



Fungi, Fire and the Fate of Sugar Pine in the Southern Sierra Nevada

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Sierra Nevada Global Change Research Program

Sierra Nevada Forest Dynamics: Pattern, Pace, and Mechanisms of Change

Contributors

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Gregg Riegel, USFS

David Parsons, USFS

Famous naturalists sing the praises of sugar pine



The most princely of the genus

The Queen of the Sierras

More than any other tree gives beauty and distinction to the Sierran forest



Douglas



Muir



Jepson

White pine blister rust

- Sequoia/Kings Canyon blister rust survey 1995-1999 (154 plots)
- 21% incidence of blister rust in sugar pine

Cronartium ribicola

photo credit: Natural Resources Canada,
Canadian Forest Service



photo credit: Eric Knapp



Questions

- Is sugar pine declining?
 - demographic analysis using matrix models
- How does sugar pine respond to the reintroduction of fire?
 - long-term monitoring of prescribed fire effects
- Can we protect large trees during prescribed burning?
 - fuel removal treatment

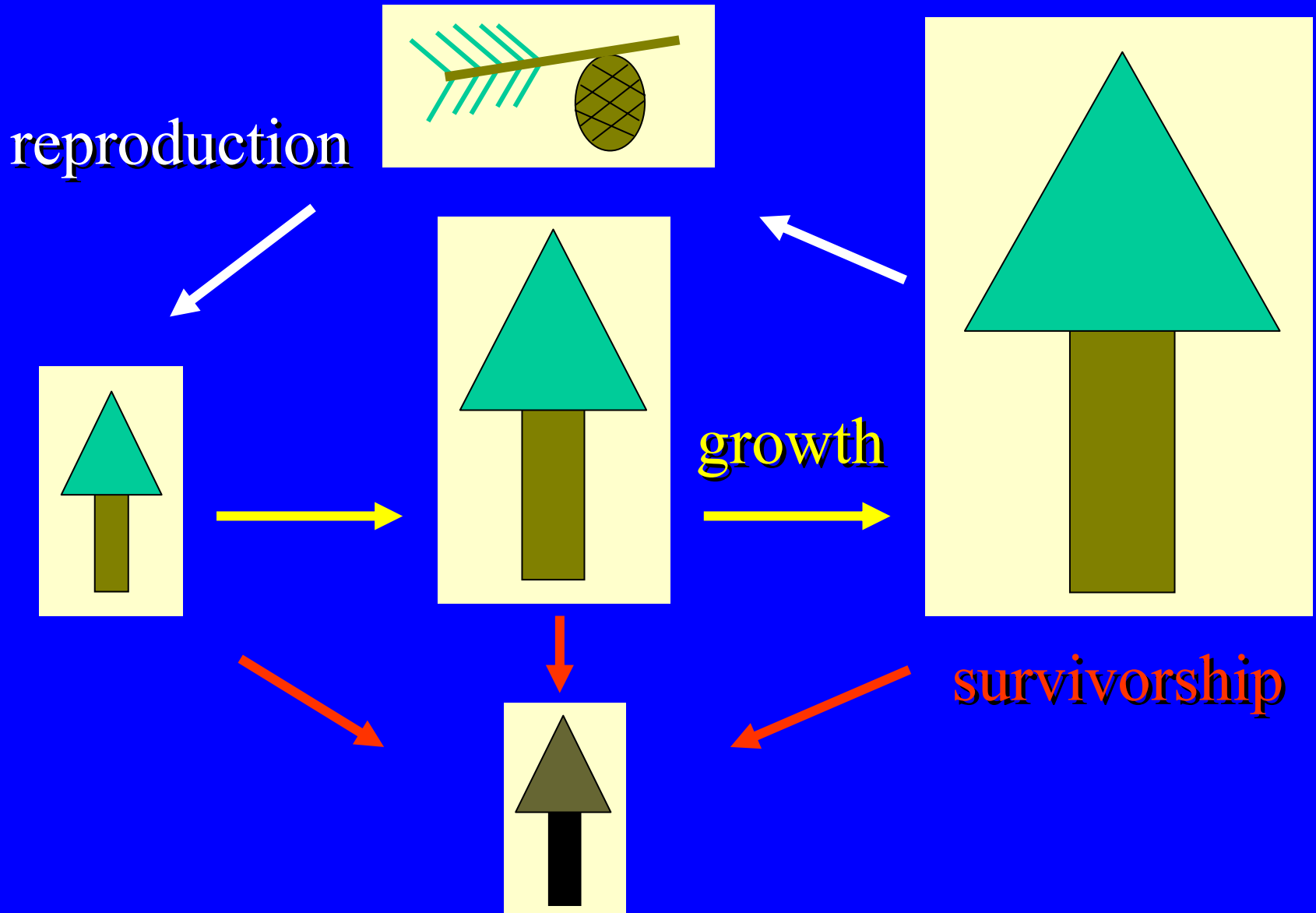
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What is the matrix?



Forest demography made easy



Forest demography made abstract

The matrix approach

		time 1			n
		1	2	3	
time2	1	P(11)	0	P(31)	100
	2	P(12)	P(22)	0	50
	3	0	P(23)	P(33)	5

		time 1			n
		1	2	3	
time2	1	0.80	0.00	3.50	100
	2	0.05	0.85	0.00	50
	3	0.00	0.05	0.95	5

