

Management of fires and ecosystems and implications for GHG emissions: Past and current

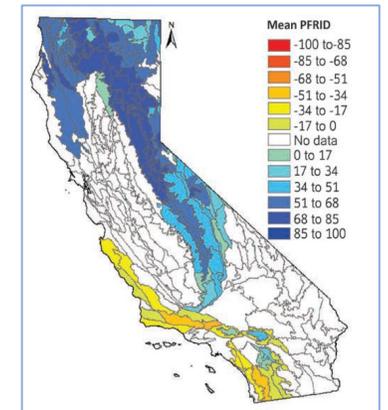
The view from California



Hugh Safford, PhD

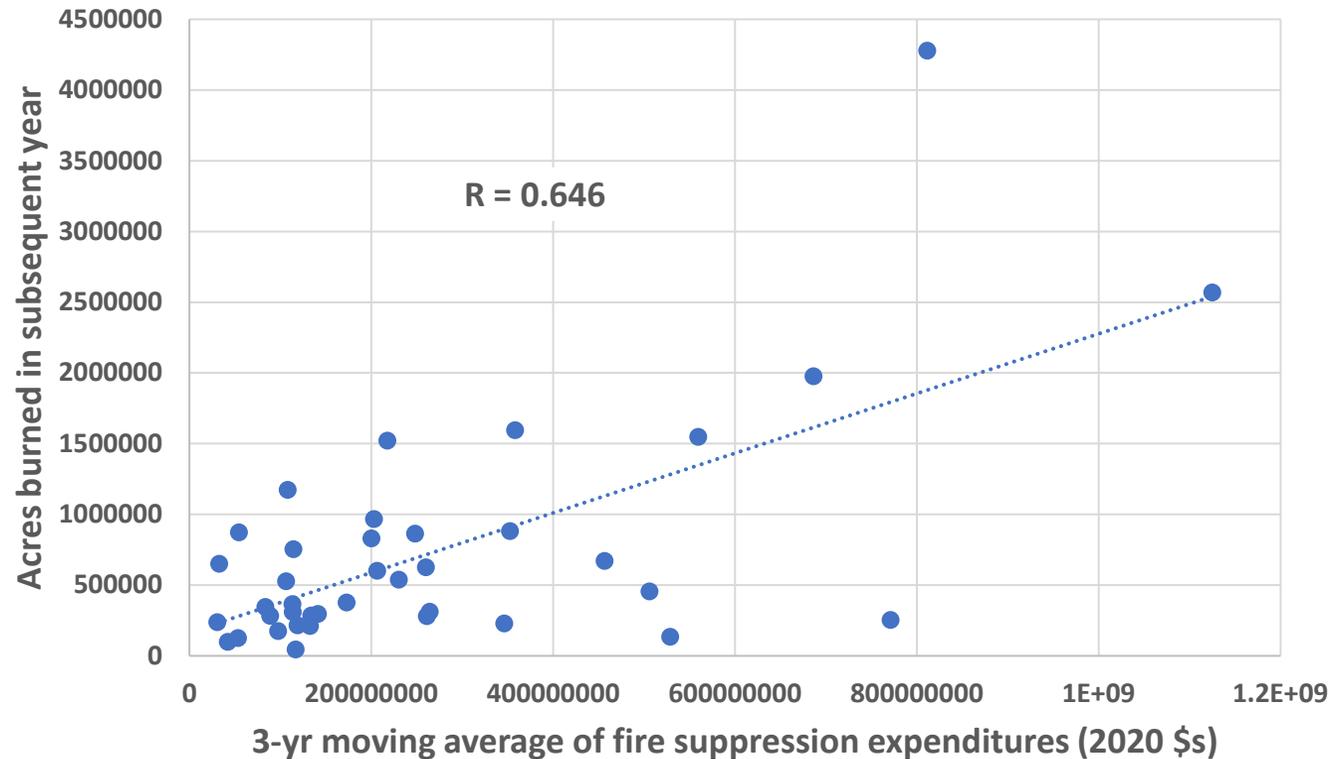
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Our current focus in fire management: Reducing burned area via fire suppression - Does it work?

