Fire in the Sierra

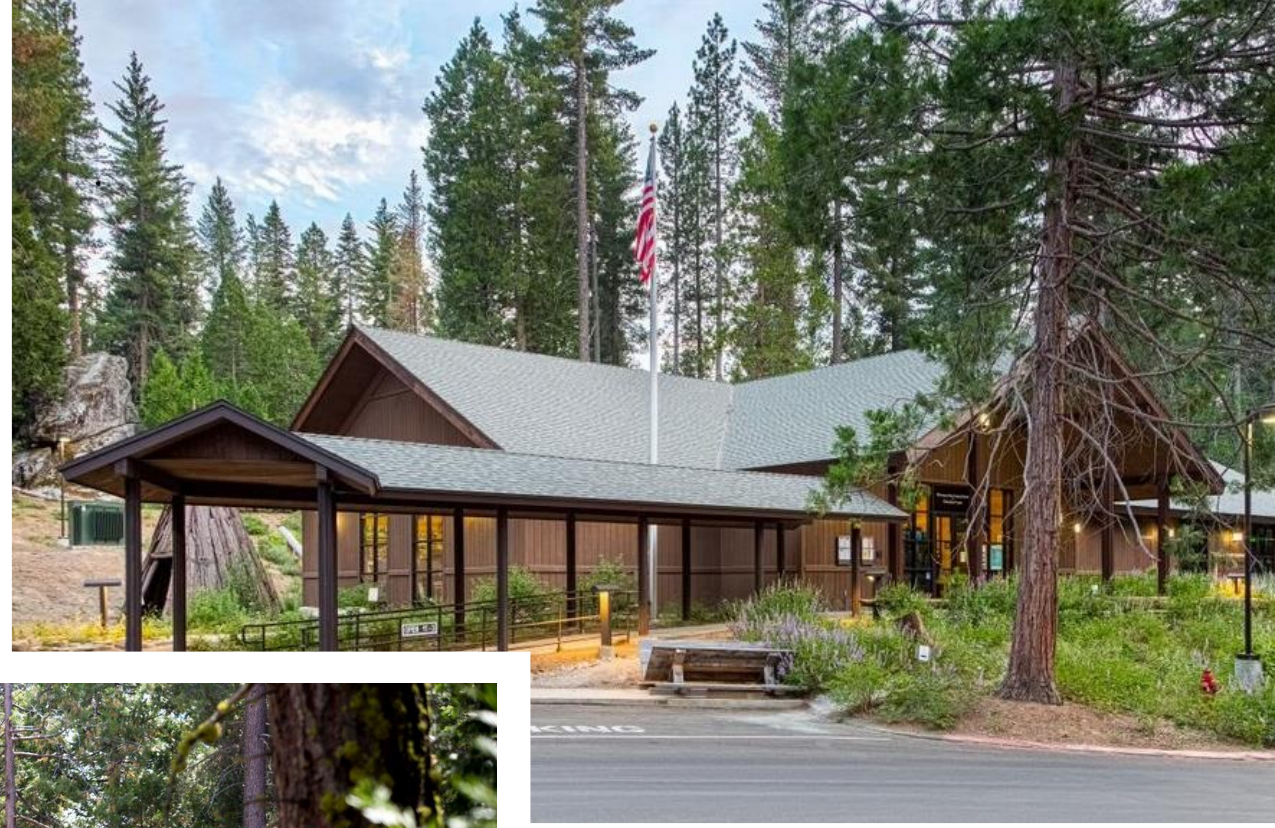
Learn from the past, create a better future

Central Sierra
HISTORICAL SOCIETY

INSTITUTE of Museum and Library SERVICES

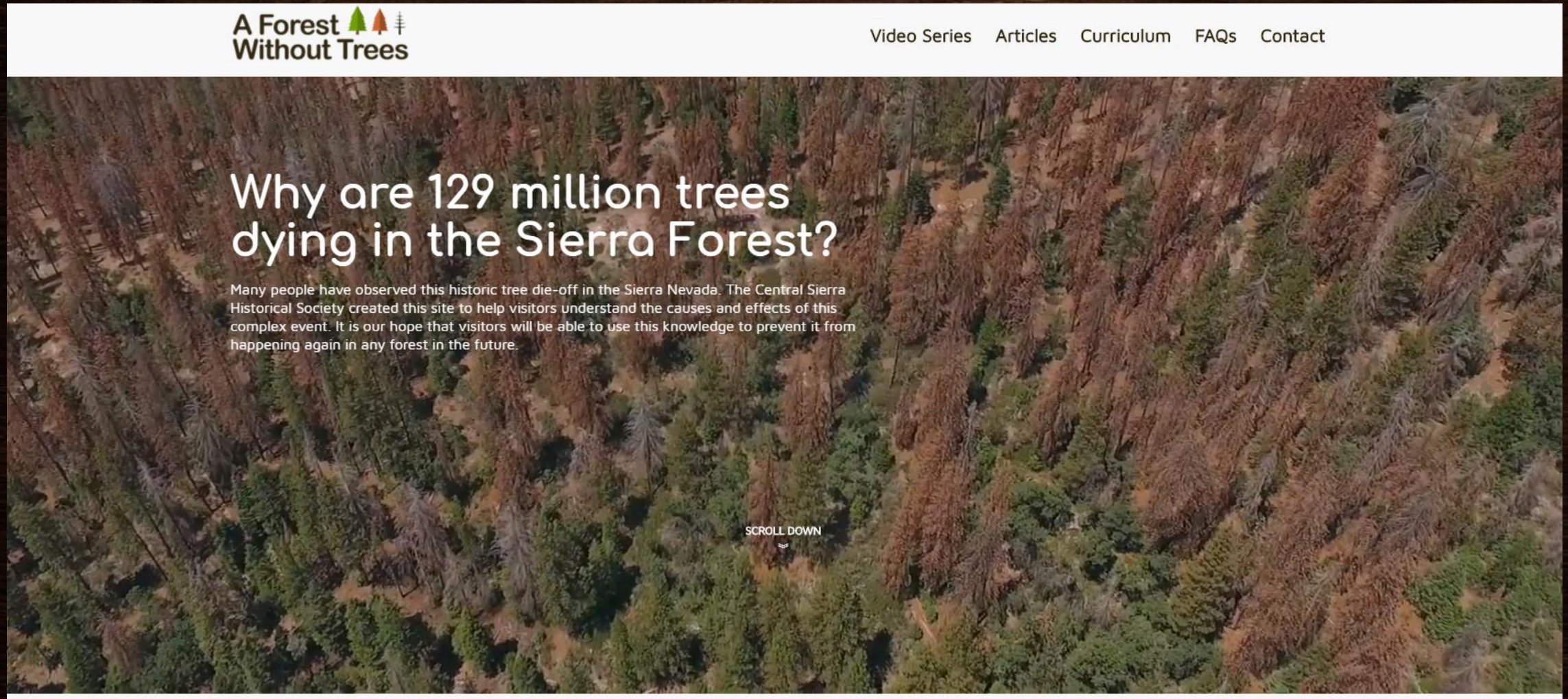
Central Sierra Historical Society & Museum
Shaver Lake, CA

Central Sierra
HISTORICAL SOCIETY




ALPINE

AForestWithoutTrees.com

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Presenters:

- Stephen Byrd – Natural Resource Manager, Southern California Edison Company
- John R. Mount Jr. - Registered Professional Forester, Retired
- Juliane Stewart – Registered Professional Forester, Vermillion Resource Management