$$\lambda = 1.03$$

A word about λ



$\lambda < 1$, decline

$\lambda = 1$, stationary

$\lambda > 1$, growth





Study Area

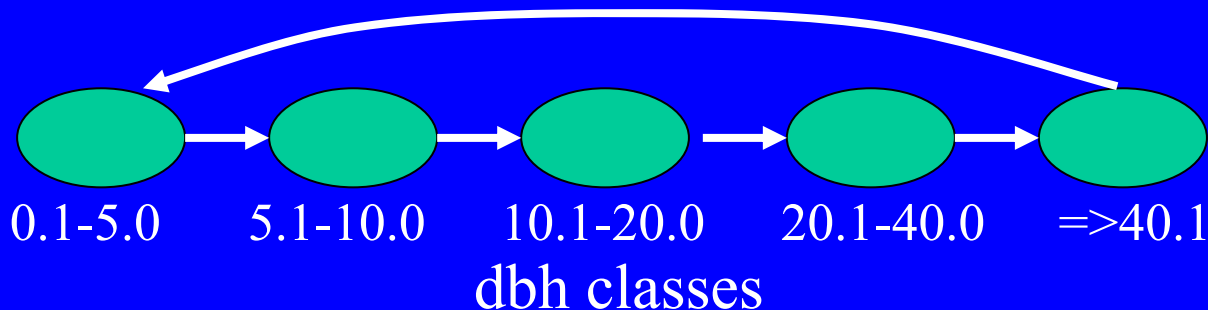
2 Yosemite NP sites

2 Sequoia NP sites, plus:

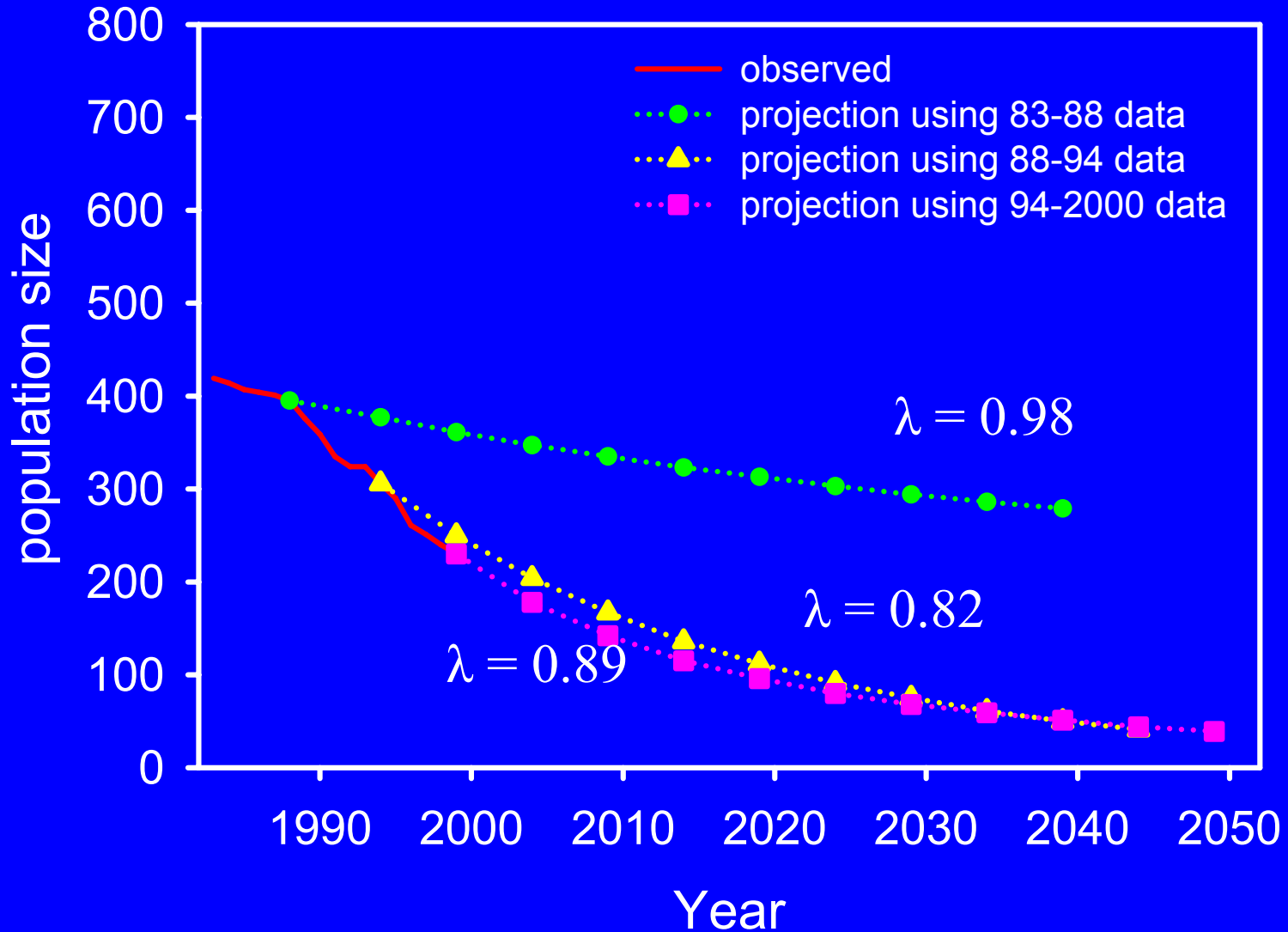
- 17 other burned areas (fire effects monitoring plots)

