

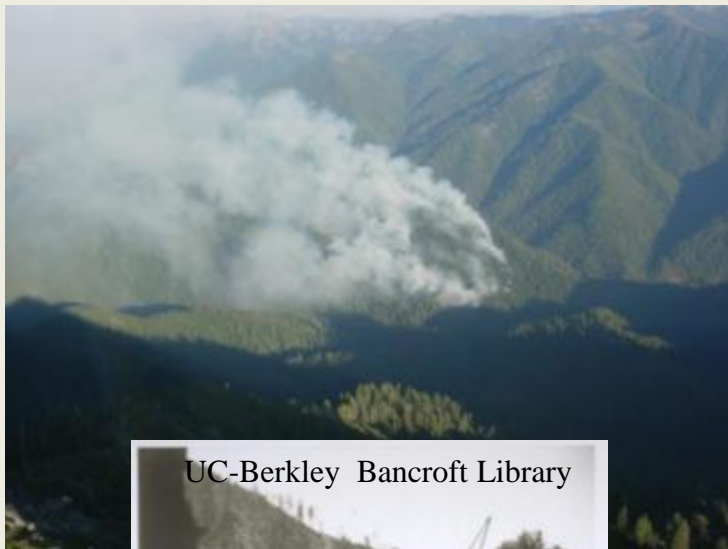
Paleoclimate and fire history reconstruction of culturally significant lower elevation lake sites in the Lower Klamath River Region, California.



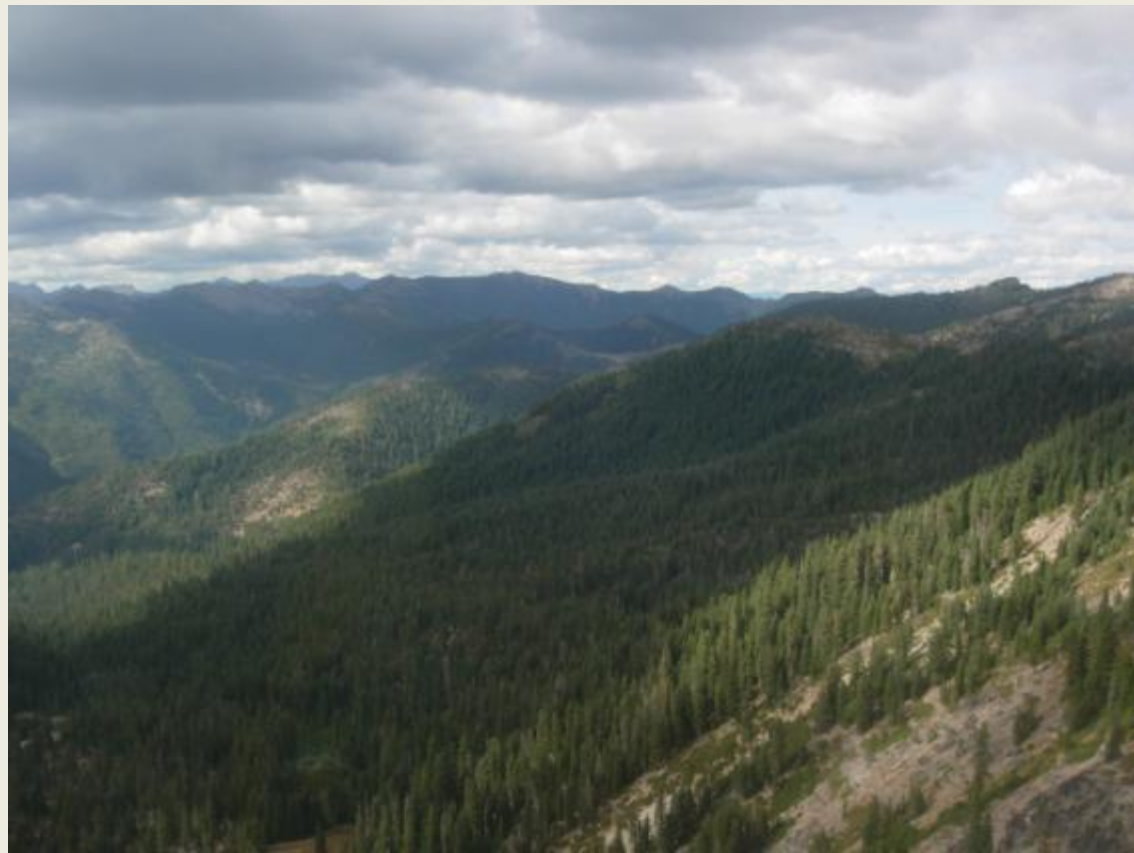
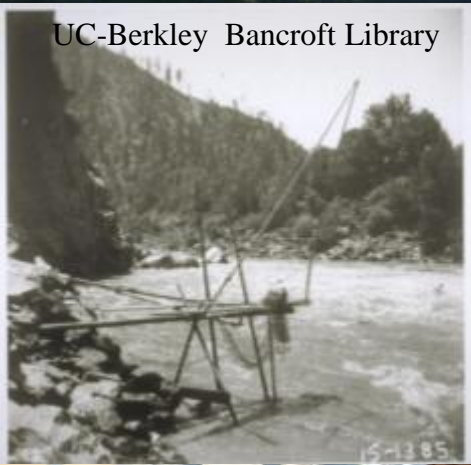
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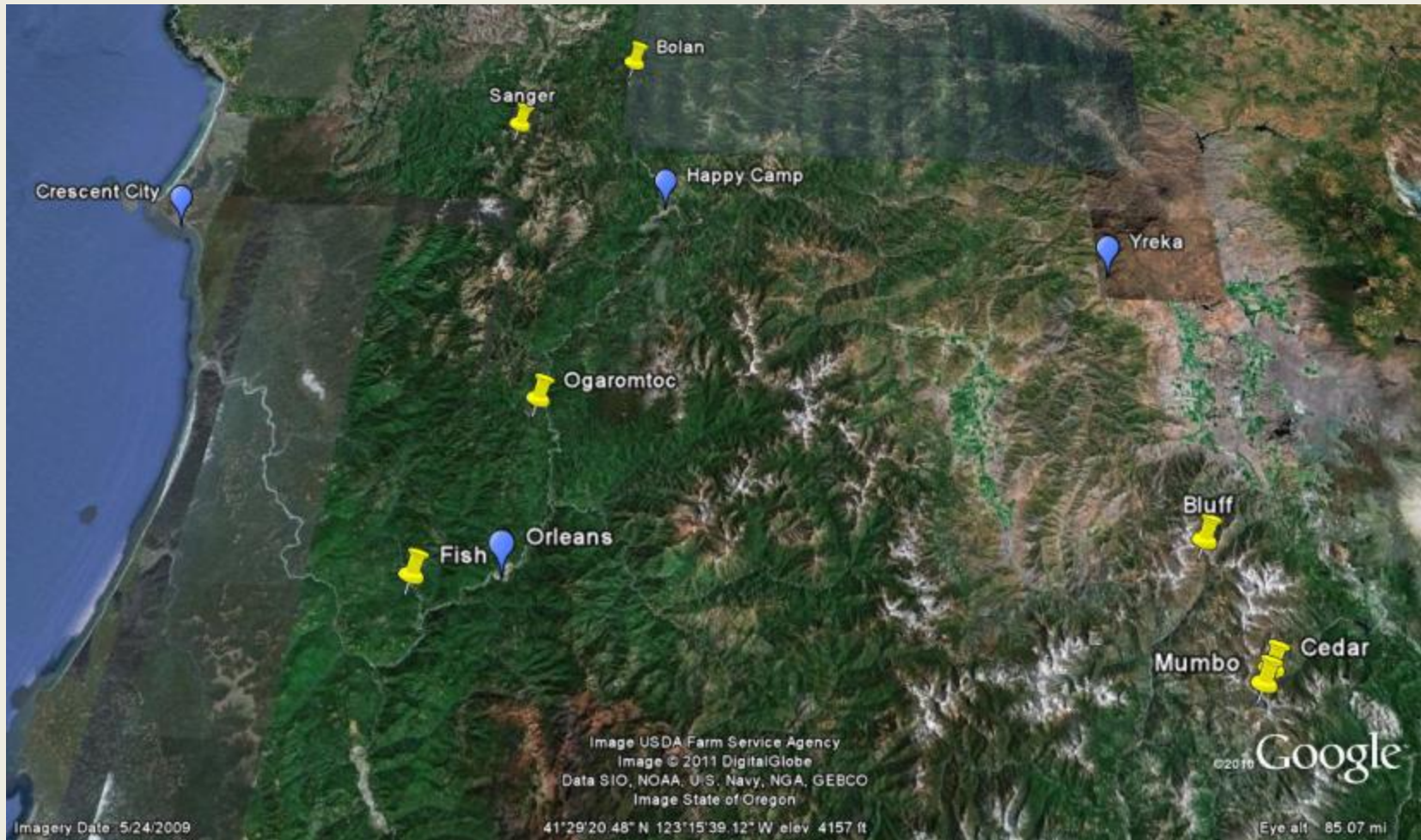