Fire in the Sierra Introduction

Fire Triangle

John R. Mount

PURPOSE

HISTORICAL PERSPECTIVE

CLIMATE CHANGE

FIRE

Historical

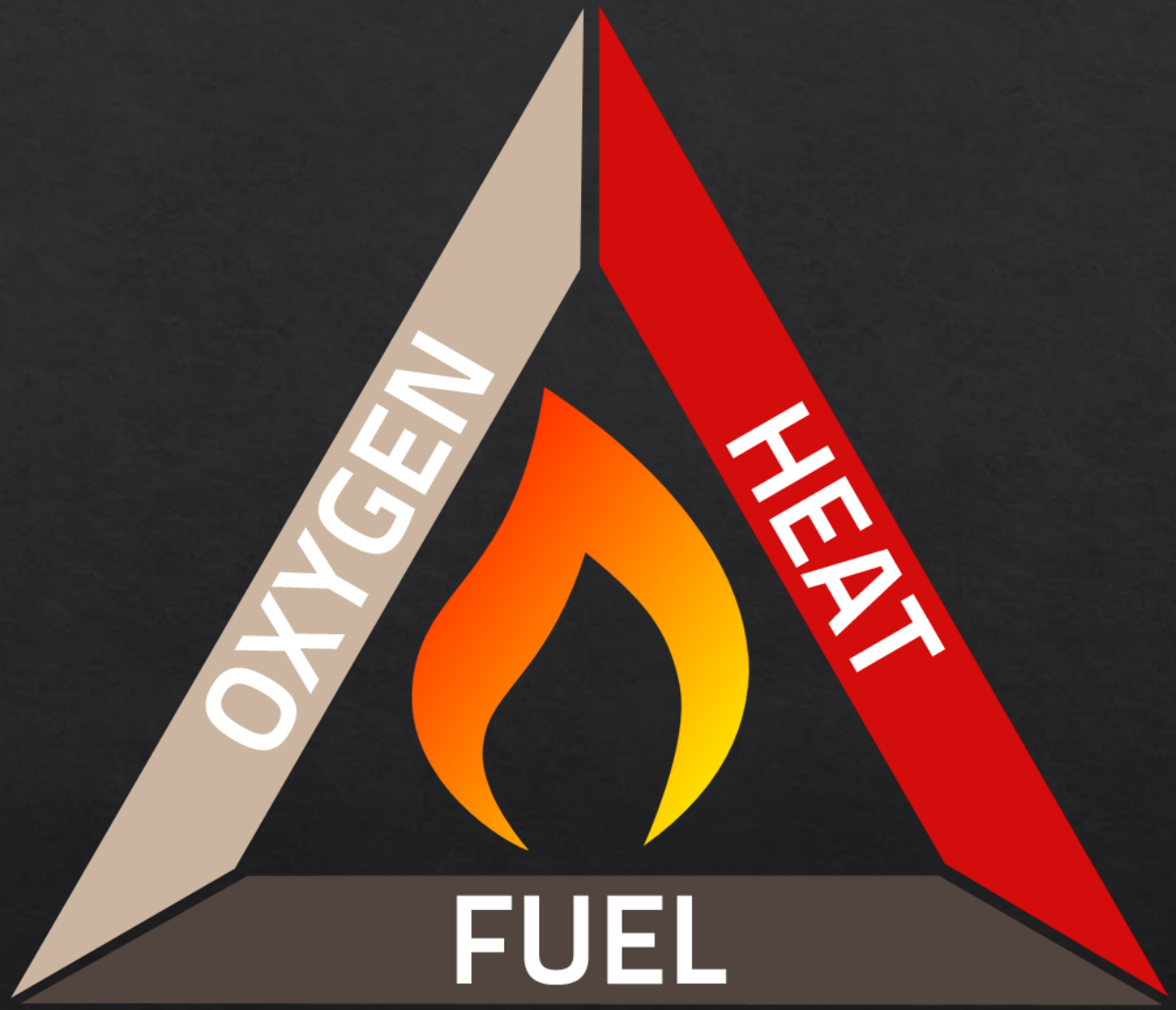
Current

HUMAN IMPACTS

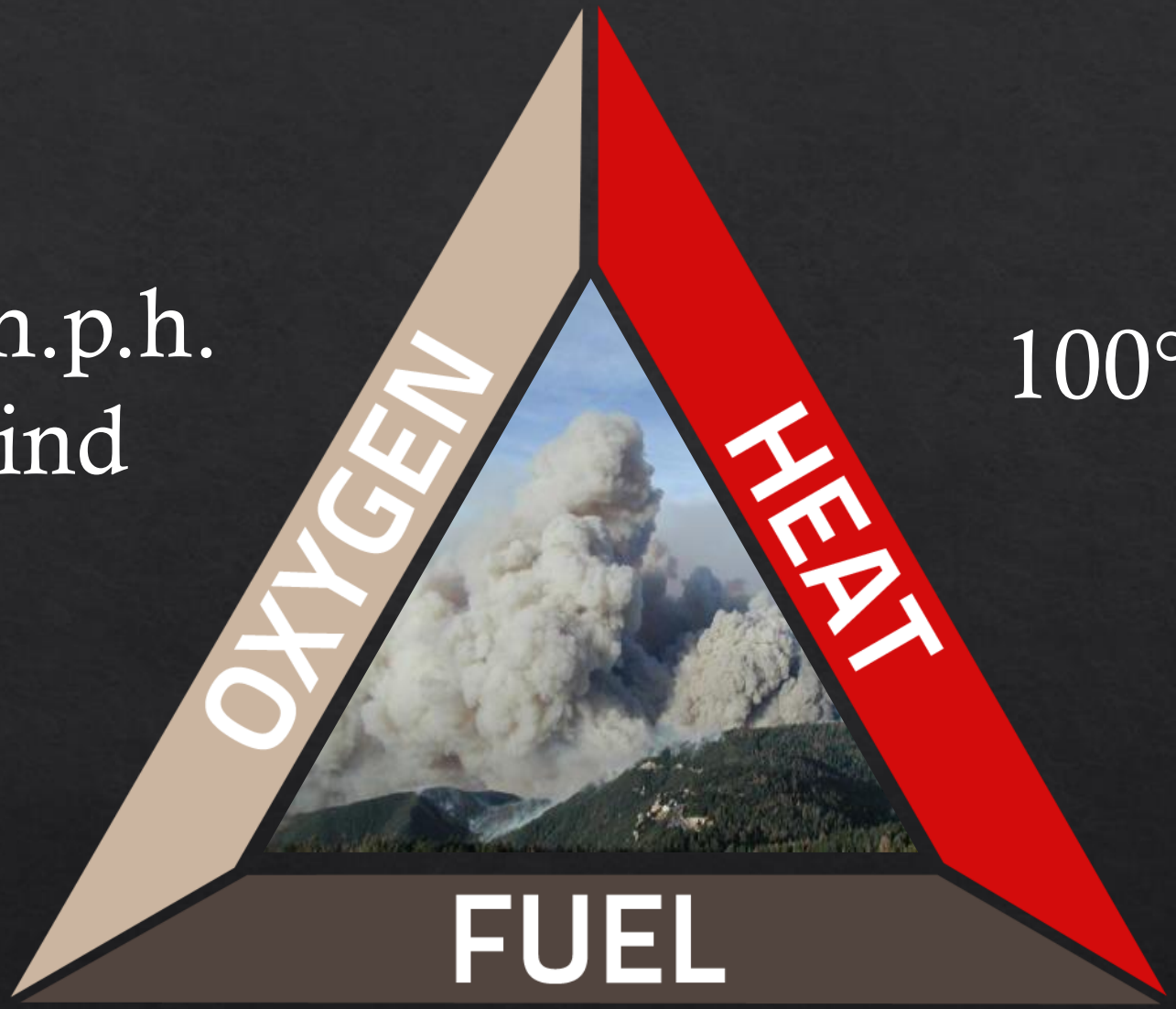
COSTS and BENEFITS

Ecosystem Services
Costs without forests

Laws, Regulations, Policies & Court Actions


OXYGEN
HEAT
FUEL

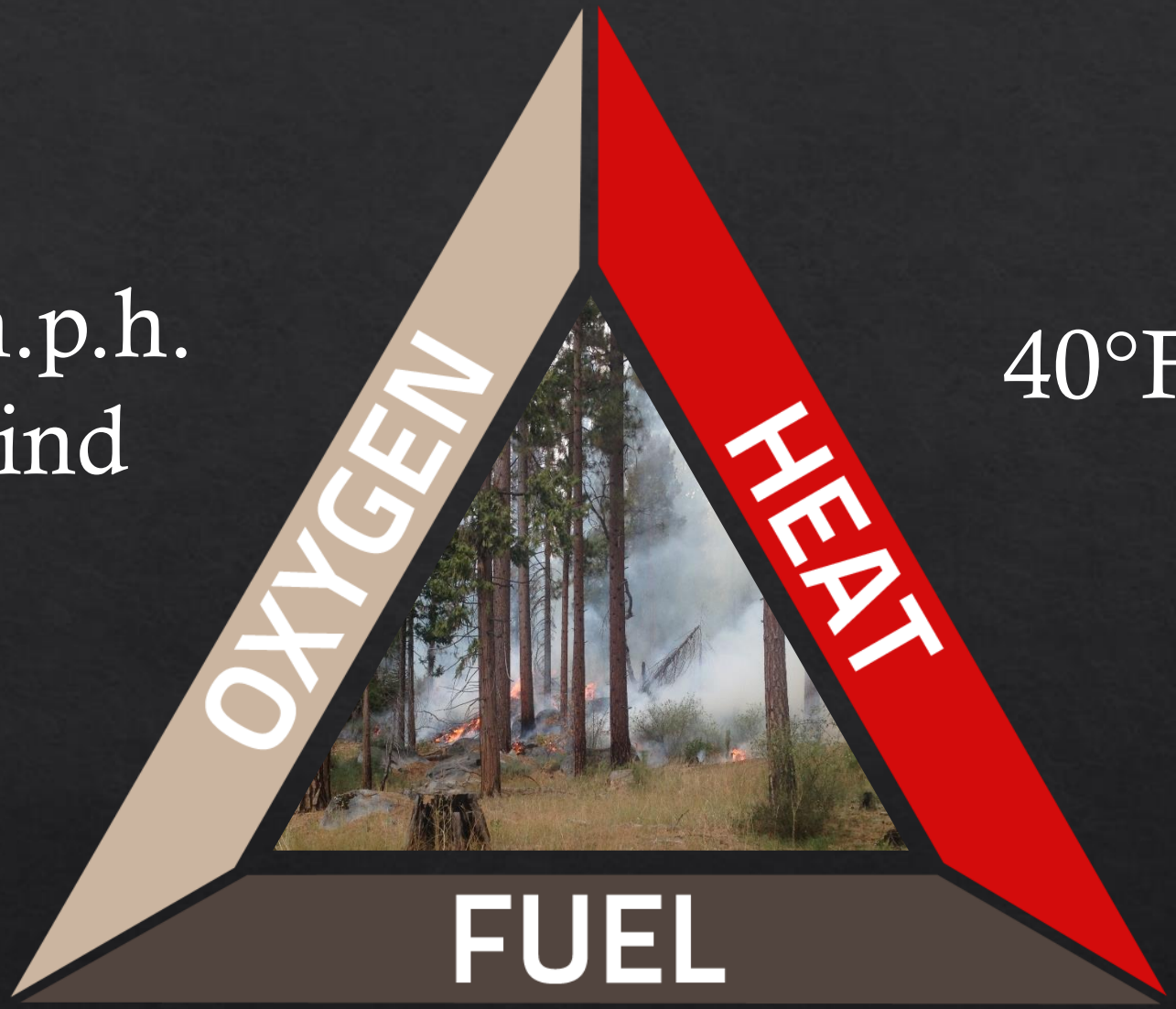
40 m.p.h.
wind



100°F

600 tons per acre

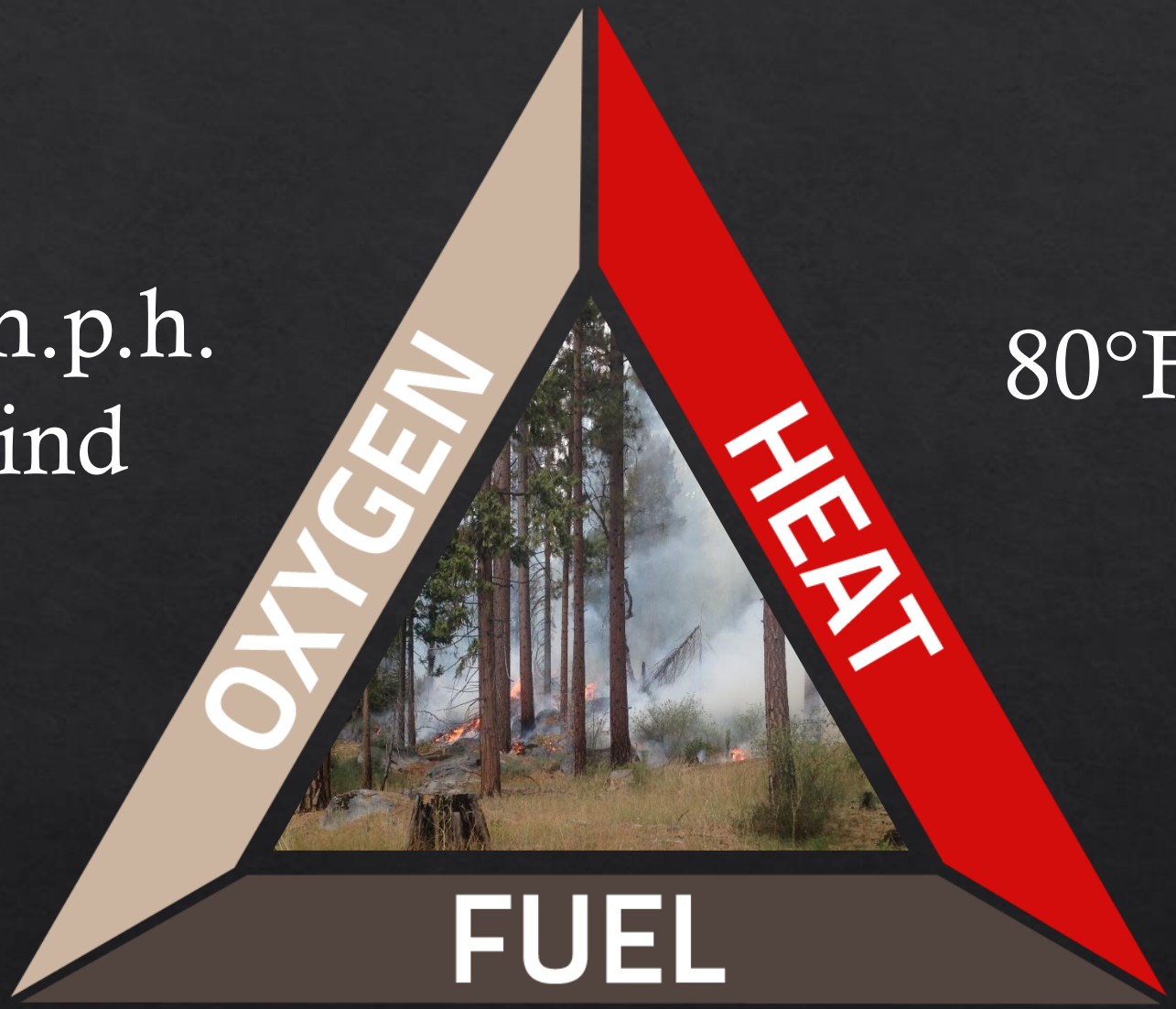
5 m.p.h.
wind



40°F

600 tons per acre

20 m.p.h.
wind



80°F

30 tons per acre

Ancient history fire and forests

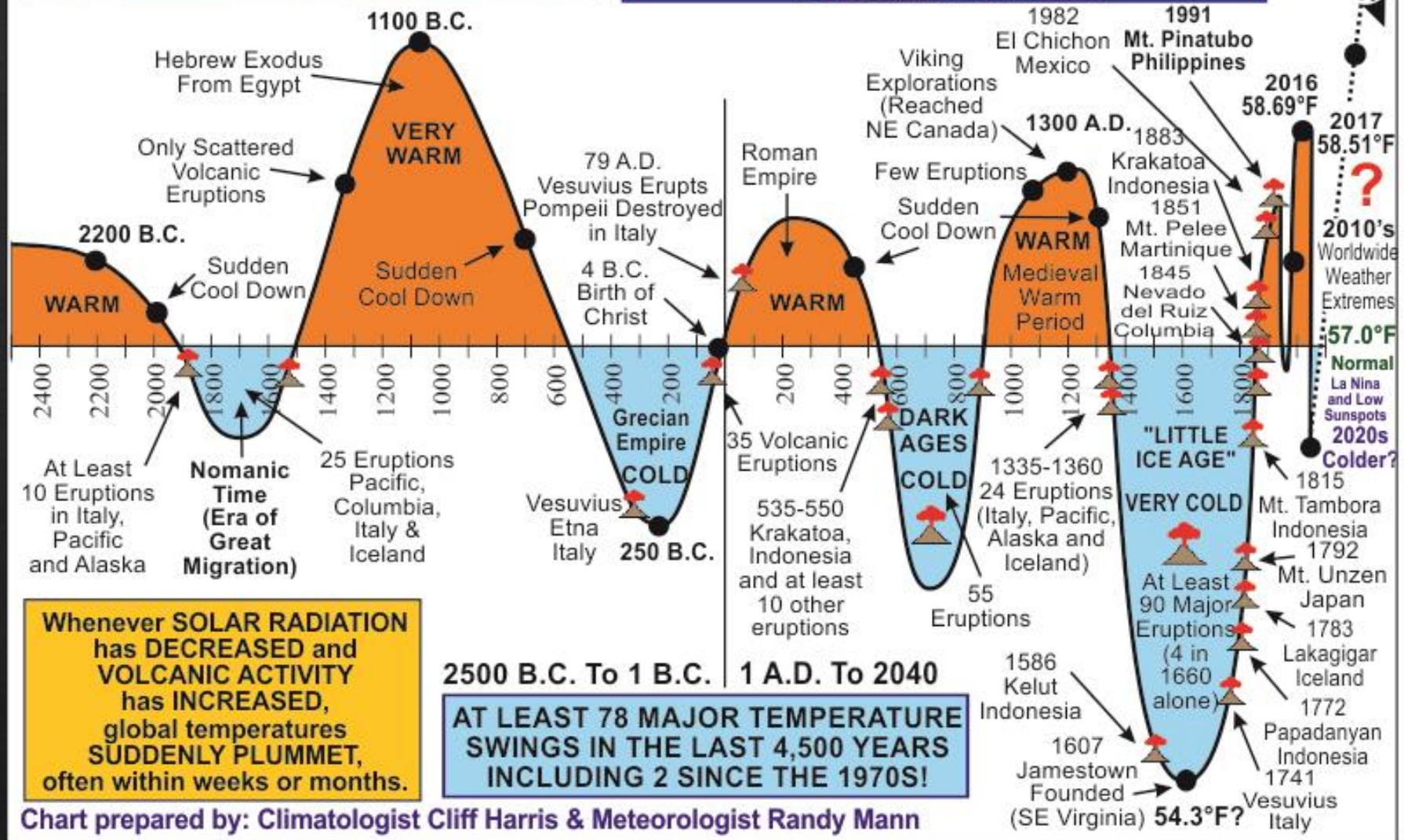
Fire and forests are integral
and cannot be separated

John R. Mount Jr.

GLOBAL TEMPERATURES (2500 B.C. TO 2040 A.D.)

MAJOR GLOBAL COOLING FROM 2007 TO 2009
A 0.9 Degree Fahrenheit drop in global temperatures occurred from October 2007 to February 2009.

MOUNT PINATUBO ERUPTION (Philippines)
1.1 Degree F. Rapid Cool Down (June 1991 to March 1992)
Global Temperature Went From 0.6 Degrees Above Normal To 0.5 Degrees Below Normal.



Whenever SOLAR RADIATION has DECREASED and VOLCANIC ACTIVITY has INCREASED, global temperatures SUDDENLY PLUMMET, often within weeks or months.

2500 B.C. To 1 B.C. | **1 A.D. To 2040**

AT LEAST 78 MAJOR TEMPERATURE SWINGS IN THE LAST 4,500 YEARS INCLUDING 2 SINCE THE 1970S!