5-15 years of observation at each site

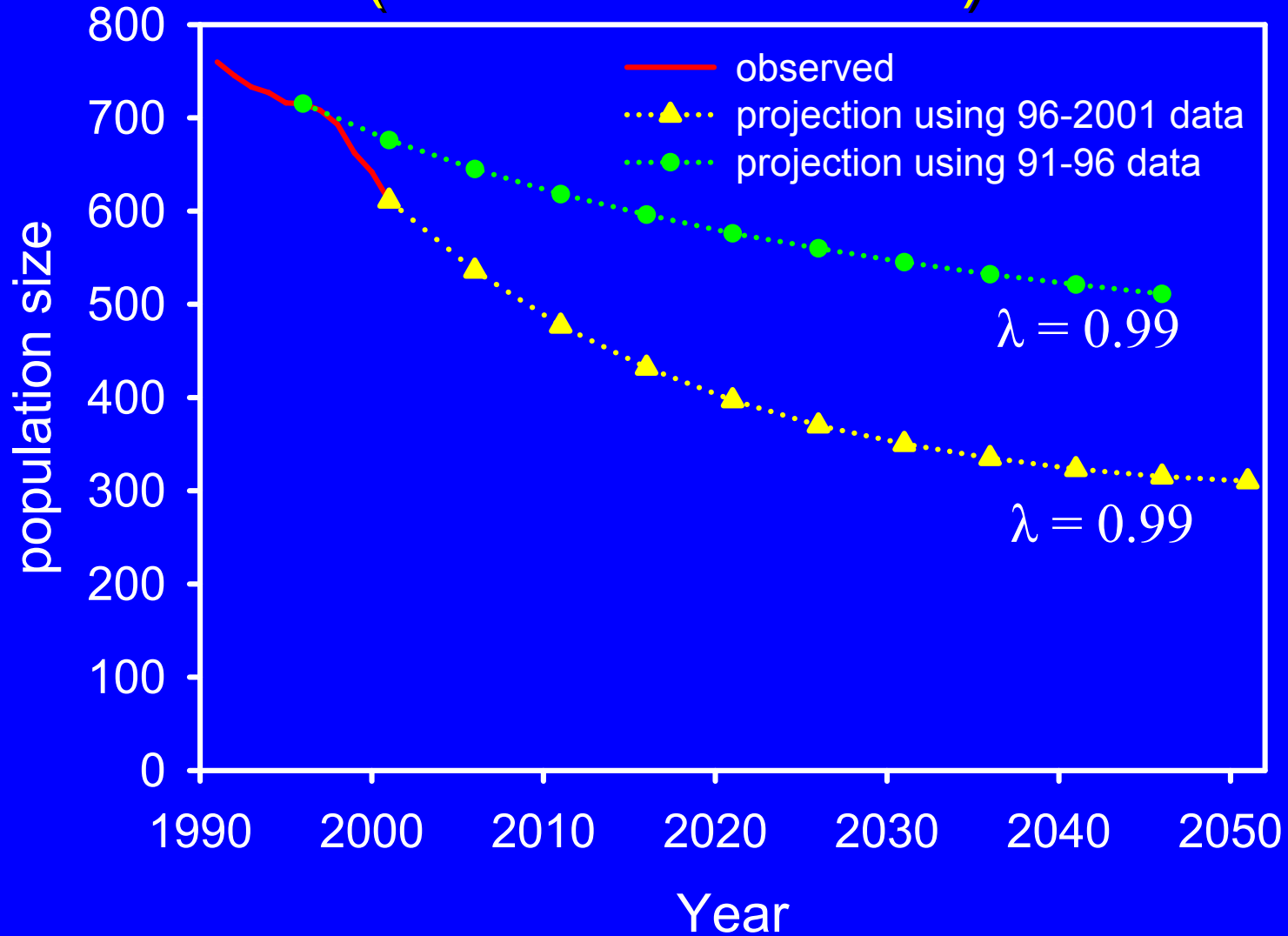
~1,800 trees (~20,000 tree years)



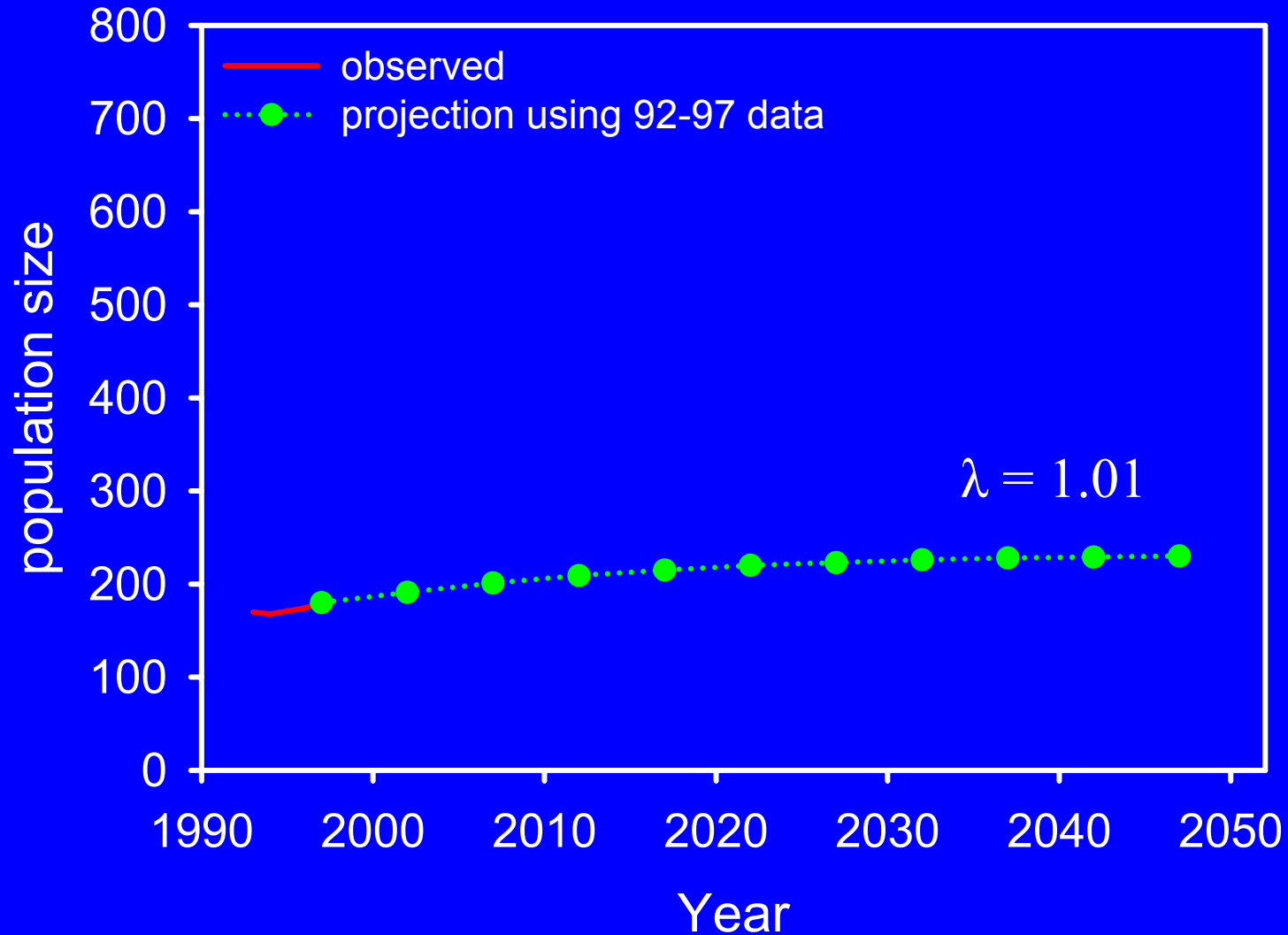
Suwanee projection results



Hodgedon Meadows projection results (Crane Creek similar)

