CLIMATE CHANGE AT EAGLE LAKE, CA LOCATED IN THE TRANSITION ZONE OF THE NORTH AMERICAN DIPOLE

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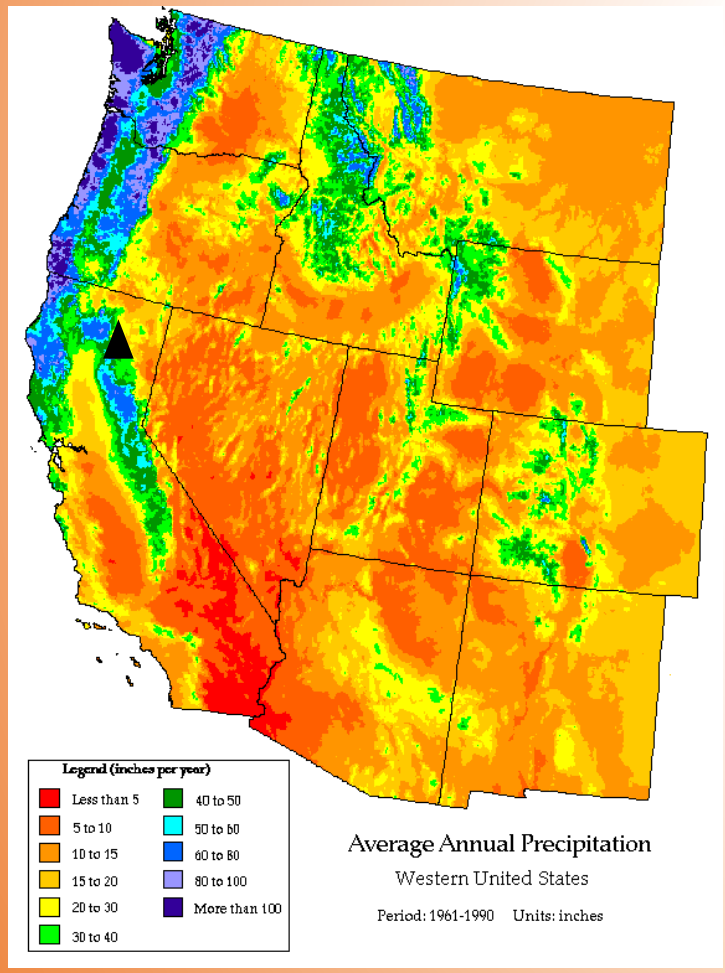
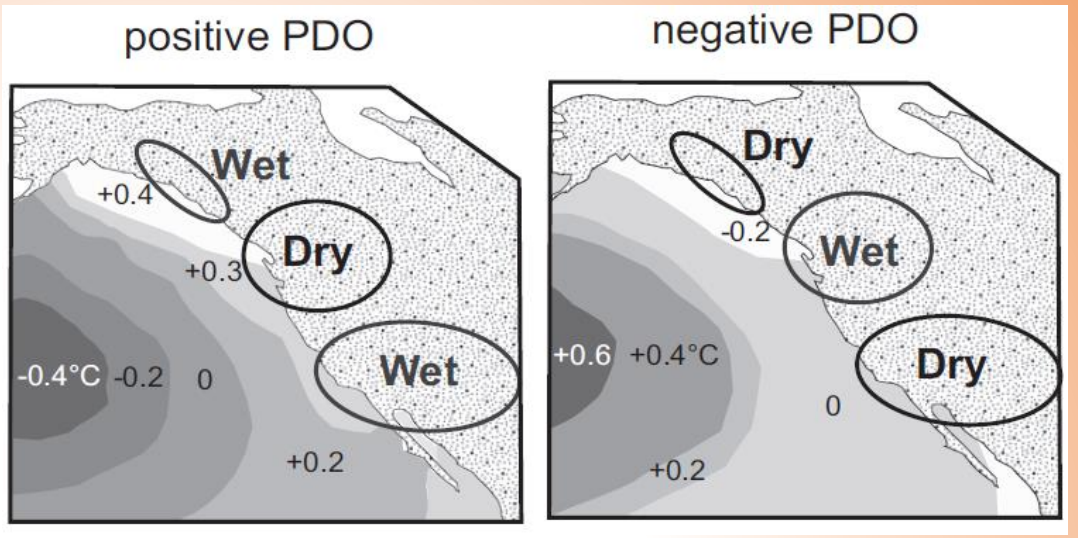
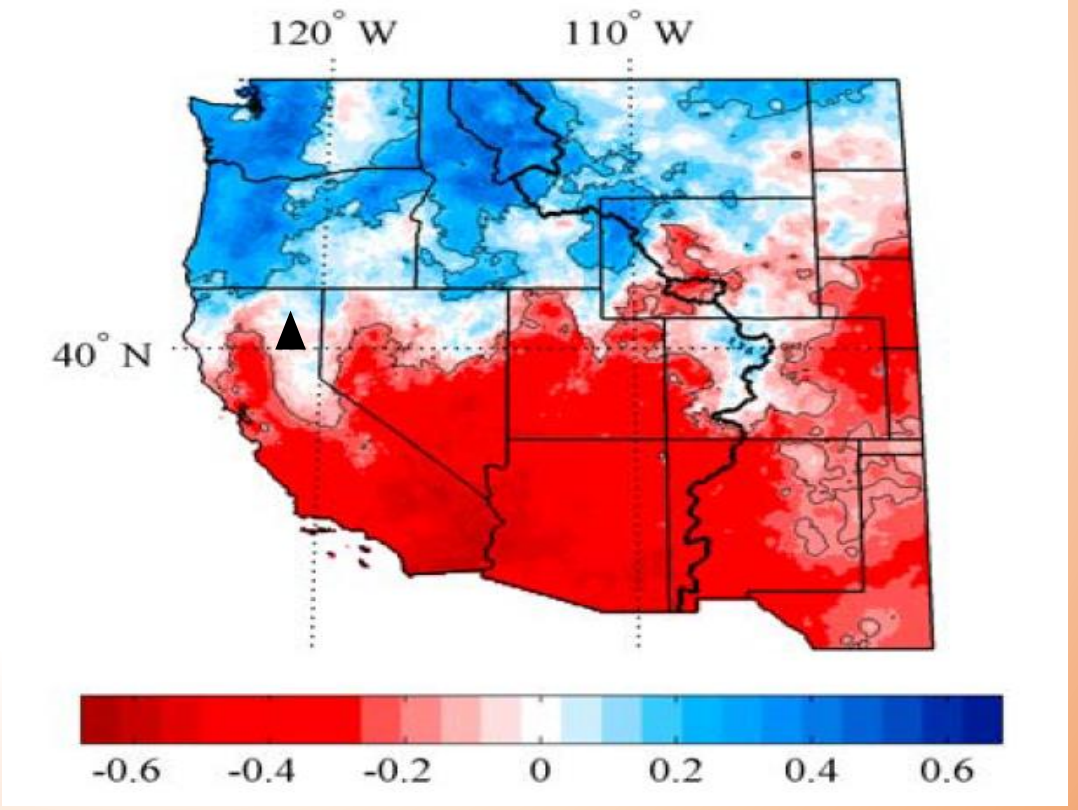
North American Precipitation Dipole



