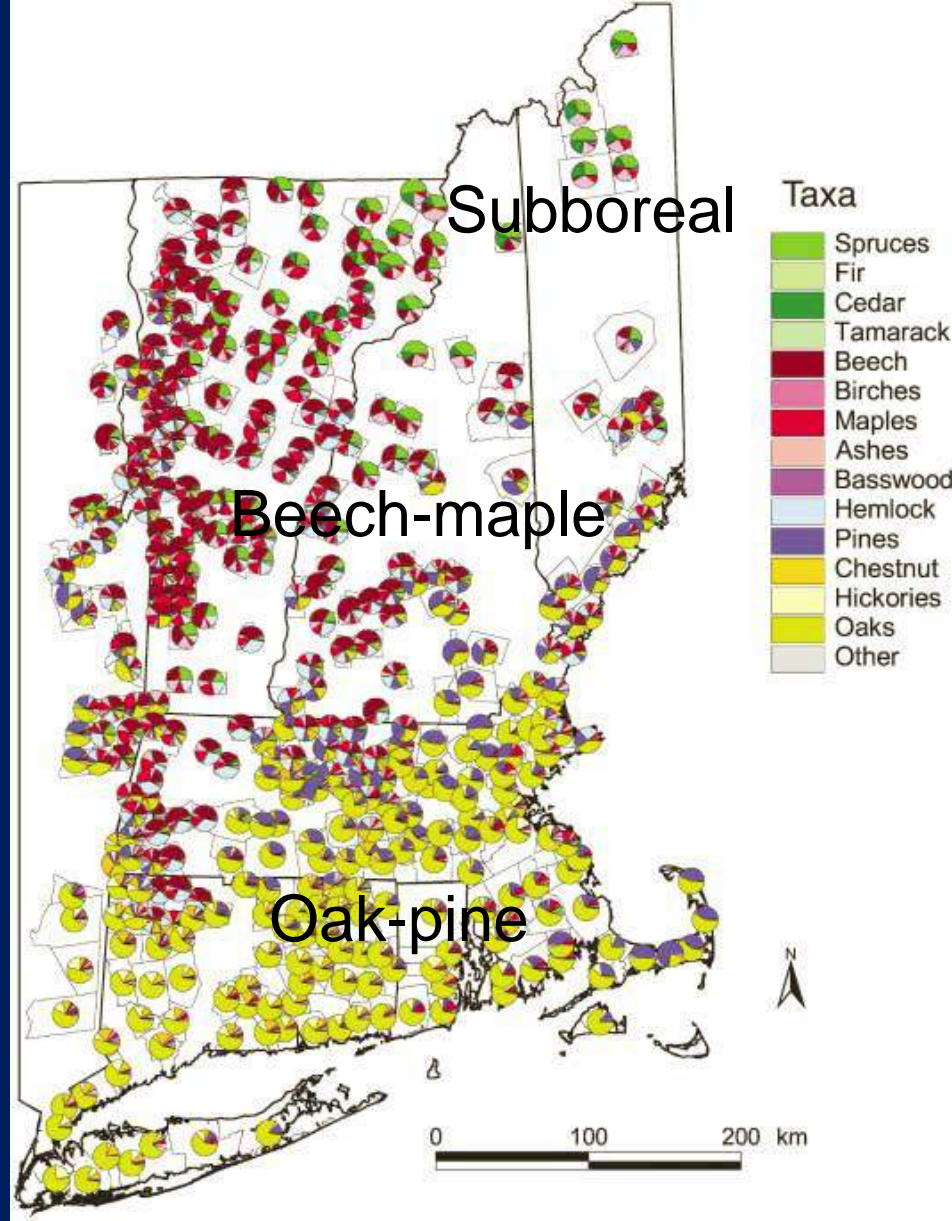
- Role of Am. Indians as forest managers
- NA depopulation-European settlement veg. impacts
- An ecological cycle (fire and oak) has been broken
- How to best manage eastern oak



Pre-European
settlement
forest types;
(Nowacki and
Abrams 2008)