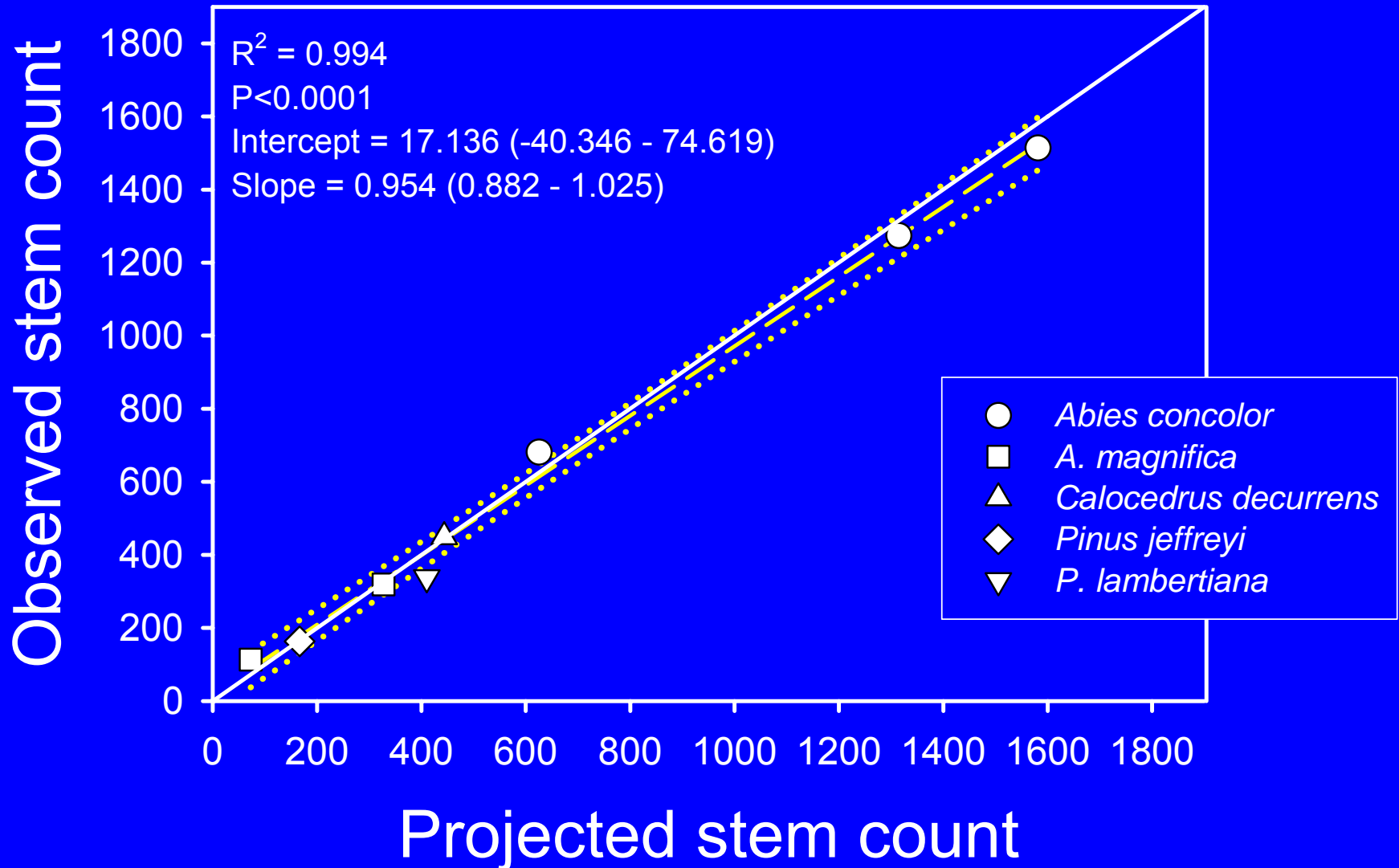


Crystal Road projection results



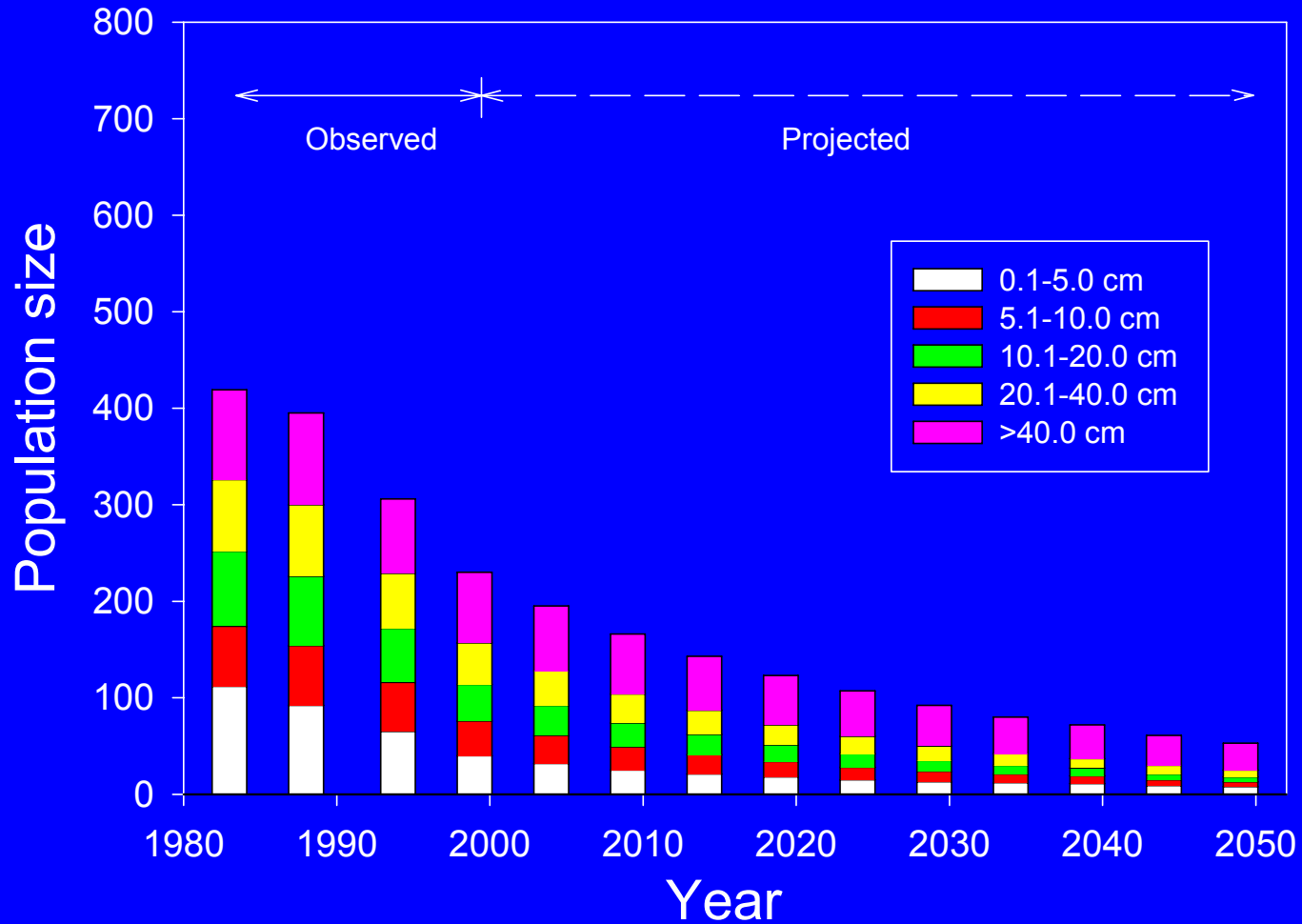
Accuracy of matrix models

Trends from year 0-5 predict trends at year 10-15