Chart prepared by: Climatologist Cliff Harris & Meteorologist Randy Mann

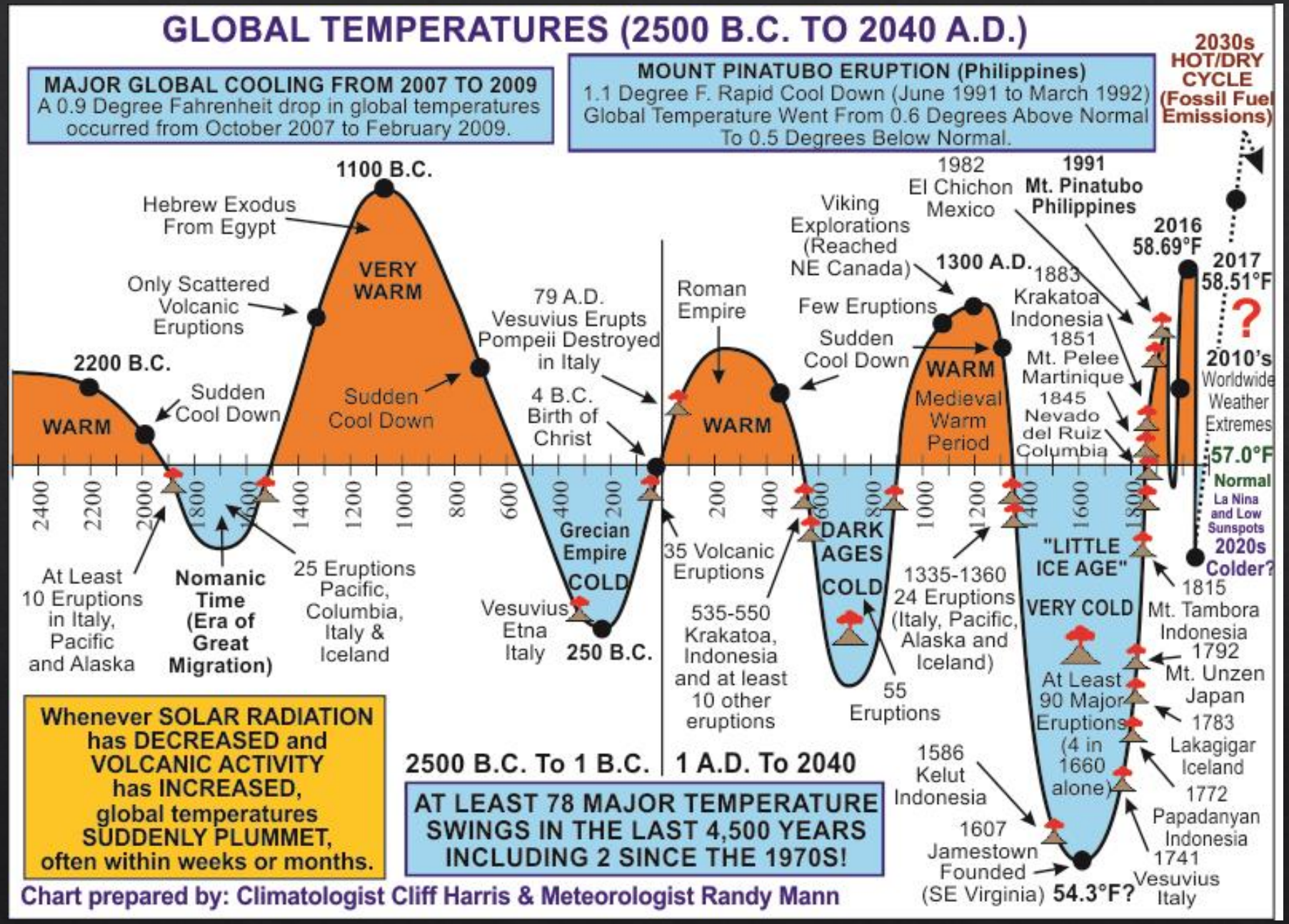
LIGHTNING

AVERAGE OF 4500 FIRES PER YEAR

WITH A RETURN INTERVAL OF 4-40 YEARS

“we found no statistically significant differences in the average annual area burned….for the two periods”

Roos-Swetnam tree ring study years 500 to 1900.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2030s HOT/DRY CYCLE (Fossil Fuel Emissions)
1100 B.C.
Hebrew Exodus From Egypt
VERY WARM
Only Scattered Volcanic Eruptions
2200 B.C.
WARM
Sudden Cool Down
Sudden Cool Down
79 A.D. Vesuvius Erupts Pompeii Destroyed in Italy
4 B.C. Birth of Christ
Roman Empire
WARM
1982 El Chichon Mexico
1991 Mt. Pinatubo Philippines
Viking Explorations (Reached NE Canada)
1300 A.D.
Few Eruptions
Sudden Cool Down
WARM
Medieval Warm Period
1883 Krakatoa Indonesia
1851 Mt. Pelee Martinique
1845 Nevado del Ruiz Columbia
2016 58.69°F
2017 58.51°F
?
2010's Worldwide Weather Extremes
57.0°F Normal
La Nina and Low Sunspots
2020s Colder?
2400 2200 2000 1800 1600 1400 1200 1000 800 600 400 200 200 400 600 800 1000 1200 1400 1600 1800
At Least 10 Eruptions in Italy, Pacific and Alaska
Nomanic Time (Era of Great Migration)
25 Eruptions Pacific, Columbia, Italy & Iceland
Grecian Empire
COLD
Vesuvius Etna Italy
250 B.C.
35 Volcanic Eruptions
535-550 Krakatoa, Indonesia and at least 10 other eruptions
DARK AGES
COLD
55 Eruptions
1335-1360 24 Eruptions (Italy, Pacific, Alaska and Iceland)
"LITTLE ICE AGE"
VERY COLD
At Least 90 Major Eruptions (4 in 1660 alone)
1815 Mt. Tambora Indonesia
1792 Mt. Unzen Japan
1783 Lakagigar Iceland
1772 Papadanyan Indonesia
1741 Vesuvius Italy
1586 Kelut Indonesia
1607 Jamestown Founded (SE Virginia)
54.3°F?
Whenever SOLAR RADIATION has DECREASED and VOLCANIC ACTIVITY has INCREASED, global temperatures SUDDENLY PLUMMET, often within weeks or months.
2500 B.C. To 1 B.C.
1 A.D. To 2040
AT LEAST 78 MAJOR TEMPERATURE SWINGS IN THE LAST 4,500 YEARS INCLUDING 2 SINCE THE 1970S!
Chart prepared by: Climatologist Cliff Harris & Meteorologist Randy Mann

Fire

the sculptor of the forest

THE NATURAL ROLE OF FIRE

On June 10, 1981, a fire was ignited when lightning struck a sotol plant not far from where you are standing. Fanned by winds associated with the thunderstorm, the fire began to spread and move down the slope. Because naturally-caused fires maintain the diversity of a natural ecosystem, it was closely monitored and allowed to burn.

After several days the fire burned itself out, as it would have 200 years ago before "man-the firefighter" entered the scene. A total of 680 acres (275.3 hectares) were involved, but the fire burned in a mosaic pattern leaving many "islands" of green.

With the nutrients released by the fire, revegetation began immediately. Within a few years grasses and cacti will again cover the area, providing fresh forage for the many animals that have already moved back.

Naturally-occuring fires cannot be defined as either "bad" or "good"--they are simply natural and as much a part of the ecosystem as sun, rain, wind, and flood.

1914 Mixed Conifer Forest from Chiquito Basin on the Sierra National Forest

Fuel buildup in the Sierra Nevada

- Ten years (1910) 60 tons/acre
- Thirty years (1930) 180 tons/acre
- Fifty years (1950) 300 tons/acre
- 1955 first large fires
- Eighty years (1980) 480 tons/acre
- California on Fire 1987
- One hundred years (2000) 600 tons/acre
- California on fire 2008
- Today 648 ton/acre

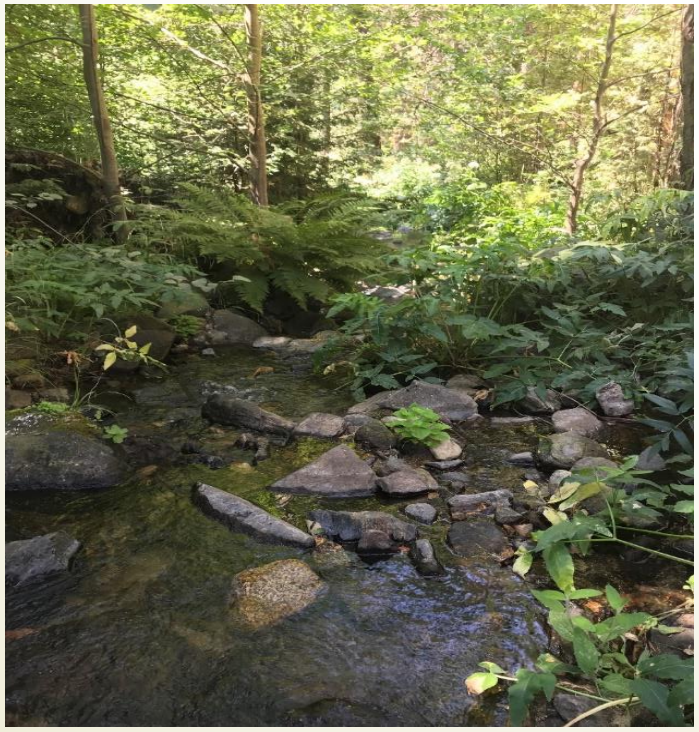
Aftermath of Fire – Stephen Byrd

Wildfire - Water

Water yield ↑ (temporary) Soil Storage ↓
Water temp ↑ Water quality ↓

Water

- Natural Fire regulates stems per acre
  - Water yield increase
  - Maintains high water quality
  - Riparian areas become perennial
  - Meadows maintain size and moisture



Wildfire-Soil

- Slope stability
- Sedimentation
  - Downstream habitat degradation/loss
  - Hydrologic infrastructure
  - Costs/feasibility of dredging behind dams - $60/cu. yd., plus permitting
  - It's much more expensive to dredge out your reservoirs after a fire than it is to take preventive action, like reducing fuel loads and restoring forests," said Jason Kreitler, a research geographer with the USGS and a coauthor of the study.