Follows
climate trend,
but related to
other factors

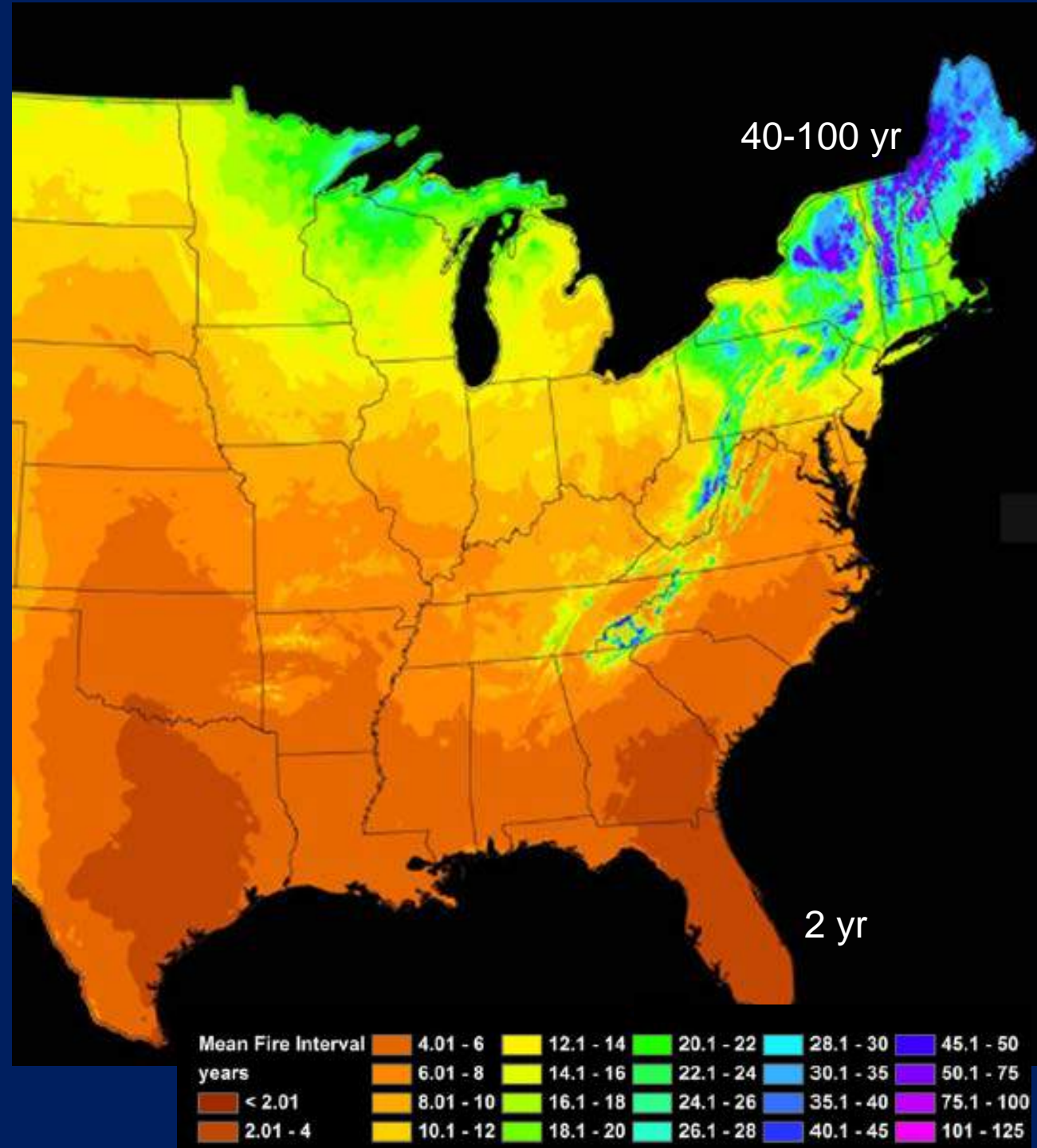
Temp-fire
gradient



Presettlement forests of New England; Cogbill et al. 2002

Presettlement fire regimes follow climate trend somewhat (but high in many northern locations)

Guyette et al. 2012



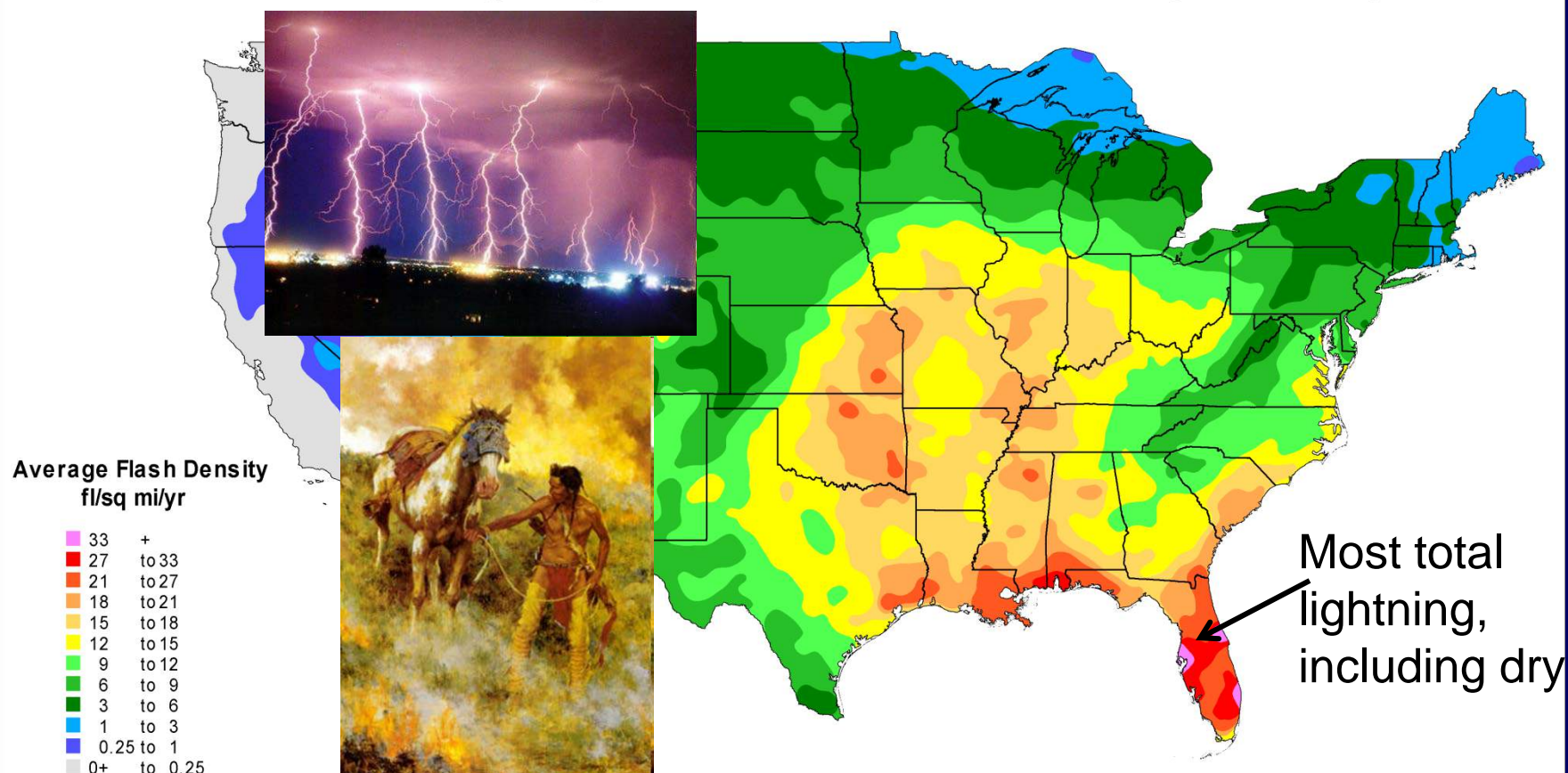
Climate-fire hypothesis- has big issue.