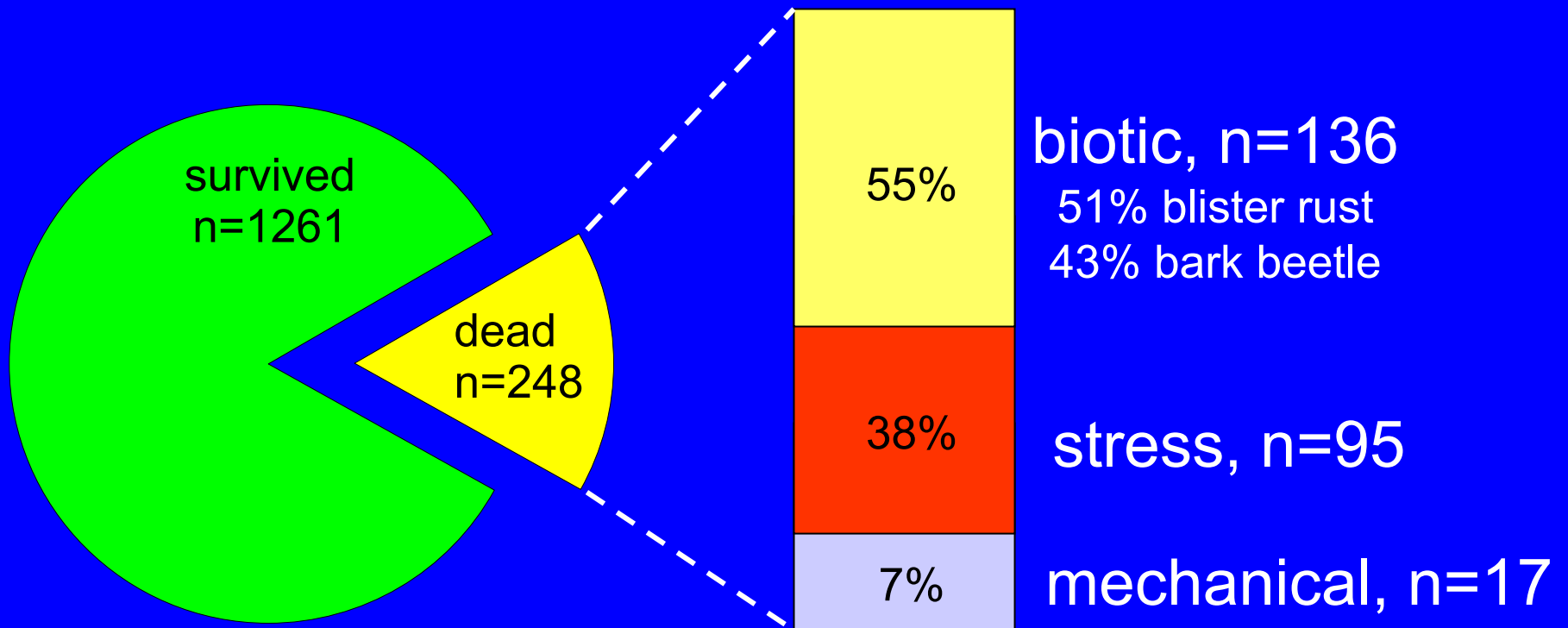
Suwanee projection results

Size structure



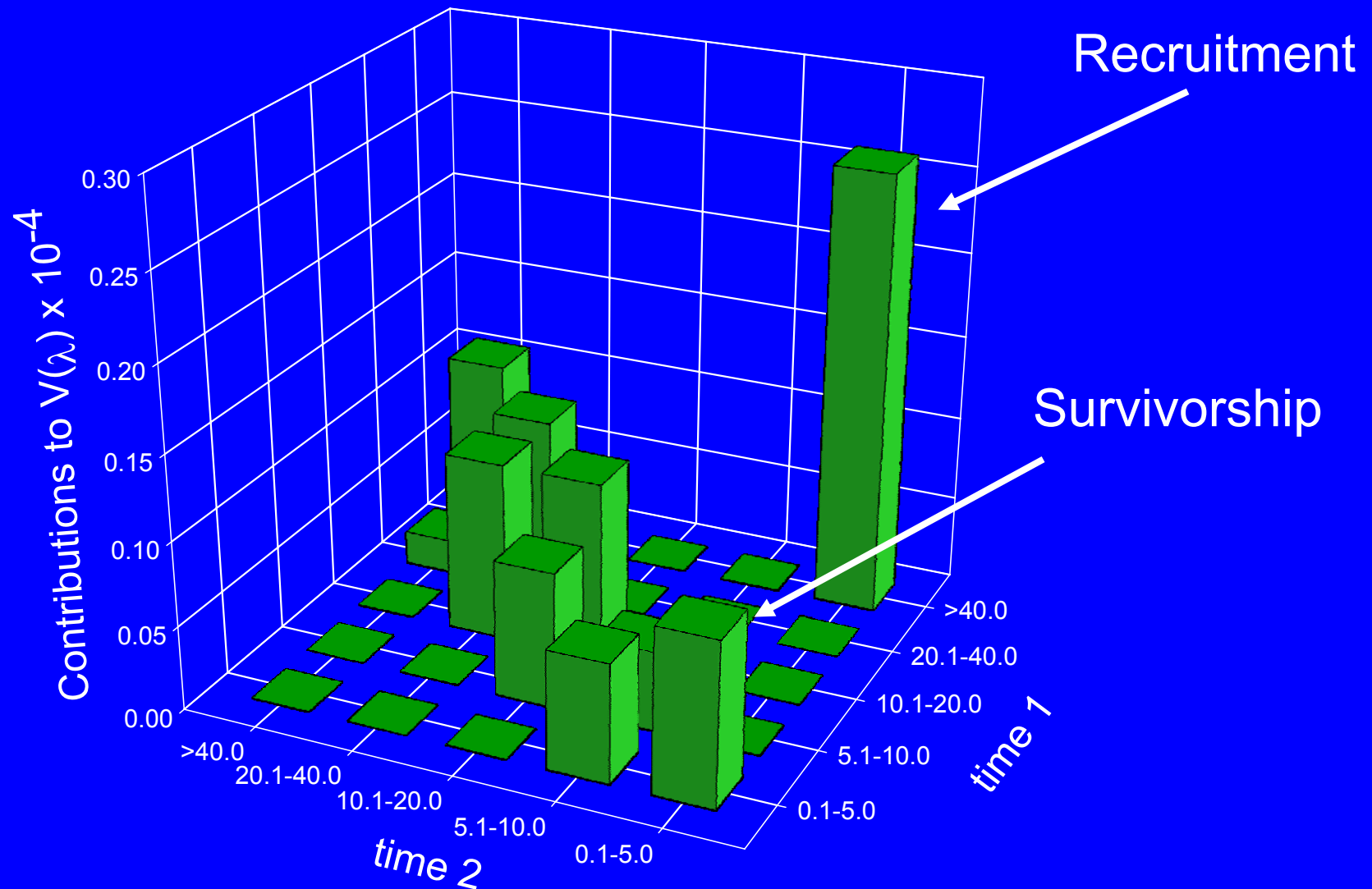
Proximate causes of death

All populations, most recent 5 years



