Recent trends and strategies for adaptation to wildfire in the US

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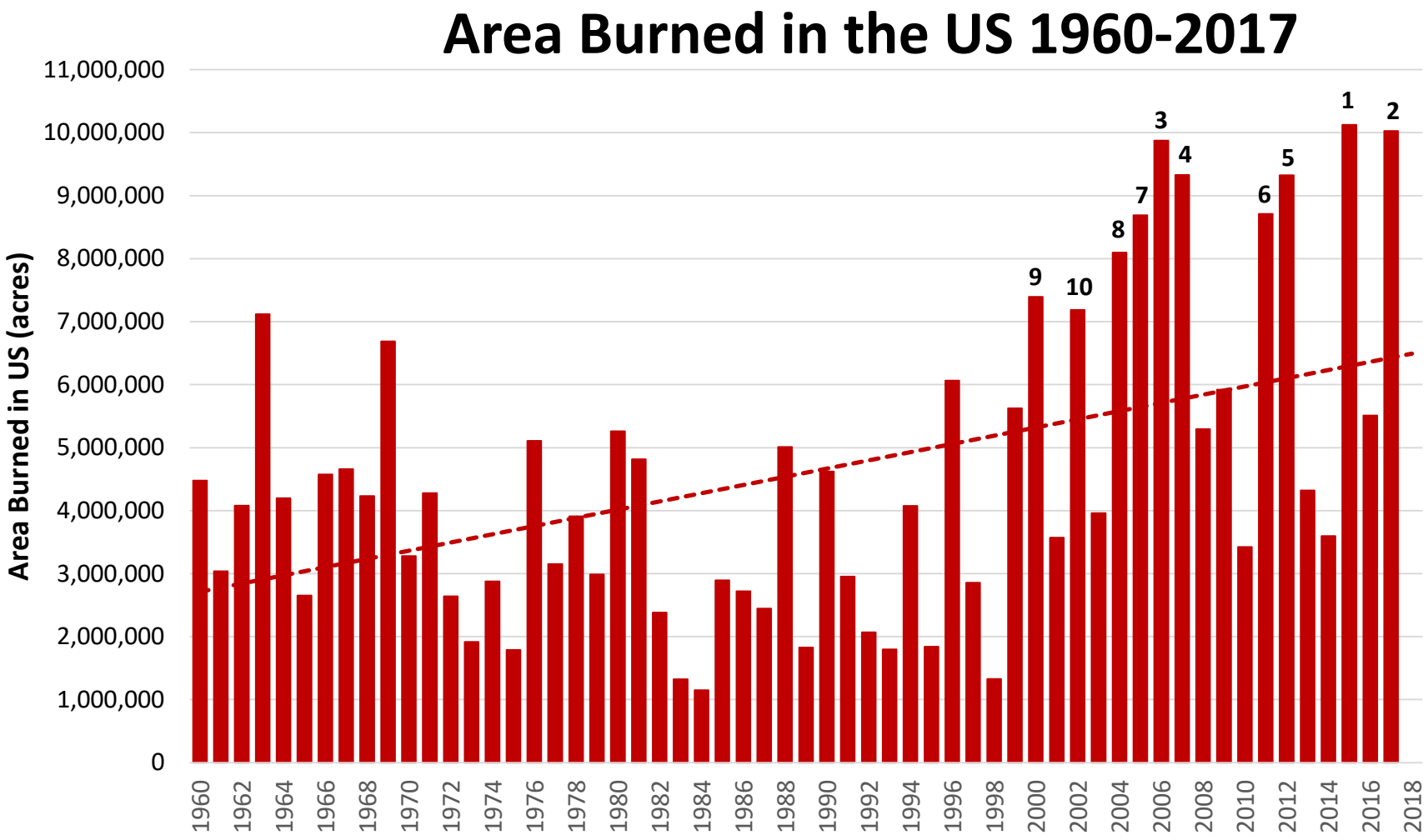
Adapting Wildfire Management to 21st Century Conditions
Policy & Critical Issues Webinar
American Geosciences Institute
May 16, 2018

- Recent trends in wildfires in the US
- Overview of wildfire management policy
- Strategies for adaptation to wildfire