WRCC



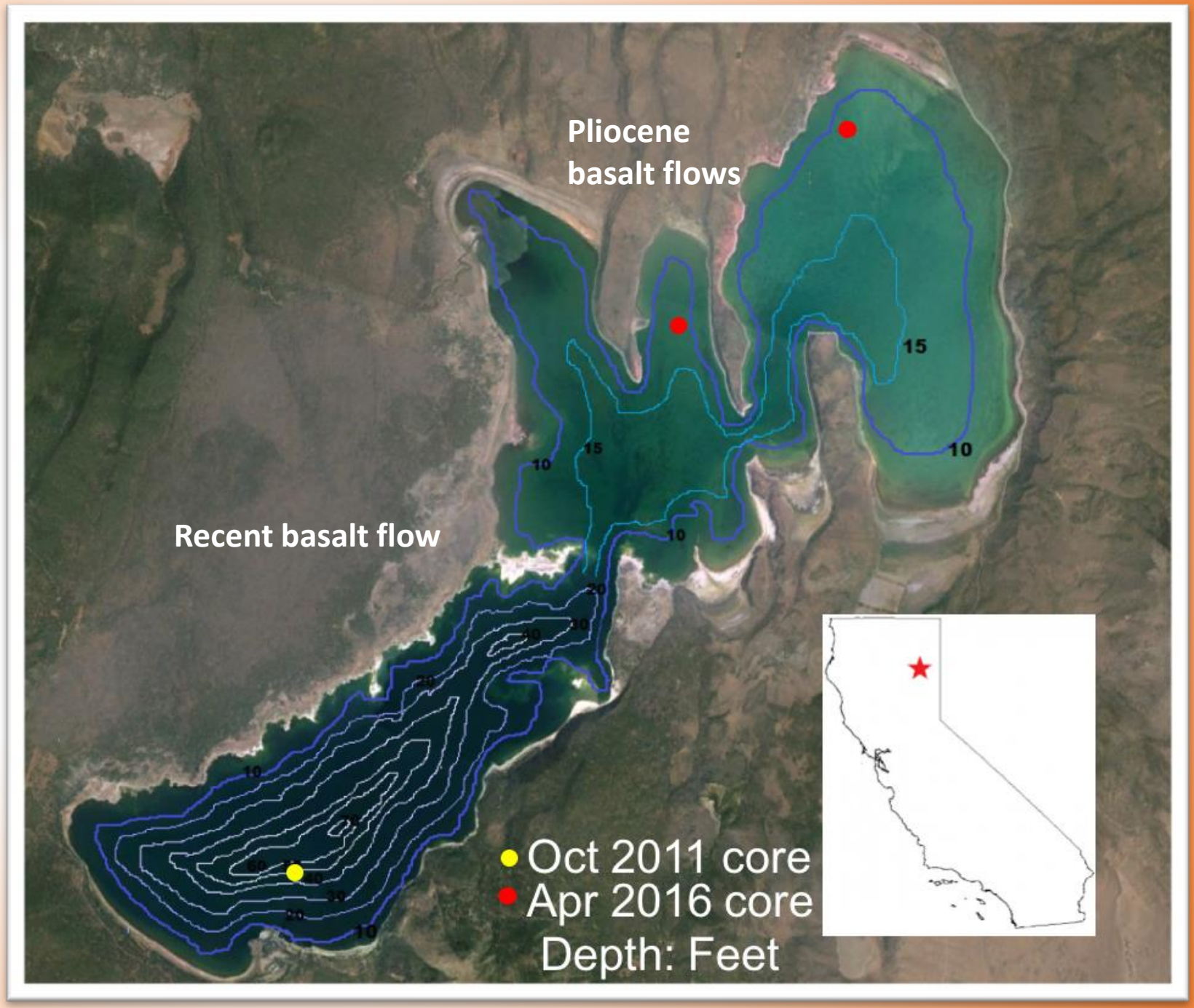
Barron & Anderson, 2011



Wise,2010

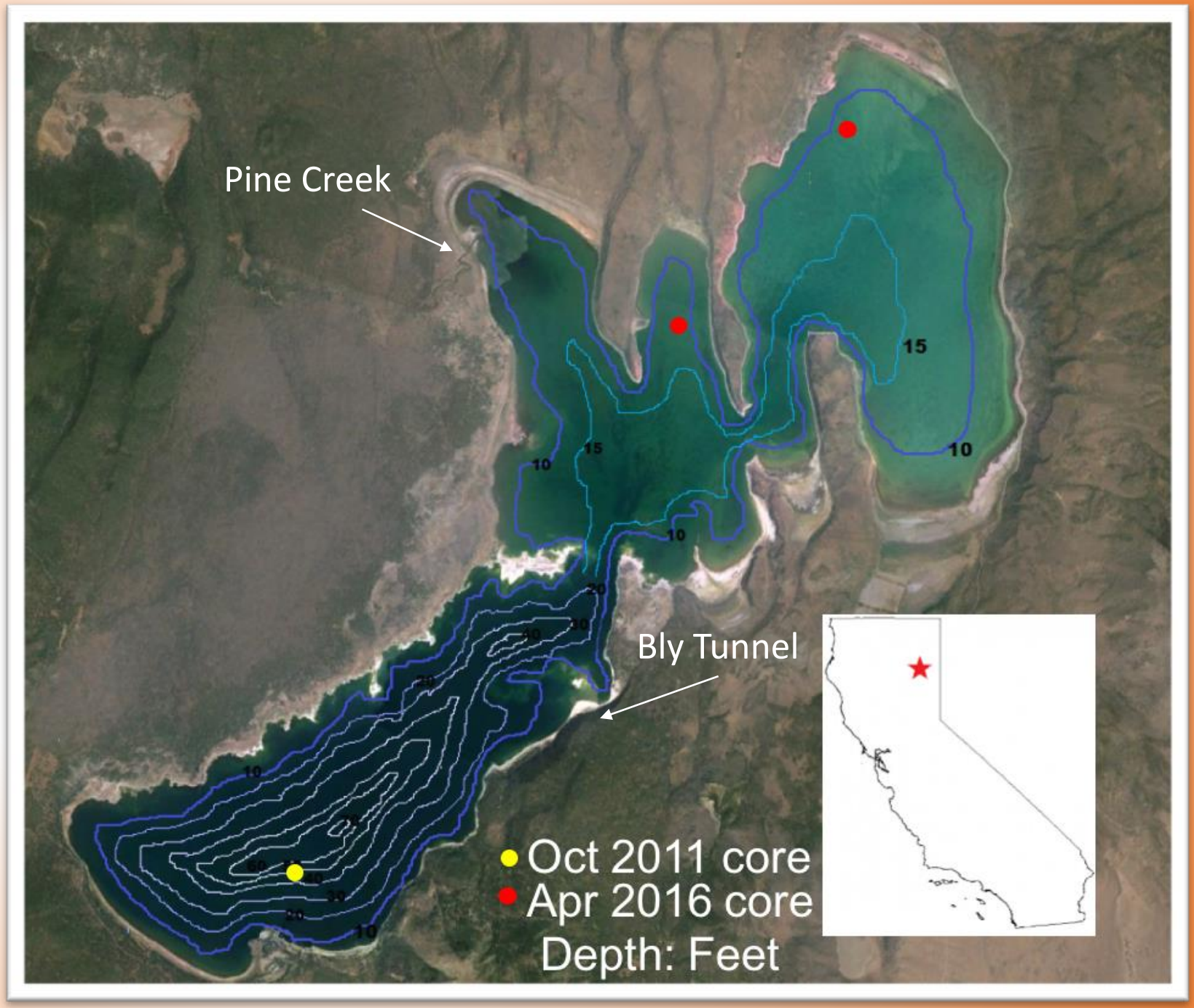
Eagle Lake, California

- 40°38’ N, 120°44’ W
- southern-end of Cenozoic-aged Modoc volcanic plateau
- Directly east of Mt. Lassen



Eagle Lake, California

- no natural surface outlet (closed basin)
- artificial outlet (Bly tunnel)
- seasonal inlet: Pine Creek
- maximum depth
  - Southern basin ~70 feet
  - Northern basin ~15 feet
- current lake is ~ 8 feet below level on figure



Questions

- Does Eagle Lake record Holocene shifts in this precipitation transition zone?
- What are the climatic differences between the early and late Holocene?