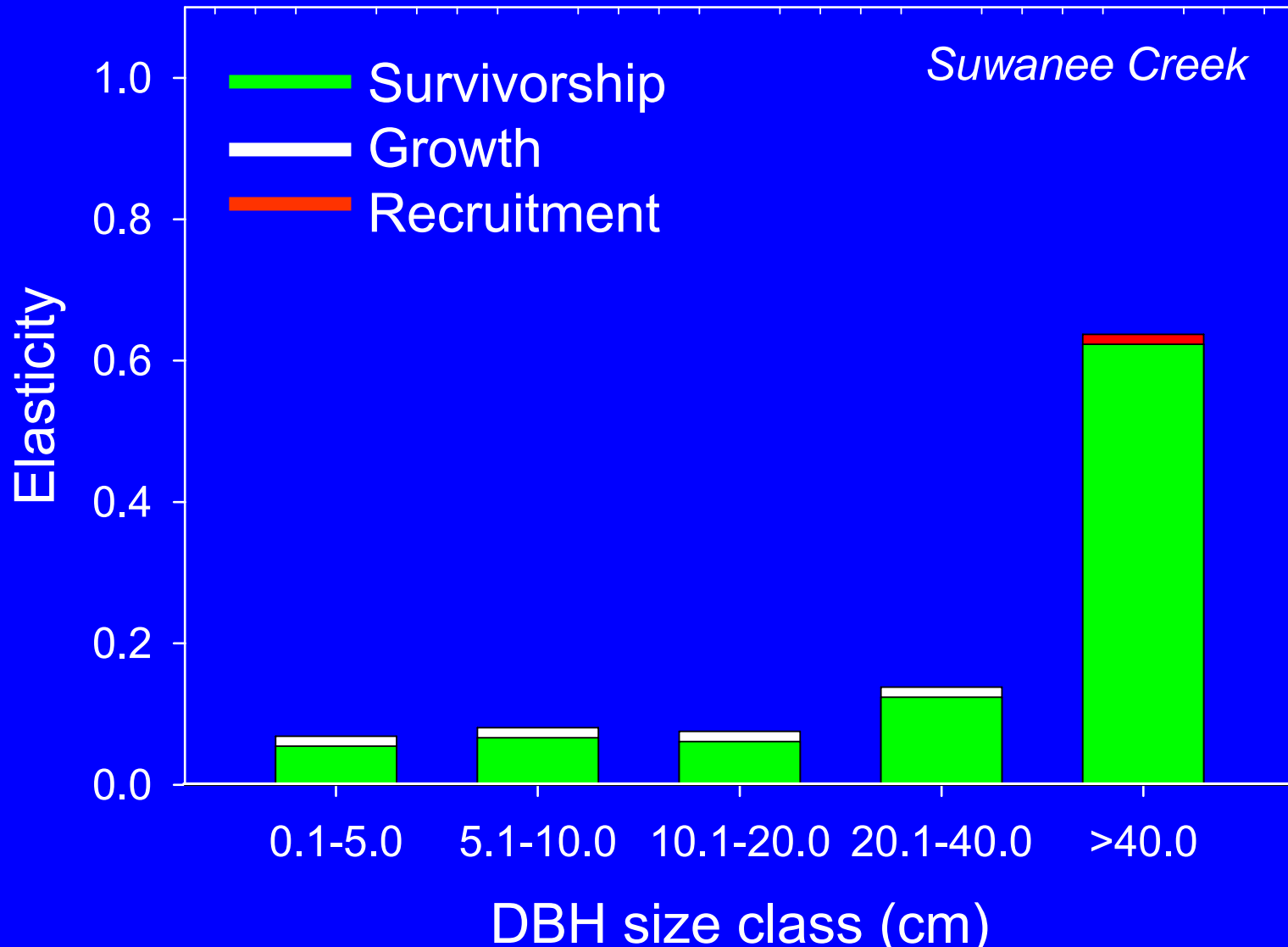
Retrospective analysis

Differences of matrix entries among populations



Prospective analysis: elasticity

Which rates have the largest effect on lambda?