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- The complexity of Klamath fire and vegetation patterns are the result of a number of factors....
- Today I am going to focus on the overlap of culture and climate and how it may influence fire and vegetation patterns at two local sites.

Regional Holocene Climate Overview

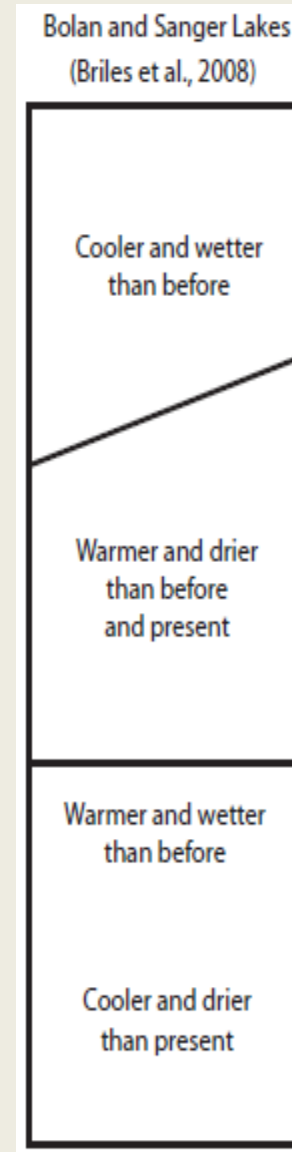


- Sites range in elevation from ~1600-2300m.
- Fish Lake and Lake Ogaromtoc are the low elevation sites analyzed later in this presentation.

Holocene Climate Summary

Age (cal. yr BP.)	Mumbo Lake (present paper)	Cedar Lake (West, 1989)	Bluff Lake (Mohr <i>et al.</i> , 2000)
1000	Cooler & Wet	Cool & Moist	Cool & Wet
2000			Cool & Moist
3000			Cool & Moist
4000	Cool & Moist	Somewhat Cooler & Dry	Warm & Slightly Wetter
5000			
6000			
7000	Warm & Dry	Warm & Dry	Warm & Dry
8000			
9000	Cool & Moist	Warm & Dry	Transitional
10,000			
11,000	Cool & Moist	Cool & Moist	Cool & Moist
12,000			
13,000	Cold & Dry	Cool & Moist	Cold & Dry
14,000			
15,000			
16,000			