3-yr moving average of CALFIRE suppression expenditures vs acres burned in subsequent year (1979-2020)

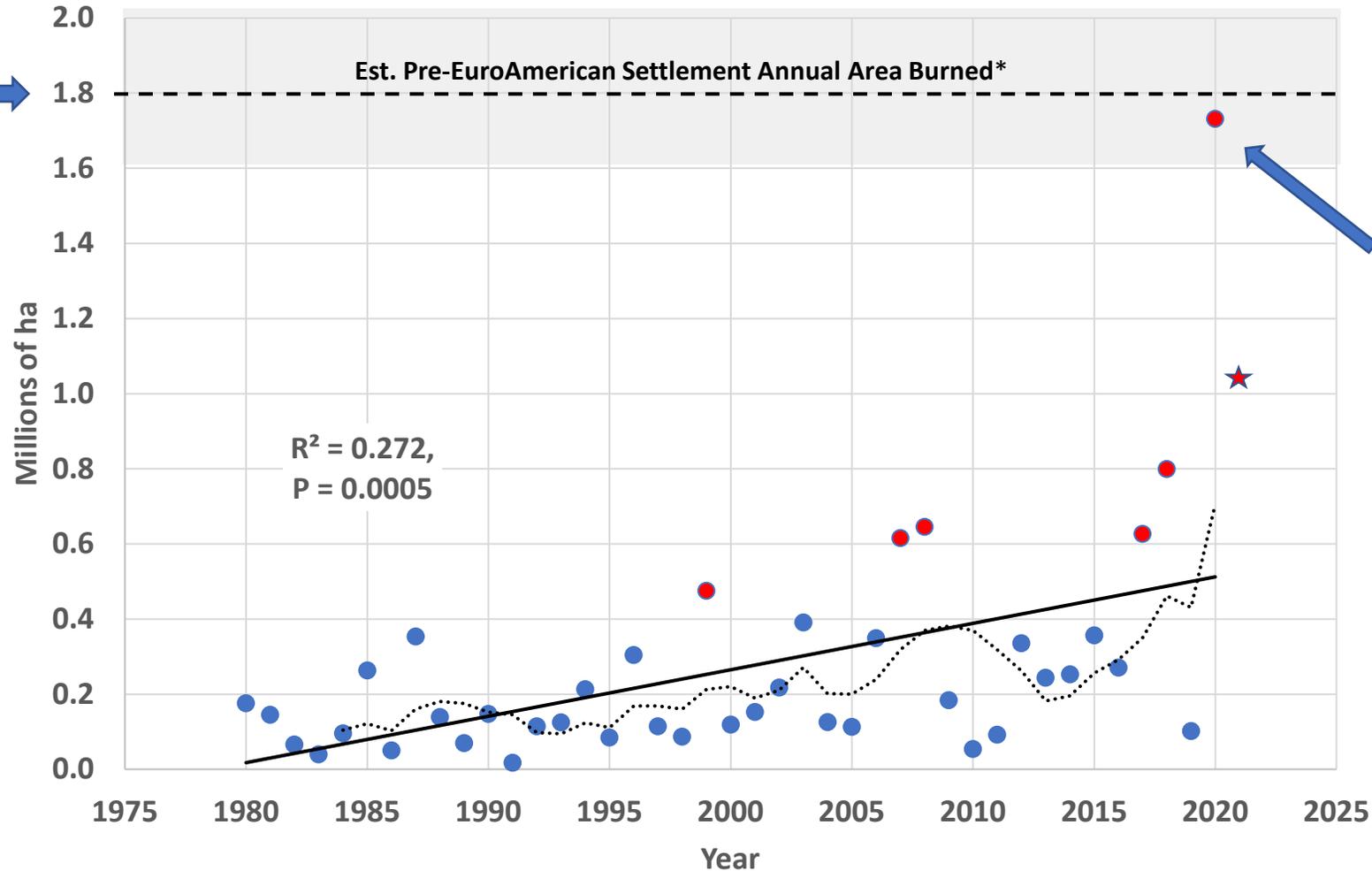


Not in the long run!
Fire suppression expenditures are *positively* correlated with burning in subsequent years

Our current reactive policies aren't producing the desired outcome because we have been focused on symptoms, not causes

But should reducing burned area even be our major focus?