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NPS Long-term fire effects monitoring

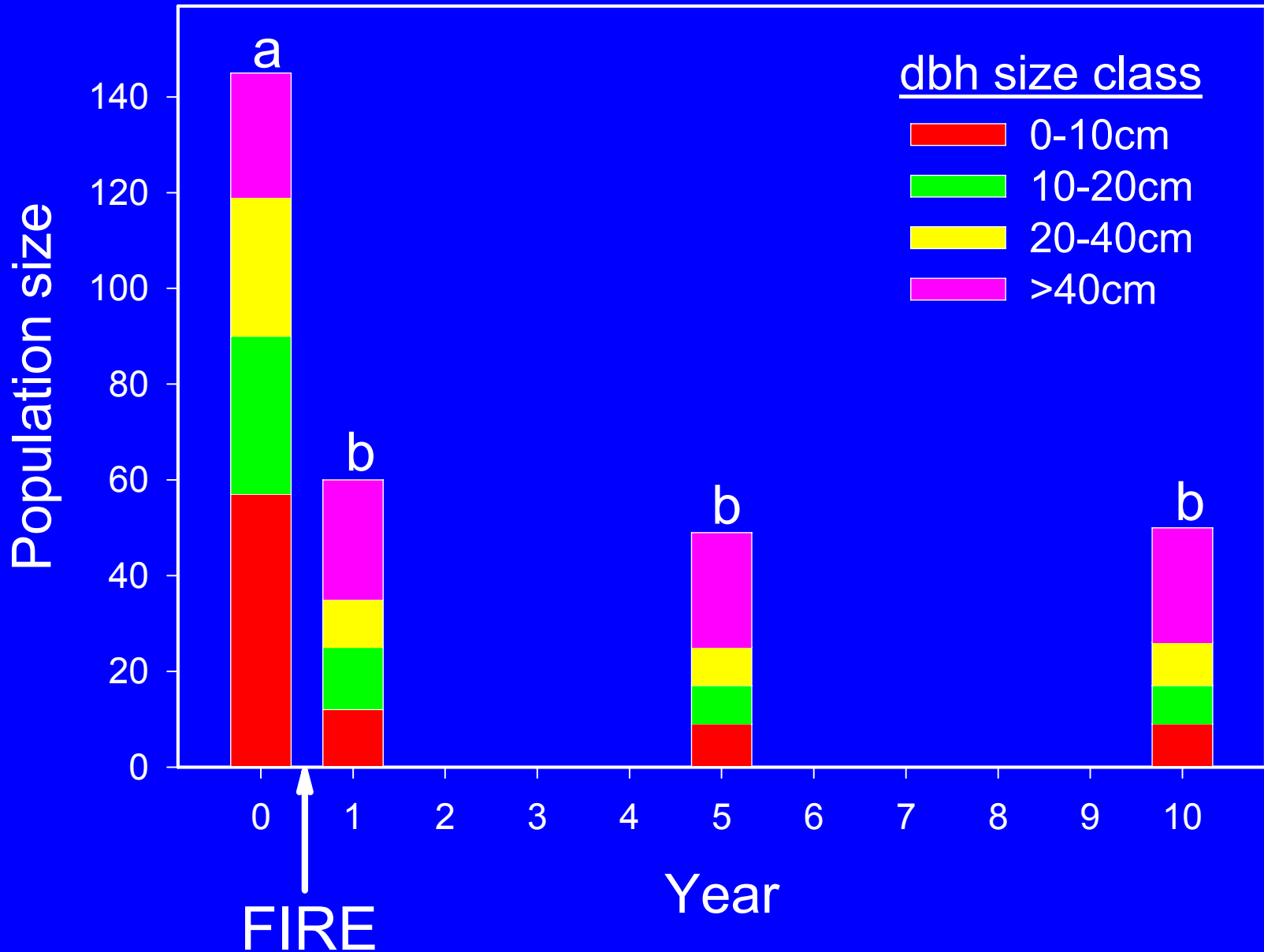
17 fires; 21 plots

145 sugar pine individuals

followed for at least 10 years post-fire



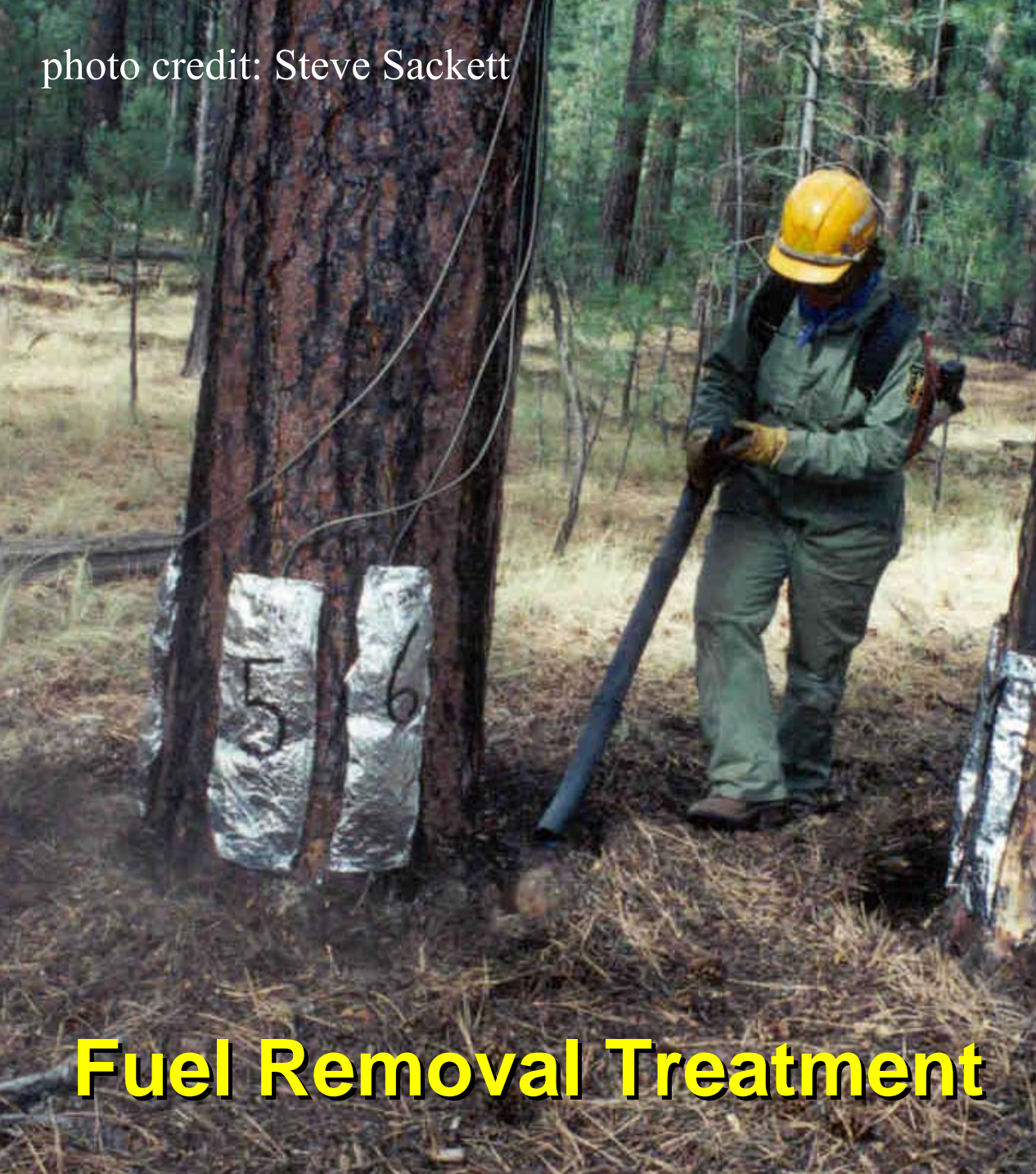
NPS Long-term Fire Effects Monitoring



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photo credit: Steve Sackett



Preburn:

- fuel depth

Postburn:

- fuel consumption
- bark char
- crown scorch
- damage and mortality

Fuel Removal Treatment

Preliminary Fuel Removal Results

Bear Hill Prescribed Burn (2001) - 16 tree pairs

