



**Fire in Temperate and Boreal Forests:  
Challenges and Opportunities**  
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Valentin (Val)  
Lopez, Chairman  
of the Amah  
Mutsun Tribal  
Band

“Fire is a gift from  
creator for the  
stewardship of the  
land”

Very important

# Canadian Boreal Forests

- Dominant tree species
  - White spruce (*Picea glauca*)
  - Black spruce (*Picea mariana*)
  - Jack pine (*Pinus banksiana*)
  - Quaking aspen (*Populus tremuloides*)
- Greater than 90% lightning fires
  - Human caused fires low
  - High severity fires every 40-150 years historically
  - Closed cones and thin bark trees
- Largest area ever burned in Canadian Boreal forests this year, > 16 million ha

# Northwest Territories, Canada



# Old-Growth White Spruce Forest: 160 Years Old



# Spruce Forest Burned in 1980



2016  
Picture

06/17/2016

# 2004/2014 Fires NW Territories Jack Pine Skeletons



# Mostly Native Grass and Shrubs



# Fire Return Interval Decreasing

- Return intervals < 15 years in some areas
  - Very rare before the 2000's
  - Increased temperatures from climate change key
  - Stable high pressure system this year
- Canadian forest ecologist/managers very concerned (*Whitman et al. 2019, Parisien et al. 2014*)
  - High emissions from fires impacting North America and beyond
- Climate change will continue to produce large area burned and impact carbon cycling

# Sierra Nevada Temperate Forests

**Mixed-conifer and ponderosa pine forests:**

Show and Kotok (1924):

“California pine forests represent broken, patchy, understocked stands, worn down by the attrition of repeated light fires.”



Bear Creek Guard  
Station - 1915  
Plumas National Forest

“Extensive crown fires...are almost unknown to the California pine region.”

These forests have thick bark and open cones:  
Adapted to frequent fire regimes

# Historical Fire Area and Emissions in California

- Approximately 1.8 million ha burned annually in California prehistorically (*Stephens et al. 2007*)
  - Lightning and Indigenous burning were common
    - Area burned approximately 50% lightning, 50% Indigenous
  - Paper rejected at 3 journals, comments that Indigenous burning estimates too high or should be removed (western science needs to change)
- Estimates of 33.6 Tg of carbon dioxide emitted annually from historical California fires
- Removing fire for > 100 years and harvest of the largest trees dramatically changed these forests
  - Increased forest density and fuels over millions of ha's of US frequent-fire forests (Hagmann et al. 2021)
  - Appropriate fire/corresponding emissions and restoration treatments necessary for forest conservation (Stephens et al. 2020)