Wildfire-Soil

In the case of the King Fire, the U.S. Forest Service estimates 300,000 tons of topsoil are poised to erode into Rubicon River

Soils

Soil remains stable
- most trees remain
- revitalizing to brush and grass
- nutrients are rapidly recycled

Wildfire and Air Quality

- Emissions and carbon output go up dramatically
- Particulates –quantifies particulates in automobiles
- Timing
  - Usually in summer heat when air movement is stagnant

Air Quality

- Volume of smoke is at LEAST 10 times less than wildfire
- Smoke is far less toxic
- Timing is more friendly to sensitive groups

Carbon Management

- Carbon Dump – initial
- Decrease or loss carbon Sequestration rate into the future
- Carbon sequestration
- Biomass

Carbon Management

- Natural fire increases carbon sequestration
- Healthy forests = rapid steady growth
- Healthy forest avoids massive carbon dump
- Biomass
  - Natural fire surrogate, with minimal emissions and a valuable byproduct

Wildfire - Vegetation

- Wood products loss
- Post Fire Fuel accumulation
- Stand structure/type-conversion
- Reforestation challenges

Wildfire - Wildlife

- Habitat Change or Loss
- Loss of cover
- Loss of specialized habitat components

Wildlife

- Provides a variety and abundance of food
  - Browse, mast and insects
  - Meadows
  - Water
- Maintains specialized habitat components and diversity
  - Logs
  - Snags
  - cavities

Recreation

- Access
- Aesthetics
- Public safety

Homes/WUI/Communities

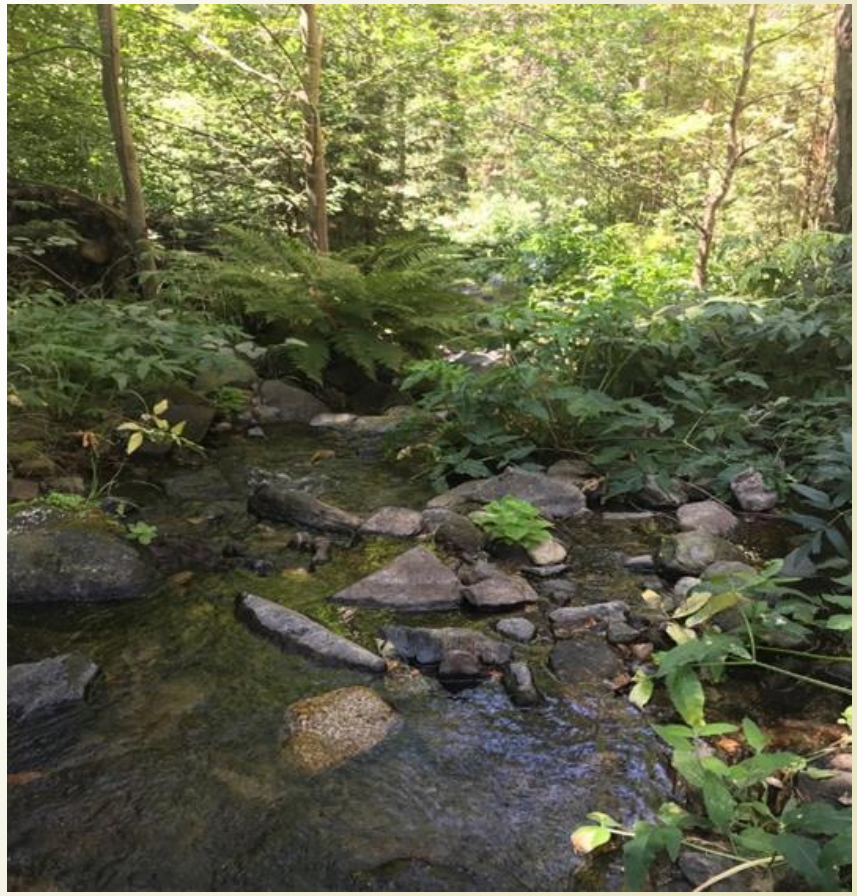
- Safety of homes
- Fire insurance issues –average cost?
- Smoke, health risks
- Long term impacts to local economy

Mountain Communities

- Safety of homes
- Fire insurance issues
- Protection of investment
- Smoke, health risks lessened/averted
- Long term security to economy

Wildfire VS Prescribed Fire

Decrease in both **Water** **Quality & Quantity improvement**



Wildfire VS Prescribed Fire

Decrease in both	Water	Quality & Quantity improvement
Rapid permanent loss	Soil	Stability, vibrant veg growth, nutrient recycling

Wildfire VS Prescribed Fire

Decrease in both	Water	Quality & Quantity improvement
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Health hazard	Air	Fraction of the smoke & good dispersal

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Massive dump	Carbon	Increase in sequestration

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Enormous habitat loss	Wildlife	Increase diversity, forage production & pines
High risk & High cost	WUI	Reduced risk & Reduced cost

Yosemite National Park, Mariposa Grove

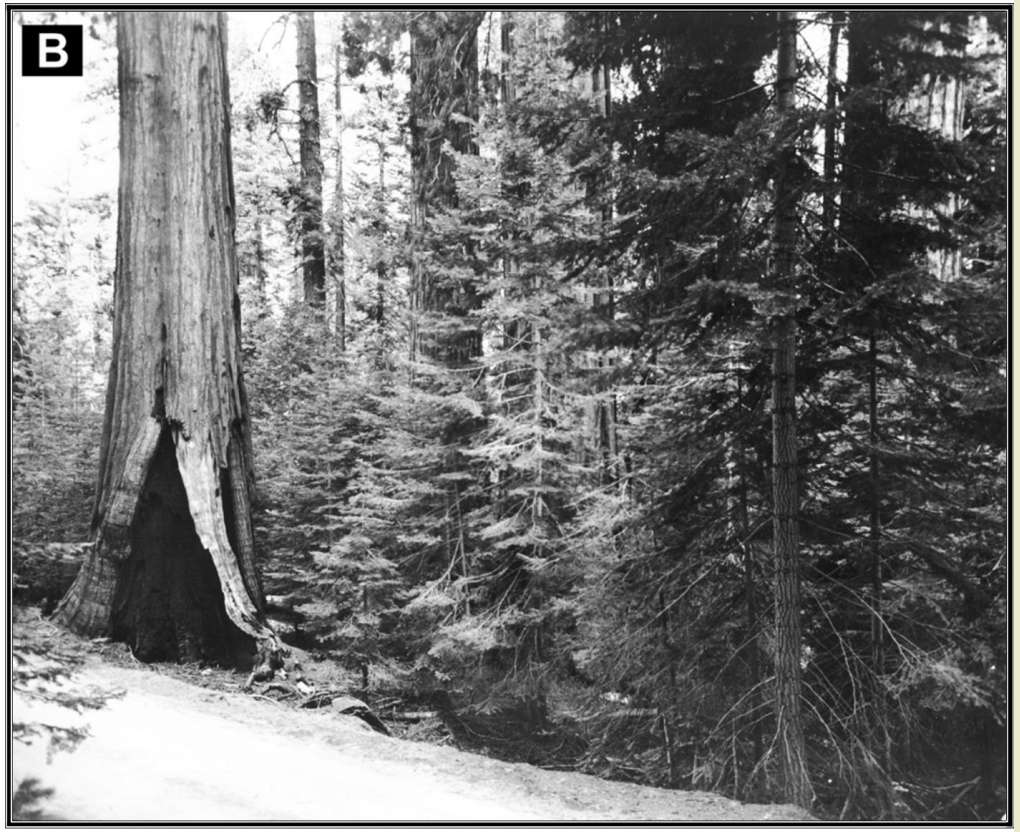
The Confederate Group

1890

Natural Forest Condition

Pre-European

1970



Park Management

No young Sequoias

Catastrophic Fire Hazard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H. O. PEABODY, BOSTON

