

Fire Effects on River Cane (*Arundinaria gigantea*) in a Bottomland Hardwood Forest Four Years After Burning

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Pecano Plantation circa 1905 near present-day Waterproof, LA in Tensas Parish; USDA photo negative

Acknowledgements:

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Bill Platt

Kyle Harms

Bruce Williamson

Sammy King

Jim Cronin

Kevin Robertson

Tim Paine

Jane Carlson

Kenny Ribbeck

Tommy Tuma

Funding Agencies:

US EPA STAR Fellowship Program

Louisiana Board of Regents

American Bamboo Society

J. B. Johnston Science Foundation

Sigma Xi Grants-in-Aid of Research

Collaborating Agencies:

Louisiana Department of

Wildlife and Fisheries

River Cane or Giant Cane

One genus, 3 species (*Arundinaria gigantea* Muhl.)

Giant grass with perennial culms (stems)

“Running bamboo” with spreading clonal growth

Grew in vast monodominant stands called “canebrakes”

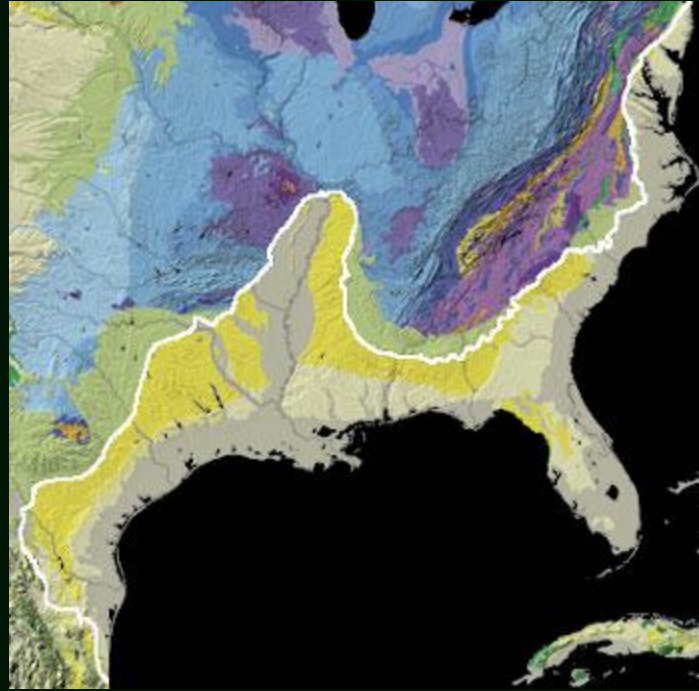


Early naturalists (e.g., Bartram, Nutall, Audubon) frequently described expansive canebrakes

Canebrakes reduced by 98%
What happened?

Altered disturbance regime?

Southeastern Coastal Plain



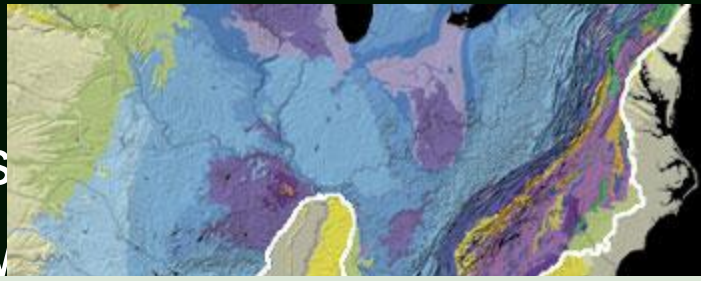
Multiple interacting disturbances on the coastal plain