- Can we identify the effects of the Bly Tunnel construction and subsequent closure in the lake record?

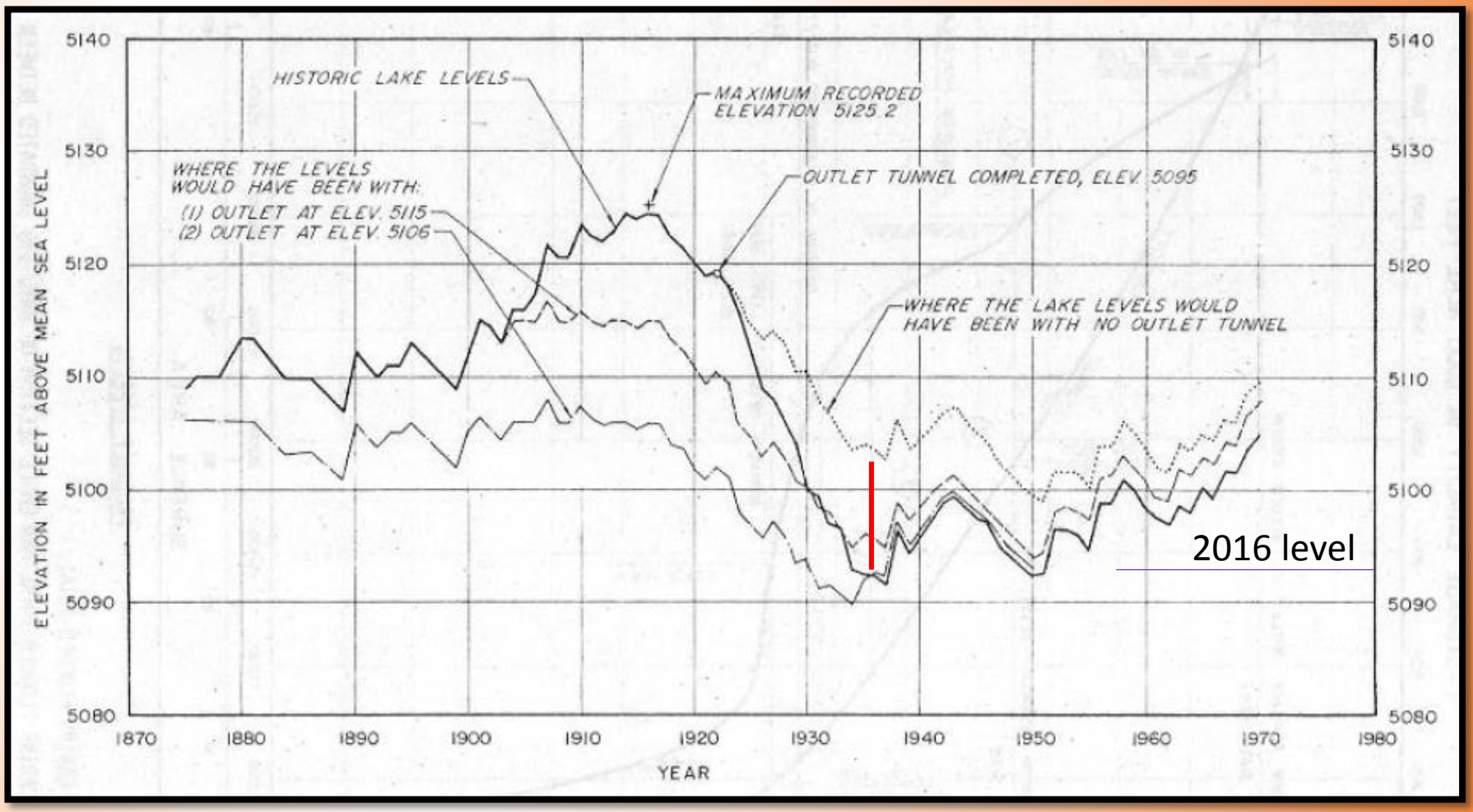
Objectives

- Reconstruct variations in productivity and lake level with sedimentology and geochemistry for
  - Early Holocene (~10 – 7.5 ka BP)
  - Late Holocene (~ 3 – 0 ka BP)

- Place Eagle Lake results in regional network of paleoclimatic sites

Eagle Lake History: *problems with modern "calibration"*

- 1923: Bly Tunnel completed
- 1930s drought drops lake further than expected
- South Basin lake level dropped 27 feet in 12 year period
- Tunnel filled in 1974



