California's Historical Fire Activity Before Modern Fire Suppression

PRESENTATION TO WESTAR FIRE & SMOKE WORK GROUP

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Background

SB 901 (Dodd, Statutes of 2018, chaptered 626) directs CARB to develop "a historic baseline of greenhouse gas emissions from California's natural fire regime reflecting conditions before modern fire suppression."

This report:

- summarizes the current scientific understanding of greenhouse gas (GHG) emissions from historical fire in California;
- provides an overview of California's fire history over the past 1,500 years;
- summarizes the dynamic interactions of climatic, environmental, and human drivers that shaped the fire landscape through time; and
- puts contemporary wildfire in historical context.

Science Advisors

Alan Taylor, PhD
Pennsylvania State University
- Fire scar dendrochronology
- Fire ecology
- Vegetation change

Don Falk, PhD
University of Arizona
- Fire history
- Fire Ecology
- Ecological resilience

Don Hankins, PhD
California State University, Chico
Miwko? (Plains Miwok) traditional cultural practitioner
- Pyrogeography
- Conservation
- Indigenous Stewardship Practices

Frank Lake, PhD
U.S. Forest Service,
PSW Research Station
Karuk descendant
- Indigenous knowledge research applications
- Tribal wildland fire and fuels

Glen MacDonald, PhD
University of California, Los Angeles
- Process and impacts of long-term climate change
- Climate, vegetation, change relationships
- Long-term climate records

Jennifer Marlon, PhD
Yale University
- Climate Change
- Fire history
- Public opinion

Scott Stephens, PhD
University of California, Berkeley
- Fire ecology
- Historical fire
- Fire and forest policy

Fire serves many natural functions that support the life cycle of plants and animals

- Fire is a natural ecosystem process
- Fire performs several ecosystem functions such as:
  - Facilitating germination of seeds
  - Replenishing soil nutrients
  - Stimulate tree growth
  - Reducing fuels

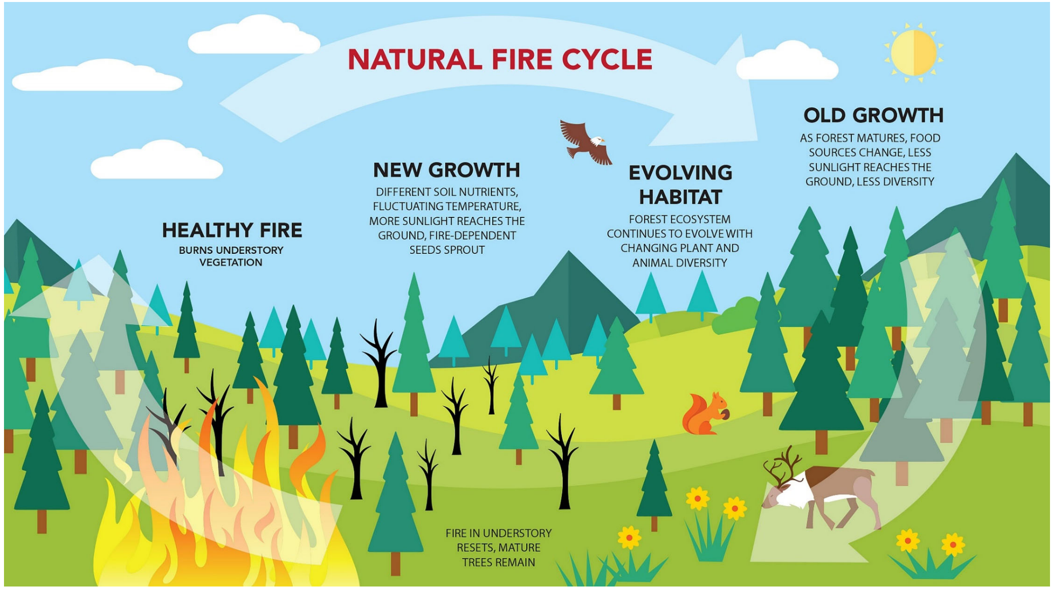


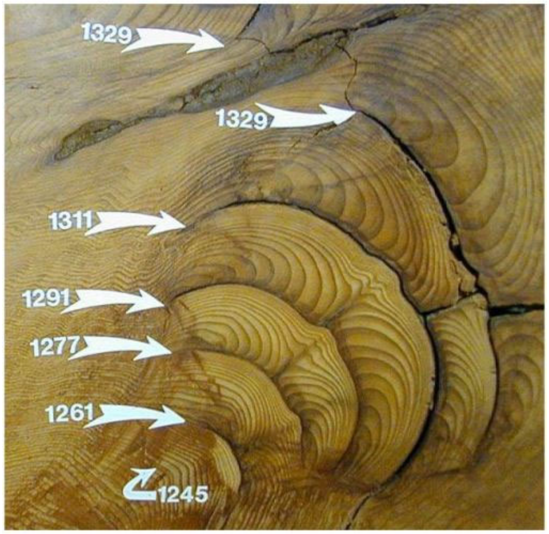
Image courtesy of www.openspaceauthority.org