Floods

Space-opening dis

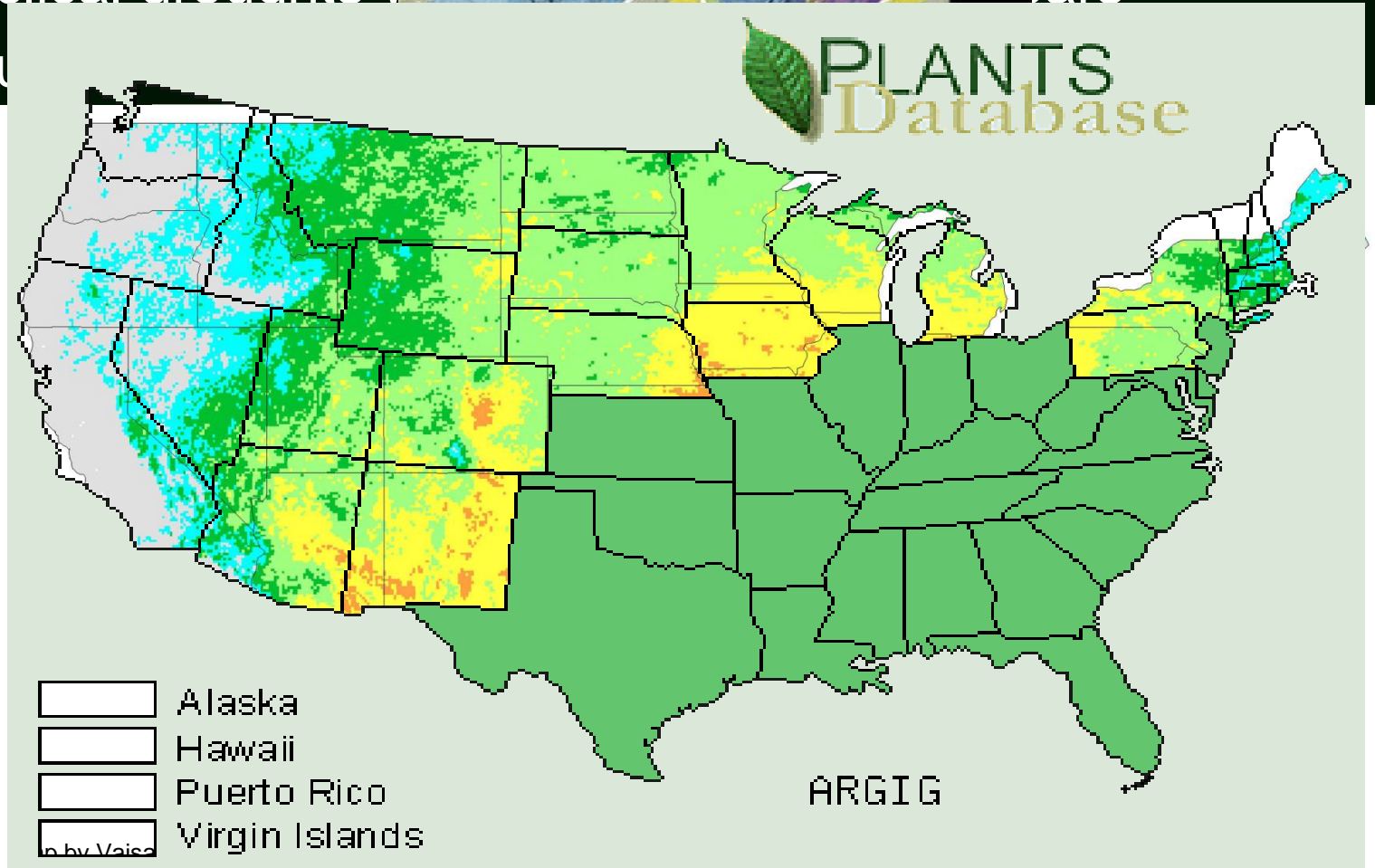
Cyclical droughts v

Abu



storms

years



- Alaska
- Hawaii
- Puerto Rico
- Virgin Islands

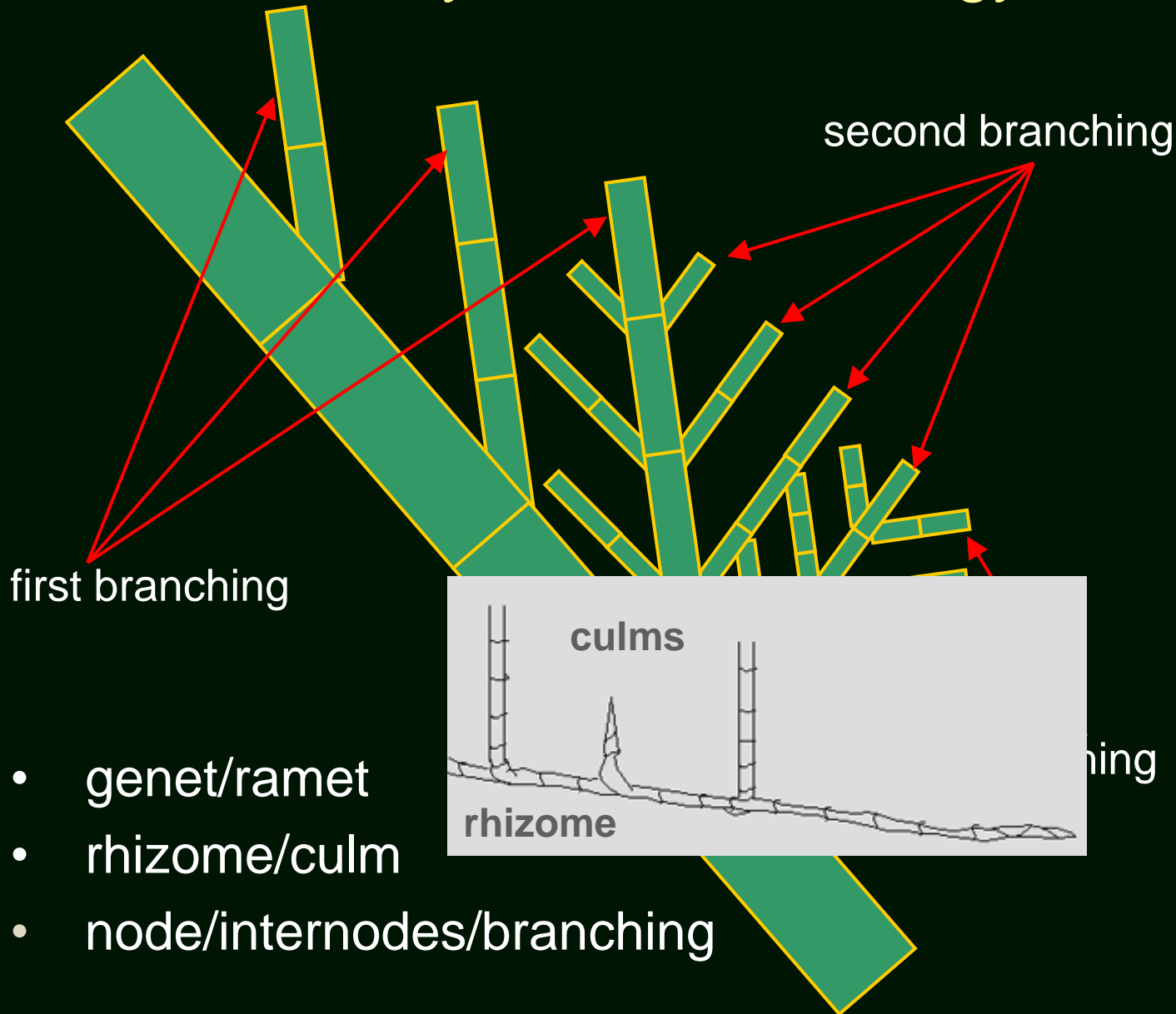
ARGIG

Fire – Ecological and Evolutionary Force?

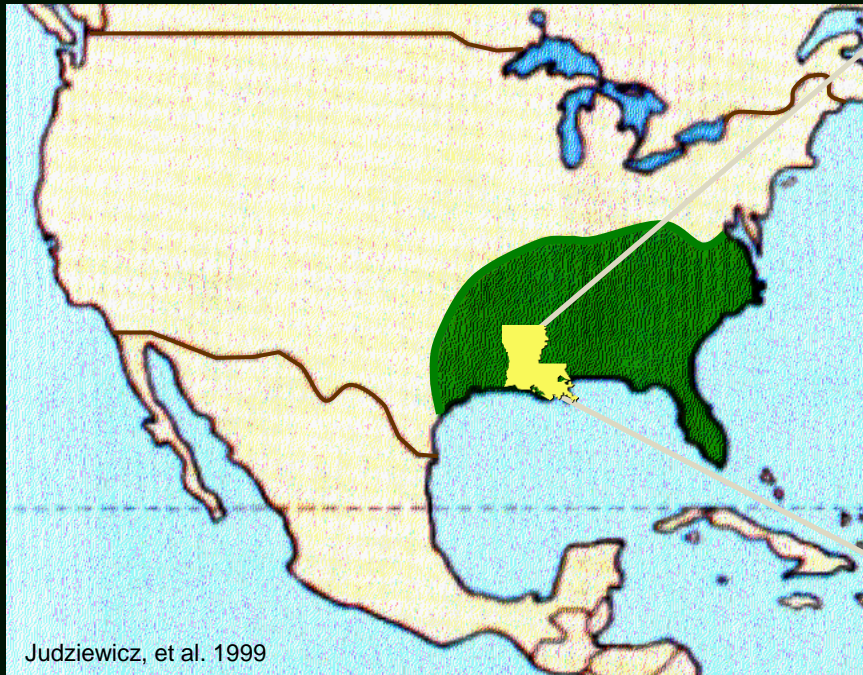
Fire in Ecological Context (Lentz 1931, Kaufert 1933)

- Fire possible, especially in large gaps during droughts
- Fires several years after initial disturbance event
- Fires in late winter or spring (early lightning season)
- Interval between fire years: 5-13 years

Cane life history and clonal biology



Range of Arundinaria



Study site





Applied question: Cane still widespread throughout range

- why no more canebrakes today?

Basic questions: How do interacting disturbances influence

- demography of a potentially dominant clonal plant?
- boundary between ecological communities?