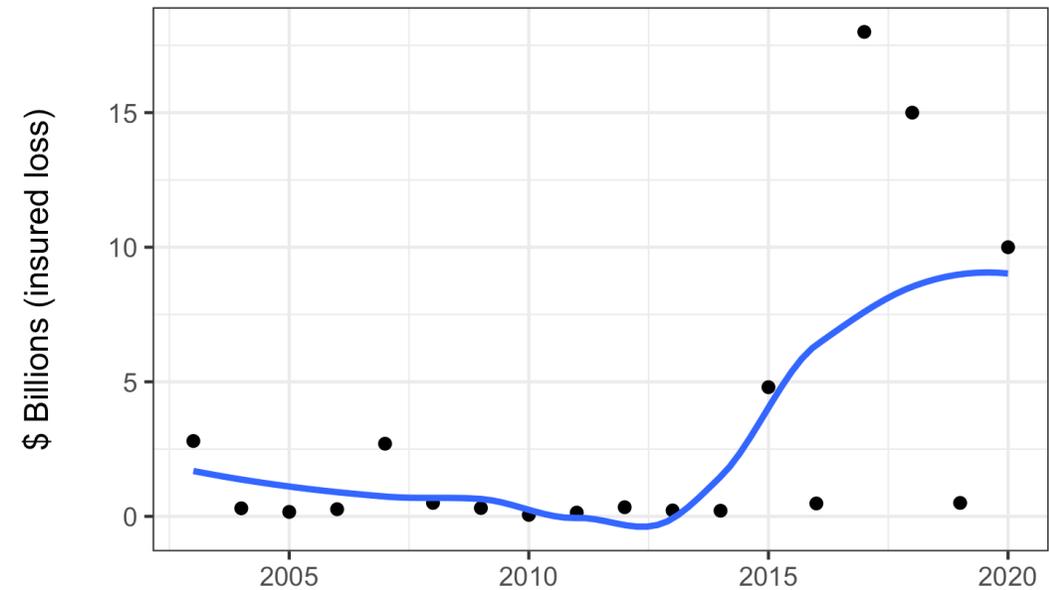
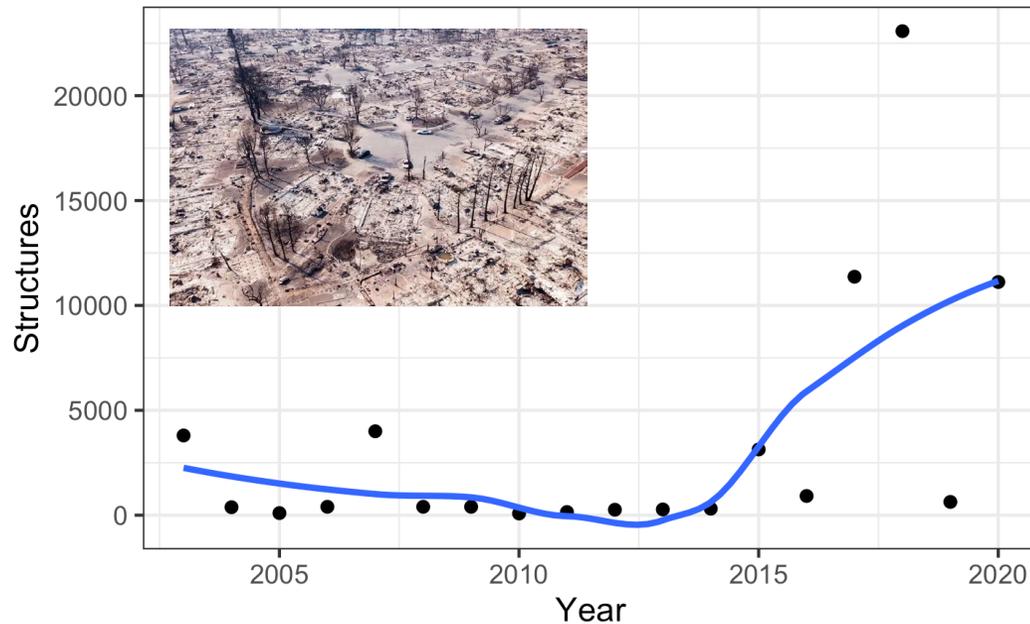
The ecological reference: a normal burn year before 1850



