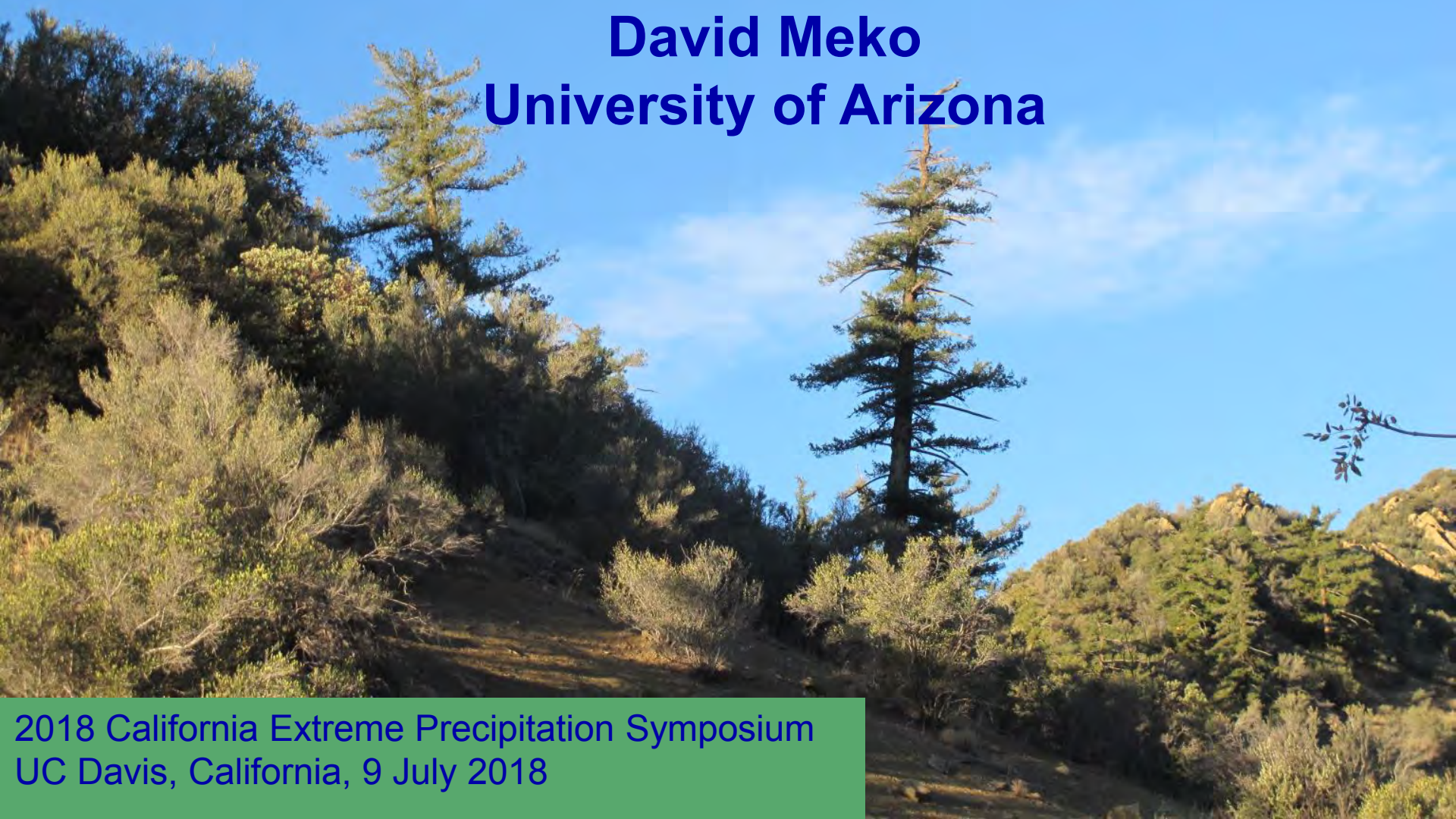




Historical perspective on California dendrohydrology



David Meko
University of Arizona

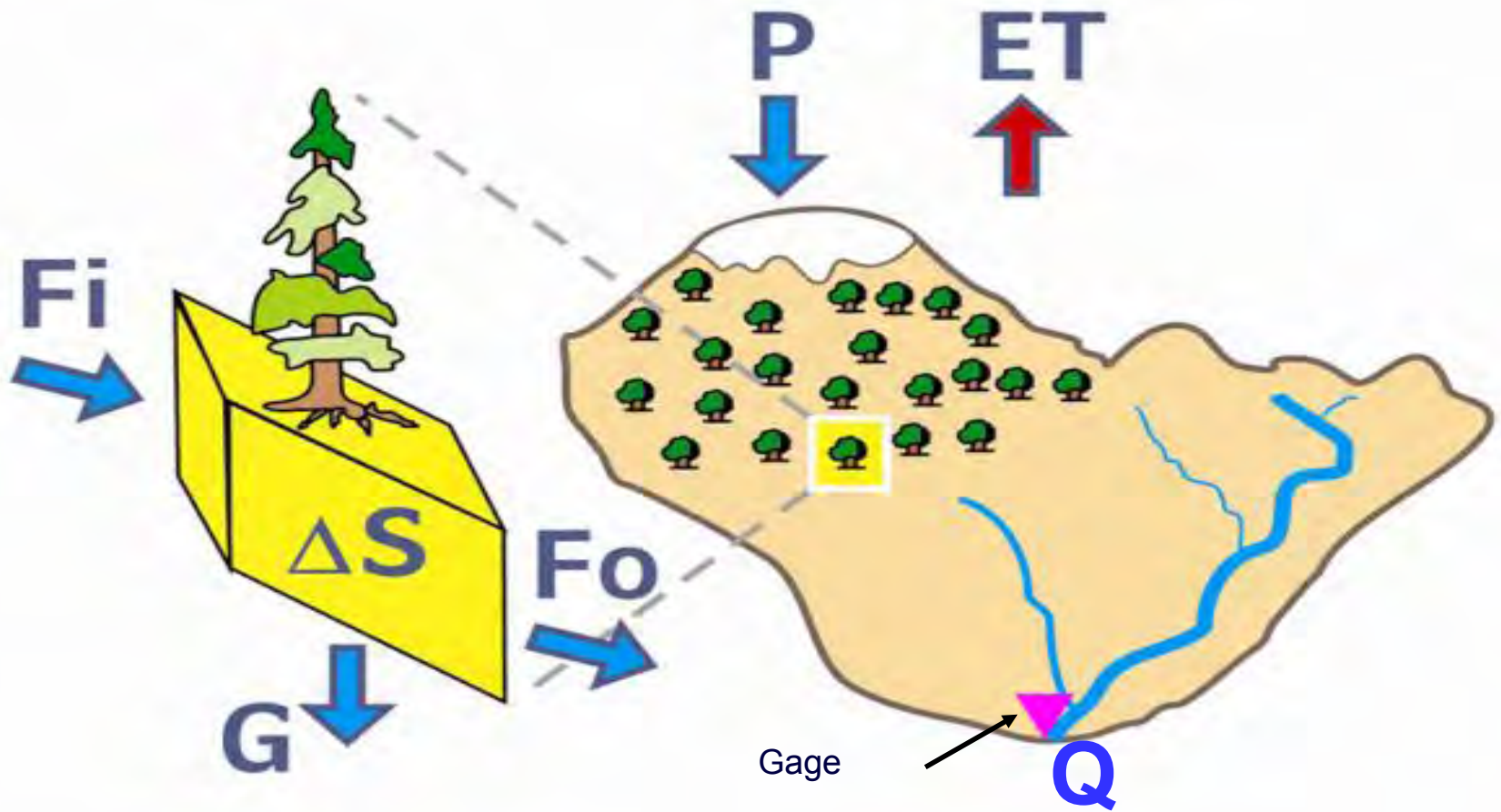


2018 California Extreme Precipitation Symposium