Experimental design – windstorm & fire

Habitat type – 10 plots in each

forest (small forest stands)

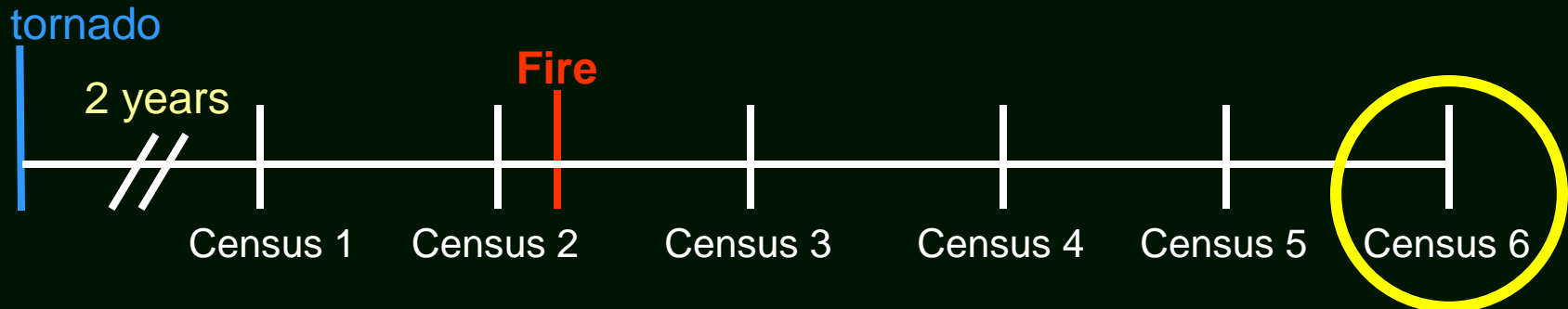
blowdown caused by windstorm

canebrake (large forest stands)

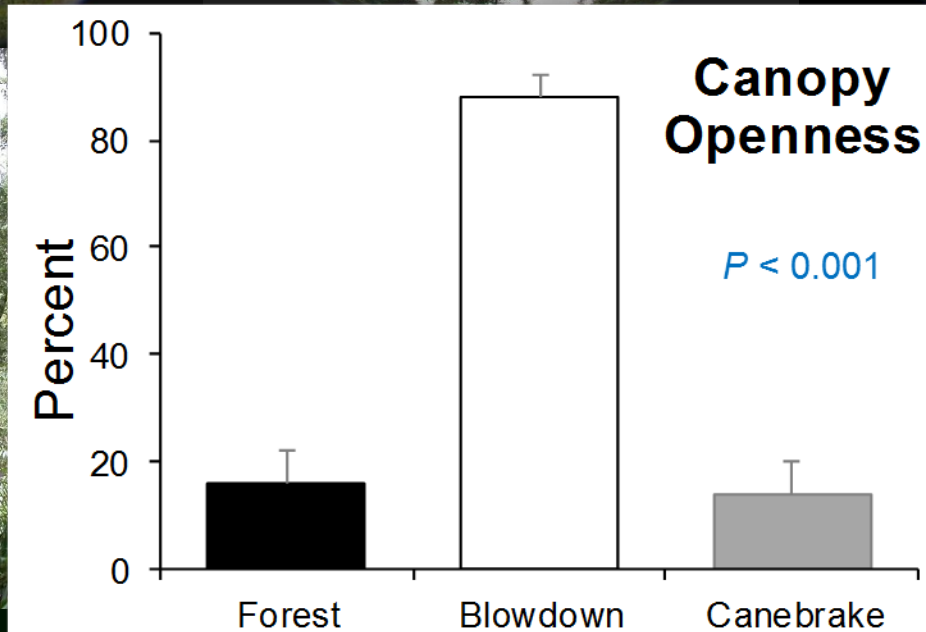
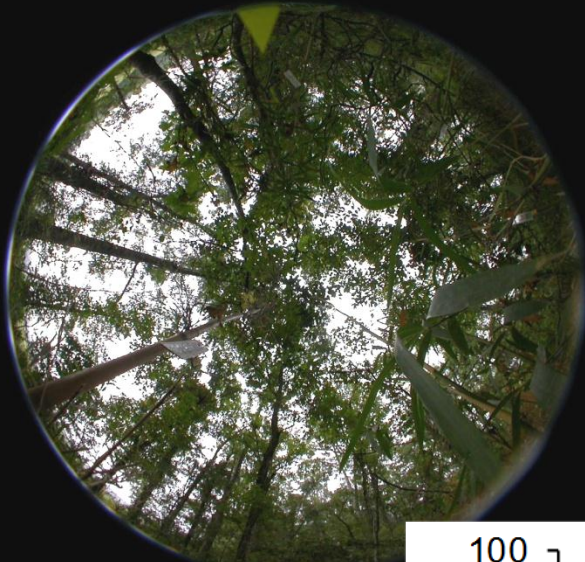


Tagged and tracked every individual culm (ramet)