Fire needs an ignition source: “dry” lightning or human.

Dry lightning is rare in most of eastern U.S.

Vaisala's National Lightning Detection Network® (NLDN®)

Cloud-to-Ground Lightning Incidence in the Continental U.S. (1997 - 2011)



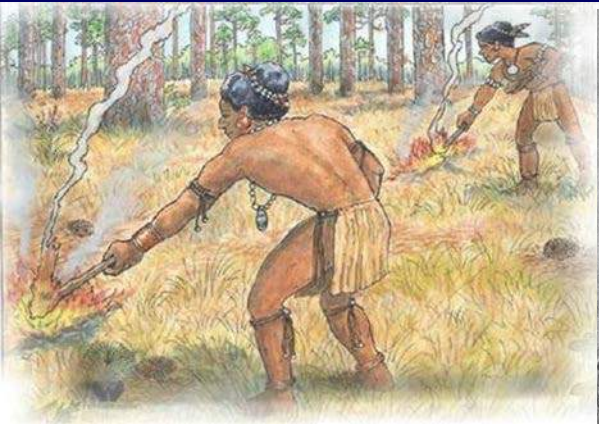
Broad-leaf, summer green forests not very conducive to burning

Human effort, timing (dry spring and fall) needed to explain so much **pre-European** fire in east.



If lightning fires were not that extensive....

The human-fire hypothesis:
Native American use of fire



Indian burning often observed by early explorers

Hunting- driving game animals

Crop and forest management

Creating and preserving agric. fields

Getting rid of unwanted tree species

Promoting desired species

Pest management

Felling trees and clearing land

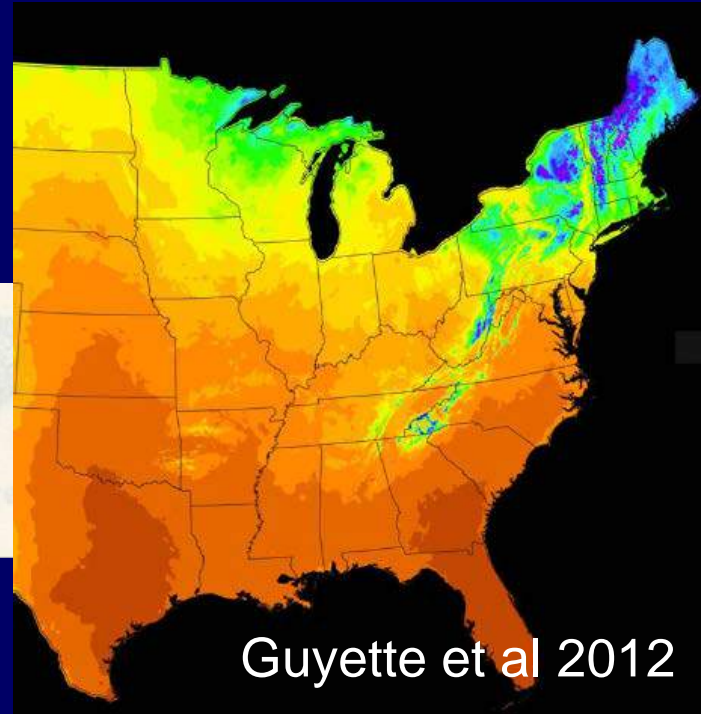
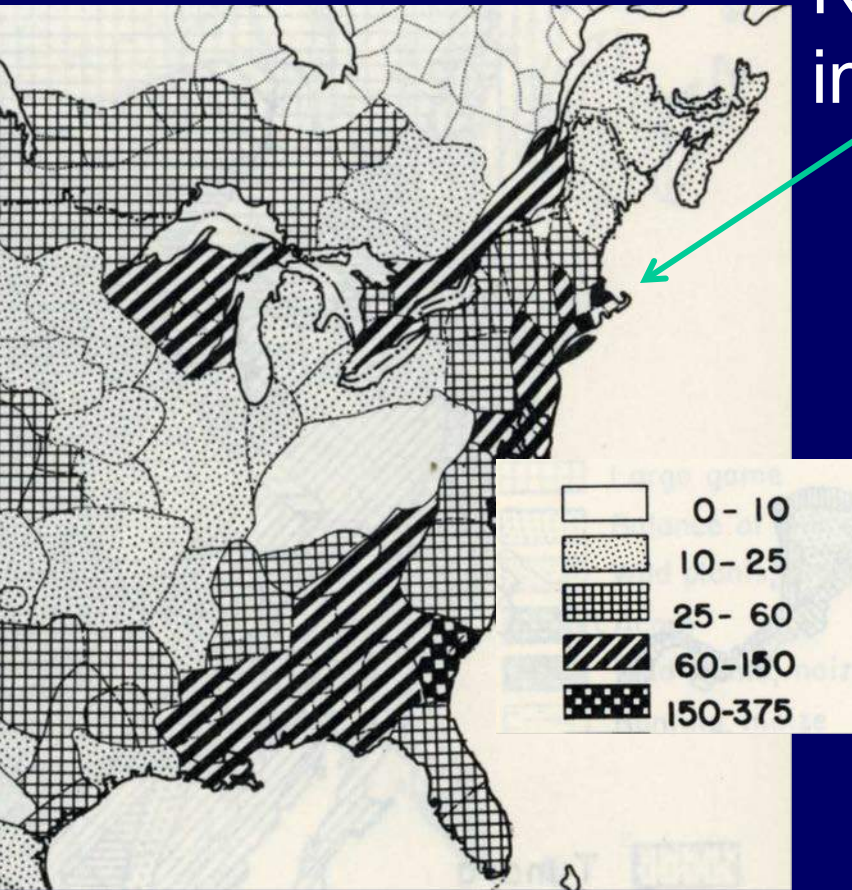
Culture of burning, very good fire managers!