Raymond Vail and Associates, 1979

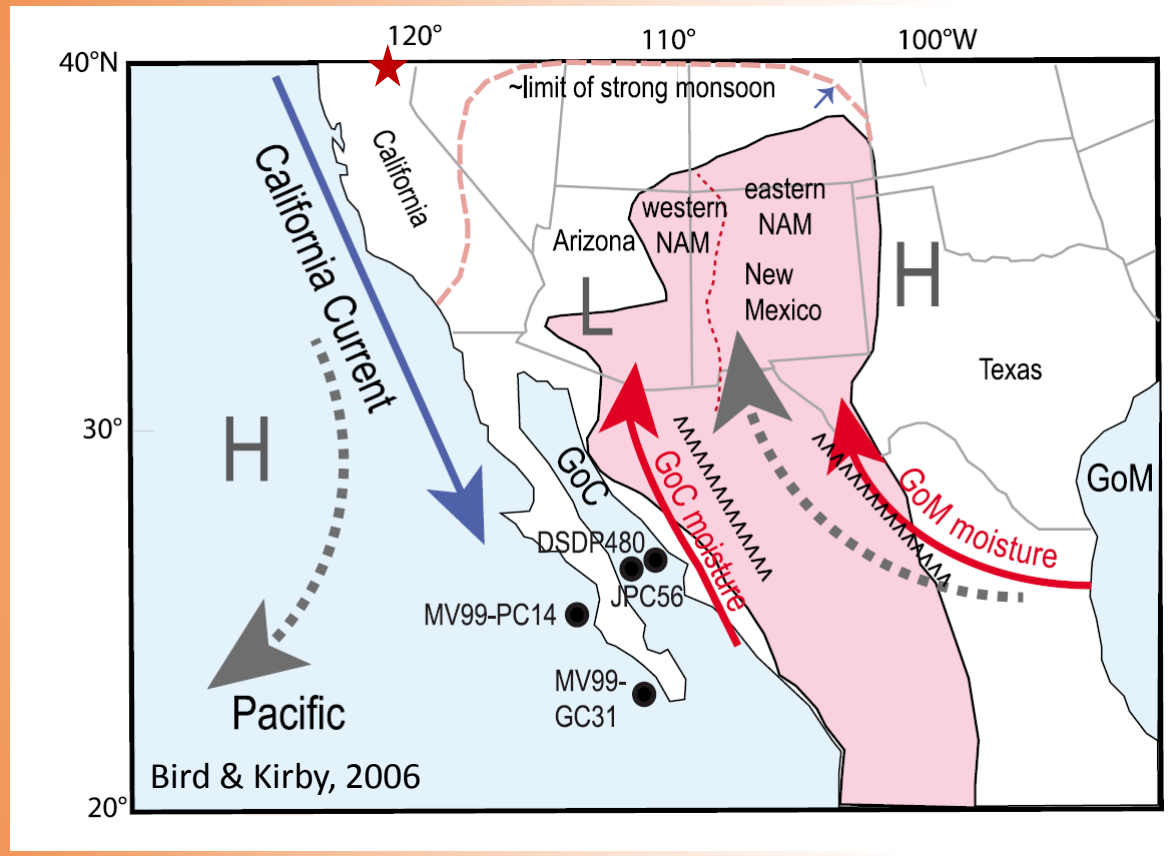
Eagle Lake History: *Lassen chronomarkers*

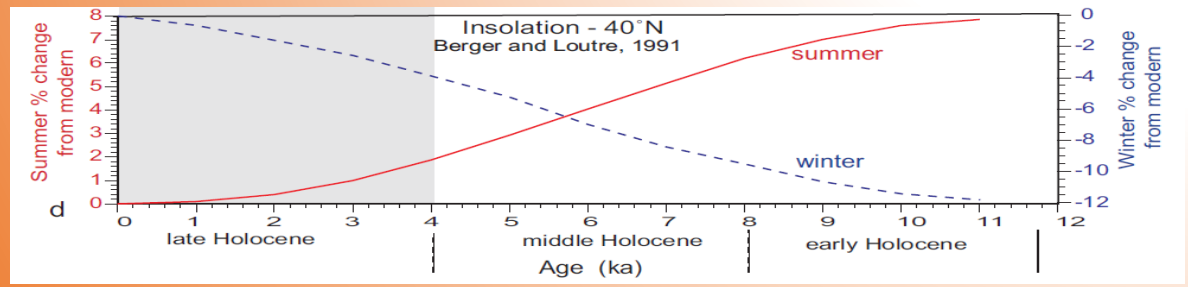
- In **1915**, Lassen Peak erupted with ash fall as far as 200 miles east.
- Eagle Lake is located ~98 miles east of Lassen Peak.
- Earlier Chaos Crags eruptions: **1,100 years ago**

NPS USDI

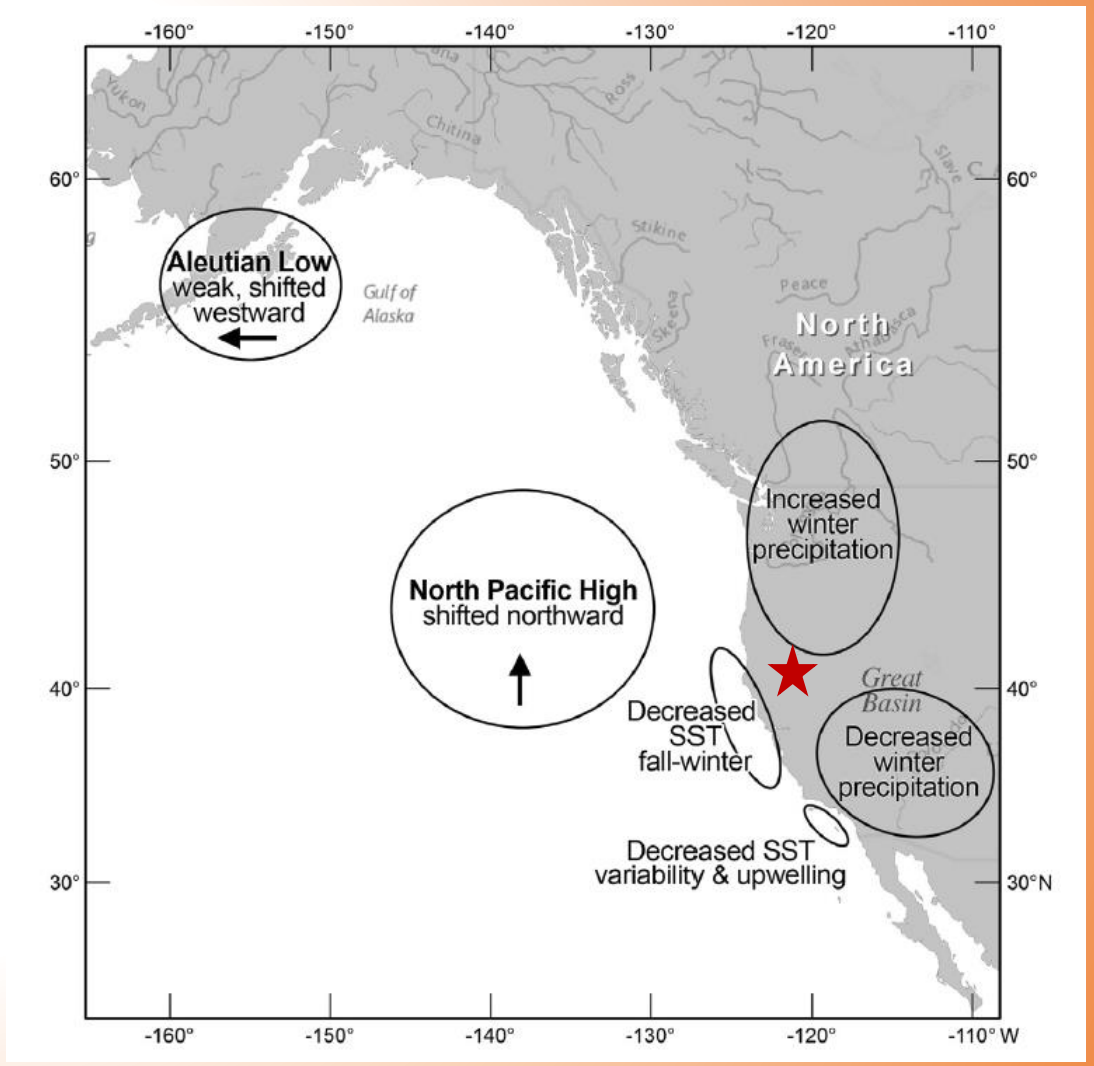
Holocene climate in the Western United States