Adapted from Daniels *et al.*, 2005



Cooler and wetter
towards the present

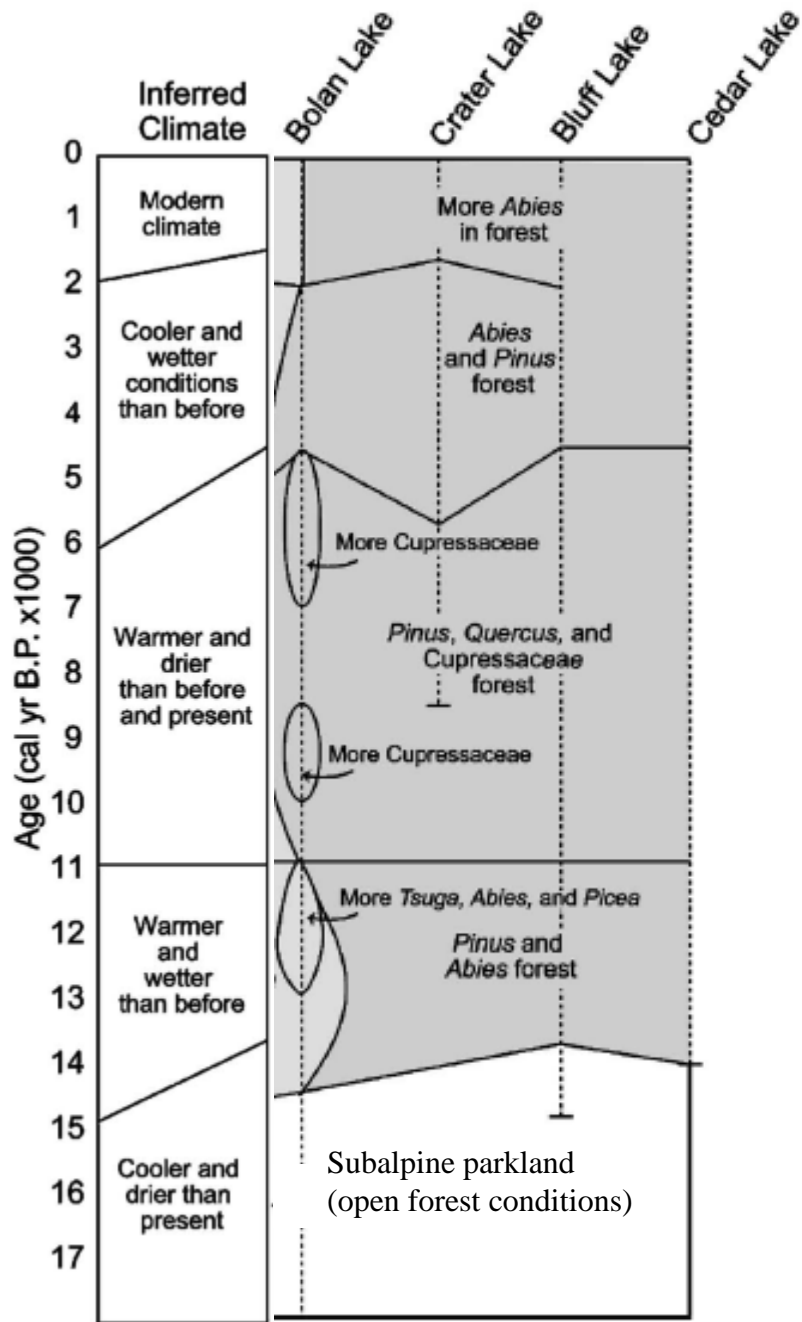
Asynchronous
regional cooling

Warm and dry

Cool and moist

Cold and dry

Adapted from
Briles *et al.*, 2008



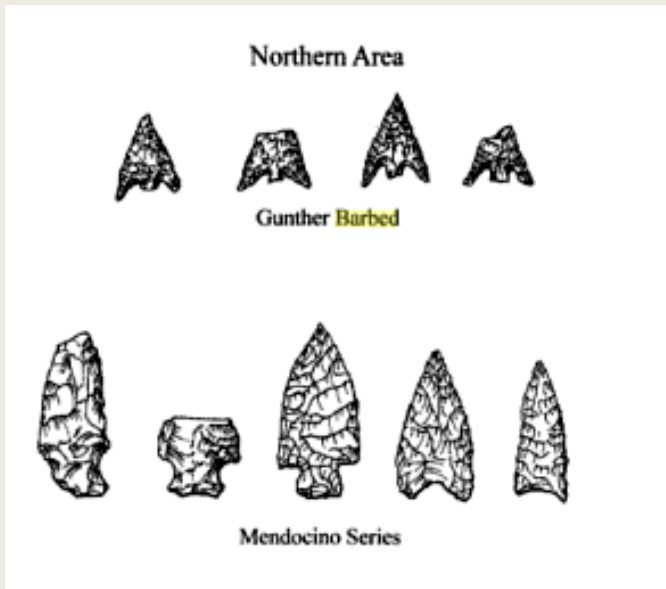
Holocene vegetation change

From Briles et al., 2005

Cultural History

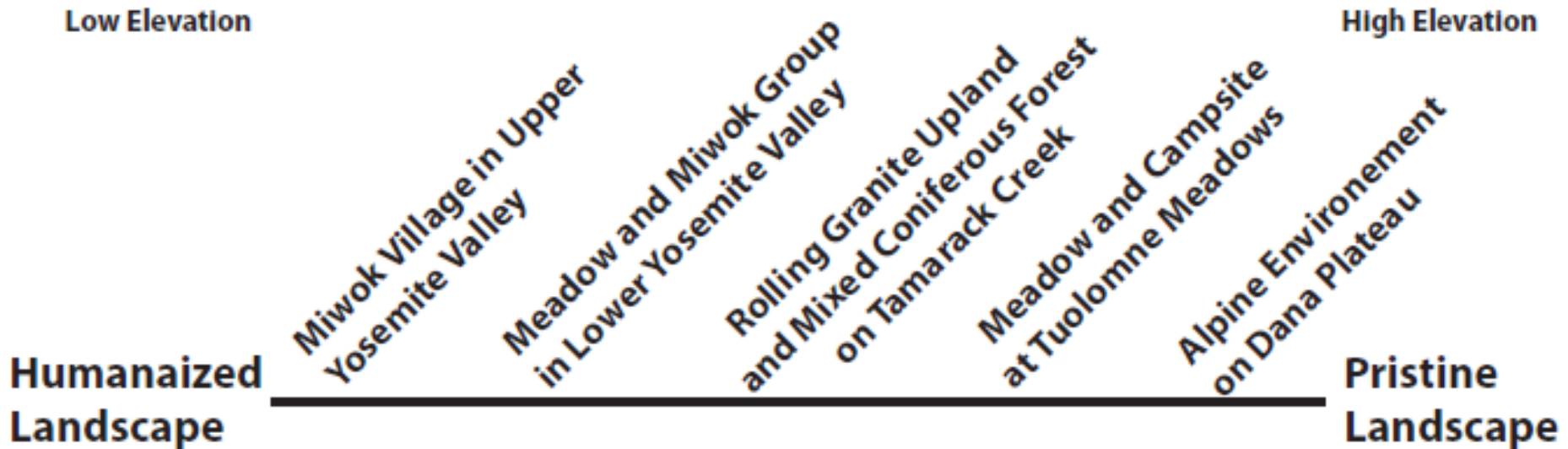


- Northwestern California has a long history of human habitation.
- The archeological record is compiled from several regional sources.
- Environmental interactions are detailed in modern ethnographies.
- Landscape management practices include vegetation manipulation to improve hunting, encourage specific plant species, and control pests.
- This was often accomplished through the selective use of fire.



Both illustrations from Jones and Klar, 2007

Introduction



Gradient of human impacts, Yosemite NP (Adapted from Vale, 2002)

- In the western U.S., our knowledge of pre-European Native American land use and its impact on fire regimes and vegetation is generally poor.
- The extent and intensity of their impacts are still widely debated and hypothesized impacts range from very localized to regional in scale.
- ‘Pristine versus humanized’ landscape debate.

Introduction

	Low Elevation				High Elevation	
	Miwok Village in Upper Yosemite Valley Meadow and Miwok Group in Lower Yosemite Valley Rolling Granite Upland and Mixed Coniferous Forest on Tamarack Creek Meadow and Campsite at Tuolumne Meadows Alpine Environment on Dana Plateau					
	Humanized Landscape	<hr/>				Pristine Landscape
	Gradient of human impacts, Yosemite NP (Adapted from Vale, 2002)					
Number of archeological sites	66	53	18	89	74	
% of each acre covered by sites	9	5	6	14	14	

(Gassaway, in press)