Fire was essential to Indian diet (Abrams and Nowacki 2008). Set fires to promote mast and fruit trees, shrubs, grasses; attract, feed game they hunted



Native American # per 100 km²
in 1492 (Driver 1969)

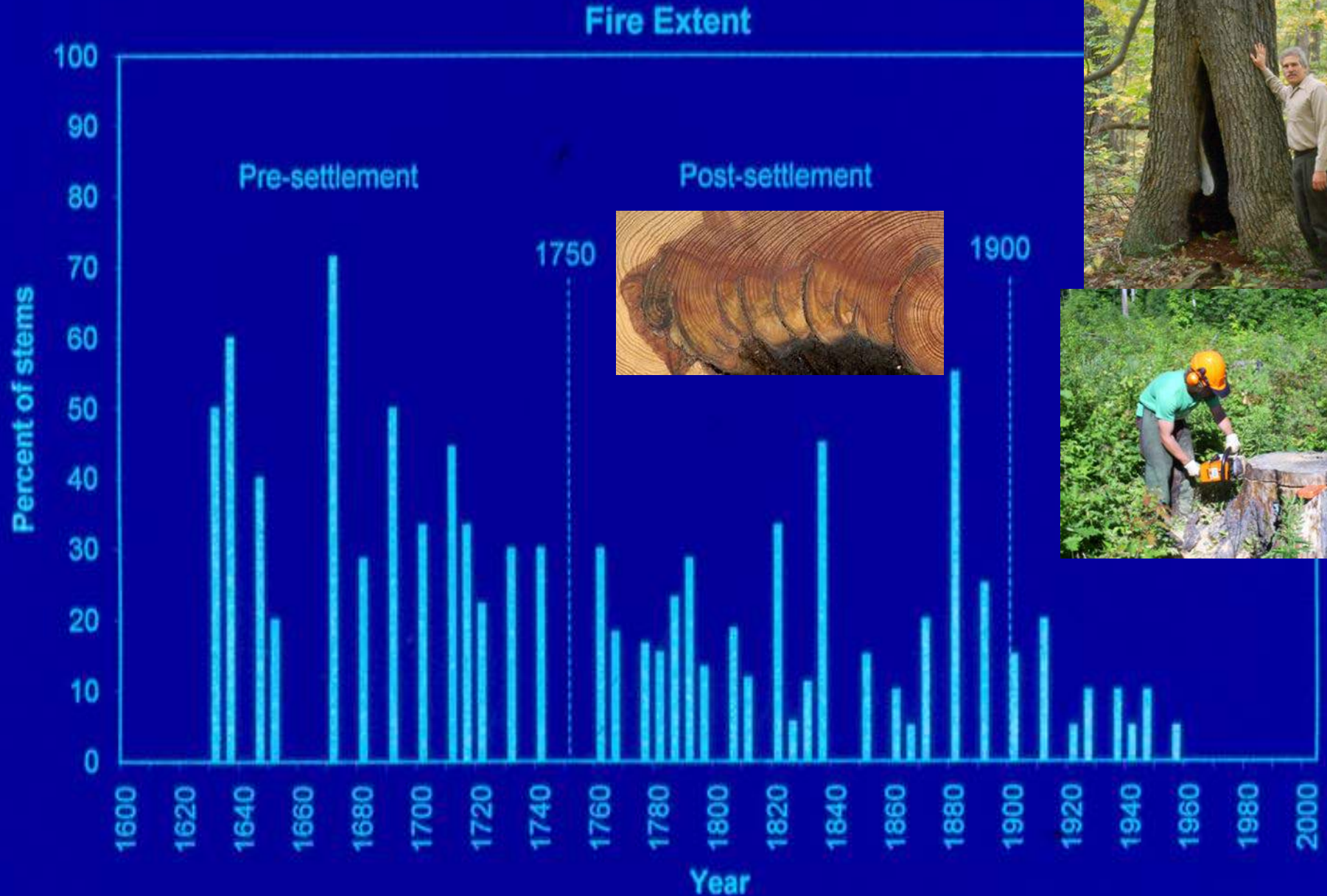


Now northern
fires makes
more sense

NA pop. #'s and fire frequency are related. Human ignitions
explain fire up north.