Exactly one year in the last 100 has come anywhere near the pre-1850 average

The real issue: fire damage to ecosystems and human values

Human deaths, structural losses, and economic costs are all rising quickly



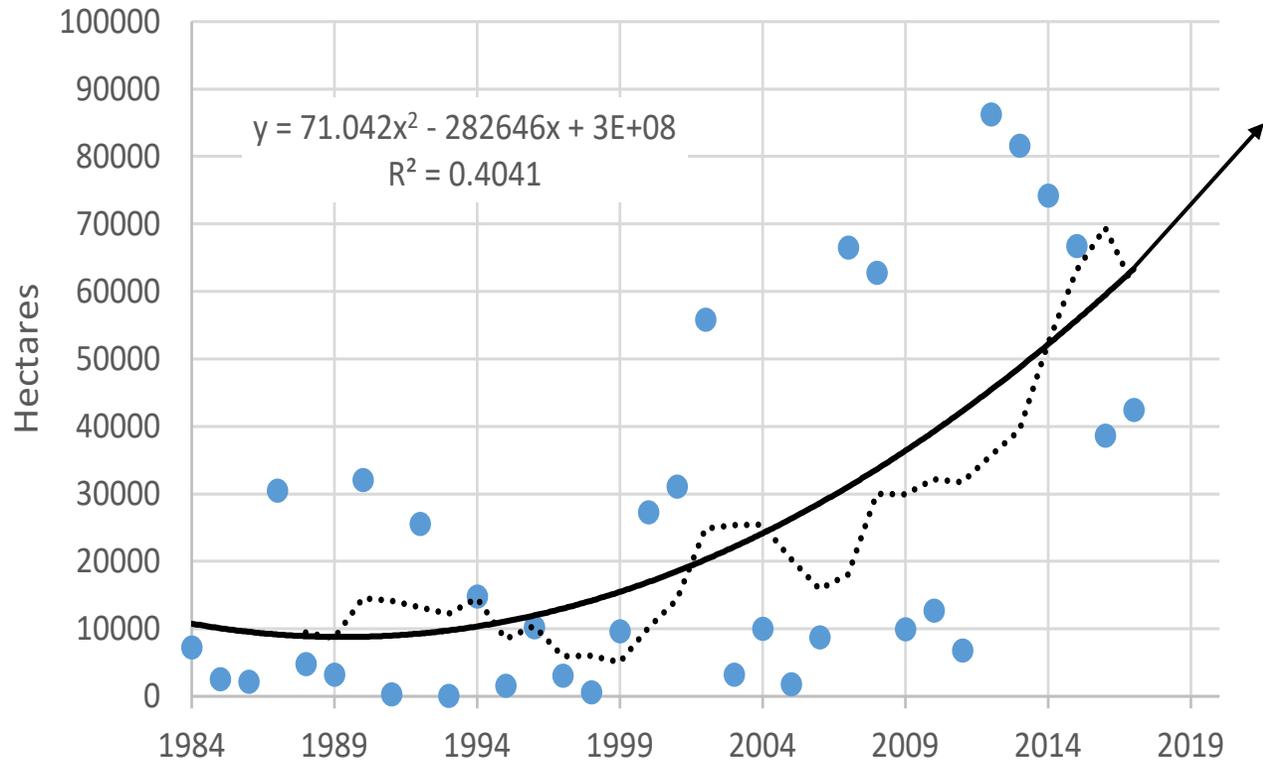
Especially in forested landscapes in northern & central California: southern California chaparral is no longer the poster child for the US wildfire problem