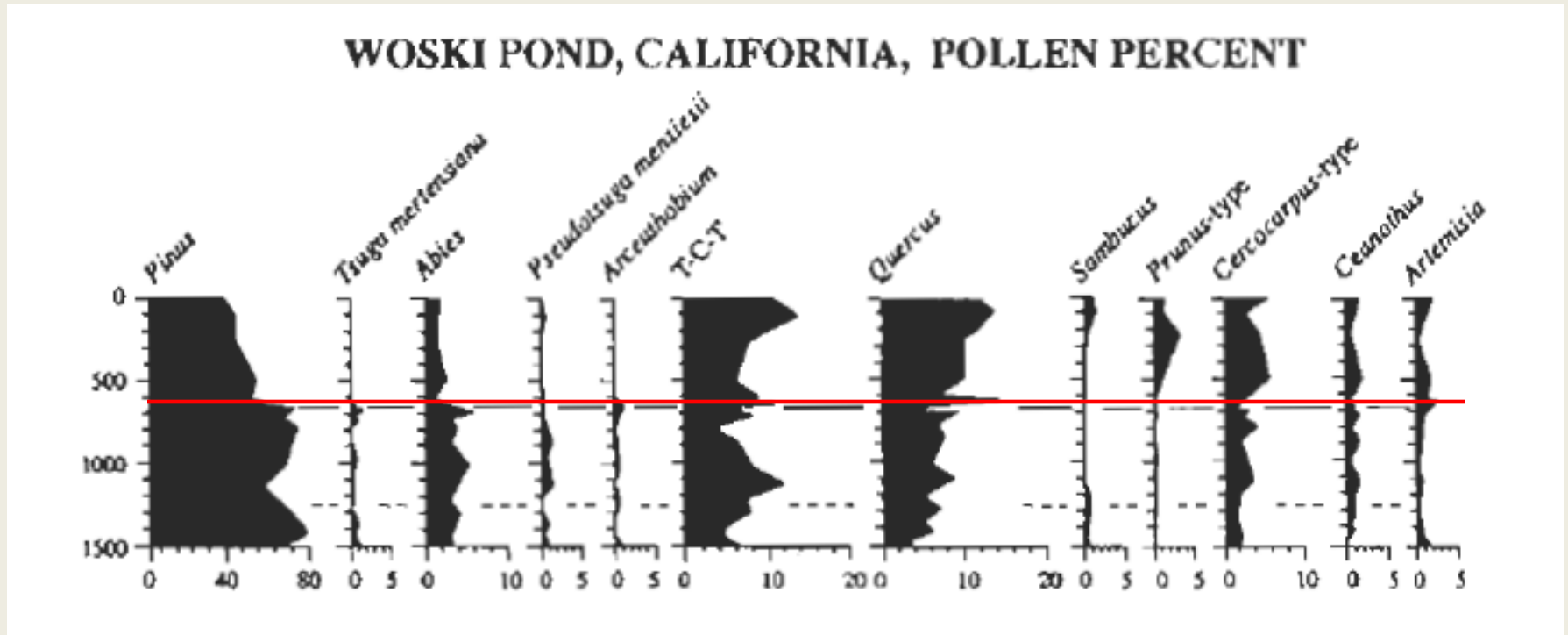
The archeological record finds no such distinction in Yosemite NP.

Introduction

- Did Native Americans in the Klamath Mountains of northwestern California influenced forest composition and structure at a landscape scale through the use of fire?
- Suggested lines of evidence include:
 - Paleoecology, archeology, anthropology, and population dynamics.
 - Stress the need for interdisciplinary studies and studies at lower elevation.
- Today, I am presenting preliminary data that uses a methodology intended to examine anthropogenic impacts based on the preceding lines of evidence.



Woski Pond Evidence, Yosemite Valley



- Anderson and Carpenter (1991)
- Found evidence of vegetation shifts that conflict with dominant climate trends.
- Vegetation change at ~650BP is coincident with a cultural shift.

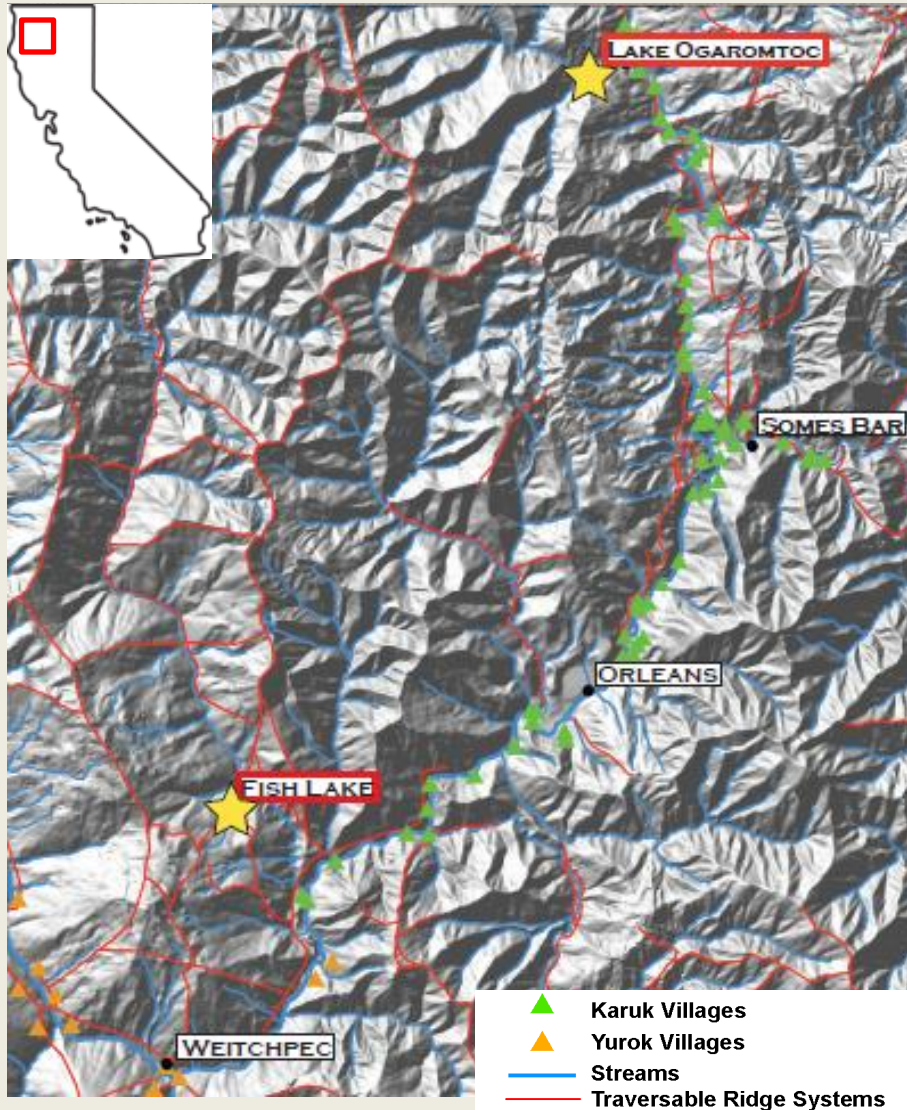
Research Questions

Two central questions:

1. Does past vegetation composition and fire occurrence change in a manner inconsistent with regional climate reconstructions?
2. Is the timing of landscape level change consistent with archaeological evidence for Native American occupation across the region and their use of the environment?



Site Selection



These two low-elevation sites offer the interdisciplinary records needed to address the issue of anthropogenic influences on fire regimes and vegetation.

Site Selection

- Oral Histories and informal interviews indicate that Lake Ogaromtoc (Frog Pond) was along a prominent trail, was used as a acorn and basketry material gathering place.
- Fish Lake was along a trail that connected Orleans to lower Klamath villages and is also the lake associated with the ‘Inland Whale’ story.