Fire history Savage Mountain MD, ~every 8 years 1630-1940

(Shumway, Abrams, Ruffner 2001)



Is there recent evidence for fire and oak?

Wildfires on military training facilities

Major ignition sources:

- 1) Prescribed burns
- 2) Exploding ordinances

Impact Area

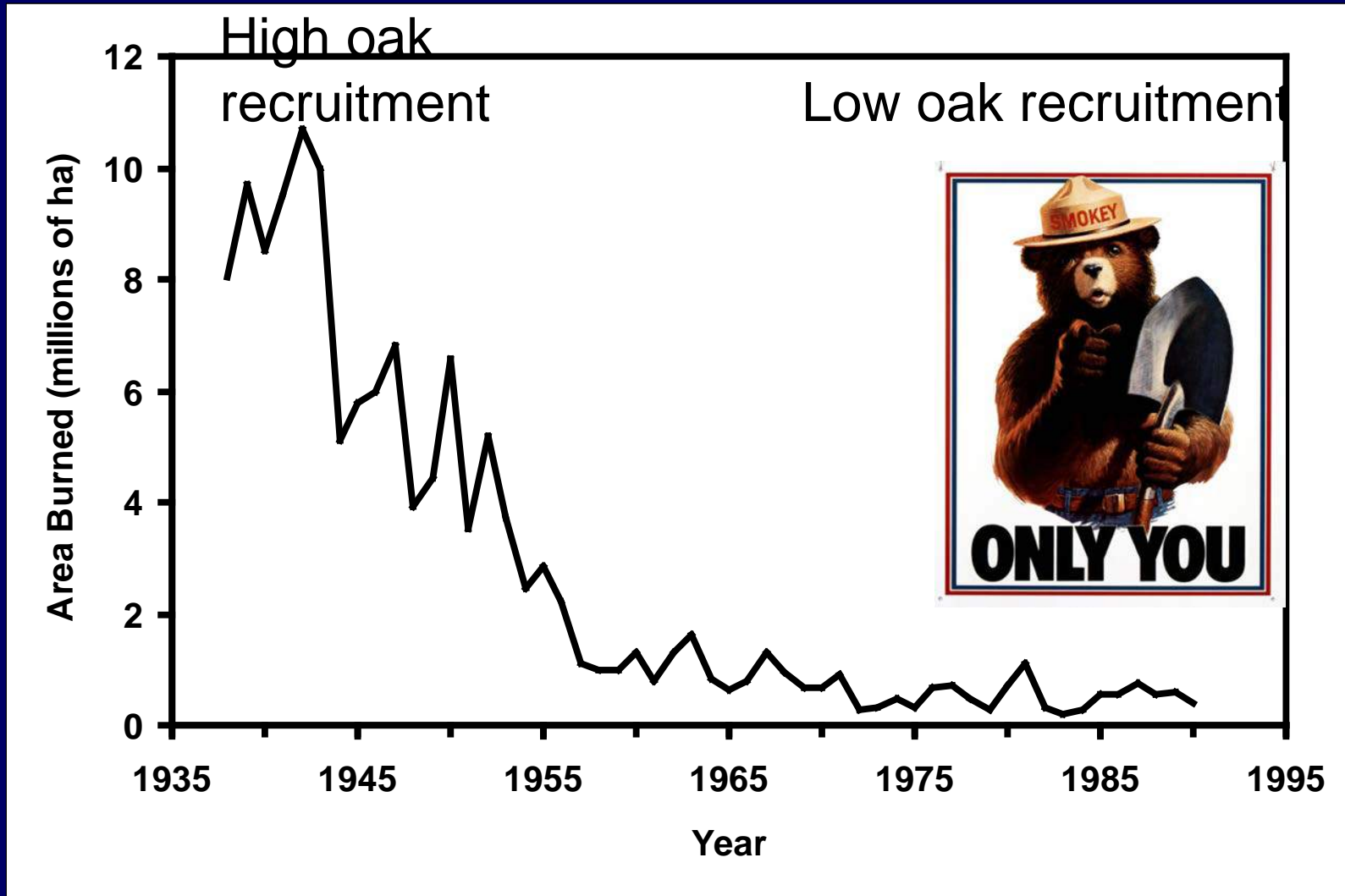


Dense oak saplings in open stand with frequent fire- Ft. Drum NY