Fire – 5 of each plot type burned



Light regime



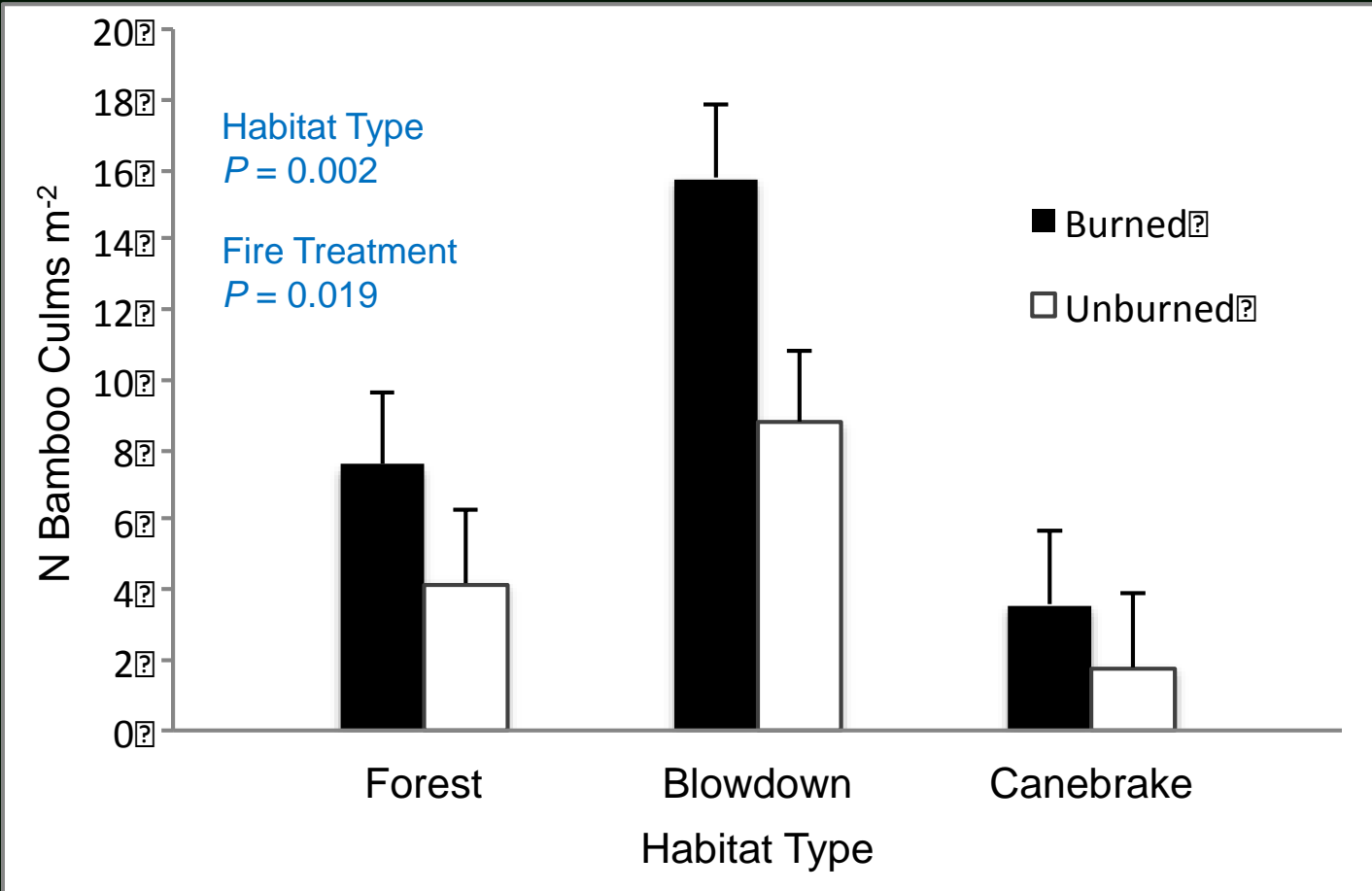
mean +/- 95% CI

Cane burns explosively...



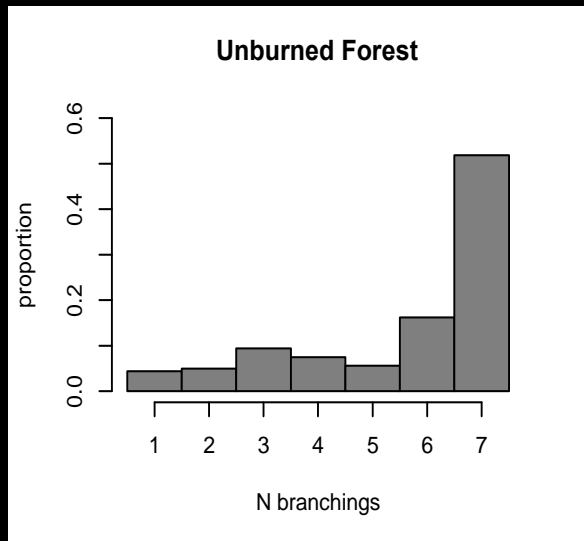
...and resprouts vigorously

4 years post-fire

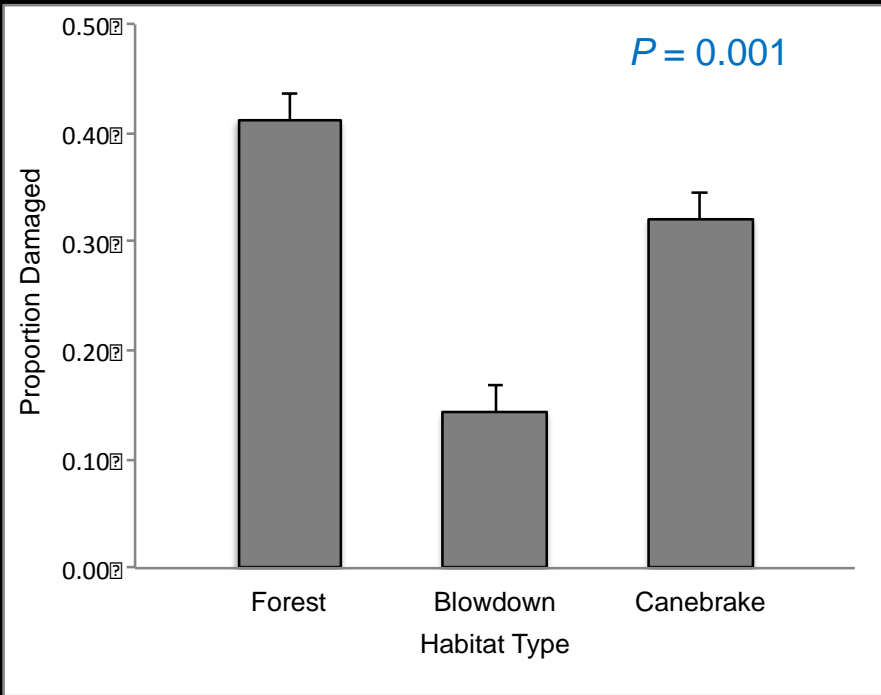


mean +/- 1 SE

4 years post-fire

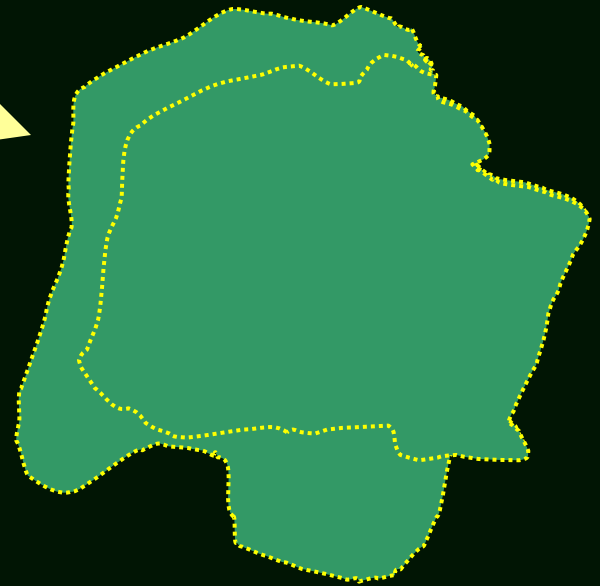
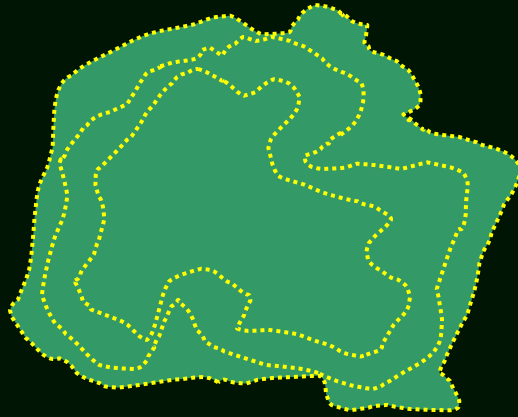
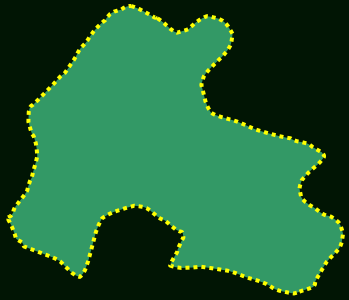