UC Davis, California, 9 July 2018

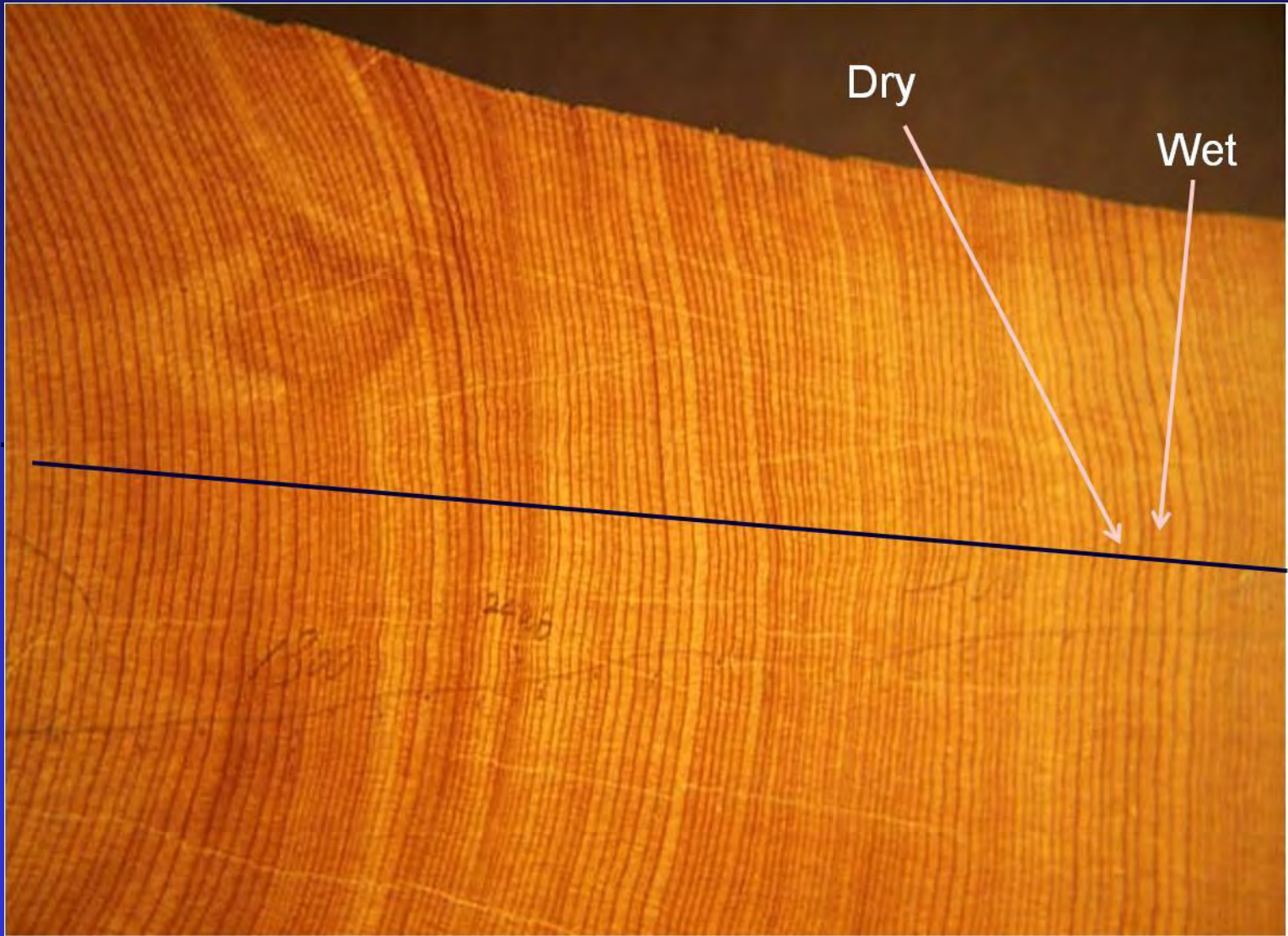
Talk outline

- Physical basis for dendrohydrology
- Timeline of California dendrohydrology
- Highlights from a few recent studies