Alfred Kroeber photo of village near Somes Bar

Methods



Methods

Dendrochronology-based fire reconstruction based on fire scars from each basin

Sedimentology Based Fire and Vegetation History

(~8.0m sediment cores collected at each site)

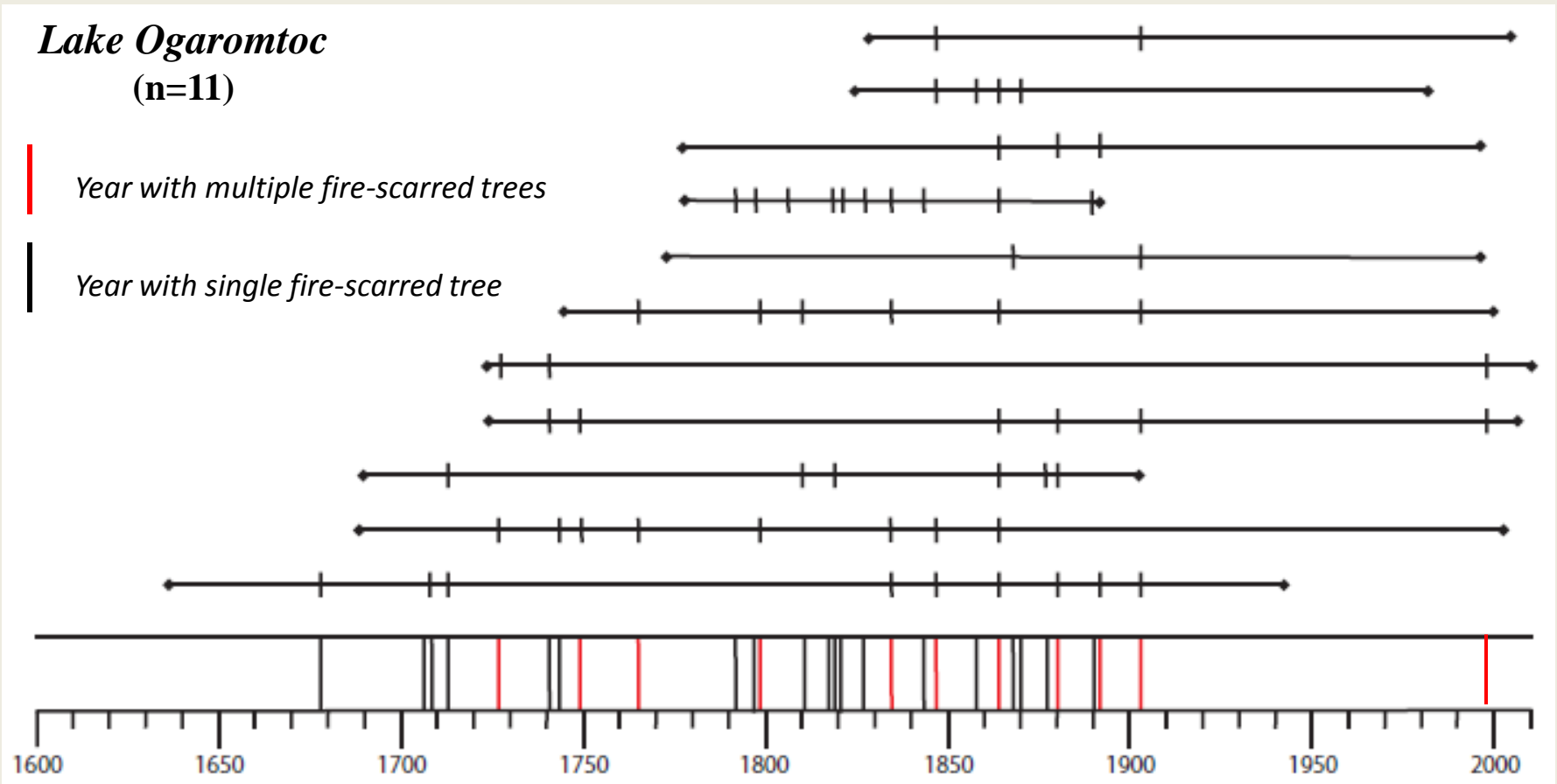
- ***Age Model - Radiocarbon***
 - Derived from macrofossils in the sediment core
 - Used to constrain the paleofire and vegetation records
- ***Charcoal Analysis:***
 - Charcoal particles ($>125\mu\text{m}$) were tallied at 1cm intervals
 - **CharAnalysis** program (Higuera *et al.*, 2009) used for analysis
- ***Pollen***
 - Four-hundred terrestrial grains from each sampled level were identified

Comparison of the paleo-record with the local cultural sequence

- Derived from the regional archeological and anthropological record

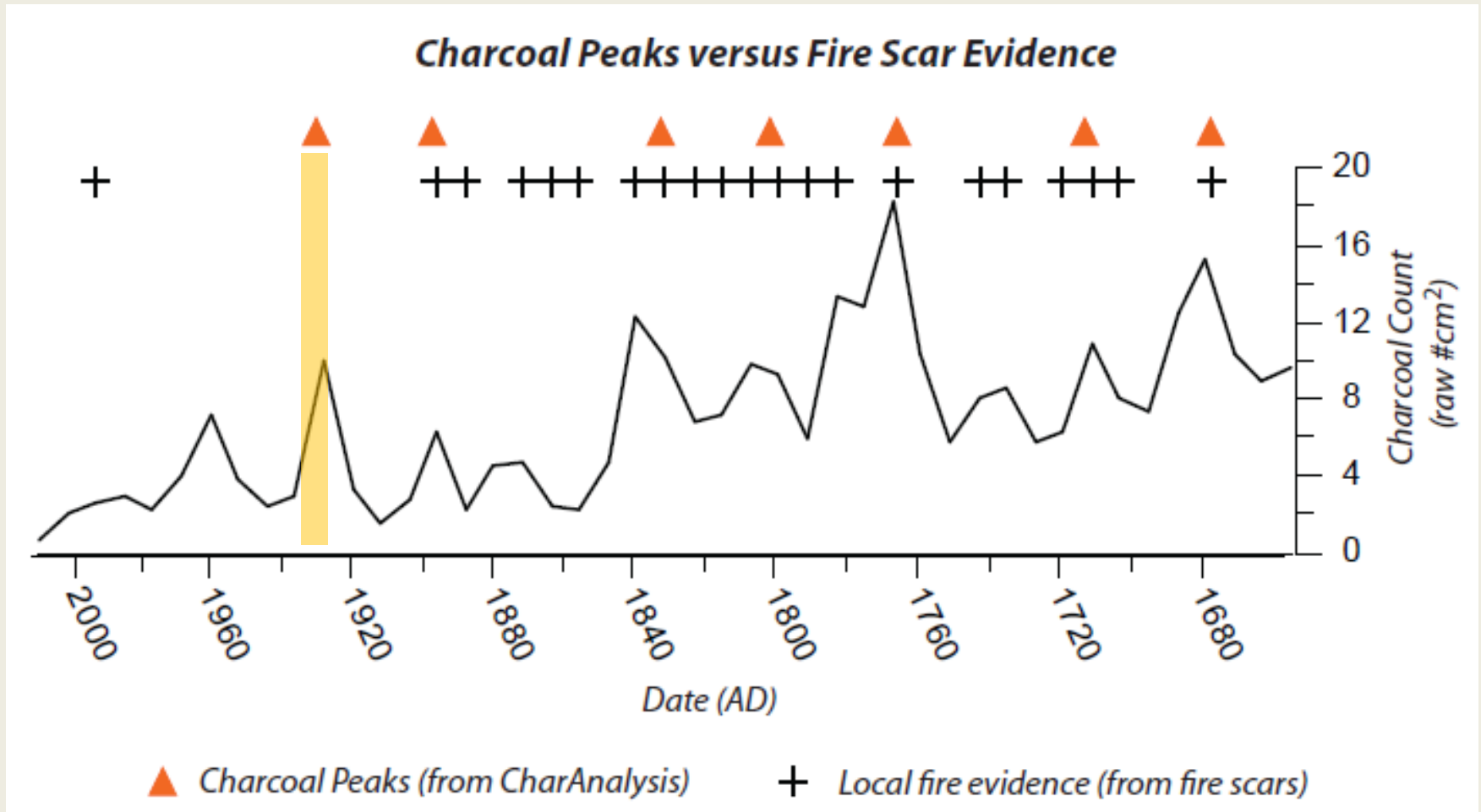


Results – Preliminary Fire Scar Record



- Mean Fire Return Interval = ~11 years
- 90% of the fires are late or dormant season.
- Evidence of very light fires (Scarring trees < 4" in diameter)
- Marked decrease in fire frequency post-1900AD.