Early Holocene





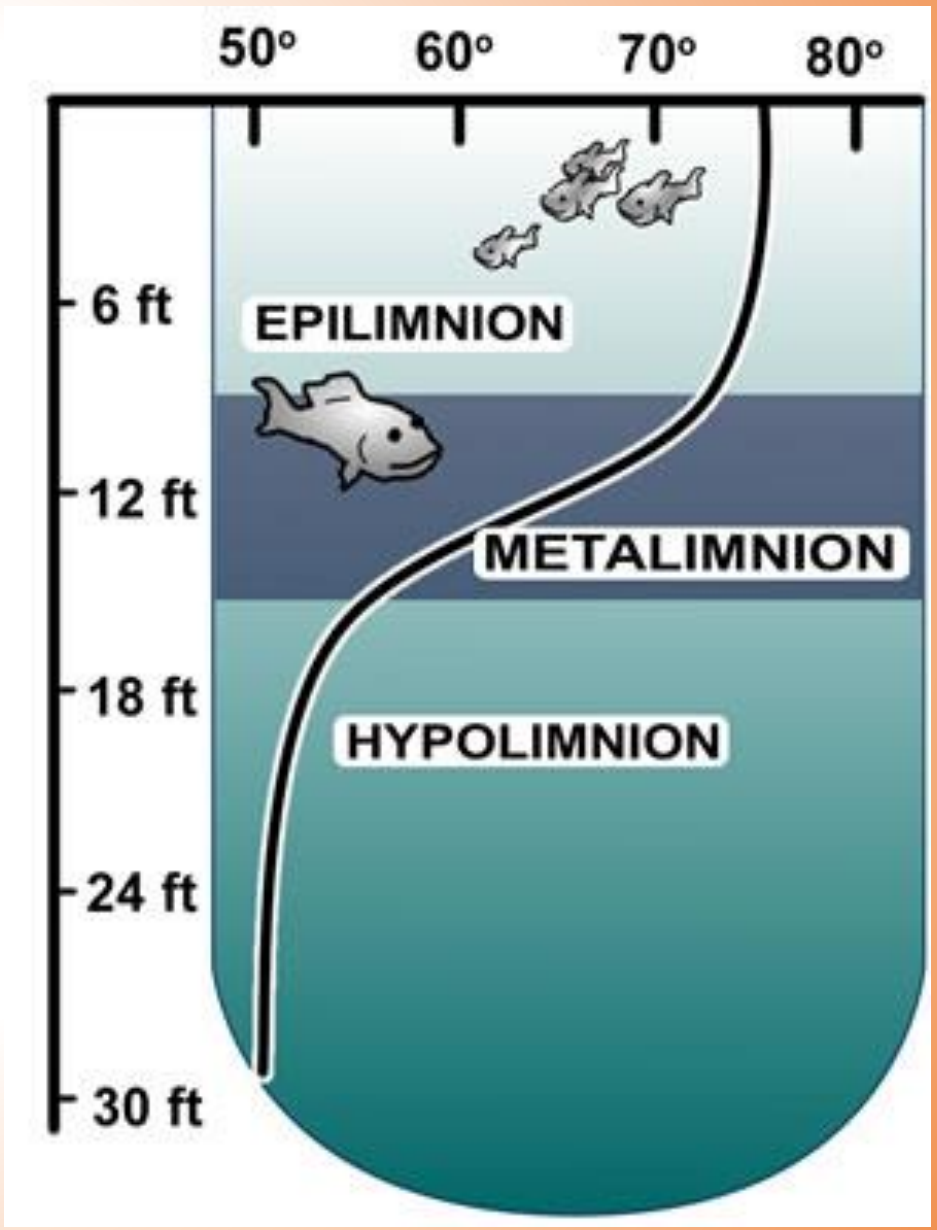
Late Holocene



Barron & Anderson, 2011

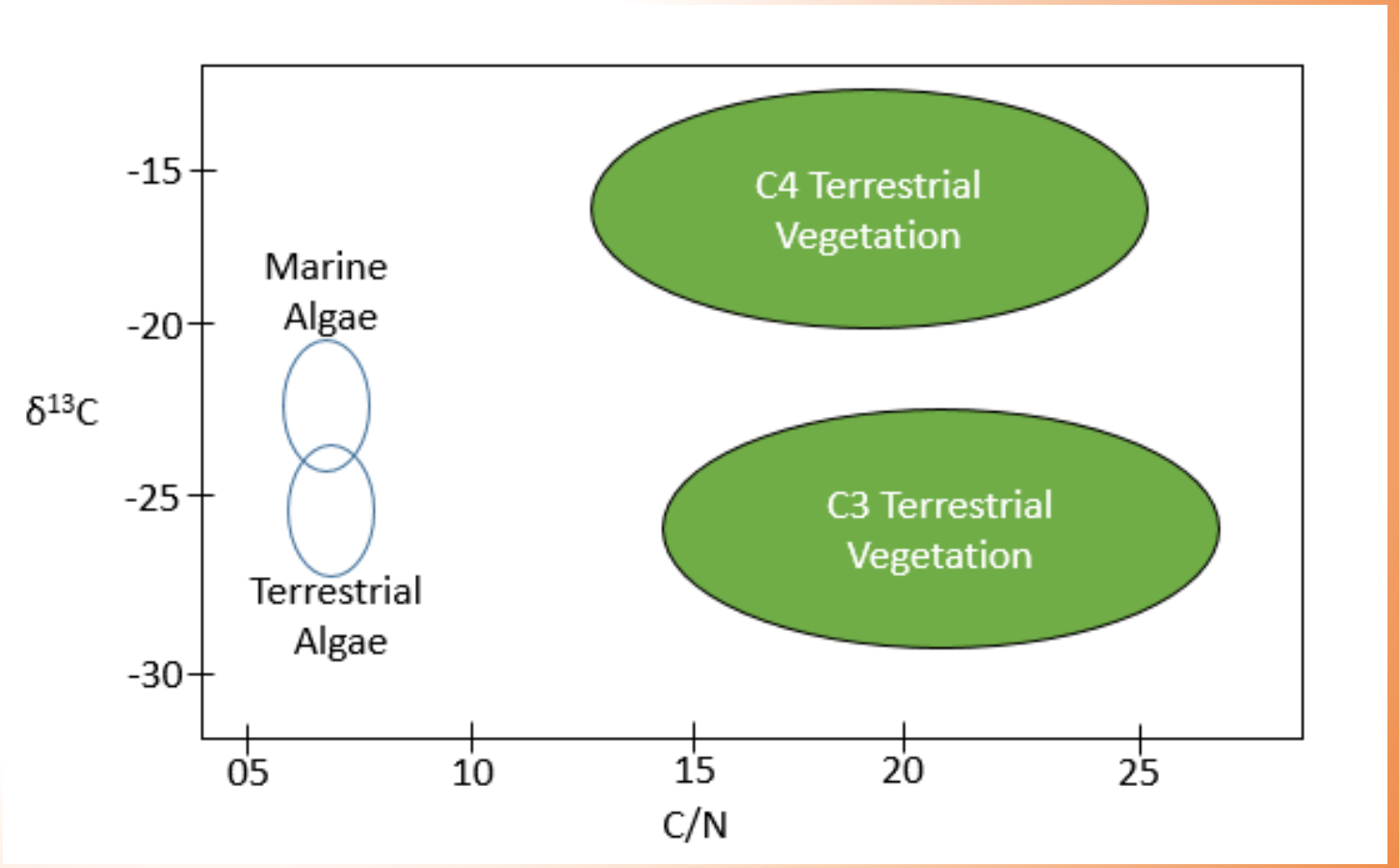
Tracking Productivity and Preservation: *Total Organic Carbon*