Understanding Past Fire Activity

Scientists use proxies to estimate fire activity in the past

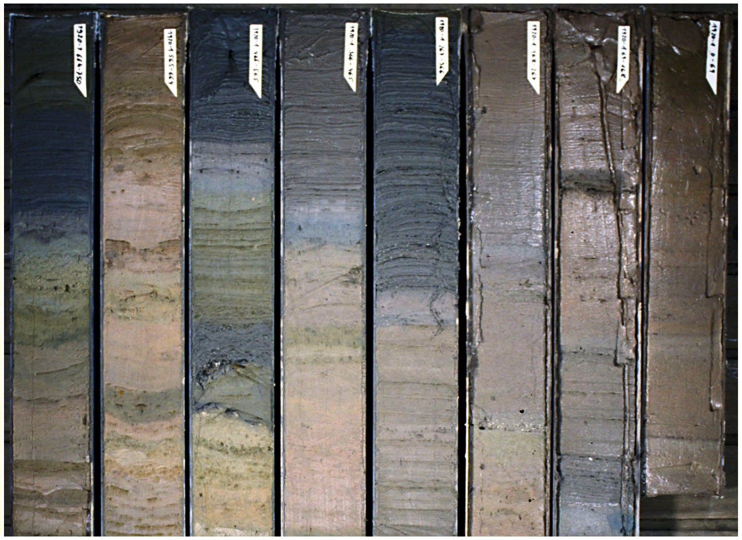
- Trees
- Sediment cores
- Oral histories
- Archeological sites
- Early explorer accounts

Burn Scars



Credit: Tom Swetnam

Sediment Cores



Credit: Hannes Grobe

Indigenous Use of Fire

- Physical evidence of humans in North America = 33,000 years ago*
- Cultural burning changes the frequency, seasonality and specificity of a fire regime
- Short to intermediate intervals between burns
- Historically burned large portions of California
- Compared to prescribed burning, cultural burning is more locally specific, has more diverse objectives and requires traditional ecological knowledge
- Evolution of a cultural fire regime - Burning changes with conditions