Comparison of fire scars and charcoal at Lake Ogaromtoc



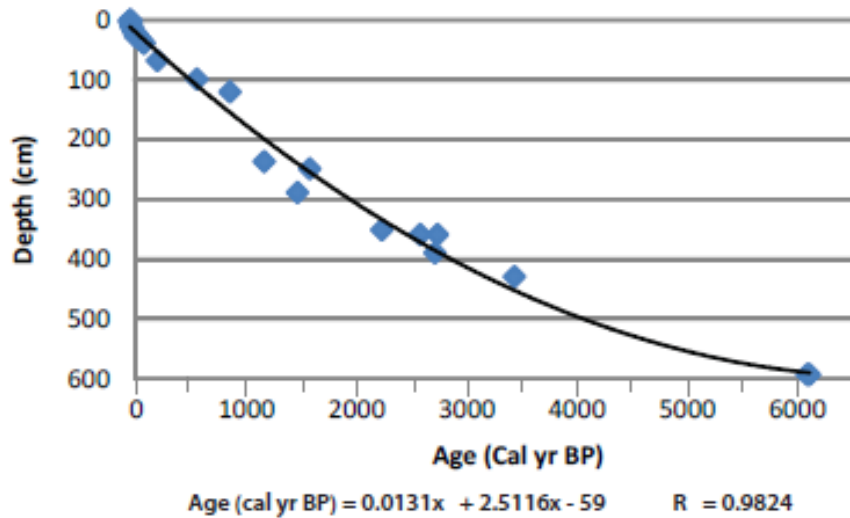
- Calibrated fire years to charcoal peaks...with mixed success.
- Charcoal record likely reflects fires beyond the immediate basin.
- Charcoal peaks represent a conservative record of fire.