What is the Eagle Lake total organic carbon recording: productivity or preservation?



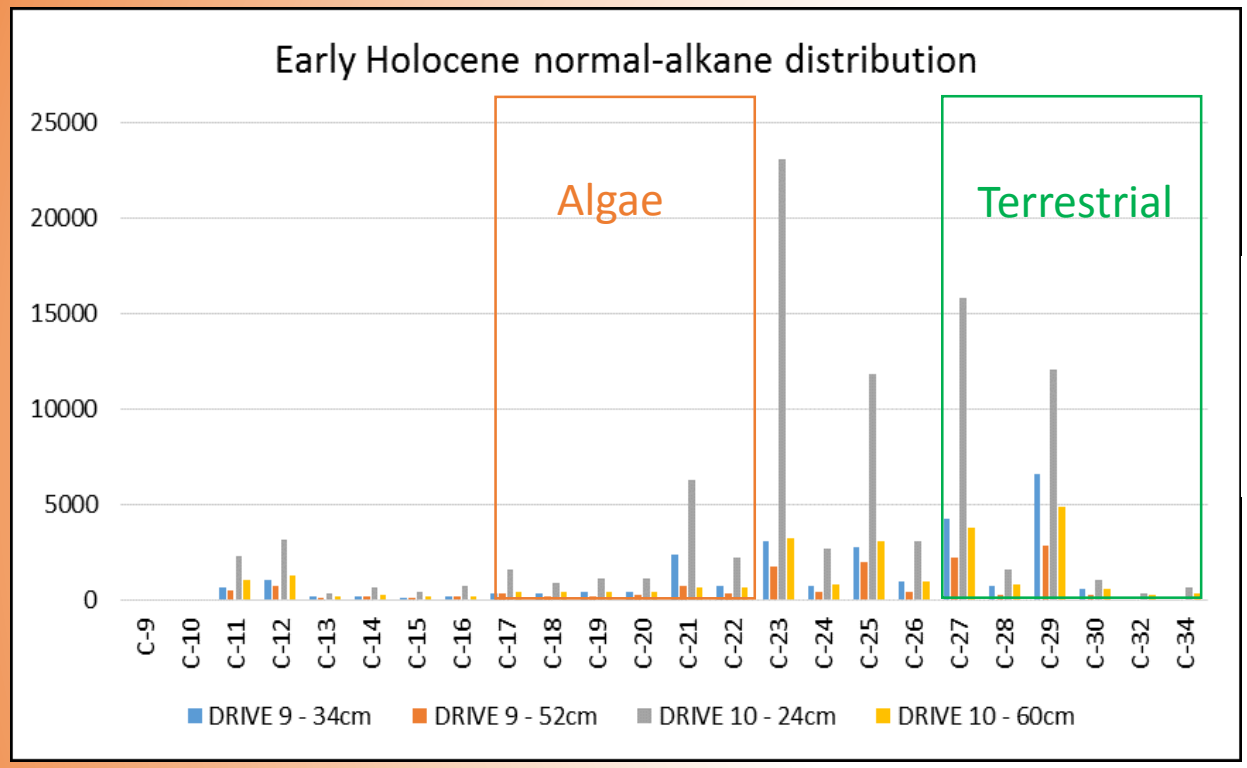
Tracking Lake Level and Organic Carbon Sources: *Carbon and Nitrogen Ratios*

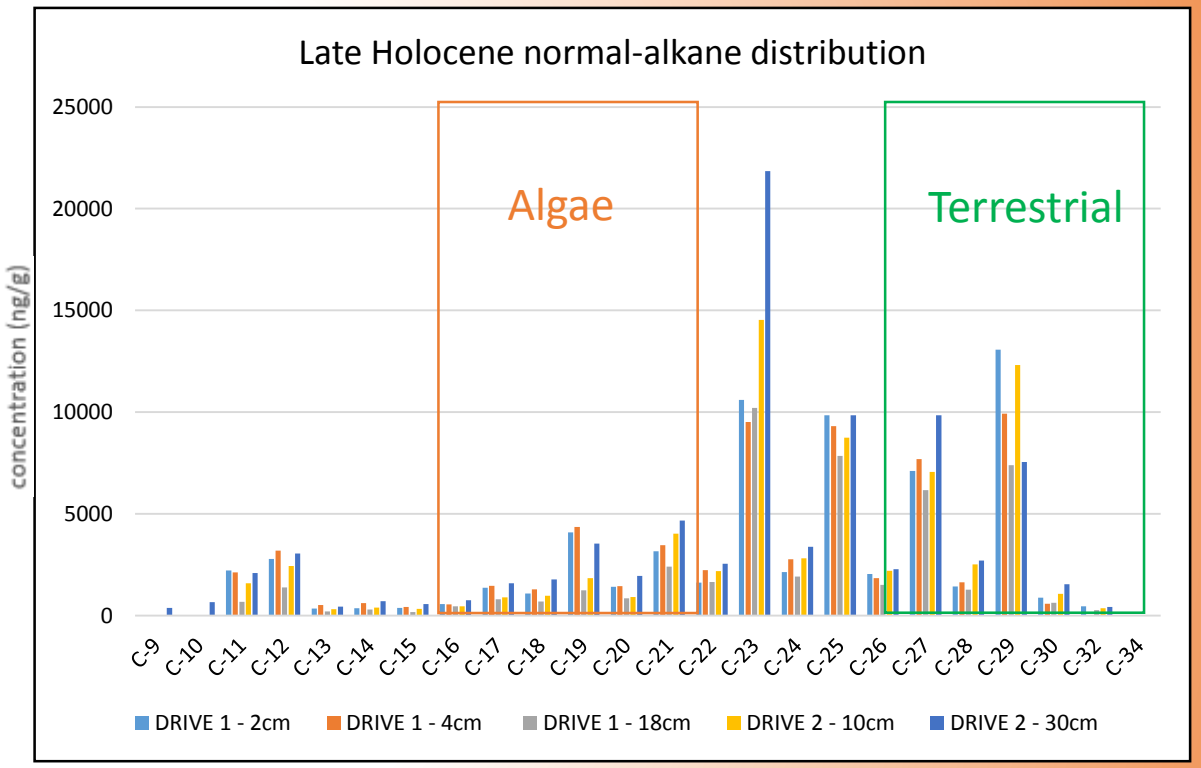
- Algae C/N ratios between 4 – 10
- Terrestrial plants have C/N ratios ≥ 20