Preburn fuel depth at tree base

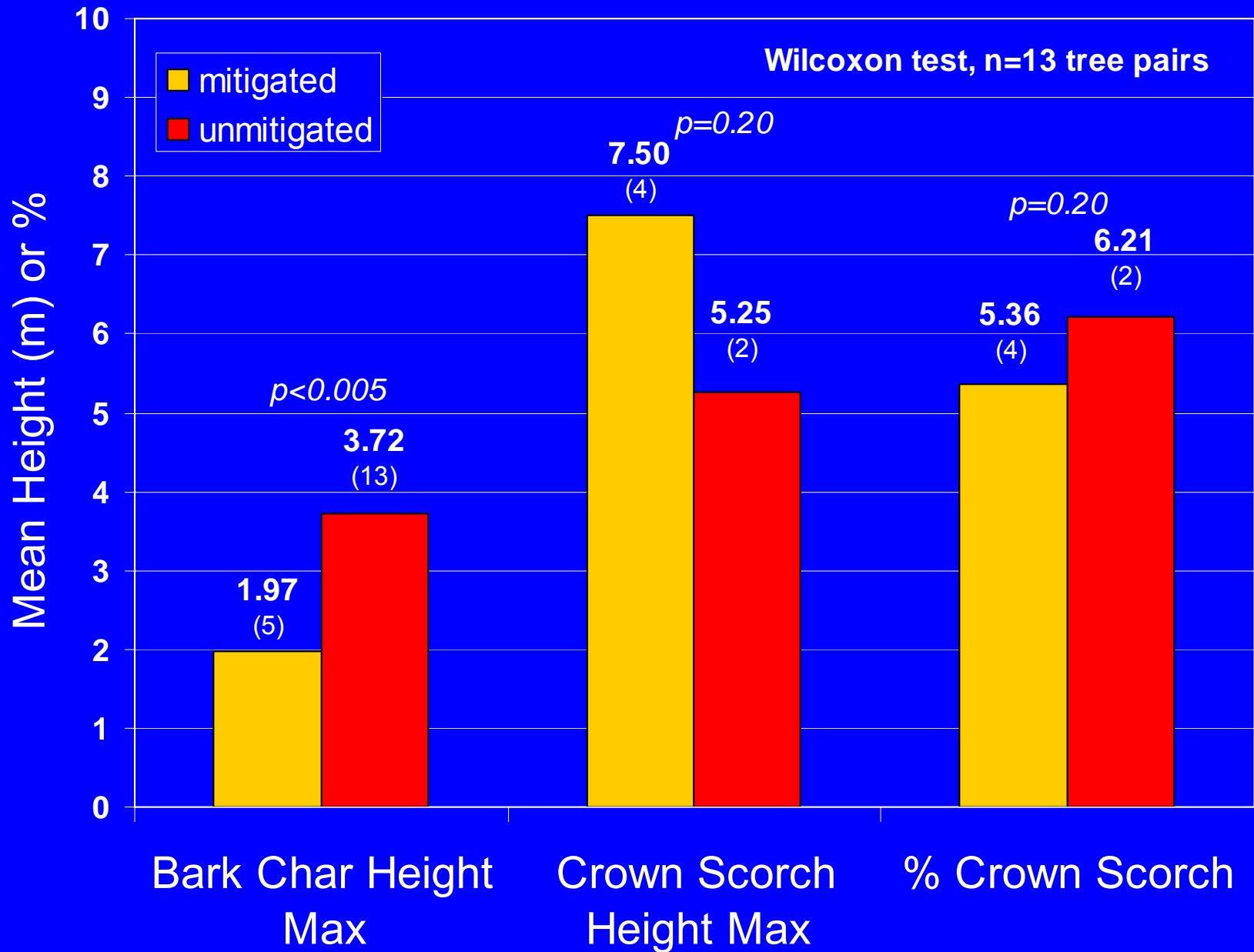
mean: 16.7 cm

range: 7.7 - 34.8 cm

(n=32 trees)

<u>1-Yr Postburn</u>	Mitigated	Unmitigated
mortality	0	0 (1)
damage	4	3

Preliminary Fuel Removal Results



Questions - and ANSWERS!

- Is sugar pine declining?
 - most populations are slowly declining
- How does sugar pine respond to the re-introduction of fire?
 - a sharp, but transient, increase in mortality
- Can we protect large trees during prescription burning?
 - early results suggest fuel removal may minimize damage

Acknowledgements



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