Sedimentology-Based Results

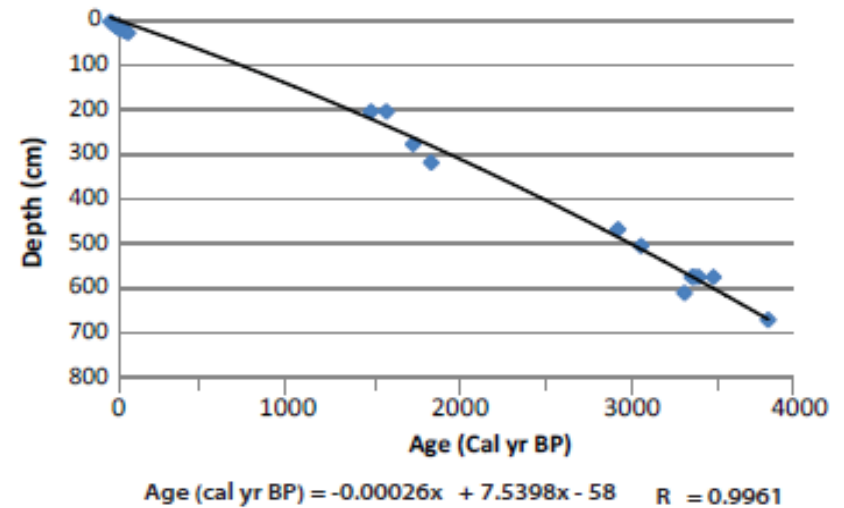


Results – Age Models

Lake Ogaromtoc



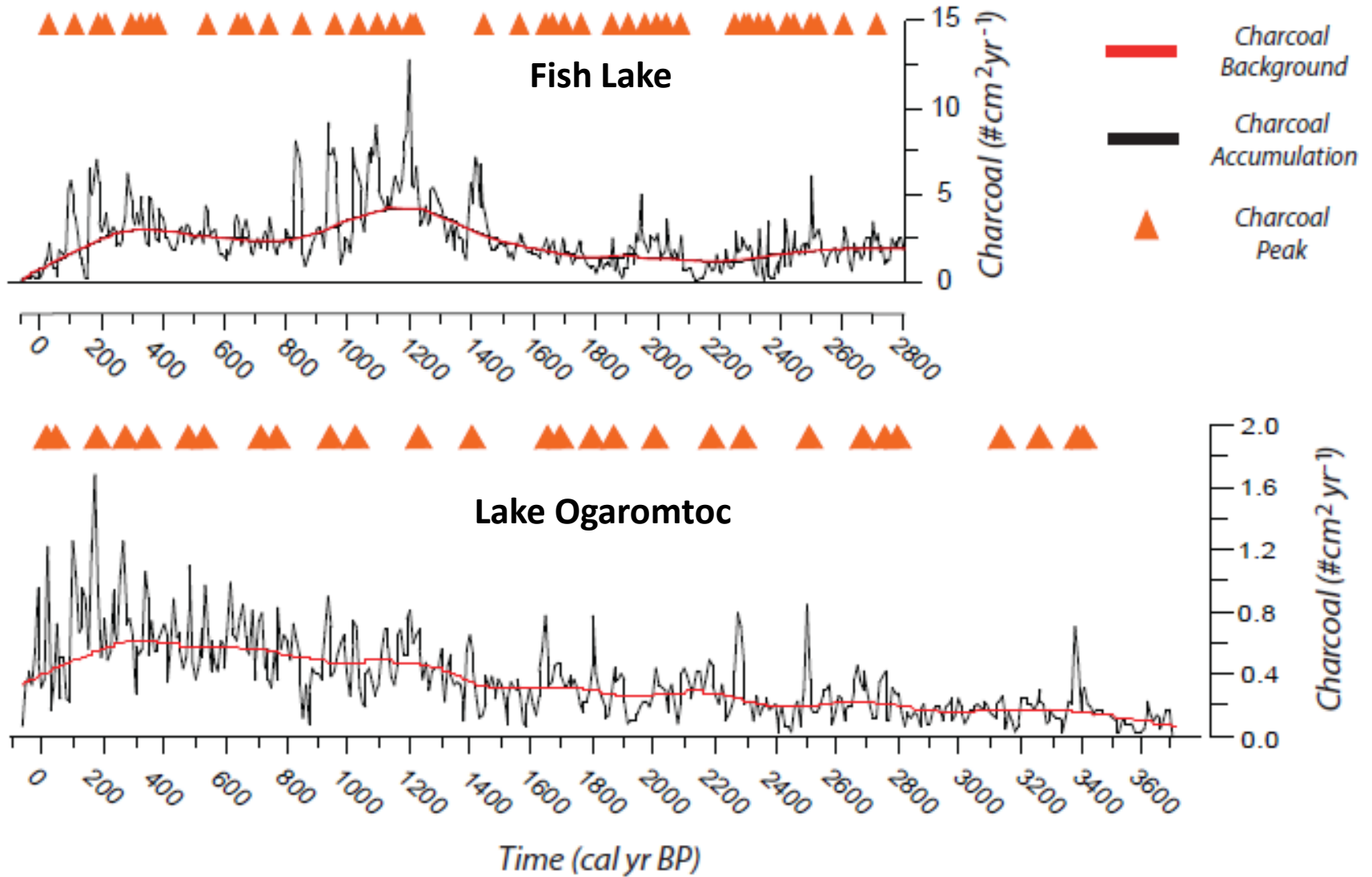
Fish Lake



- Lake Ogaromtoc sediment core dated with macrofossils (n=15) and Pb²¹⁰ (n=16).
- Sedimentation rates vary from 2.4 yrs/cm at the core surface to 18.1 yrs/cm at the base of the core.

- Fish Lake sediment core dated with macrofossils (n=13) and Pb²¹⁰ (n=12).
- Sedimentation rates vary from 7.4 yrs/cm at the core surface to 4.1 yrs/cm at the base of the core.

Results – Paleofire Record

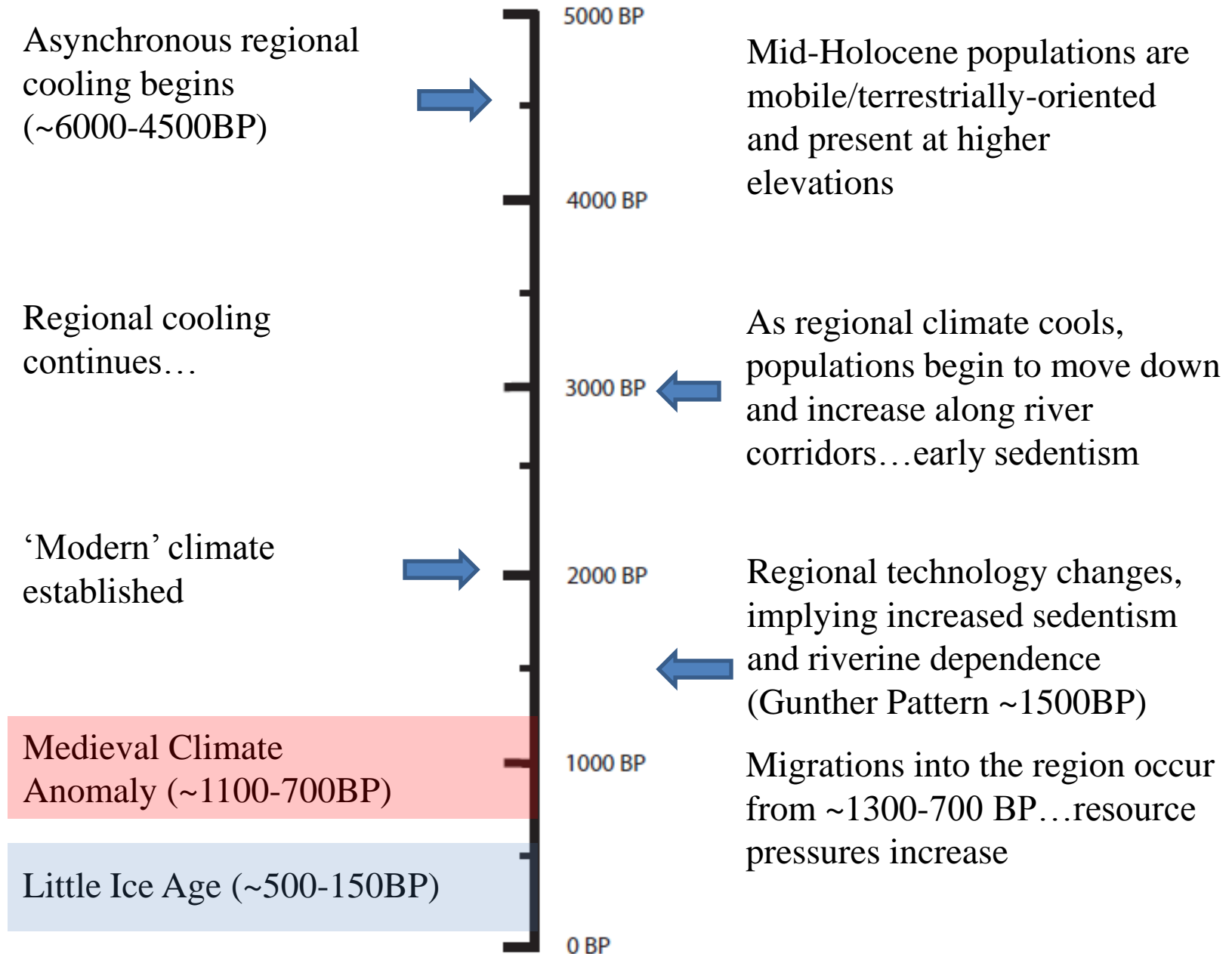


There appears to be a different fire signature in each basin.