Physical basis



Ring width



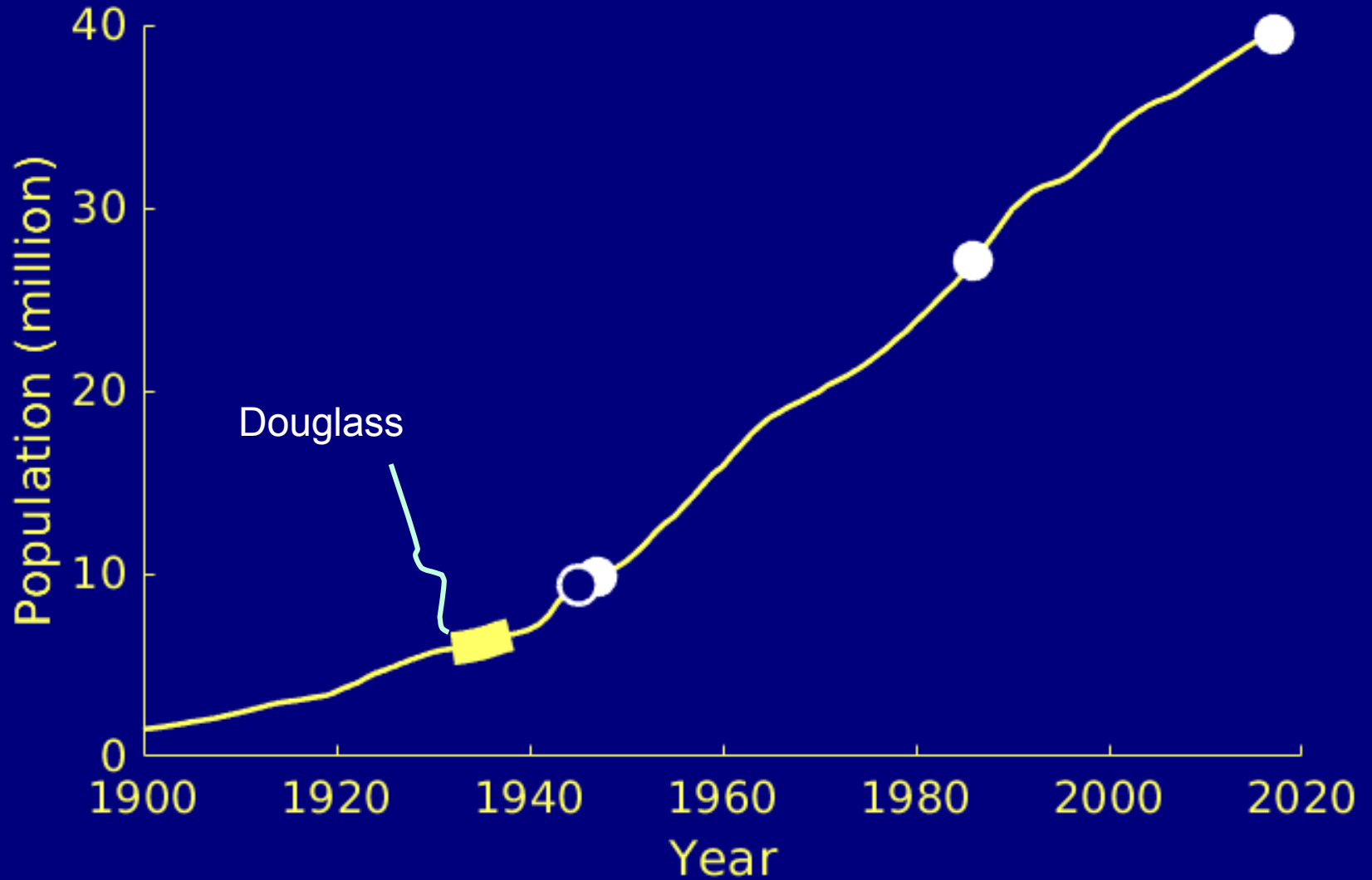






40,000,000

Landmark -- 1932



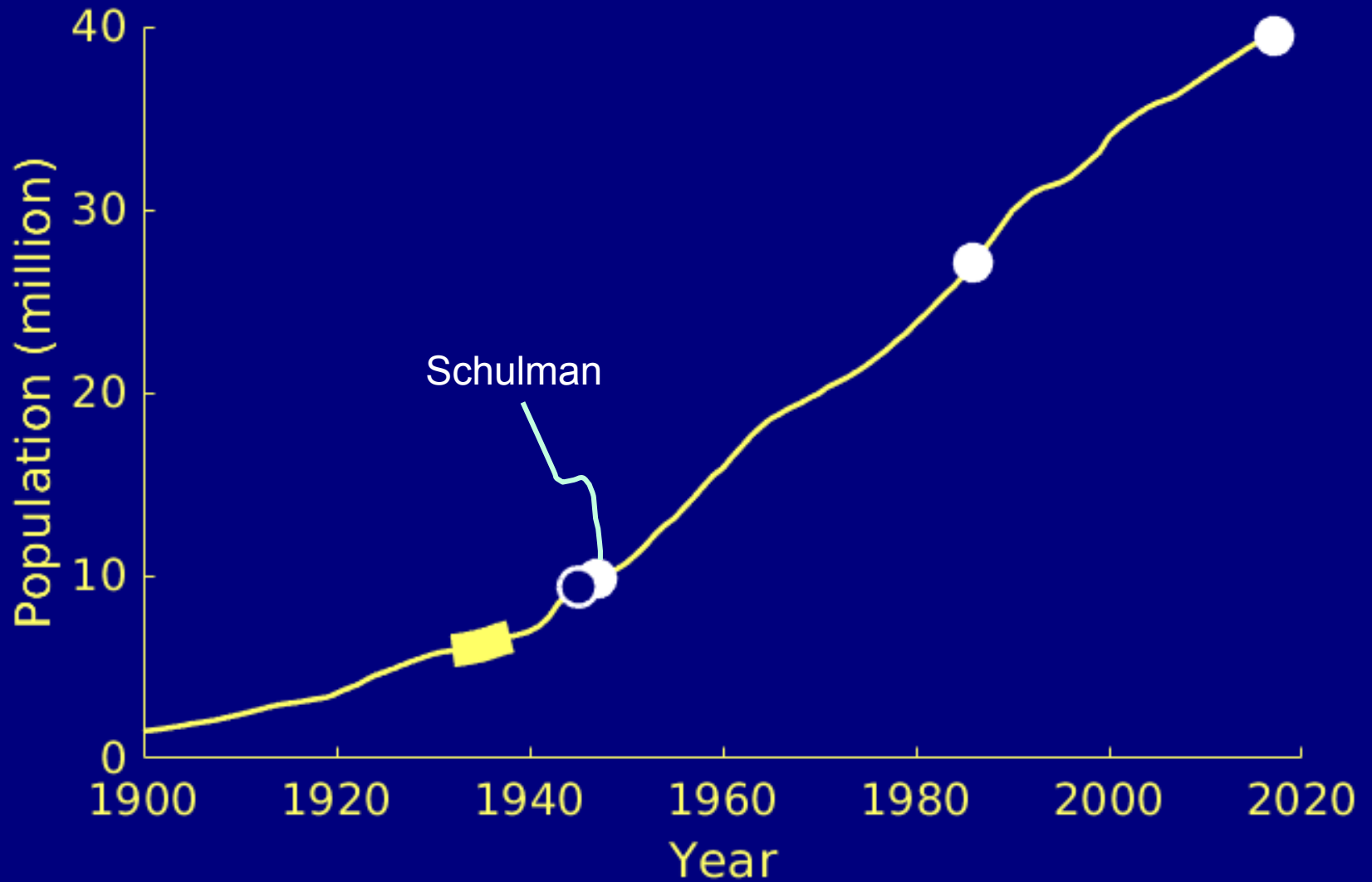
Tree-ring sampling by water agency

“Specimens were obtained at the request of A. E. Douglass in 1932 by J. J. Prendergast, Bear Valley Water Company, Redlands, California.”