4 years post-fire



mean +/- 1 SE

Clonal growth in small canopy gap

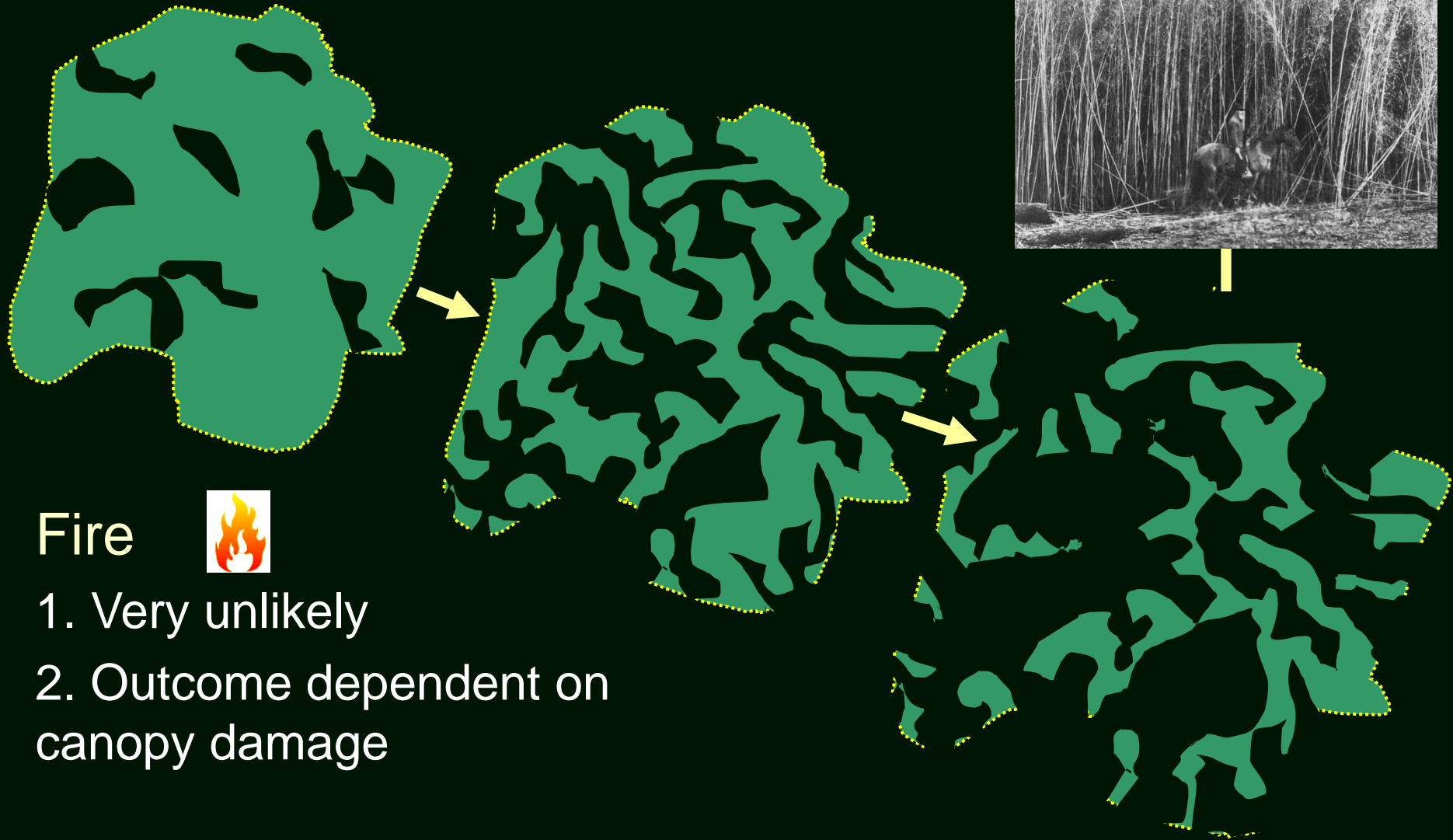


Fire



1. Low probability
2. Could open canopy
3. Initial cane decline
4. Eventual higher density

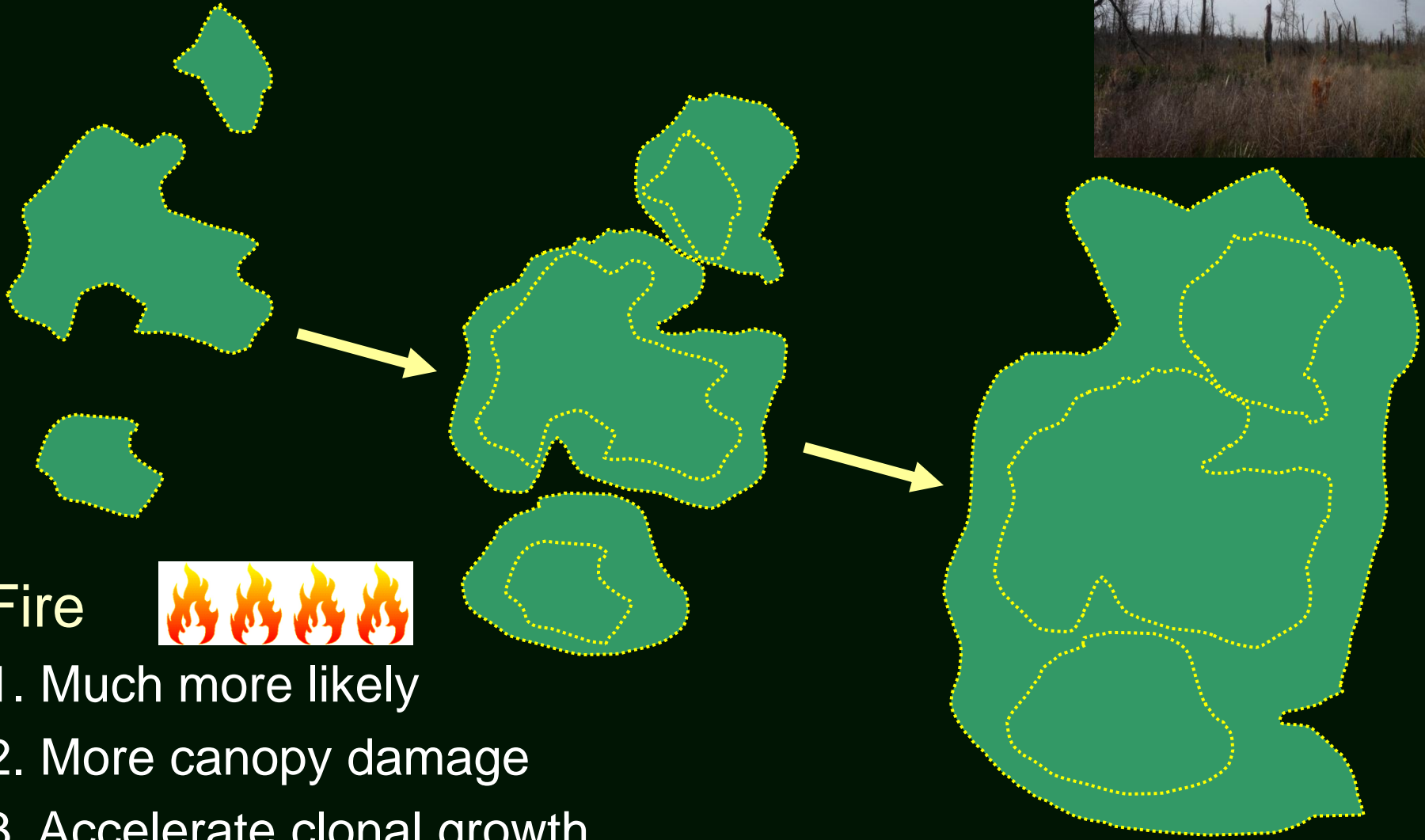
Prolonged clonal growth under forest canopy (canebrake)