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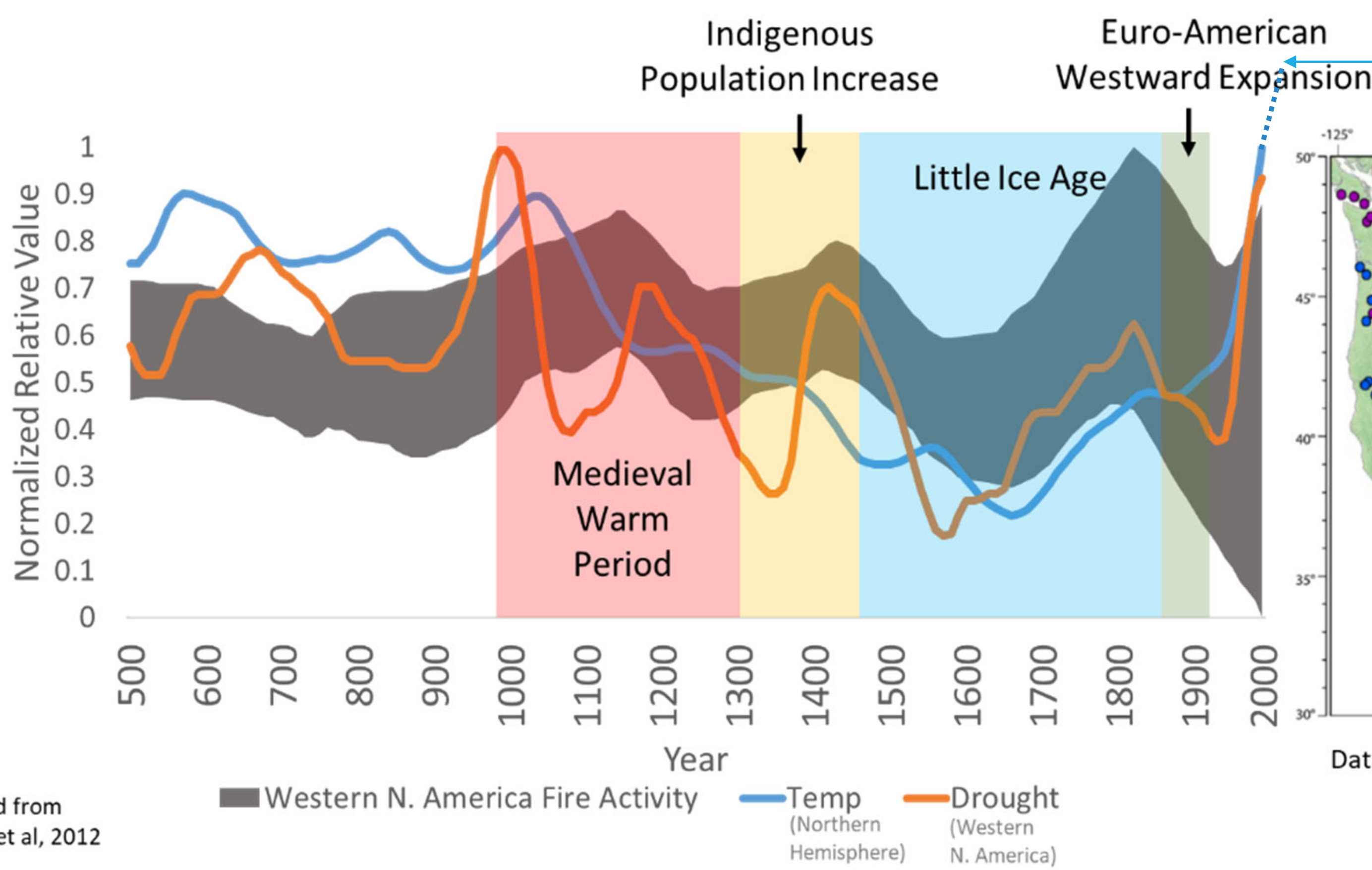
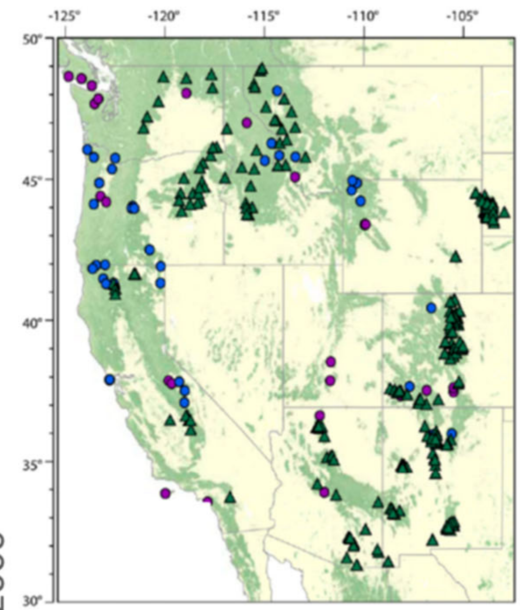
*Ardelean, Ciprian F., et al. "Evidence of human occupation in Mexico around the Last Glacial Maximum." *Nature* 584.7819 (2020): 87-92.

Key Finding: 1500-year fire trends generally followed variation in the Earth's climate until fire exclusion began





Data collection locations

Modified from Marlon et al, 2012

Key Finding: Only one study estimated historical fire in California; it suggests significantly higher fire acreages and emissions than contemporary levels.

- Stephens et al. (2007):
  - Estimates a snapshot in time: Little Ice Age (LIA)
  - Does not represent fire through time
- Modeling Assumptions:
  - Current fire models can represent historical conditions
  - Vegetation does not change through time
  - Every acre has equal probability of being burned

	Historical	Contemporary		
Statewide Annual Variable	**Estimates of Stephens et al. for 1450–1850***	**Highest in 2000–2019**	**Average of 2000–2019**	**2020**
Area burned (Million acres)	4.5–12	1.59 (2018)	0.64	4.1
CO_2 fire emissions (MMT CO_2)	34–90	39.0 (2018)	14	107

** Given limited historical data for modeling emissions, the authors of Stephens et al. (2007) made several significant assumptions regarding fire emission modeling inputs. Their estimate represents a period that is also known as the "Little Ice Age." The average temperature of this period was almost 2 degrees Celsius colder than today.*

Key Messages

- Historically, fire was an integral part of California's landscape
  - Indigenous communities were fire adapted
  - Fire activity generally followed climate variability
  - California's land base was more ecologically diverse
- Fire exclusion and climate change have led to a combination of conditions that California's ecosystems have never seen in the historical record.
- Opportunity to reintegrate Indigenous People's traditional knowledge into modern prescribed burning and land management practices.

Public Comment Period

- Draft report released: Nov 18, 2021
- Informal public comment period ends: January 31, 2022

Report available at: https://ww2.arb.ca.gov/wildfire-emissions

Please email comments to:

Anny Huang, Manager of Emission Inventory Analysis
Anny.Huang@arb.ca.gov