# Managed Wildfire

50 years of fire use  
15,000 ha watershed  
Fire removed 1875

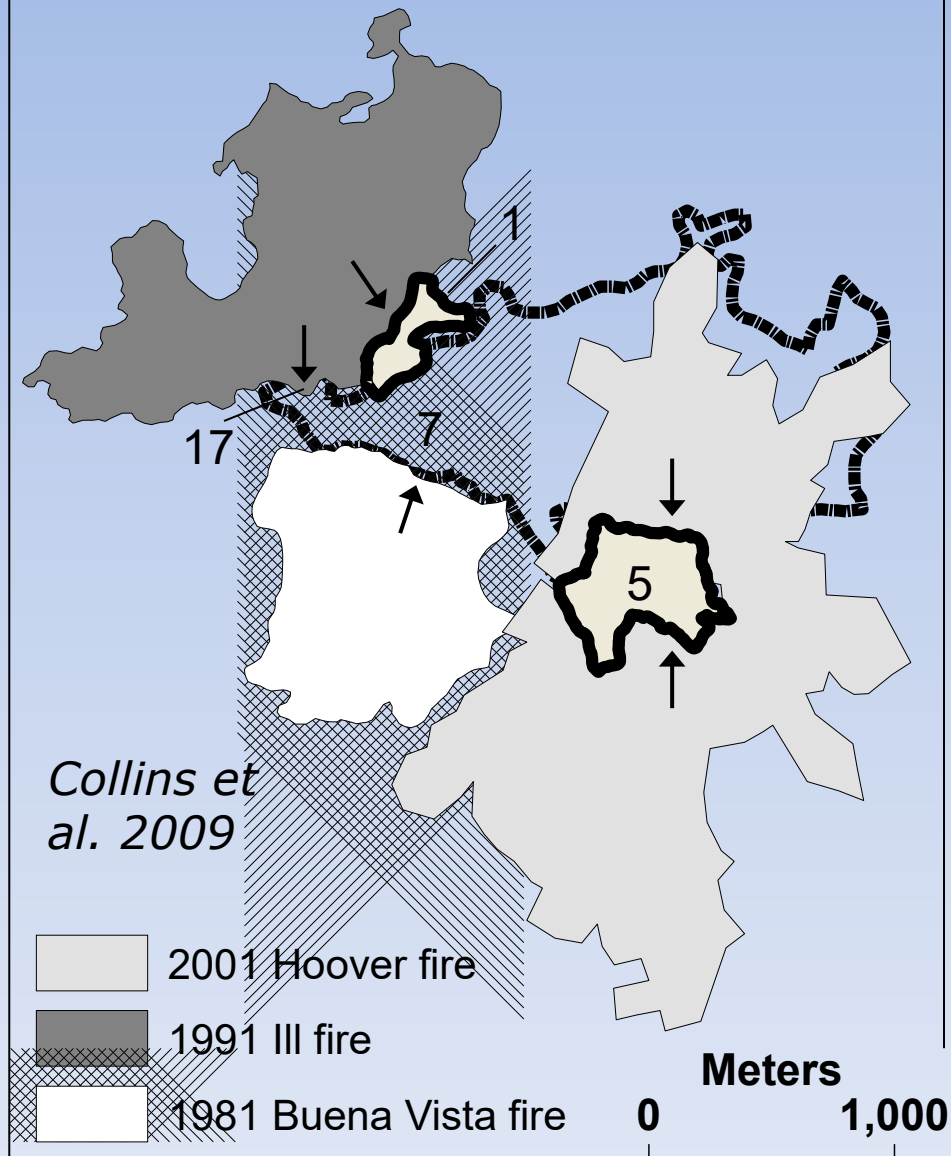
**Yosemite Program: 1974  
to Present**



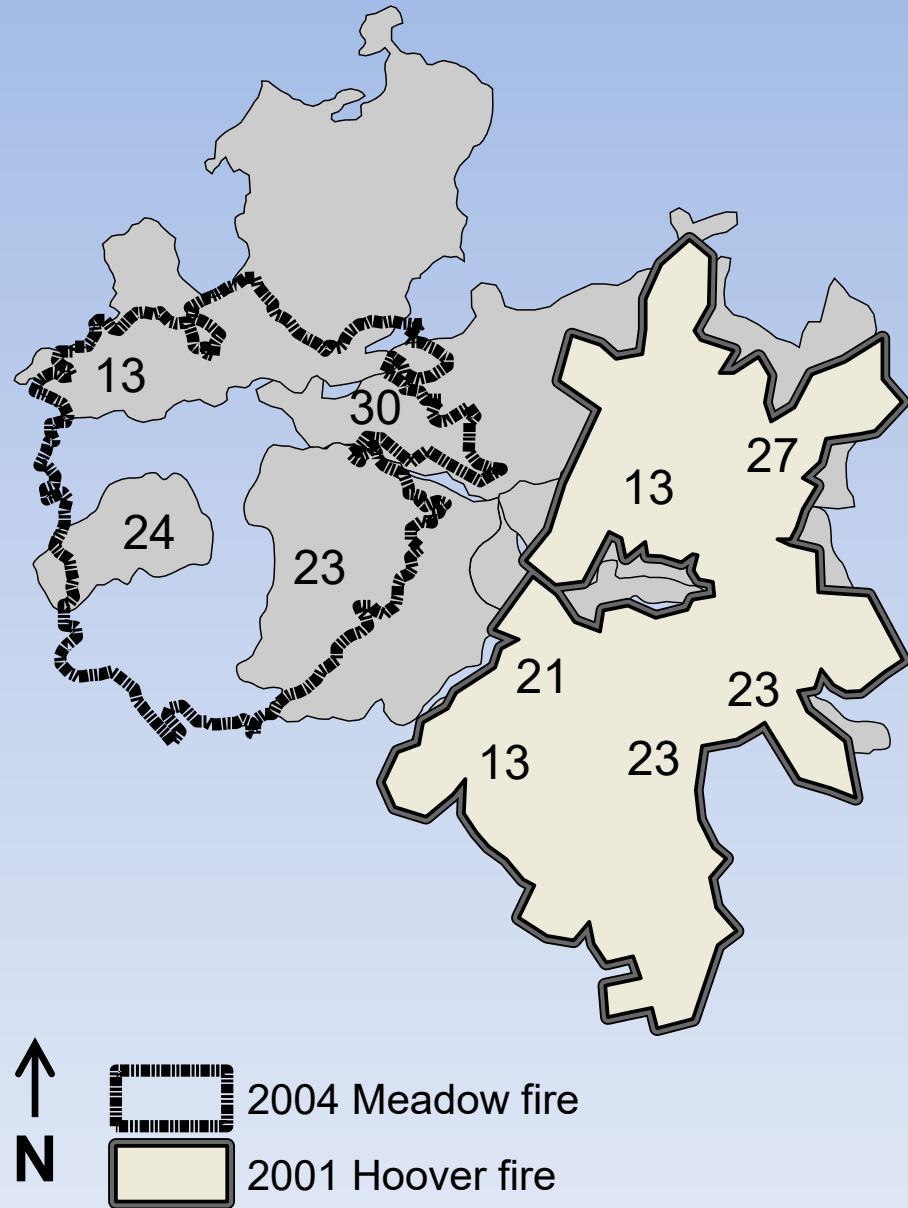
# 2001 Hoover Fire Yosemite National Park