Fire 

1. Very unlikely
2. Outcome dependent on canopy damage

Clonal growth in large blowdown gap



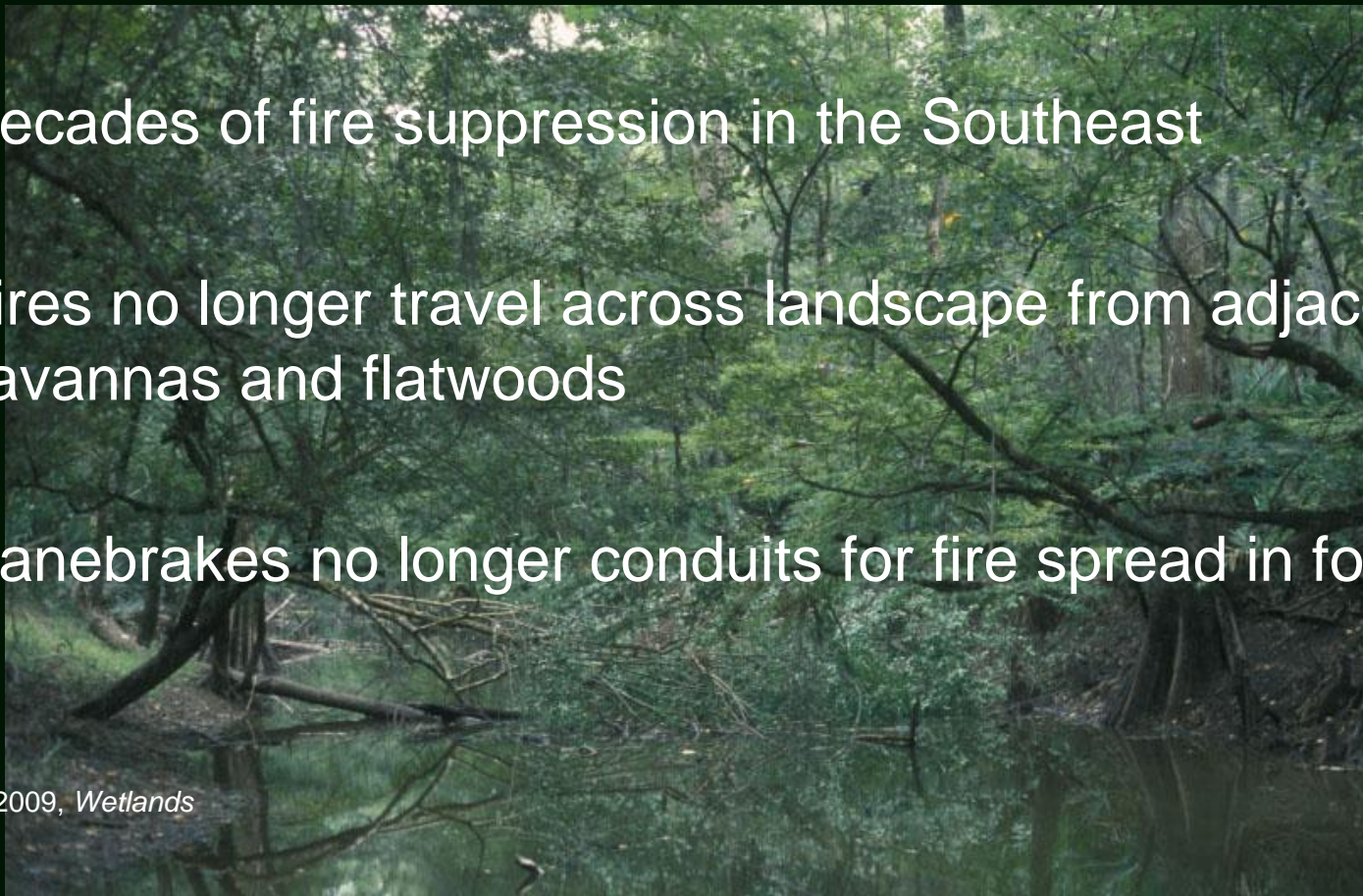
Fire



1. Much more likely
2. More canopy damage
3. Accelerate clonal growth

Fire in Modern BLH Forests – Inconceivable?

- Modern BLH forests virtually fireproof – dense canopies shade understory and minimize plant growth
- Decades of fire suppression in the Southeast
- Fires no longer travel across landscape from adjacent pine savannas and flatwoods
- Canebrakes no longer conduits for fire spread in forests



Fire – Ecological and Evolutionary Force?

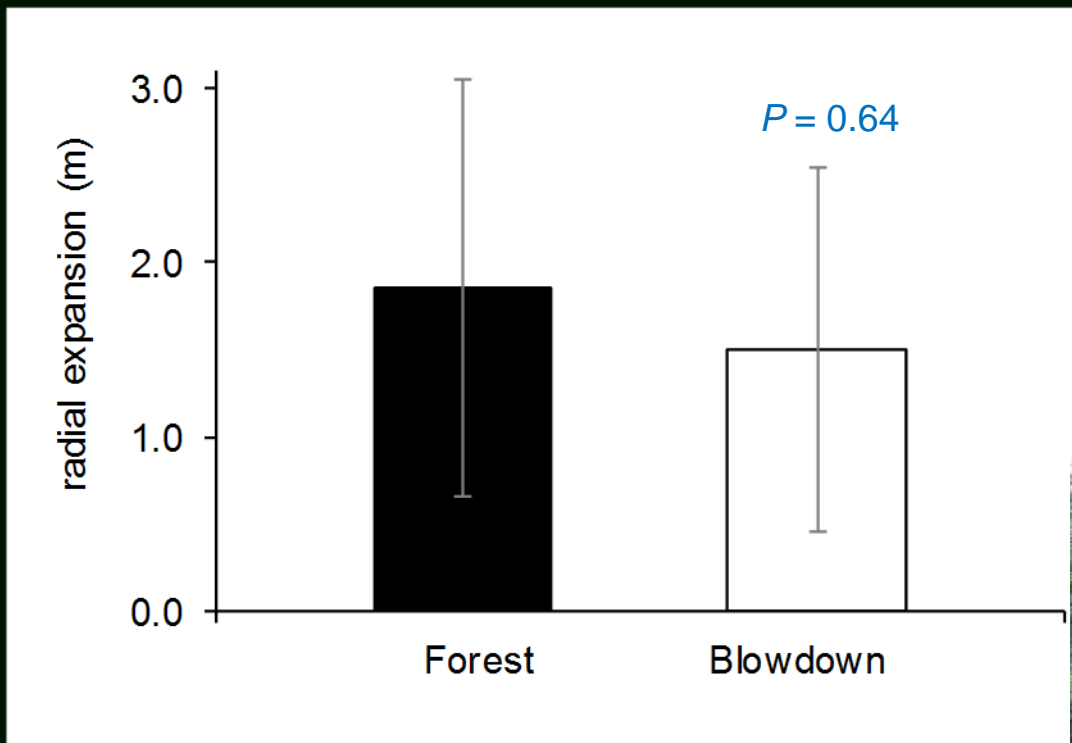
Natural fire scenario:

- 1) Powerful windstorm creates large gap
- 2) Dense vegetation fills gap over a few years
- 3) Prolonged drought dries fuels and natural fire breaks
- 4) Lightning strikes with onset of spring storms
- 5) Canebrakes, any adjoining uplands facilitate fire spread
- 6) River cane thrives after burning – fuel bed for next drought



Results – clonal spread

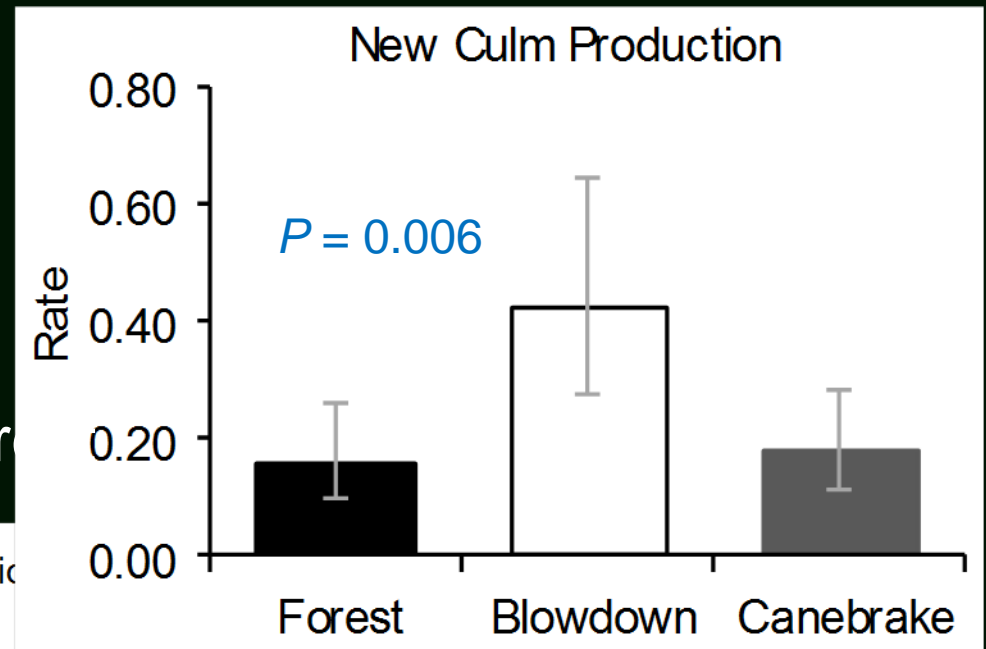
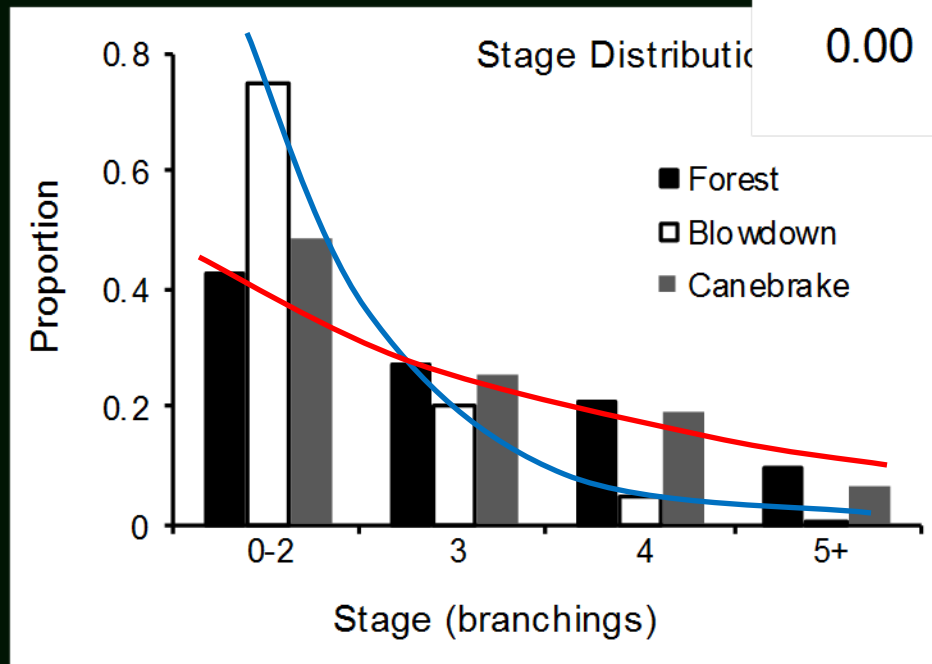
- Radial expansion not different
- Always expanding
- Mean radial expansion: 1.77 m/year +



Culm dynamics pre-fire

Stage Distribution

- Forest older
- Blowdown younger
- Canebrake similar to forest



mean +/- 95% CI

Ramet population growth comparing year 1 to 4

Population growth rate:

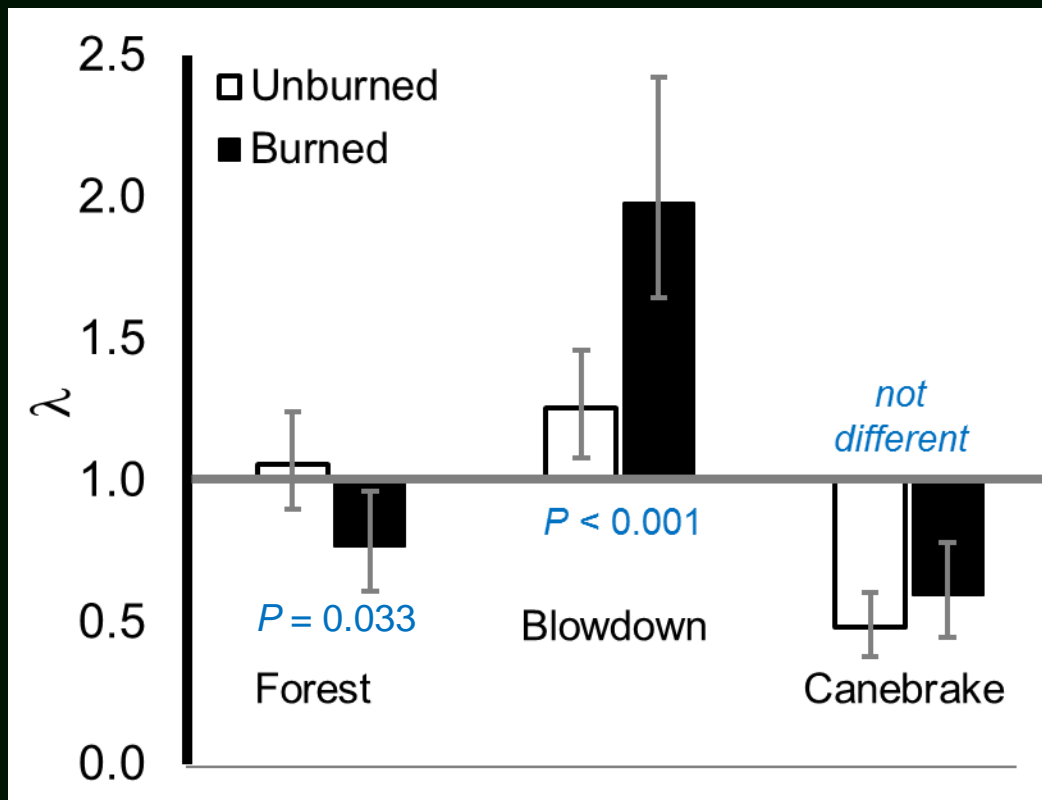
$$\lambda = (N_{t+3})/N_t$$

Population

stasis $\rightarrow \lambda = 1$

growth $\rightarrow \lambda > 1$

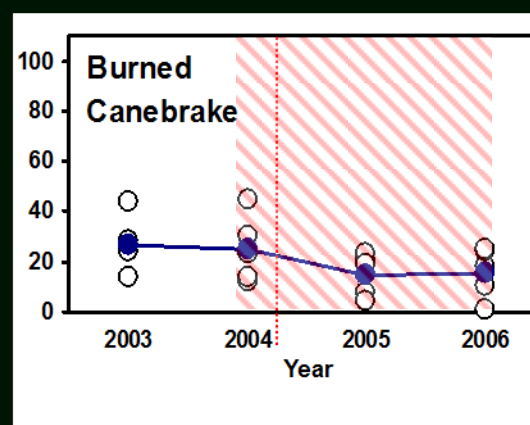
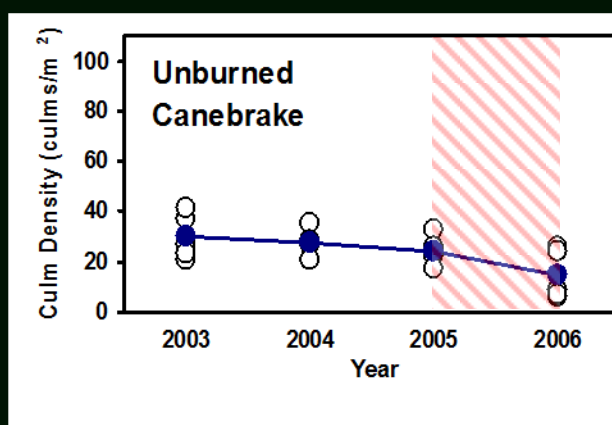
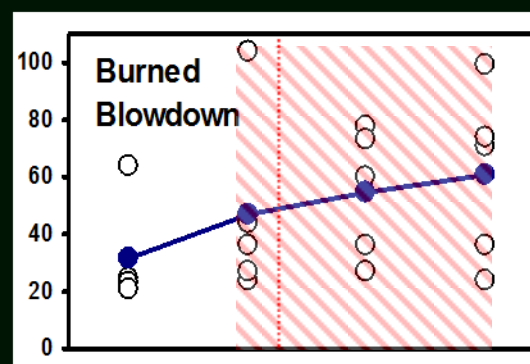
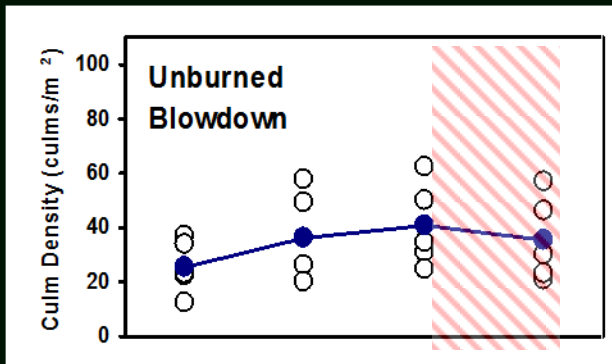
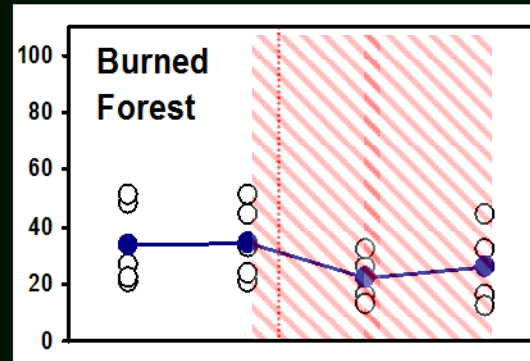
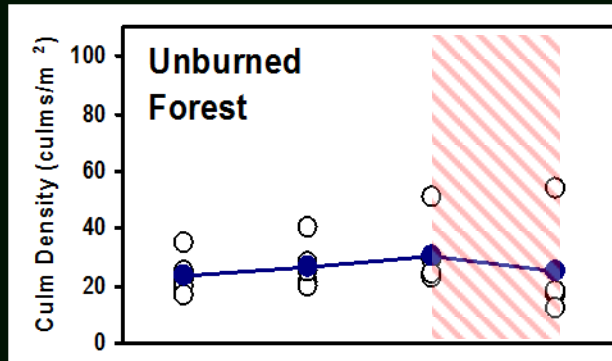
decline $\rightarrow \lambda < 1$



mean +/- 95% bootstrapped CI

P-values generated by randomization tests

Ramet population densities over 4 years



Fire During Recent Past

Lentz, G. H. 1931. Forest fires in the Mississippi bottomlands. *Journal of Forestry*. 29: 831-832.

“Although foresters and timbermen generally discount the fire problem in the southern hardwoods, a real problem exists...The past summer, 1930, was decidedly dry and followed by a fall and winter also quite dry. Many sloughs and brakes usually filled with water have been dry for several months. The spring rains have not been able to wet down the litter and debris and conditions in the woods are just right for fires to spread.”

In 3 year-old clearcut a fire was burning over a large portion of the cut-over area. This fire was so hot that most of the advanced reproduction was killed and larger residual trees were partly killed by the flames. Fires of a similar nature were burning in other cut-over hardwood stands in the region.”

Fire During Recent Past

Kaufert, F. H. 1933. Fire and decay injury in the southern bottomland hardwoods. *Journal of Forestry*. 31: 64-67.

- Studied > 500 stumps on 3 clearcut hardwood tracts in LA.
- Fires common during a dry spring following a dry fall
- Traced individual fires “back to Civil War days and farther,”
- Major fire years in 1898-1899, 1911-1912, 1916-1917, 1924-1925 and 1930-1931 (approximately every 5-13 years)
- Attributes fires to human activity. Pyrogenic power of lightning underestimated at the time.
- “Much of the evidence of these early fires has been obliterated. According to the ‘old-timers,’ however, they were more damaging than present fires, for dry cane made an excellent fuel.”

Canebrake ???

Crotalus horridus subsp. *atricaudatus*