Redrawn from Meyers, 1994

Tracking Lake Level and Organic Carbon Sources: *n-Alkane Distributions*





- $P_{aqueous} = (C_{23} + C_{25})/(C_{23}+C_{25}+C_{29}+C_{31})$

Ficken, 2000

Chronology Results: *missing ash layers*

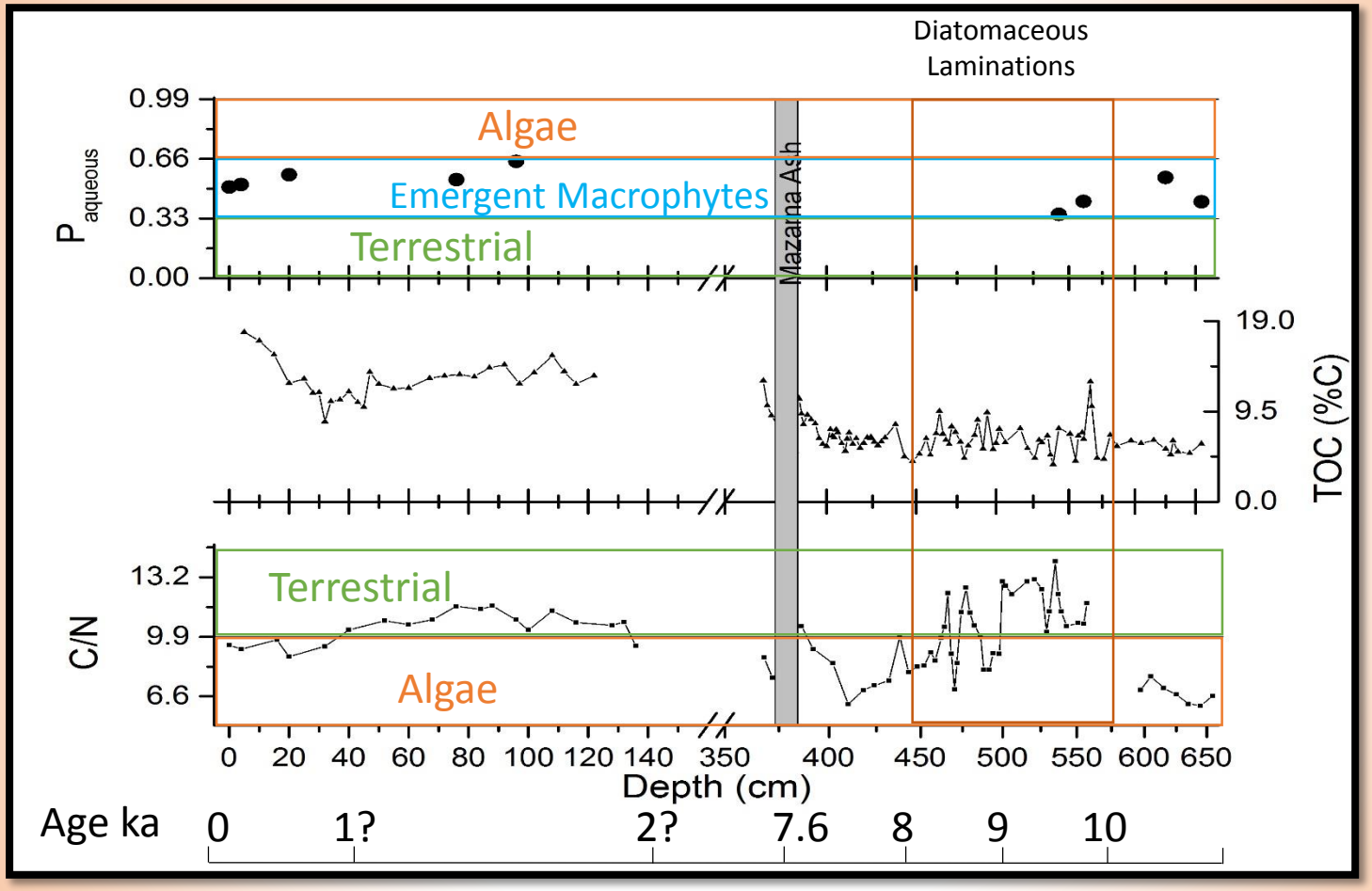
- 2016 cores clearly show the Lassen Peak eruption of 1915
- 2011 cores do not have ash layer in the upper record

WHY?

Ash Layer: Lassen Peak?

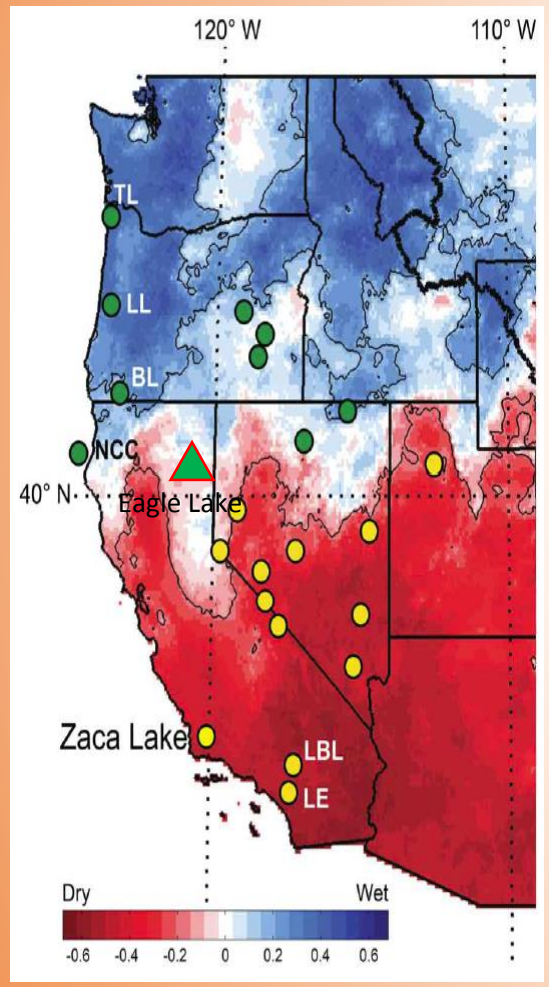
Evidence of scour in upper meter in southern basin.
Massive slump of wet heavy ash may have removed significant pieces of record!