Forest ecosystems are experiencing hotter fires than they can withstand

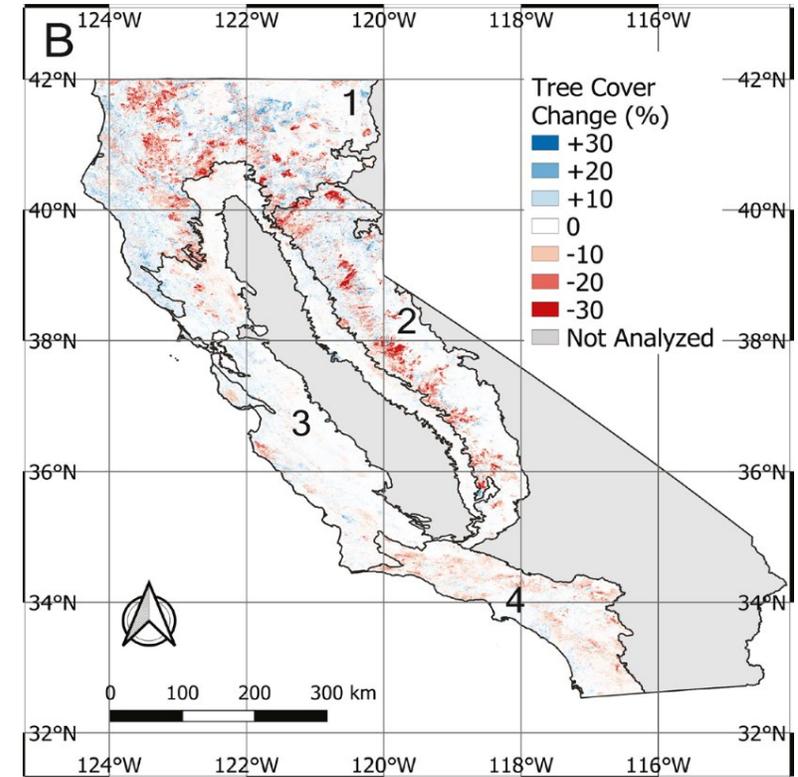


High severity burning in Caldor Fire, Lake Tahoe Basin, 2021

Forest loss to severe burning is accelerating



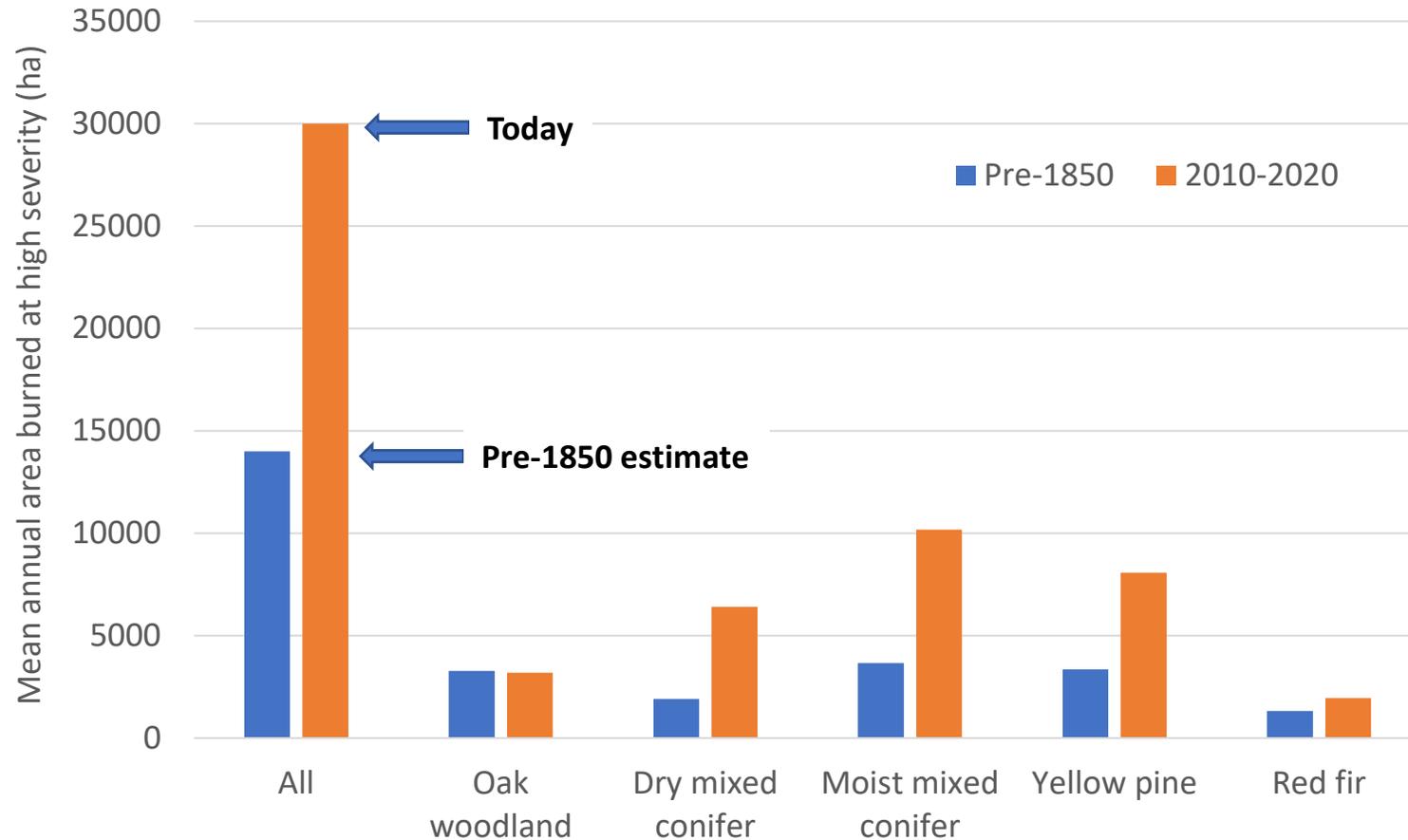
1984-2021: c. 9-fold increase in stand-replacing burning