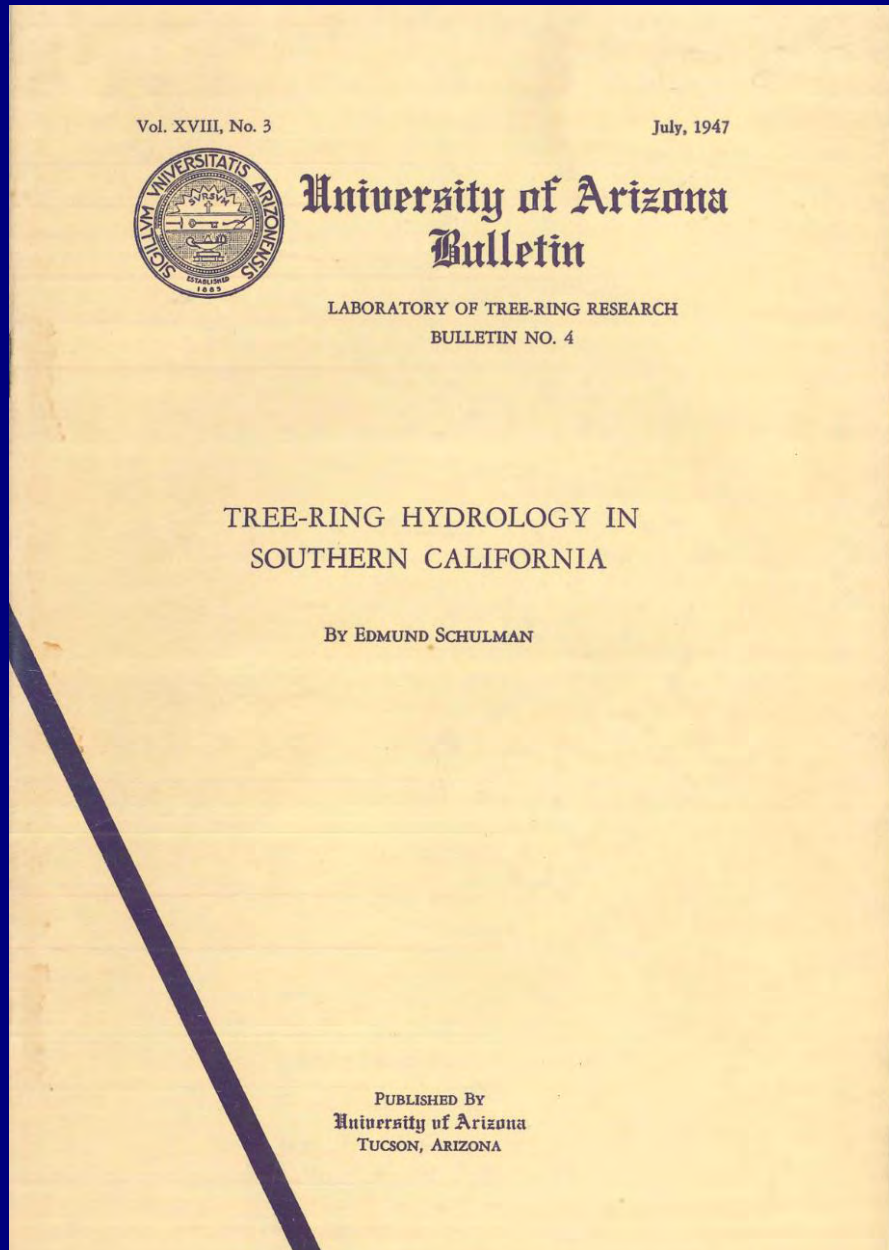
“A grant by Mr. Prendergast permitted the reduction of the specimens to growth curves at that time by Getrude C. Dewey”

,,, from footnote to table in a 1947 report by Edmund Schulman

Landmark – 1947



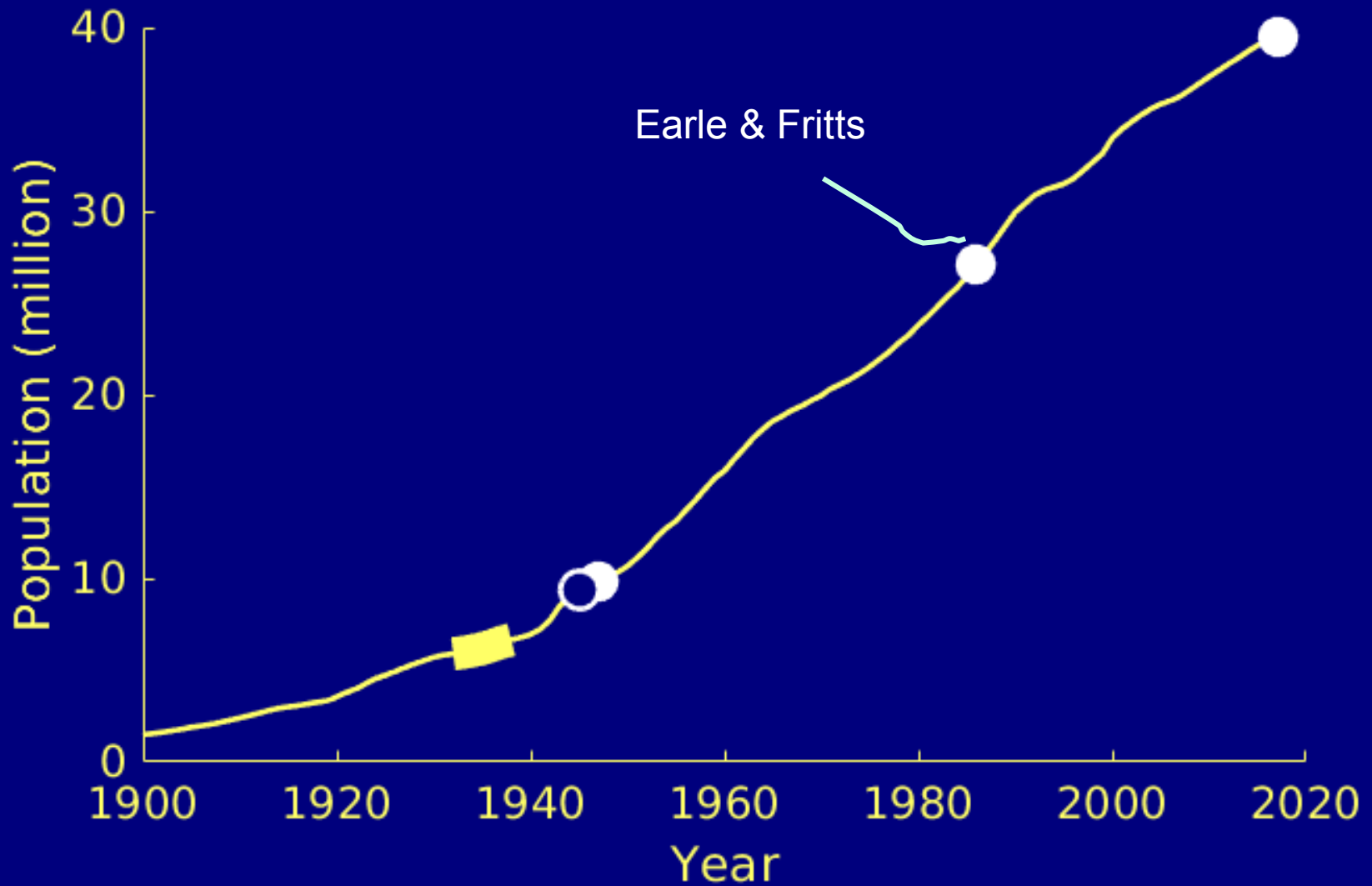
Early dendrohydrology monograph



- Demonstrated rainfall and streamflow signal in bigcone Douglas-fir
- Developed several chronologies, the longest starting in 1385