06/02/2009

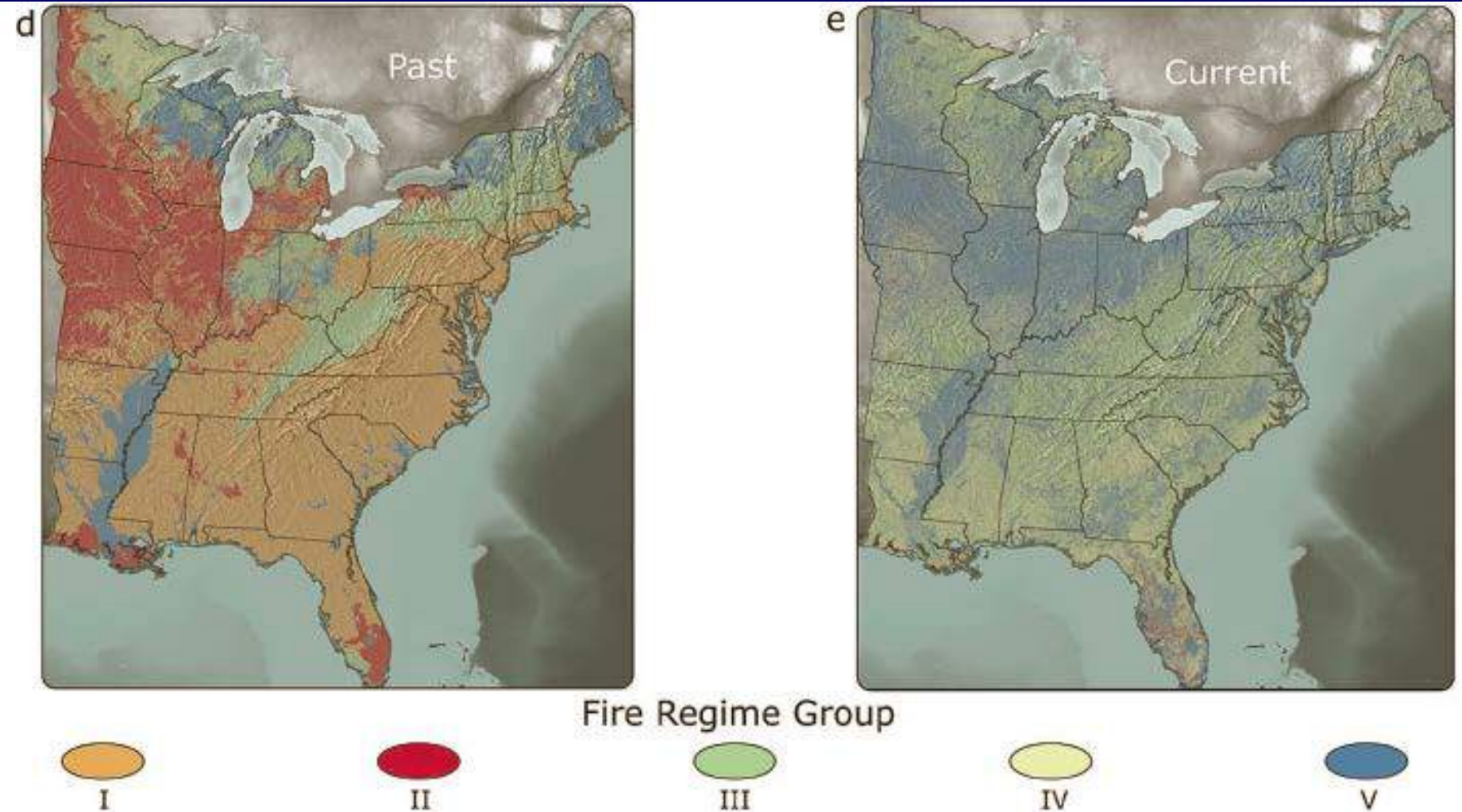
Most forests impacted by post-1940 fire suppression.
Producing unwanted **Novel Ecosystems** (Nowacki and Abrams 2008)



Red maple subcanopy in unburned oak forest
Do we accept **novel ecosystems** or manage to get oak back?

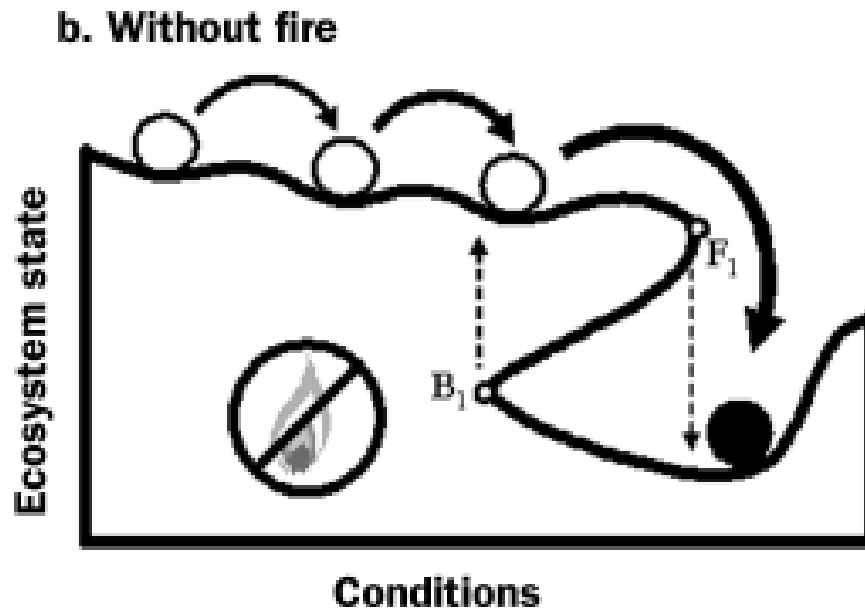
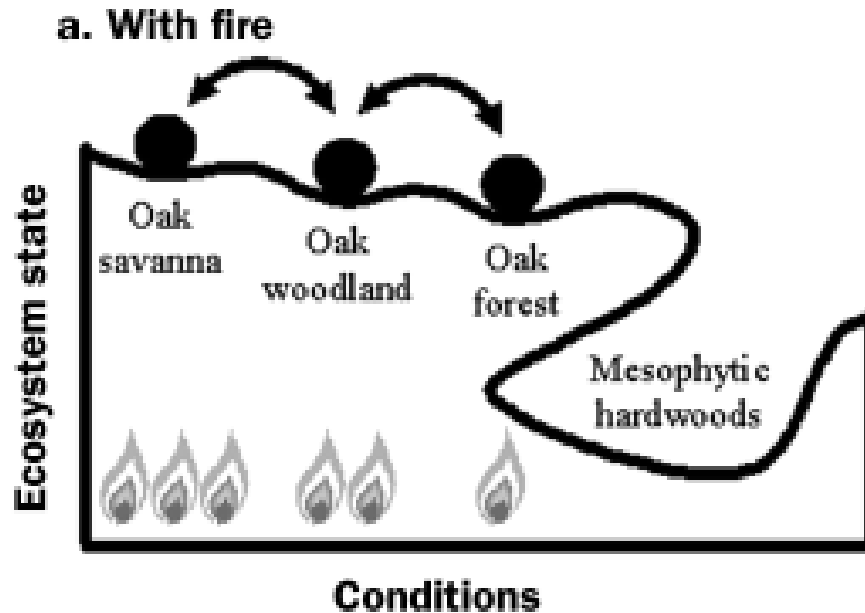