1984-2021: 6.7% loss in forest cover, mostly due to fire

Hotter fires: annual area of forest burning at high severity now generally (much) higher than pre-1850

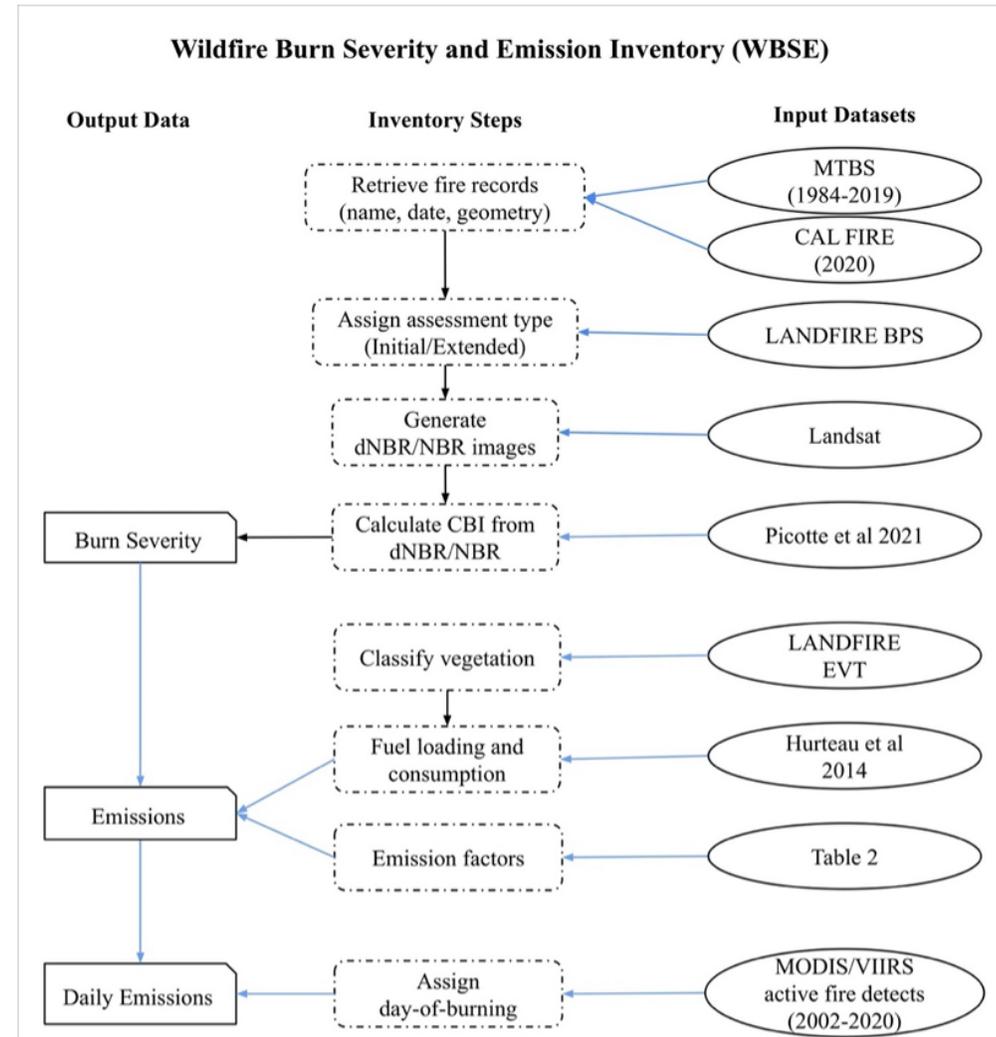
Even though total area of burning is still much lower than pre-1850