Landmark – 1986



Sacramento River reconstruction

Reconstructing Riverflow in the
Sacramento Basin Since 1560

Sponsored by California
Department of Water
Resources

Christopher J. Earle and Harold C. Fritts

Christopher J. Earle and Harold C. Fritts

Laboratory of Tree-Ring Research

University of Arizona

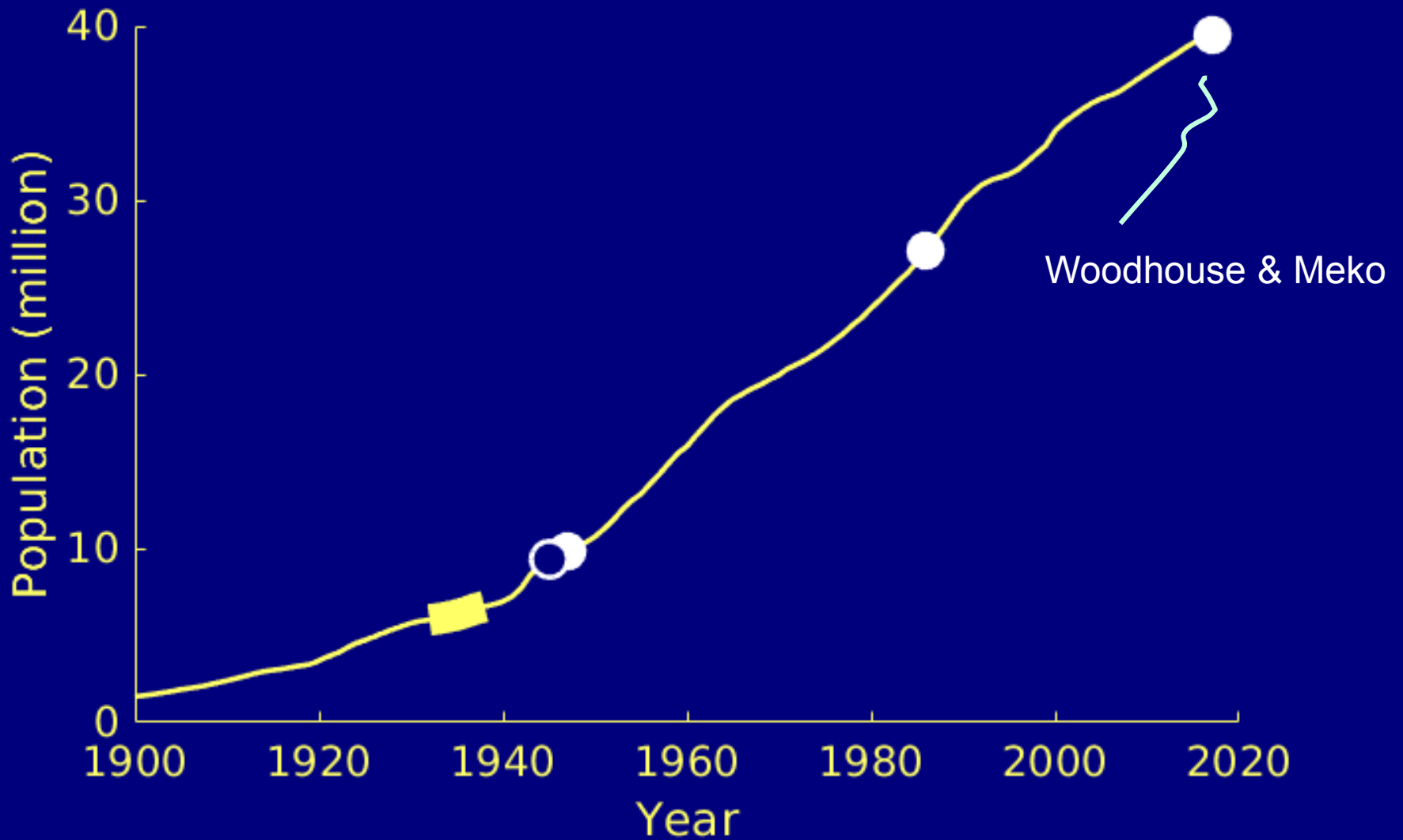
Tucson, Arizona

Major field sampling effort



- Study draws on 17 new chronologies collected 1981-1986 under NSF funding (Hal Fritts)
- Key species: western juniper (*Juniperus occidentalis*)

Landmark – 2017





Southern California tree-ring study



Using Tree-Ring Records for Understanding Droughts in a Long-Term Context: A Guidebook

Connie Woodhouse, David Meko, Erica Bigio, & Sarah Frederick



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Tree-Ring Study Reveals Historical Drought Record in Southern California

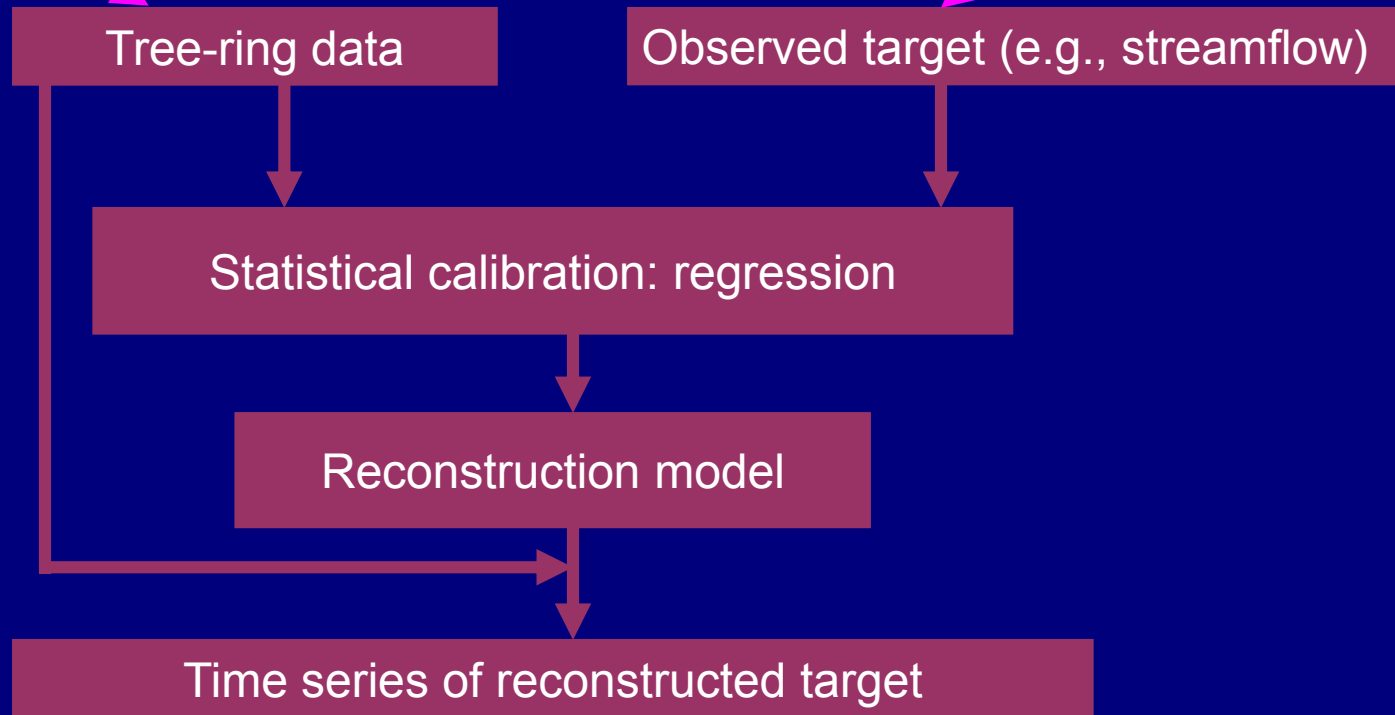
Published: Mar 12, 2018

SACRAMENTO -- As part of ongoing work to improve California's preparedness for dry conditions and better adapt to climate change, the Department of Water Resources (DWR) has released [results](#) of a study examining Southern California tree-ring data, and the centuries-long story the tree-rings reveal.