Decreased fire converting pyrogenic landscape to less flammable mesophytic forests (maple, birch, beech)



Nowacki and Abrams 2008- **mesophication** of the eastern US

Mesic uplands

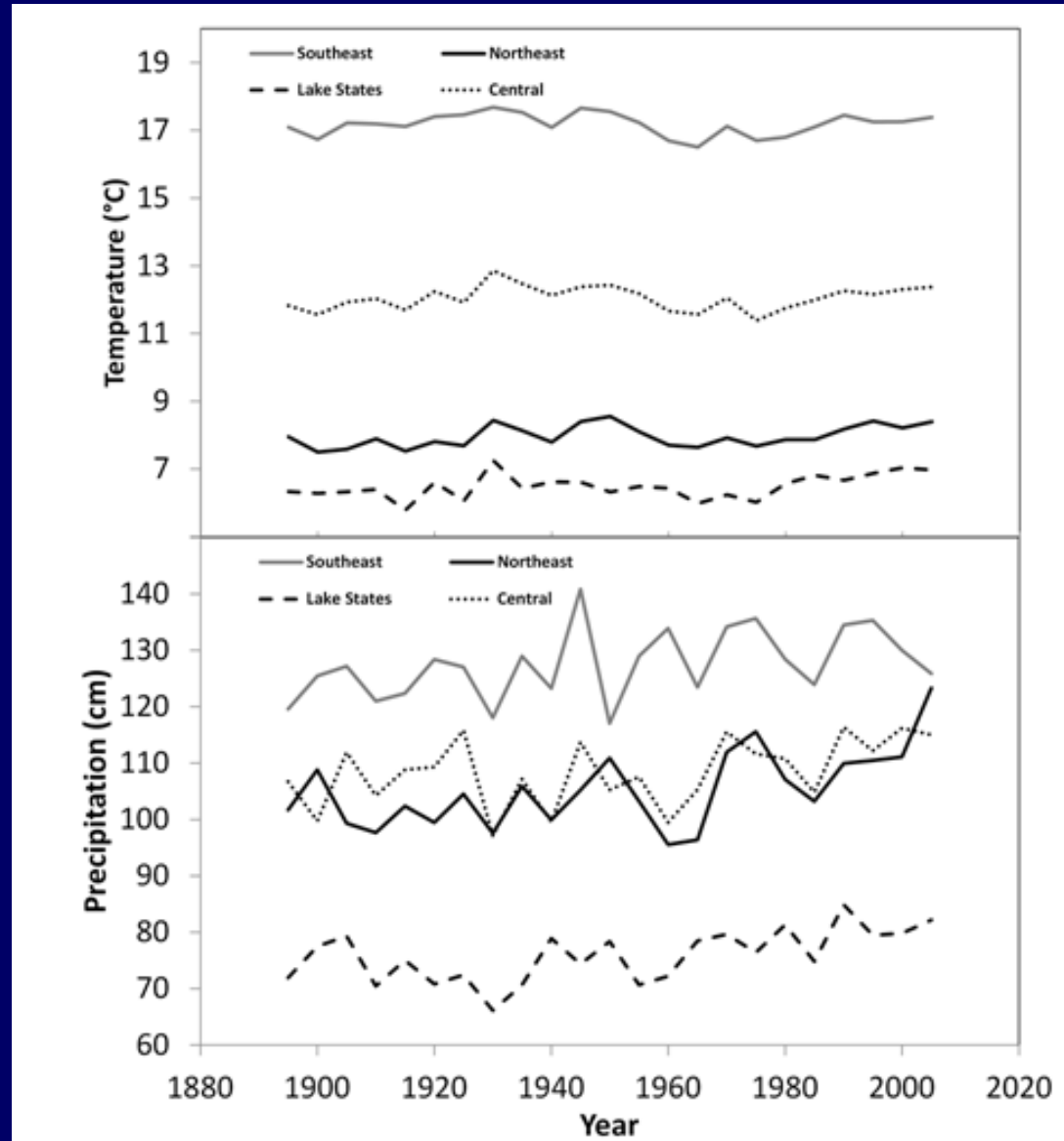


Conversion may be “irreversible” (Nowacki and Abrams 2008).