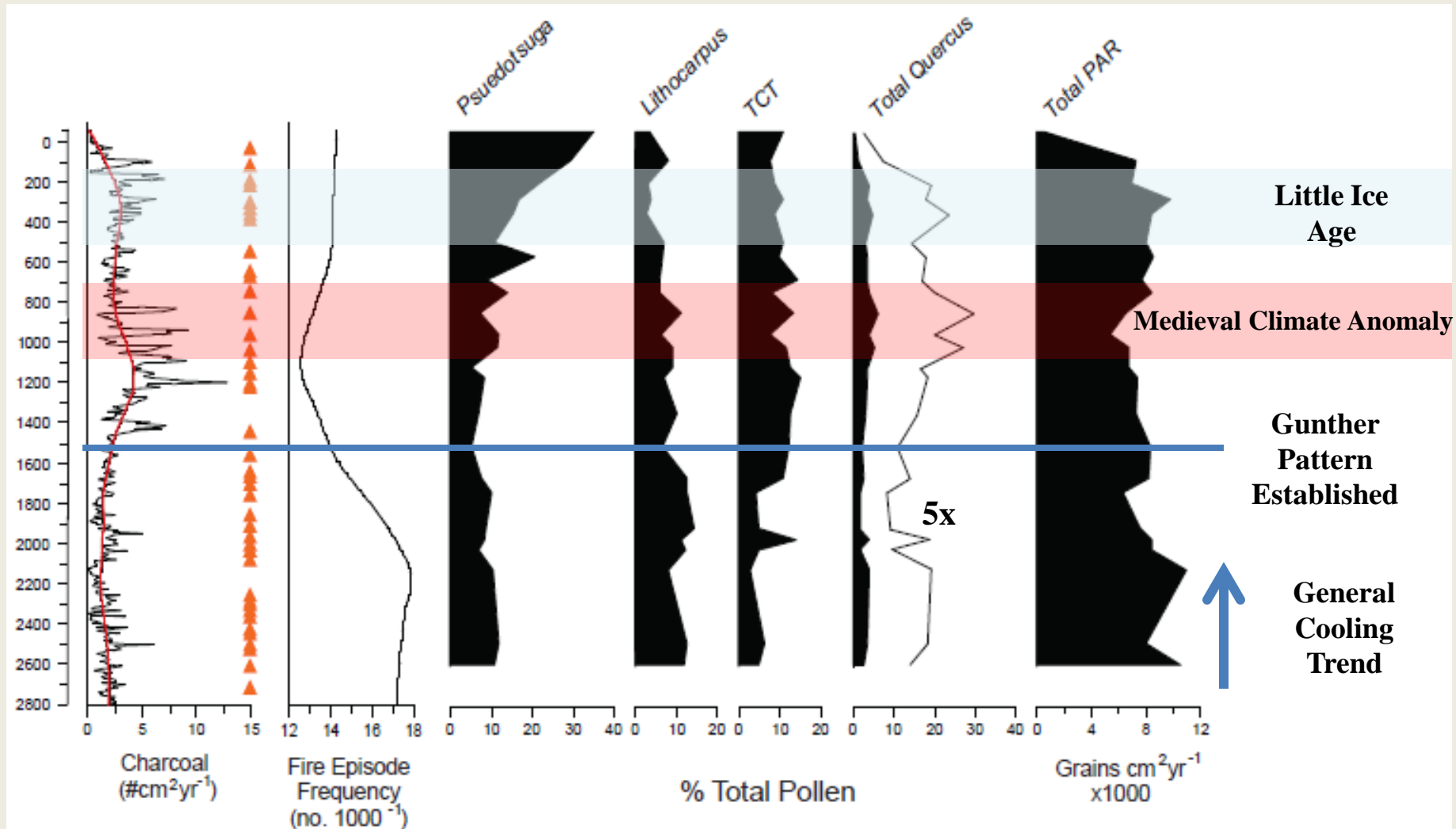
Climate and Cultural Sequences

Climate

Culture

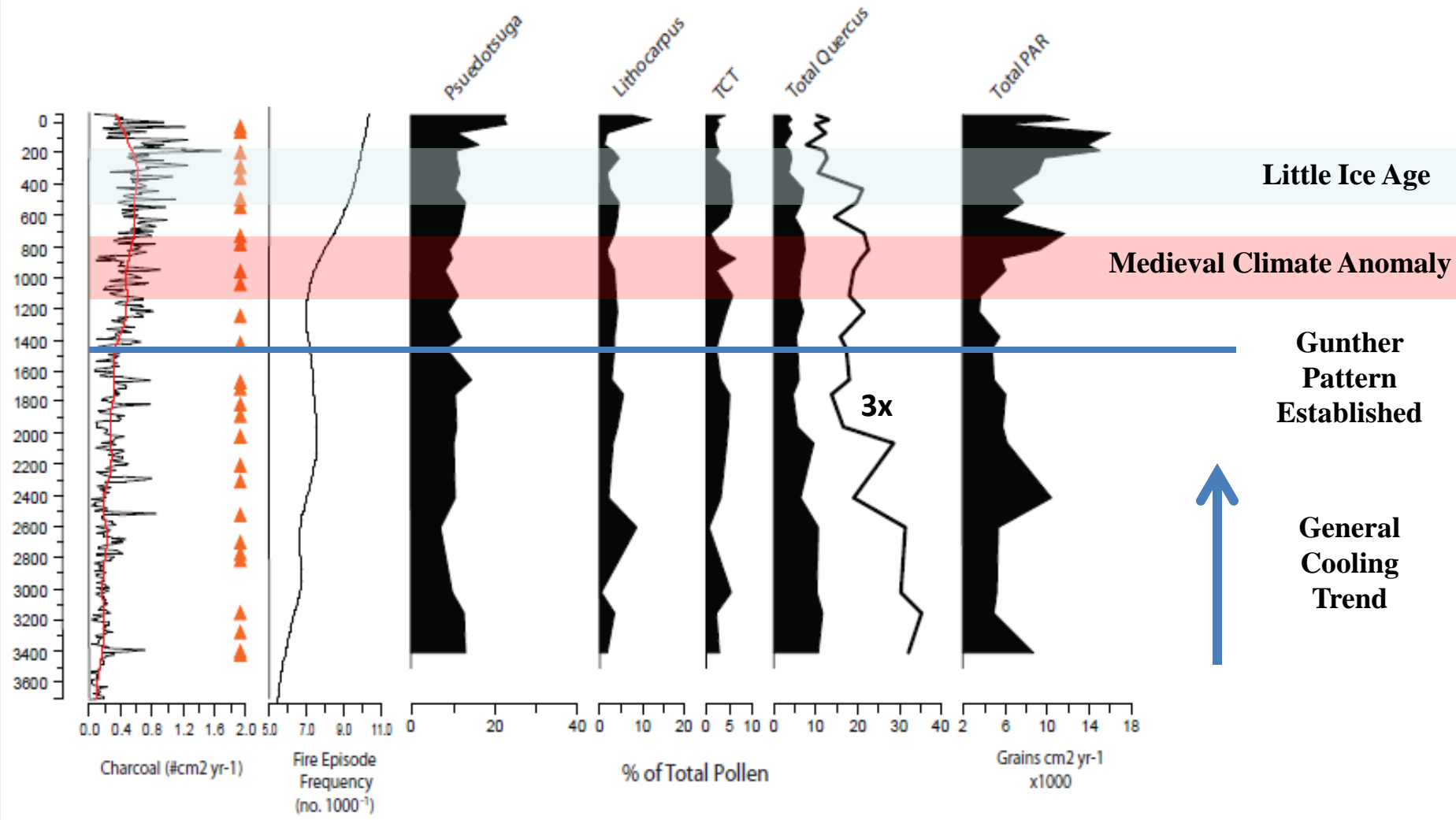


Fish Lake



- Potential anthropogenic impacts, with a pre-MCA charcoal increase in and an anomalous increase in Quercus during the LIA.

Lake Ogaromtoc



- Displays a primarily climatic signal with recent forest densification.
- Little evidence of for cultural time markers.

Potential differences?

- Lake size could be giving playing a role...
 - Larger lakes tend to be a more regional record of fire and pollen.
- Differential use?
 - Fish Lake is in closer proximity to larger cluster of known village sites.
- Coastal versus inland influences?
 - Fish Lake may be more sensitive to potential changes due to its' more coastal position.

Conclusions

- Anomalous pre-MCA charcoal increase and Quercus peak during the LIA may reflect anthropogenic impacts.
- The preliminary data at Lake Ogaromtoc displays a primarily climatic signal.
- Douglas-fir expansion clearly demonstrated at both sites.
- Differences between lakes require further investigation.
- Findings could have implications for what we consider pre-European reference conditions in areas with a legacy of Native American land use.

Future research

- Improve resolution to the pollen record in the MCA and LIA periods.
- Explore the paleo-extent of oak openings that may be influencing each sites' pollen record.
- Further examine the management implications for low elevation ecosystems throughout the region.

Acknowledgements

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