Results from 2011 core: *EH vs LH*

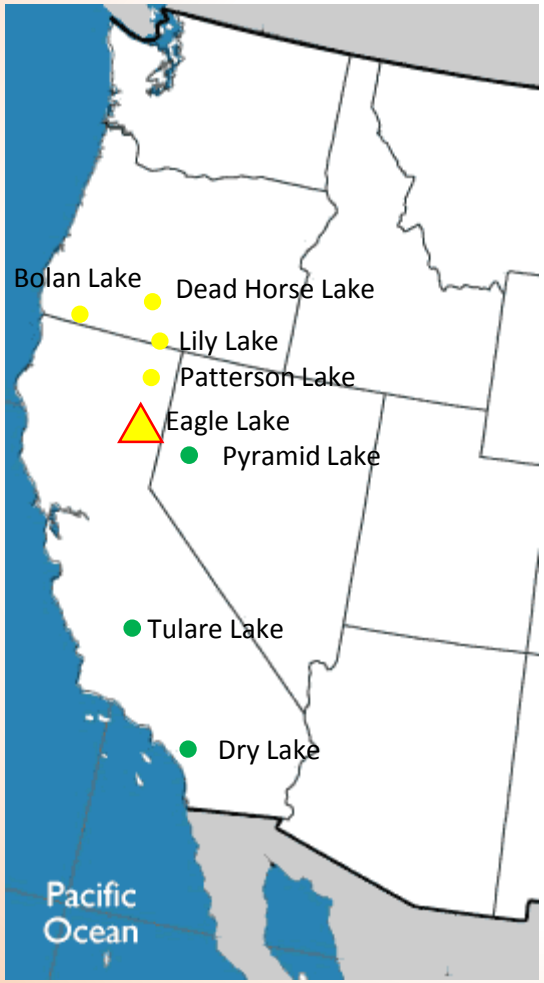


Regional Comparison

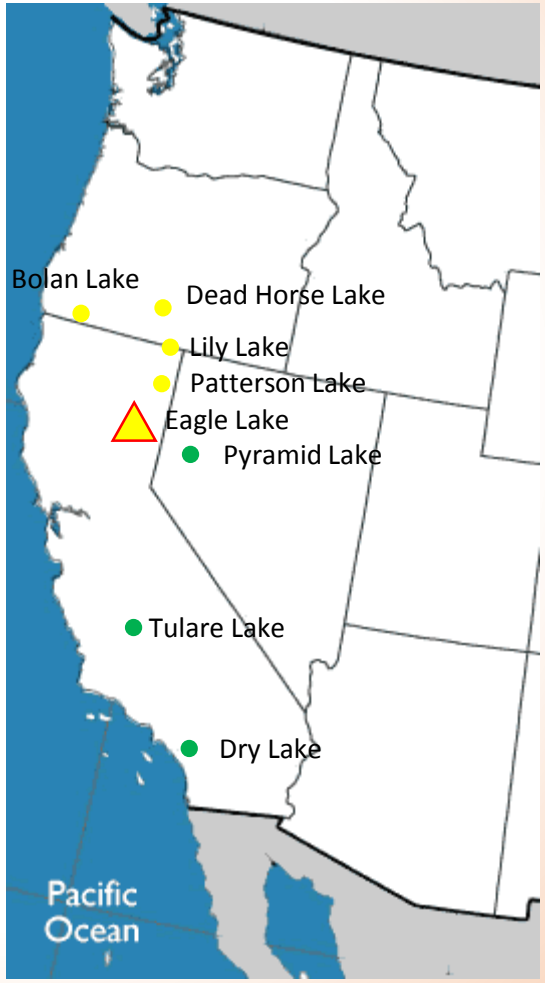
green circles (wet)
yellow circles (dry)



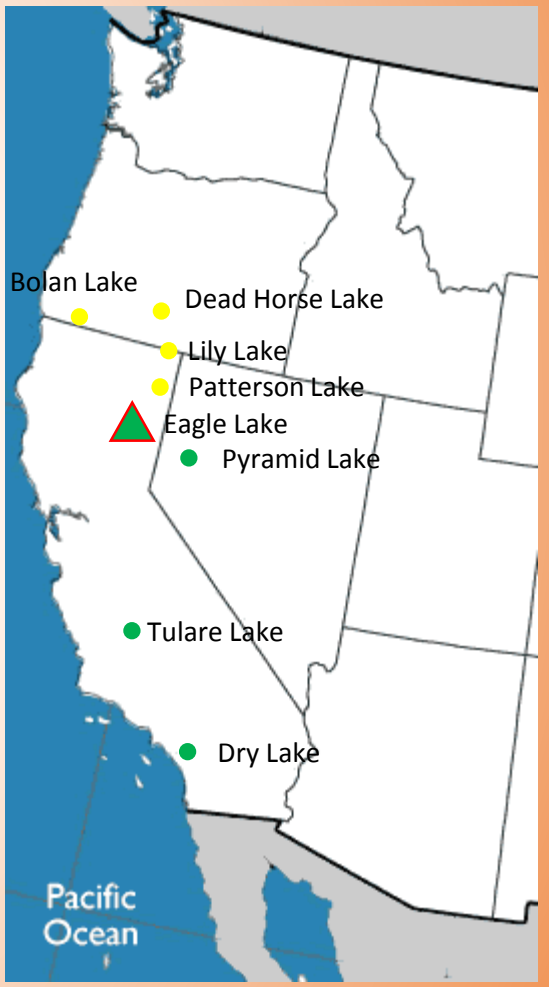
2700-2000 cal yr BP



8000 cal yr BP



9000 cal yr BP



10000 cal yr BP

Dingemans et al., 2014

Preliminary Conclusions

- LH sediment likely missing from southern basin—new cores from northern basins show Lassen Peak ash
- LH shows distinct differences with EH (higher productivity, different diatom assemblages), enhanced productivity relative to EH but no change in alkane record— unfortunately the upper record is incomplete and the chronology is uncertain
- Prior to 10 ka BP, lake level was high and climate wet—placing Eagle Lake in SW climate regime. **[Transition zone to the north]**
- From 10 – 8 ka BP, increased C/N, terrestrial n-alkanes and benthic diatoms suggest enhanced aridity—placing Eagle Lake in the Pacific NW climate regime. **[Transition zone to south]**
- From 2 – pre-Bly Tunnel, lake level is high and climate wet—placing Eagle Lake in Pacific NW climate regime. **[Transition zone to south].**

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