Intervention is needed to save existing oak



Post-1890 climate change benign and **not** the main driver of veg. change (Nowacki and Abrams 2015)

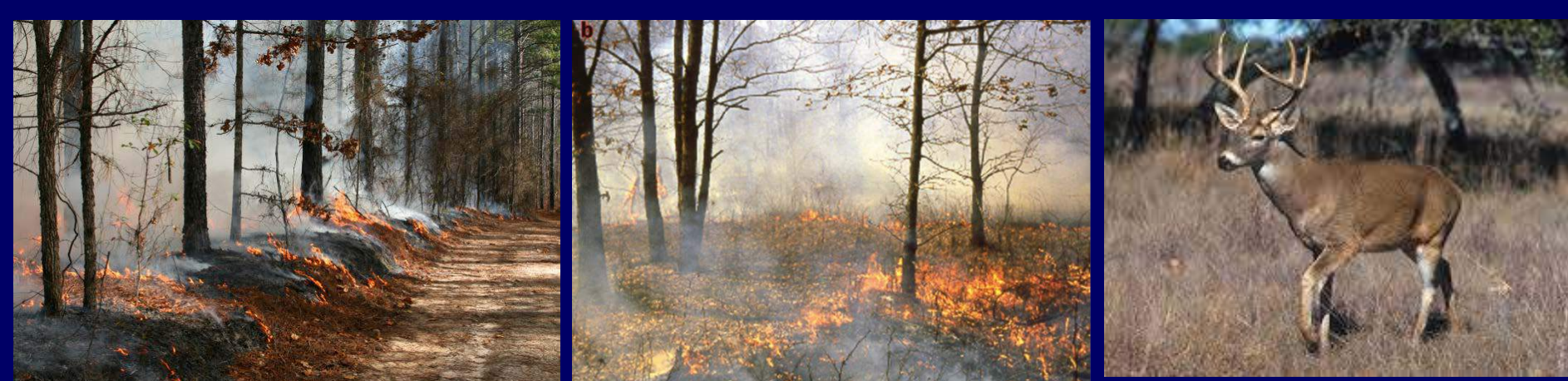


Mesophication making eastern forest **more vulnerable to future drought** (Abrams and Nowacki 2016)

What can be done to save eastern oak forests?

Silvicultural recommendations (shelterwood with fire)

1. **Logging of unwanted tree species** to increase understory light
2. The use of **understory fire (pre- and post-harvest)**:
 - eliminate undesirable species
 - create favorable germination conditions
 - create fast growing seedling/sprouts
3. Maintaining relatively **low deer populations** (< 20 per mile²).





Valley Forge, PA > 300 deer/ sq. mi; stiltgrass understory

TNC Mashomack Preserve
Shelter Island, NY

2008/07/08

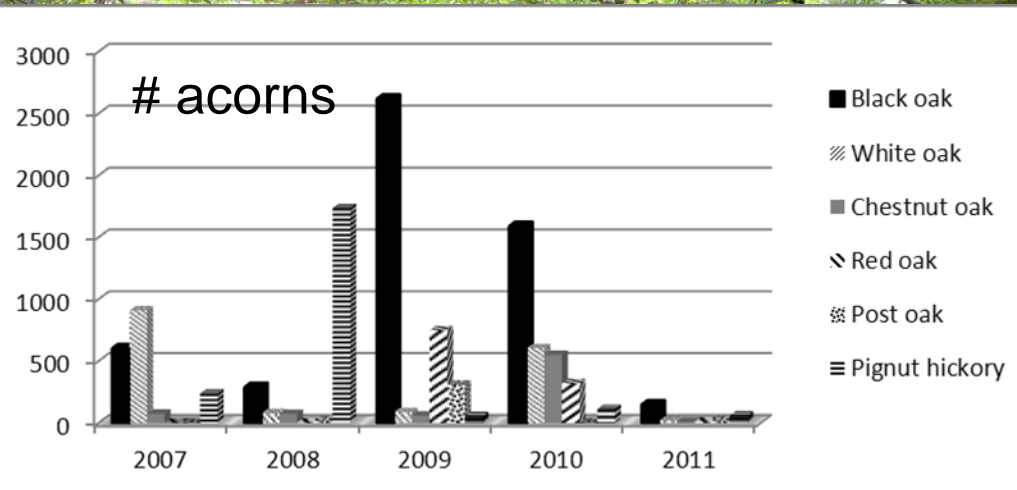


Shelter Island New York



2008/07/10

Oak forest thinned and fenced to exclude deer; oak regen. best after mast years (Abrams 2013, Abrams and Scheibel 2013)



white oak

Red oak regen on burned sites after mast year: Mohonk Preserve NY (Abrams and Johnson 2013)



Oak forests can be saved
but intensive effort needed

Conclusion:

Human land-use activity (more than climate) explains dominance of pyrogenic forests.

NA freq. used burning and other forms of silviculture to promote oak forests

Oak sustainability threatened by lack of fire, too many deer, invasives, et. al.

Fire-oak are **keystone process-genus** and should be preserved.

Let's NOT accept Novel Ecosystems replacing oak