Conclusions…

Laws and Regulations Guiding Fire Management

FIRE IN THE SIERRA WORKSHOP

JOHN R. MOUNT

1870s–1900s

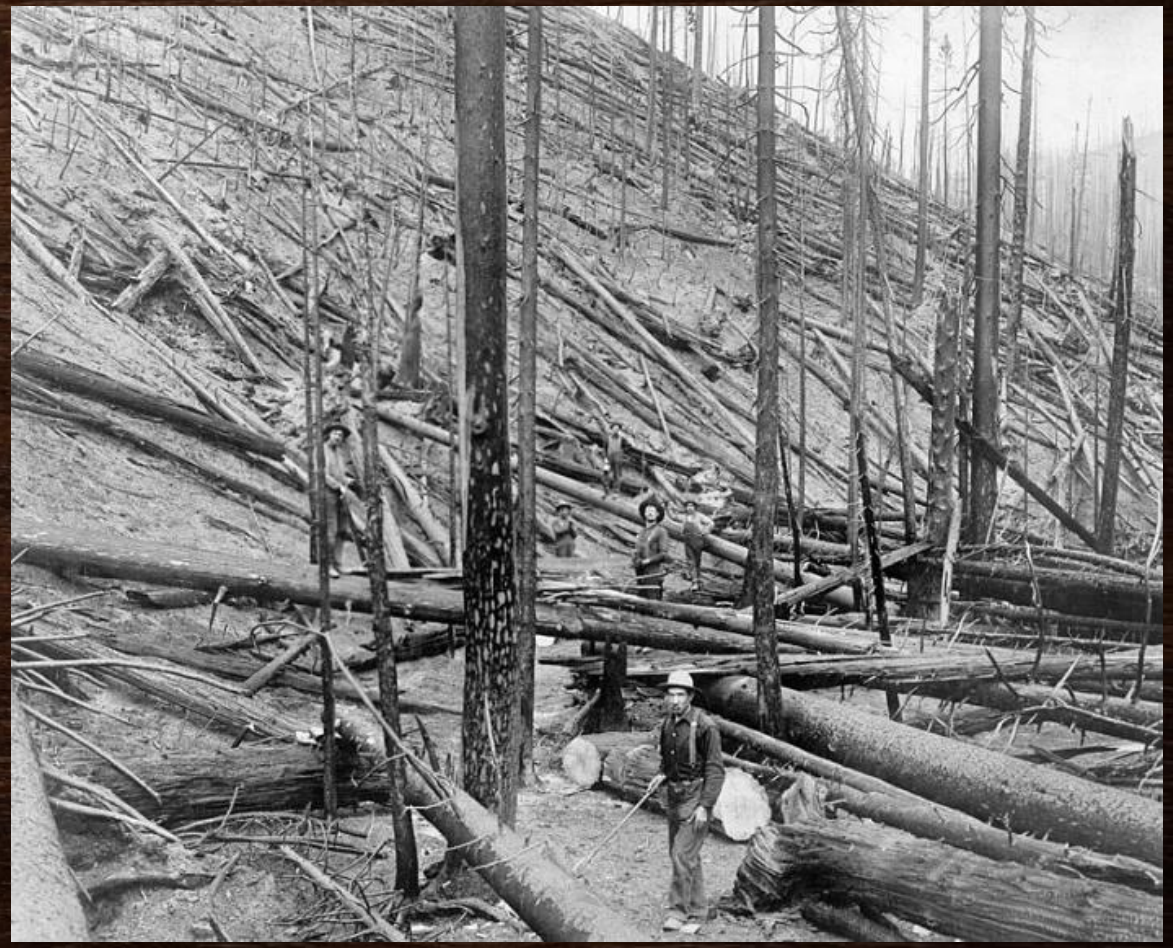
Creation of Key Federal and State Agencies and Development of Early Statutory Framework that Continues to Inform Fire Management

Organic Administration Act of 1897

- Provides that the forest reserves were originally set aside "to improve and protect the forest . . . for the purpose of securing favorable conditions of water flow, and to furnish a continuous supply of timber. . . ." 16 USC 475.
- Directed the agency to "make provisions for the protection against destruction by fire . . . " and vested the Secretary with broad authority to make rules and regulations "to preserve the forests . . . from destruction." 16 USC 551.

1910s–1930s

Development of Early Infrastructure and Suppression Policies



1933 – Civilian Conservation Corps Established

1940s–1950s

Expansion of Fire Suppression Efforts

Development of Federal Firefighting Infrastructure

1960s–1970s

Expansion of Key Environmental Laws and a Shift from Fire Suppression to Fire Management

Forest Service Multiple Use-Sustained Yield Act of 1960

- Expanded the Forest Service's mandate
- Provides that "the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes." 16 USC 528

Wilderness Act of 1964

- Established the National Wilderness Preservation System, which now encompasses more than 110 million acres
- Section 2(c) mandated that designated wilderness be “protected and managed so as to preserve its natural condition and these lands generally appear to have been affected primarily by the forces of nature”
- Section 4(d) provides that the Secretaries of Interior and Agriculture may take “such measures may be taken as may be necessary in the control of fire…subject to such conditions as the Secretary deems desirable”

1966 National Historic Preservation Act

- Enacted to preserve historic and archaeological sites
- Section 106 requires federal agencies to evaluate the impact of all federally funded or permitted projects on historic properties, including buildings and archaeological sites

1967 Clean Air Act

- Purpose is to protect and enhance the nation's air quality and to promote the public health and welfare. Establishes specific programs that provide protection for air resources
- Grants significant authority over air quality to the states, giving them an important regulatory role in federal fire and smoke management decisions

National Environmental Policy Act of 1969

- Requires that federal agencies, when contemplating "major federal actions significantly affecting the quality of the human environment," prepare an environmental analysis before deciding on a course of action
- The analysis must include the environmental impacts of the action, alternatives to the proposed action, and disclose any irreversible commitments of resources
- Opportunity for public comment
- All fuel reduction projects funded by the federal government that occur on federal land or require an agency to issue a permit, must comply with NEPA and therefore must be analyzed in an EIS, EA, or CE
- NEPA and emergencies (e.g., wildfire suppression)

1970 – California Environmental Quality Act

- Like NEPA, CEQA requires analysis of discretionary actions by a public agency within the State of California that may lead to physical changes in the environment, either directly or indirectly
- Range of environmental documents mirror NEPA: Categorical Exemptions, (Mitigated) Negative Declarations, Environmental Impact Reports (EIRs), Programmatic EIRs

Endangered Species Act of 1973

- Prohibits the “taking” of species federally listed as threatened or endangered
- Once a species is listed, requires federal agencies to consult with the USFWS and NMFS to ensure that their activities will not jeopardize the existence of any listed species or result in the destruction or deterioration of critical habitat

1980s–present

A Note on the Role of the Courts

- Courts have played an increasingly significant role since the 1970s
- Almost every major agency decision, including revisions to agency regulations and decisions analyzed under NEPA are subject to challenge in the courts
- The courts' significant role in shaping public land policy and decision-making has prompted calls by some for legislative reform to clarify agency obligations, resource management priorities, and decision-making processes

Ecoystem Services

Julianne Stewart

The mind is not a vessel to be filled but a fire to be kindled.

-Plutarch

Not just flowers and ladybugs…

- Recognition of how ecosystems could provide complex services to humankind date back to at least Plato who understood that deforestation could lead to soil erosion and the drying of springs.

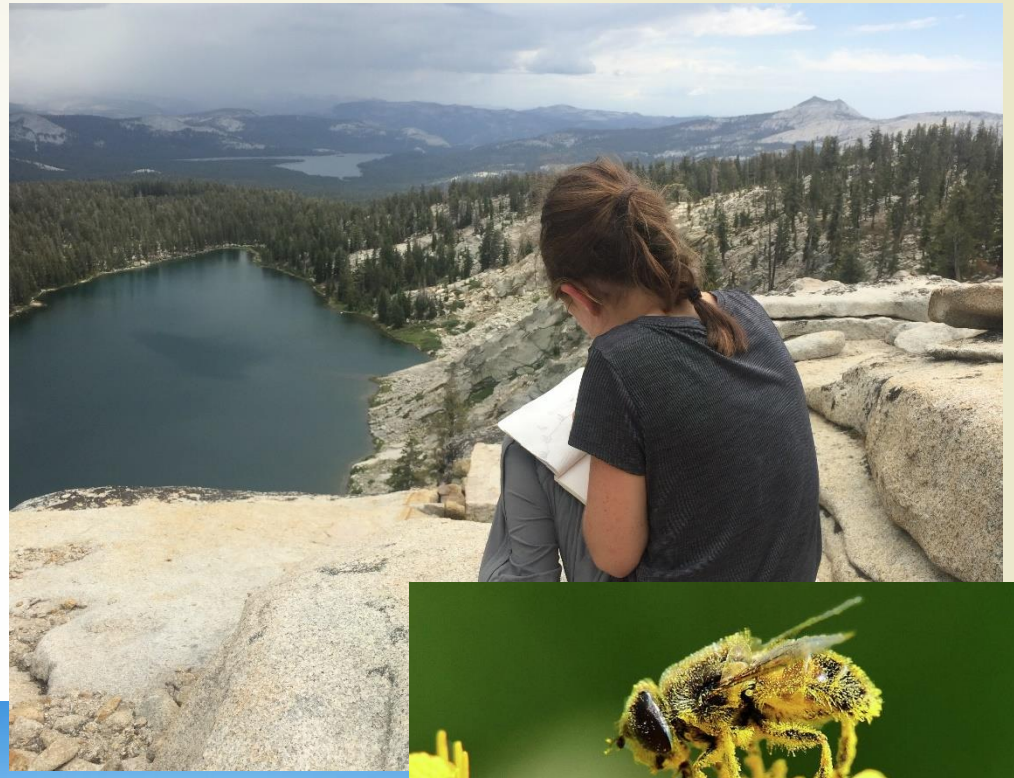
  In comparison of what then was, there are remaining only the bones of the wasted body…all the richer and softer parts of the soil having fallen away, and the mere skeleton of the land being left.