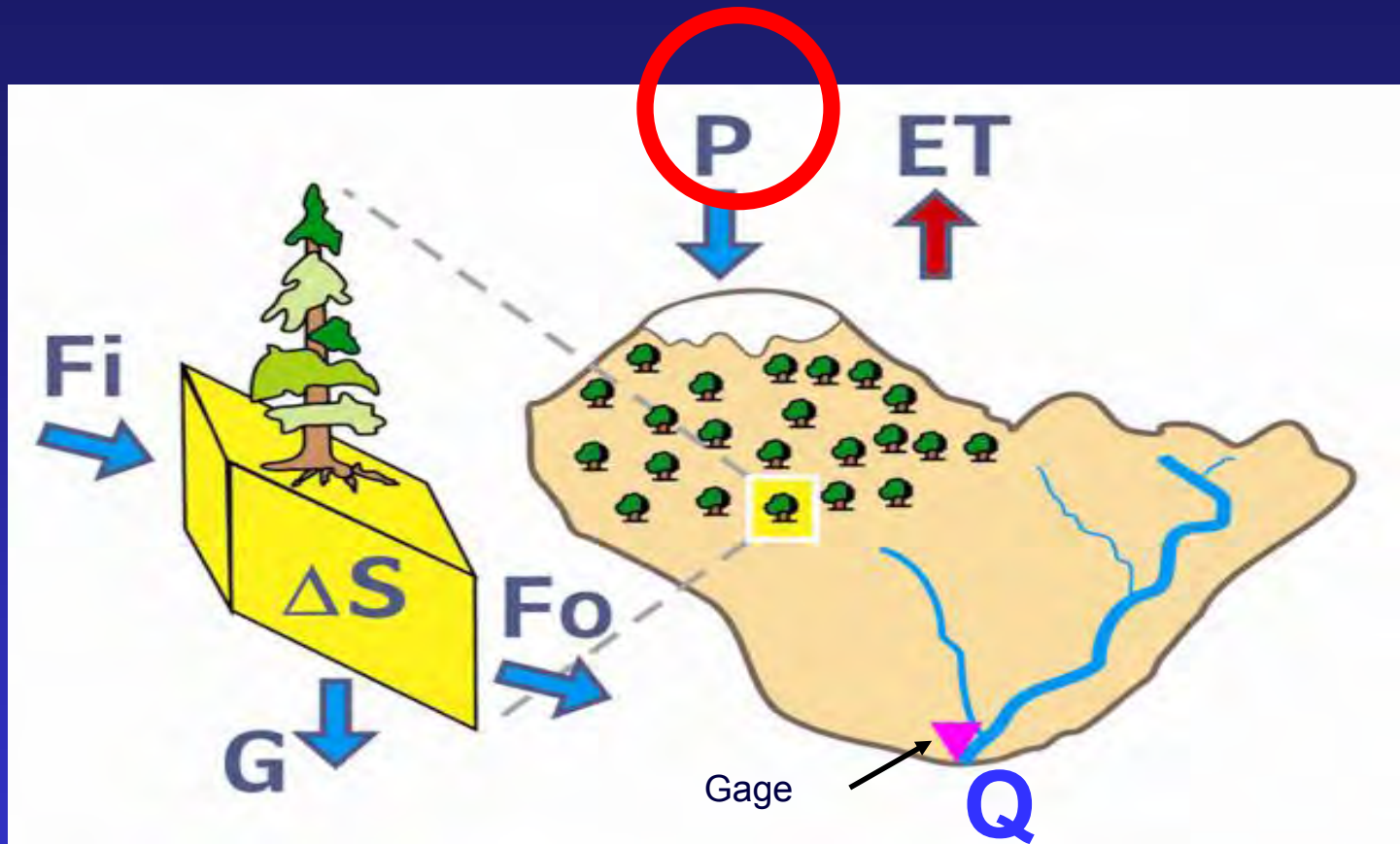
The results indicate that short durations (two to three years) of dry conditions are common in Southern California. They also show that the recent 2012-16 drought was, for most of Southern California, the driest or

<https://www.water.ca.gov/News/News-Releases/All-News-Articles/Tree-Ring-Study-Reveals-Historical-Drought-Record-in-Southern-California>