# Limited Fires



# Reburn Fires 9 Year Threshold

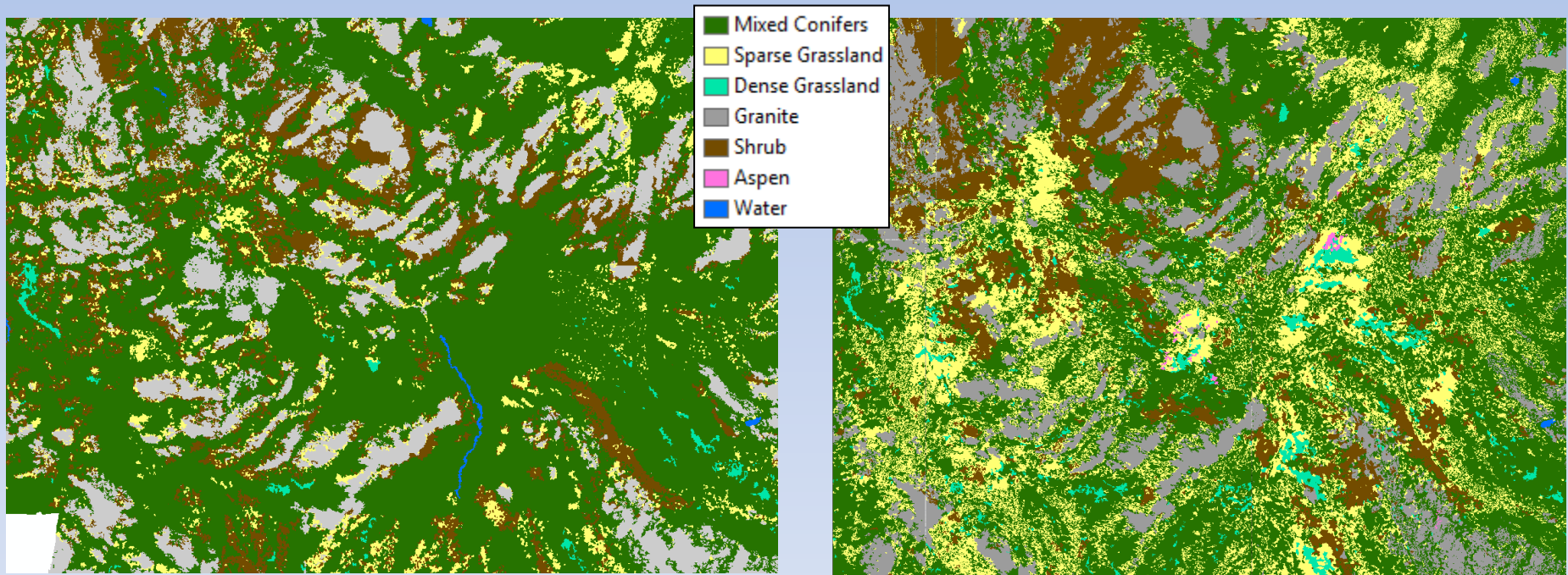


# YOSE Vegetation Change From Air Photos

## Fires Reduced Forest Area by 22%

1970 (~100 yr fire removed)

2012



Wet meadows increased by 200%  
Dry meadows increased by 200%  
Shrublands increased by 30%  
(Boisramé *et al.* 2017, 2019)

Fire severity patterns stable,  
pollinator diversity and water  
enhanced  
(Stephens *et al.* 2021)

# What Can Be Done?

## Boreal Forests:

- Infrequent, high severity fire regimes
- Fire hazard/restoration treatments including prescribed fire and restoration thinning not within their ecology, assisted migration? Carbon?
- Wildfire increasing, native species regenerating

## Temperate Forests:

- Frequent, low-moderate severity fire regimes
- Fire hazard/restoration treatments including prescribed fire, restoration thinning, good wildfire appropriate and can produce sustainable carbon
- Indigenous stewardship has huge potential if Tribes want to partner

Technological solution?

# The Stewardship Project: A Partnership of Indigenous and Western Science

50-50 policy partnership between Indigenous people and western science across the western US (Stephens, Don Hankins, Sara Clark leaders)

- Tribal Right to Burn
- Realignment of Regulatory Framework
- Workforce Development
- Wildfire opportunity zones

**Biden Wildfire Commission** results in mid Sept

Partnership with Indigenous people a solution

Western science strong but needs partnership