High severity fire = >95% of canopy trees dead

Fire severity: important driver of emissions

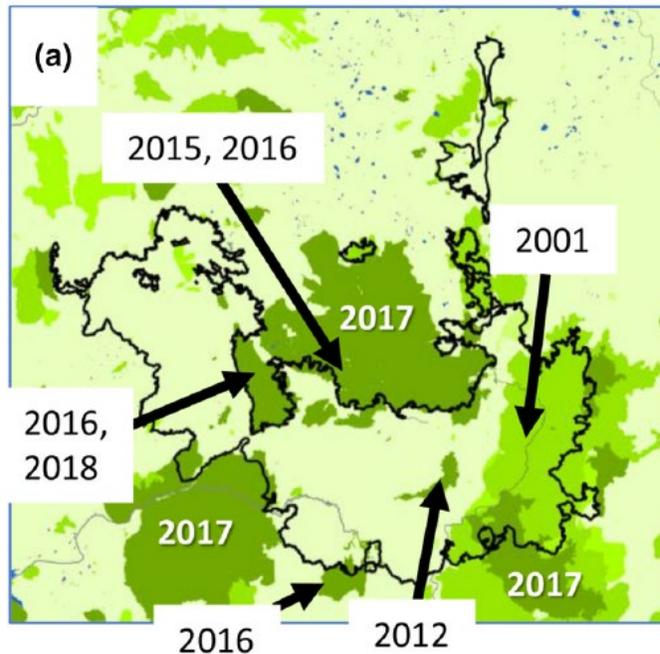
- Severity = interaction between fire intensity and species and fuels burned
- Emissions = f [(Area burned) (Fuel consumption) (Fuel loading) (Emissions factor)]