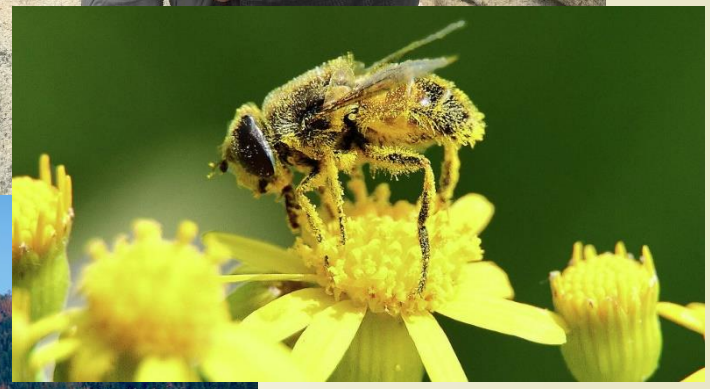
  – Plato, Critias 360 BC

- Modern Example : 1990s New York City and the Catskill Watershed Restoration Project
  - Cost of treatment plant: $8 billion + $300 million annually
  - Cost of Catskill Watershed Restoration : $1.5 billion

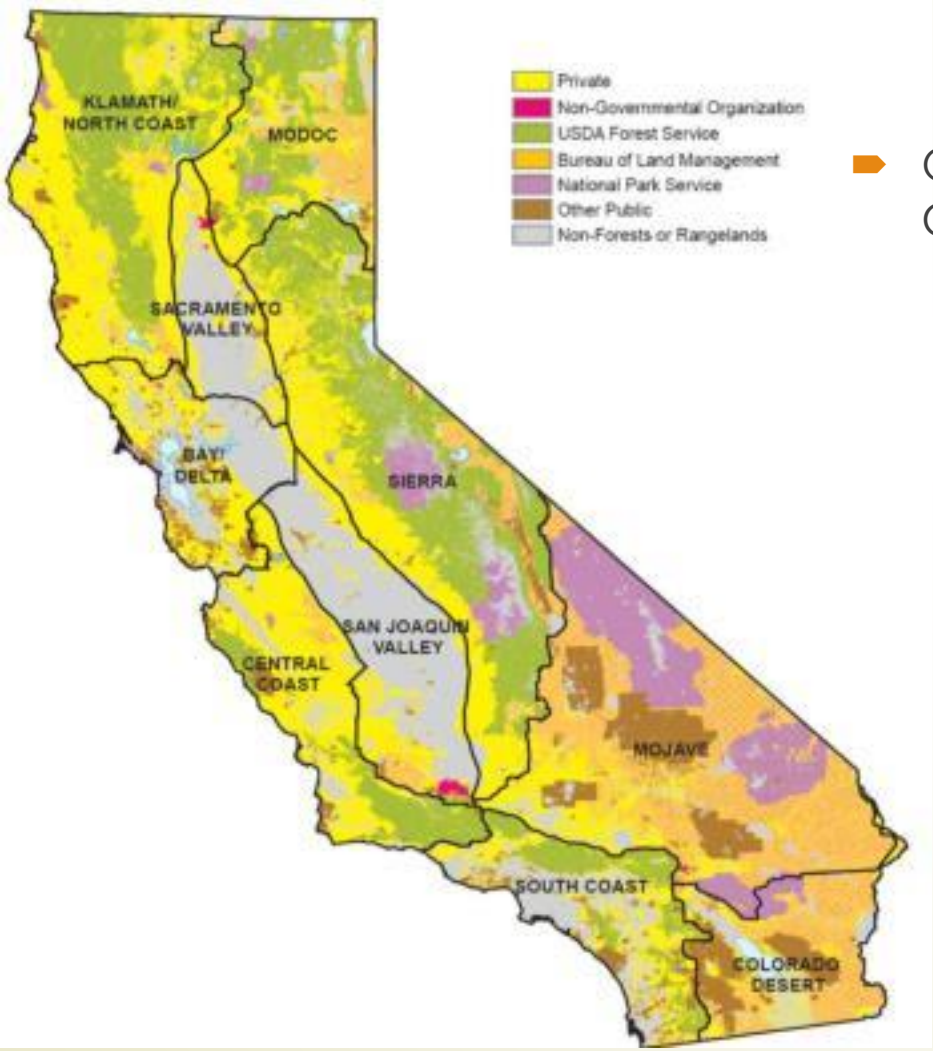
Overview

- Ecosystem services are often grouped into four broad categories:
  - *provisioning* (food & water)
  - *regulating* (control of climate & disease)
  - *supporting*(nutrients & oxygen)
  - *cultural* (spiritual & recreational benefits)
- Assigning economic value is easy for some, more difficult for others
- How does natural fire fit???





Forest Statistics



- Of the approximately 33 million acres of forest in California,
  - 19 million acres (57%): Federal agencies (USFS, BLM, NPS)
  - 1 million acres (3%): State and local agencies (CalFire, local open space, park and water districts and land trusts)
  - 13 million acres (40%): Families, Native American tribes, or companies.
    - 5 million acres: Industrial timber companies own 5 million acres
    - 8 million acres: Individuals
      - 90% of these owners having less than 50 acres of forest land.

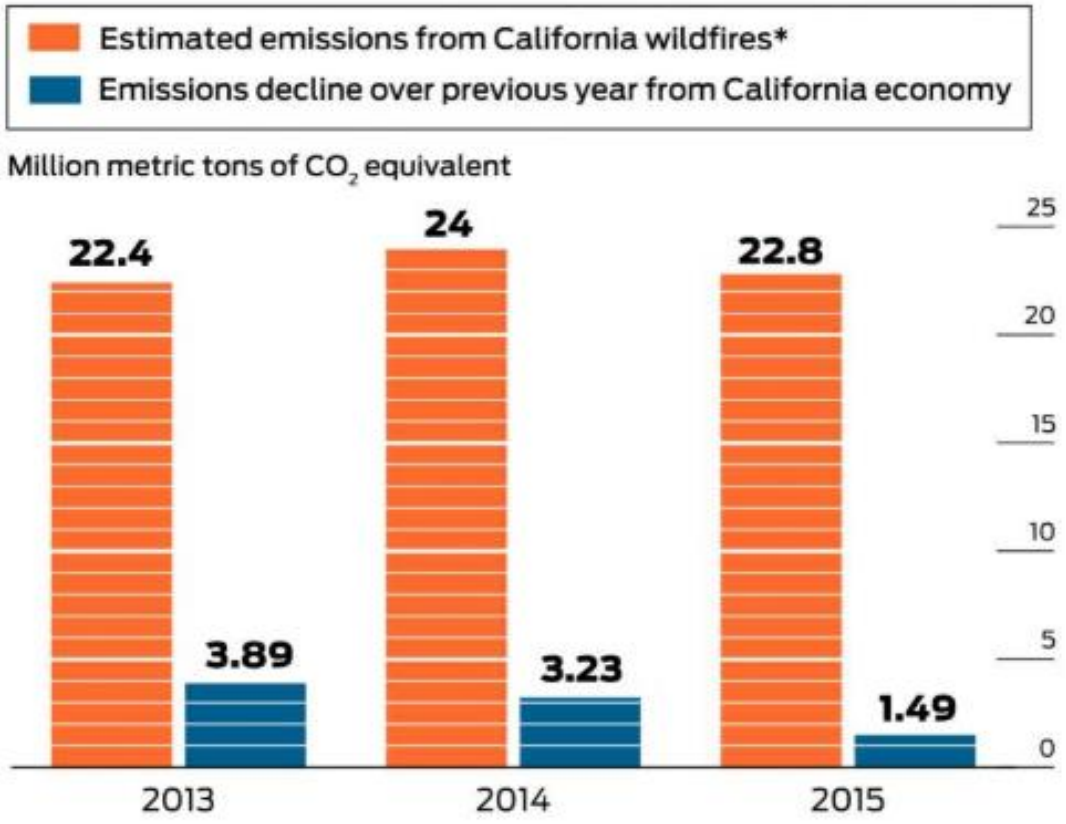
Carbon & Air Quality Costs

- Emissions permits currently $14/ton carbon
- 2013 Rim Fire: 10-15 million metric tons
  - 257,314 acres = 40 tons/acre
- 2015 Rough Fire: 6.8 million metric tons
  - 151,623 acres = 45 tons/acre
- Estimate of Annual Emissions:
  - (500,000 acres/year) * (40 tons/acre)= 20 million tons/year
- Annual Cost??? $280 million/year or $560/acre

Foreground: 2014 French Fire aftermath
Background: Mammoth Pool Reservoir with smoke from the 2018 Lions Fire

Small cuts, big fires

California wildfires produce so much carbon dioxide that in any given year, they can wipe out the global warming emissions cuts that the state is trying hard to achieve. From 2013 through 2015, California's estimated emissions from fires on federal land alone were greater than cuts achieved across the state's economy.



* Includes wildfires on federal lands only

Sources: California Air Resources Board, U.S. Forest Service

Todd Trumbull / The Chronicle

What does it all add up to??