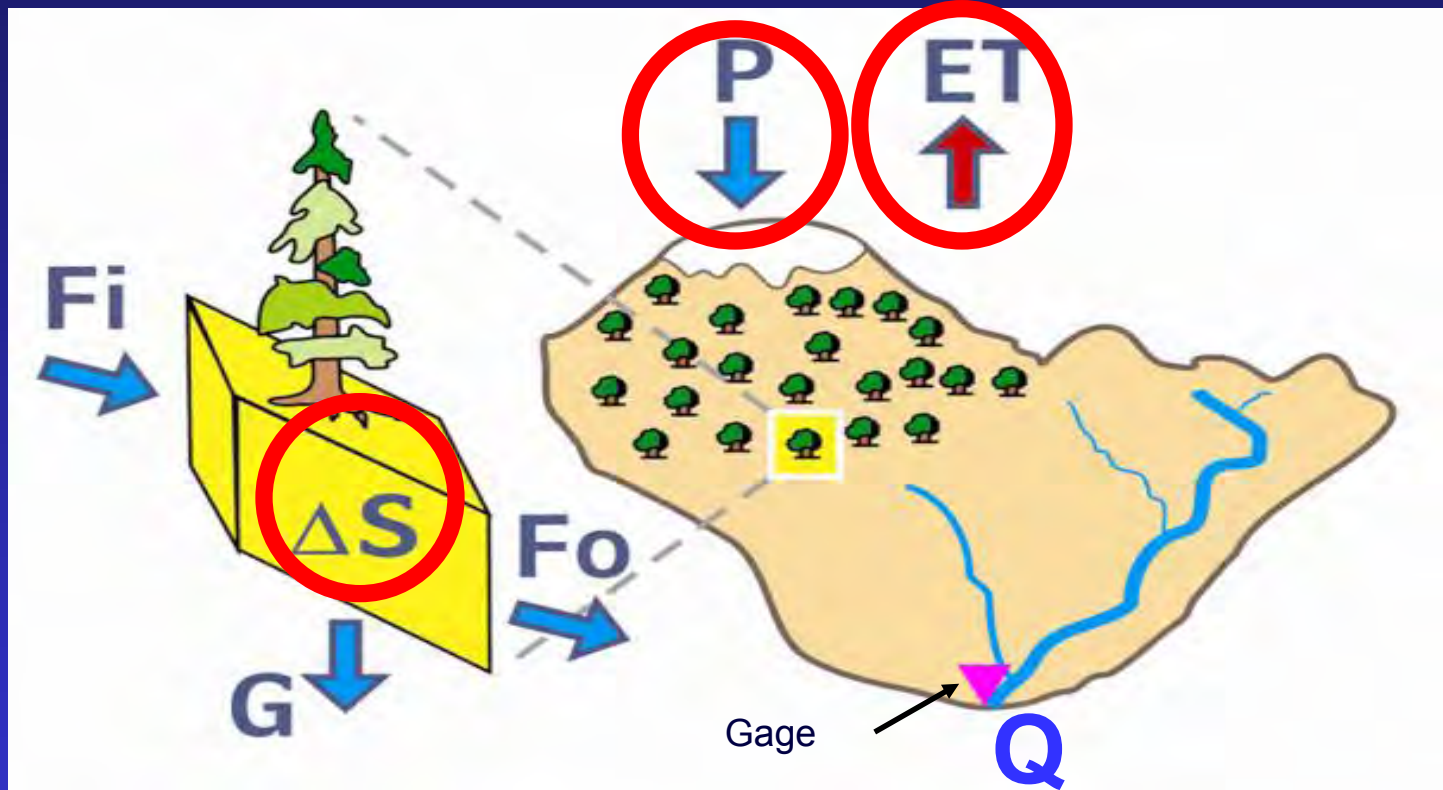
Tree-ring reconstruction modeling



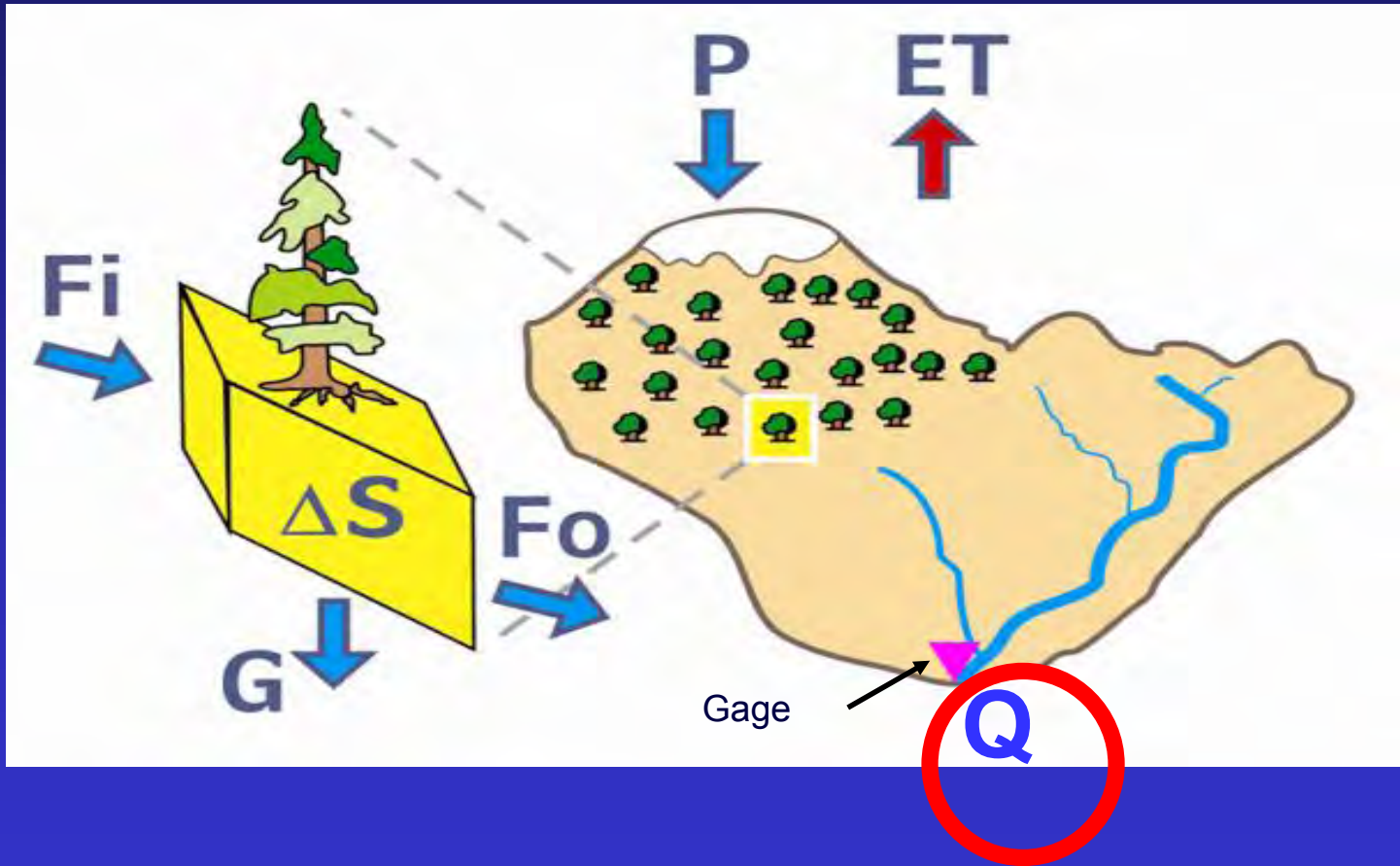
Reconstruction targets: precipitation



Reconstruction targets: drought index



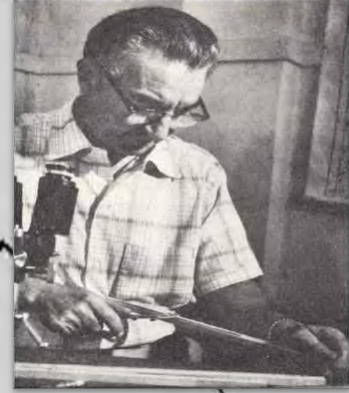
Reconstruction targets: streamflow



Bigcone Douglas-fir

Pseudotsuga macrocarpa

Edmund Schulman



Foxtail Pine

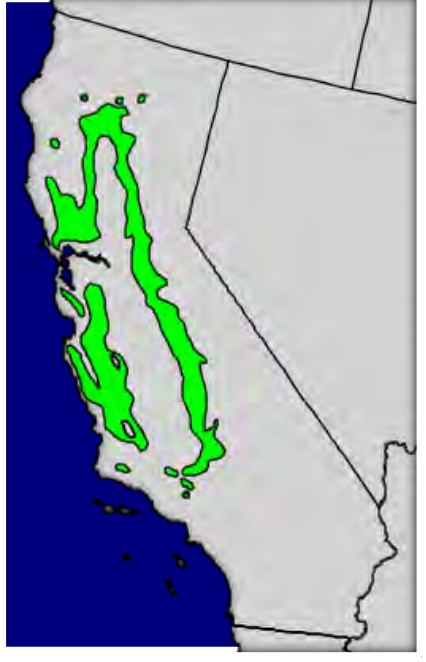
Pinus balfouriana



Tony Caprio

Blue Oak

Quercus douglasii



Dave Stahle



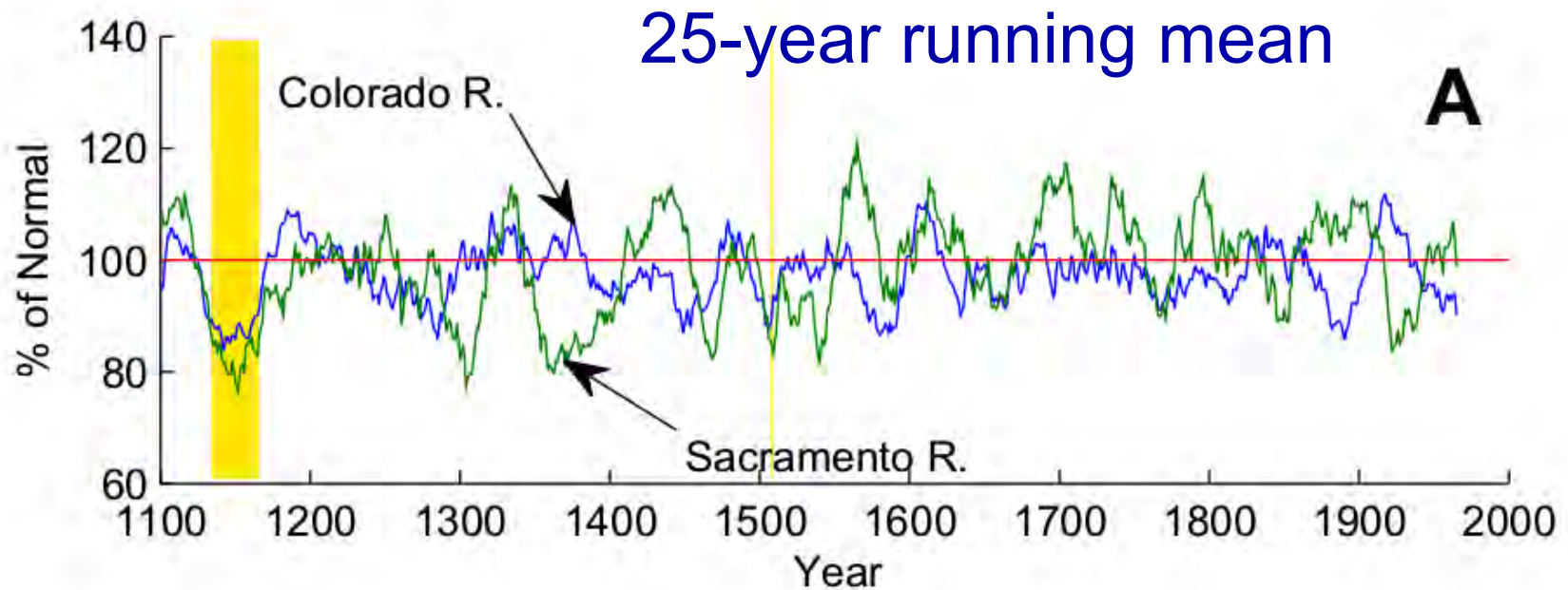


Copyright © 2013, Paper 17-012; 51245 words, 16 Figures, 0 Animations, 0 Tables.
<http://EarthInteractions.org>

The Ancient Blue Oak Woodlands of California: Longevity and Hydroclimatic History

D. W. Stahle,^{*,+} R. D. Griffin,[#] D. M. Meko,[@] M. D. Therrell,[&]
J. R. Edmondson,^{*} M. K. Cleaveland,^{*} L. N. Stahle,^{**}
D. J. Burnette,⁺⁺ J. T. Abatzoglou,^{##} K. T. Redmond,^{@@}
M. D. Dettinger,^{&&} and D. R. Cayan^{&&}

2010: mult-basin medieval drought



Foxtail pine &
other species

2011: North-south contrasts in wetness

Quaternary International 235 (2011) 89–100



Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint



Inferring precipitation-anomaly gradients from tree rings

David M. Meko^{a,*}, David W. Stahle^b, Daniel Griffin^a, Troy A. Knight^{a,1}