Xu et al. 2022. *Env Res Ltrs*

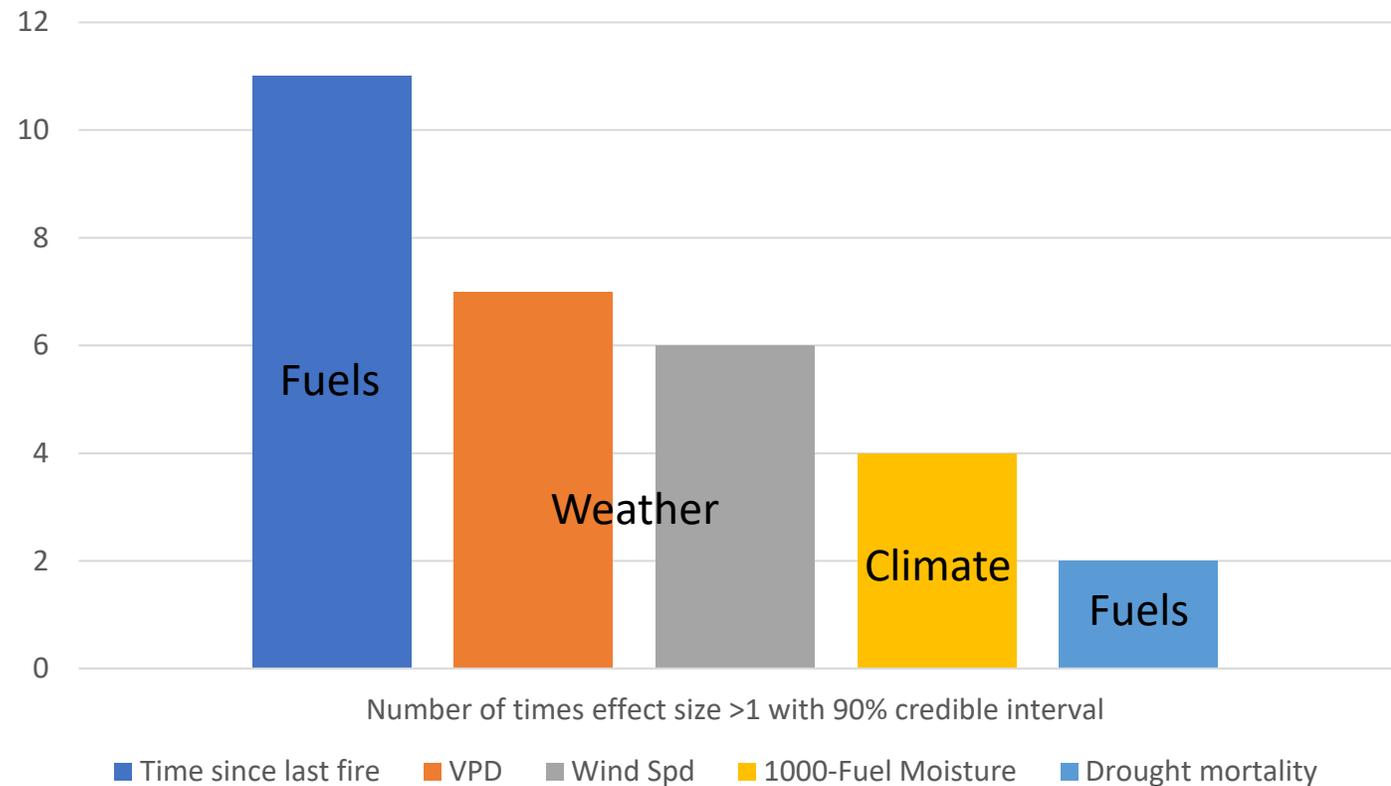
Drivers of fire severity and fire spread

- Fuels, weather, climate



Castle Fire: fire history and fire perimeter

California 2022: Drivers of fire severity in 35 largest fires



TSLF = time since last fire; VPD = vapor pressure deficit

Safford et al. 2022 *Glob Ecol Biogeog*

We need to reduce fuels in fire-suppressed forests

We have little to no direct control over climate and weather

Mechanical thinning



- Sawmill infrastructure at 70-yr low
- Lack of economic outlets for forest wood products
 - Non-merchantable materials often must be left on site or burned
- Expensive when there is no economic output
- In most western National Forests, only 20-40% of the landbase is operable
- Environmental opposition

Hand thinning



- Small diameter materials
 - Usually nonmerchantable
 - Often insufficient attenuation of fire potential
- Generates slash that must be dealt with

Like it or not, fire will be the principal arbiter of fuel reduction in western US forests

Prescribed fire

- Most effective reduction of fine fuels (which drive fire behavior)
- Usually the lowest cost treatment
- Much lower risk than wildfire
 - Controlled timing, and better control of fire effects and emissions
- Highly underutilized tool in the West
 - Forest Service rules, risk-aversion, and other issues have turned this into a boutique treatment
 - Even a 10-fold increase would still fall far short of the need

Managed wildfire

- In use for more than 50 years, almost entirely in wilderness areas
 - Mostly employed in higher-elevation forests where fuel reduction need is low
- Only treatment option for 60-70% of the federal forested landbase
- >80% of fire season days support conditions conducive to desired outcomes



Conclusion

In California and much of the semi-arid West, the question is not if a forest stand will burn, but when and under what conditions. We can influence those conditions.

The vast bulk of burning that occurs in California and the West will always occur in areas that have not experienced active fuel reduction.

The importance of fire history in influencing fire spread and fire severity underlines the key role that fire can and must play in reducing fuels on large landscapes in fire-prone regions like California.

Sustaining forests, forest carbon and forest ecosystem services in such regions will require working with nature, not against it.