- Approximately 33 million acres of forest in California,
- Most recent 30 years of Wildfire & Suppression (not including 2016, 2017, 2018):
  - 15.8 million acres have burned
  - $5.2 billion in suppression costs
  - $7.0 billion in damages
- Indirect and secondary costs are nearly unquantifiable
  - Power outages, health issues, recovery……..

Wildfire Costs according to Wikipedia

Broadscale Economic Loss

2015 California wildfires

Smoke from the 2015 California wildfires as seen from space, on August 18, 2015

Statistics[1]

Total fires	8,745
Total area	893,362 acres (3,615 km^2)
Cost	≥4.771 billion (2015 USD)[2][3]
Fatalities	2 firefighters and 7 civilians killed
Non-fatal injuries	At least 1

2016 California wildfires

A Skycrane makes a drop on the Sherpa Fire in June.

Statistics[1]

Total fires	7,349
Total area	669,534 acres (2,709.51 km^2)[2]
Cost	>$480.3 million (2016 USD)[3][2]
Fatalities	6 civilians killed, 2 firefighters killed[2]
Non-fatal injuries	Unknown

2017 California wildfires

Smoke from the Alamo and Whittier fires during the 2017 California fire season, on July 8, 2017.

Statistics[1]

Total fires	9,133
Total area	1,381,405 acres (5,590.35 km^2)
Cost	≥$18.0 billion (2018 USD) (Costliest on record)[2][3]
Fatalities	2 firefighters, 45 civilians
Non-fatal injuries	12 firefighters, 199 civilians

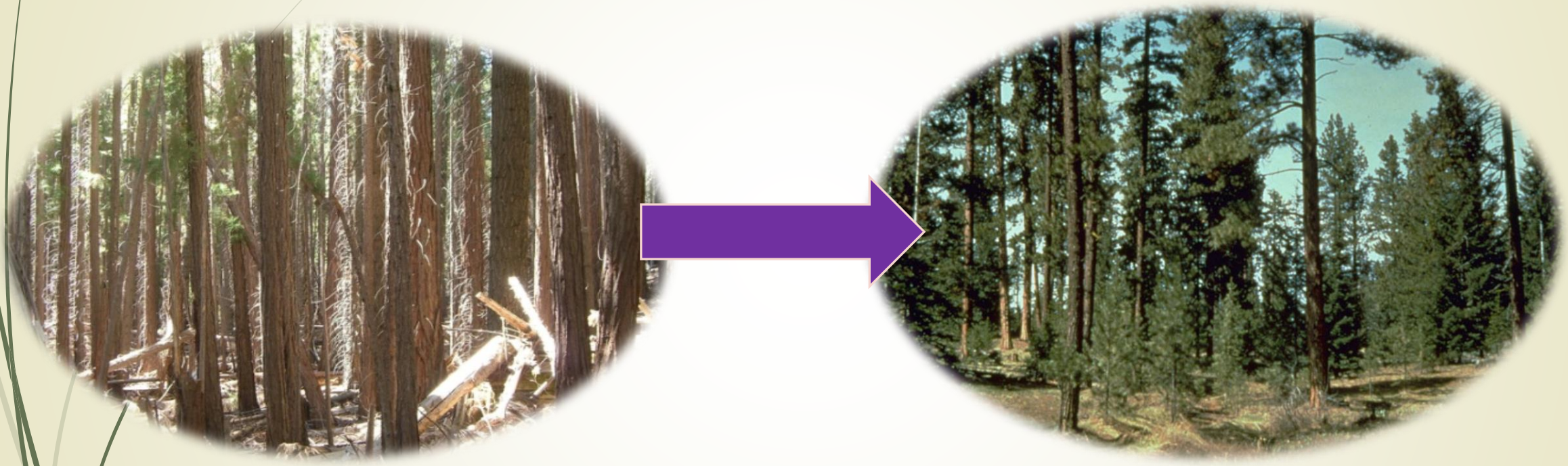
2017 Fires

The wildfires collectively caused at least $18.0 billion (2018 USD) in damages,:

- $13.2 billion in insured losses,
- $3 billion in other economic losses,
- $1.8 billion in fire suppression costs

The total economic cost, including fire suppression, insurance, direct and indirect economic losses, and recovery expenditures is estimated at about **$180 billion**

Assumption:



Options?


Suppression
$650/acre
Damages
$700/acre
Reforestation
$3000/acre
100 years?
Tree Mortality Cleanup
$3000/acre
Restoration
treatment
$1500/acre
Prescribed Fire
$200/acre
Thinning,
release
treatments
$1000/acre
GOAL

$$$

Costs: Revenue Potential:
$1700/acre HIGH

Timeline:
Goal achieved in under 5 years

Side effects:
Clean Water
Increased Water
Improved air quality
Avoidance of wildfire incurred costs
Safer Communities and Homes
Aesthetics and Recreation improved

Chance of Success meeting goal:
HIGH

Costs: Revenue Potential:
$5350/acre NONE

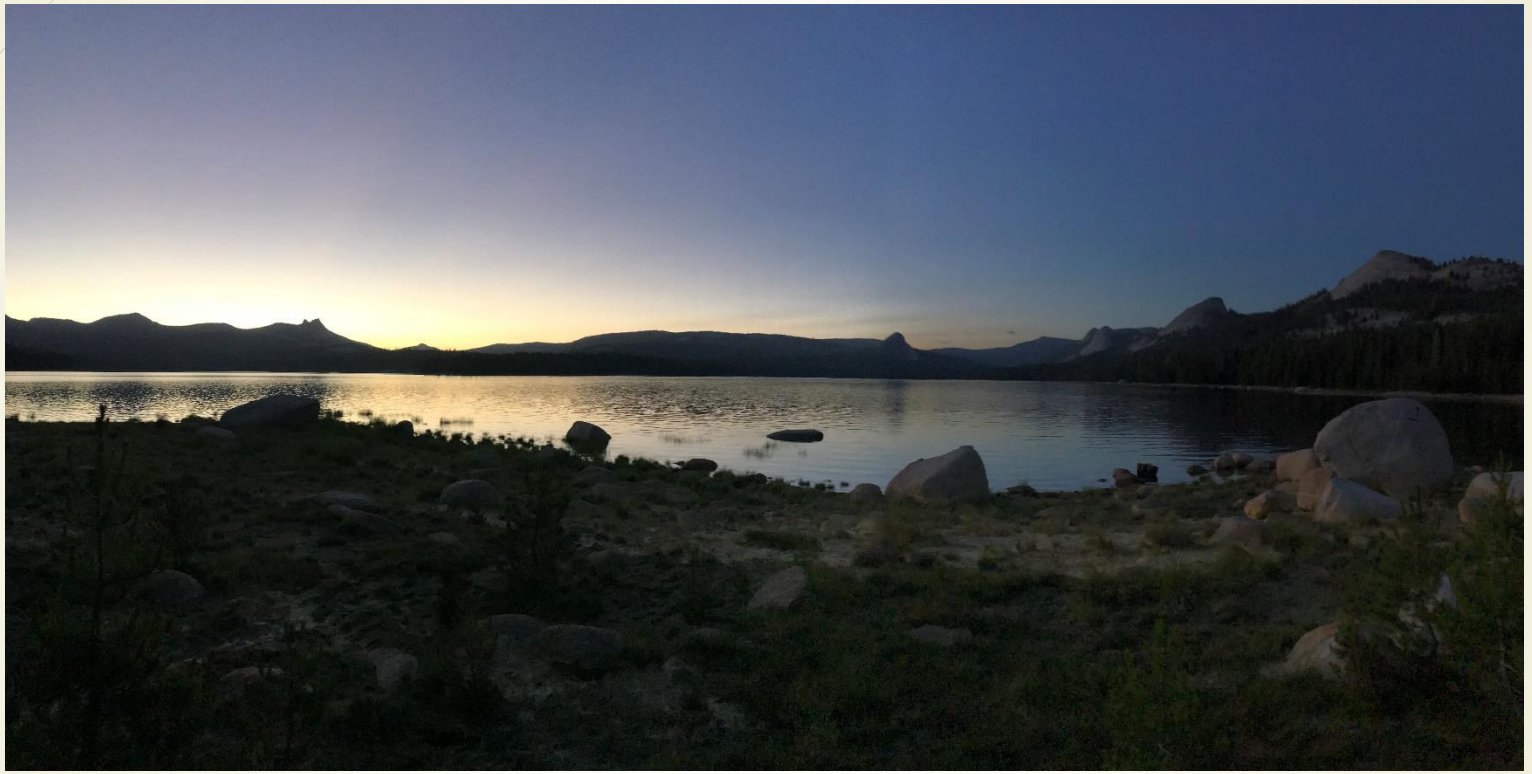
Timeline:
Goal achieved in 100+ years

Side effects:
Polluted/Decreased Water
Poor Air Quality
Rising firefighting costs
Rising (disappearing?) Homeowners insurance
Increased financial risk
Loss of Life
Loss of Critical Habitat

Chance of Success meeting goal
LOW

"Post fire rehabilitation totals about 30 times the direct cost of firefighting."
Harpers Magazine, August 2018

Conclusion & Discussion



“Ecosystem services not only produce superior environmental and social results, it produces them far more cheaply that traditional environmental strategies."

-Al Appleton, former Director, New York City's Water and Sewer System

Virtual Tour
Fire in the Sierra

- Ten years (1910) 60 tons/acre
- Thirty years (1930) 180 tons/acre
- Fifty years (1950) 300 tons/acre
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Fire in the Sierra

Thank you for attending

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