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^bDepartment of Geosciences, University of Arkansas, Fayetteville, AR, United States

Blue oak only

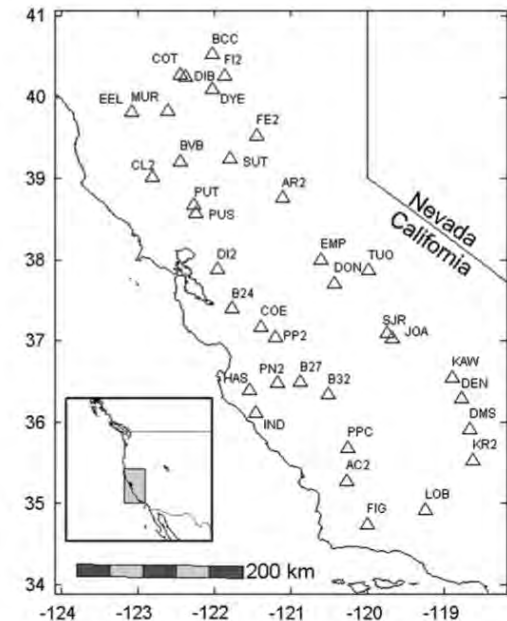


Fig. 1. Map showing locations of tree-ring sites. Site codes follow Table 1.

2014: regional multi-year drought in 1200-yr context

AGU PUBLICATIONS

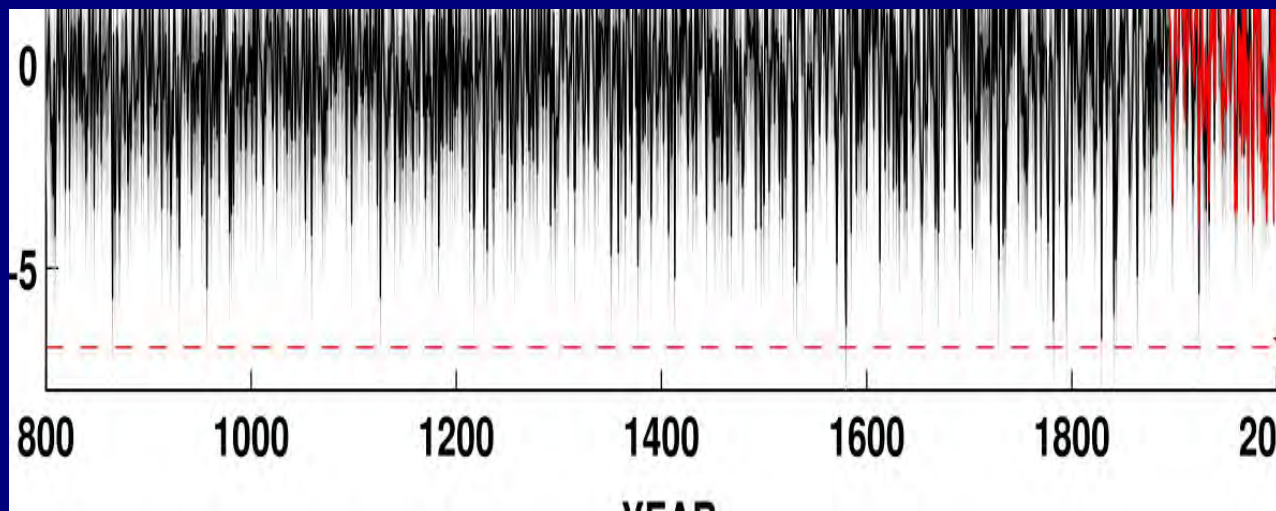
Geophysical Research Letters

RESEARCH LETTER

10.1002/2014GL062433

How unusual is the 2012–2014 California drought?

Daniel Griffin^{1,2} and Kevin J. Anchukaitis²



Blue oak & other species

Dan Griffin and Kevin Anchukaitis (2014)
Geophys. Res. Lett. 41, 9017-9023

2015: Sierra Nevada low-snowpack year in 500-yr context

*Study Finds Snowpack in
California's Sierra Nevada to
Be Lowest in 500 Years*



Nature Climate Change 14 September 2015

Authors: Soumaya Belmecheri, Flurin Babst,
Eugene R. Wahl, David W. Stahle, and Valerie
Trouet

Blue oak + tree-ring
temperature signal from
continental network of
trees

Conclusion

- The development of water resources in California has closely paralleled the development of dendrohydrology in the western United States
- California dendrohydrology is favored by a rich variety of long-lived climate-sensitive tree species
- California continues to provide a framework for advances in the application of tree rings to study various components of the water balance

Thank you