Recent trends in wildfires in the US: Area burned



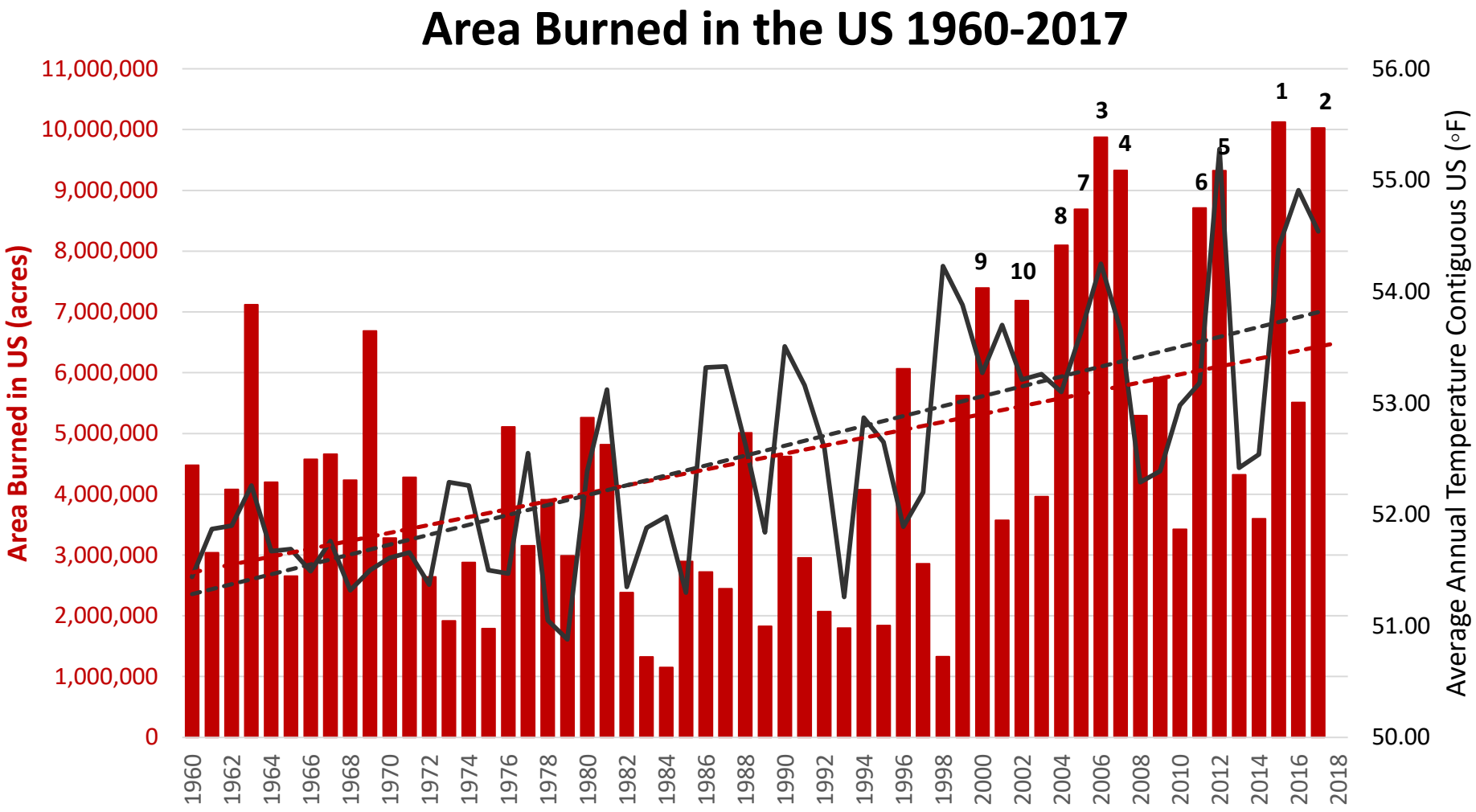
Annual area burned has risen significantly since 1960.

The top 10 years with the largest area burned have all occurred since 2000.

 # = rank of years since 1960

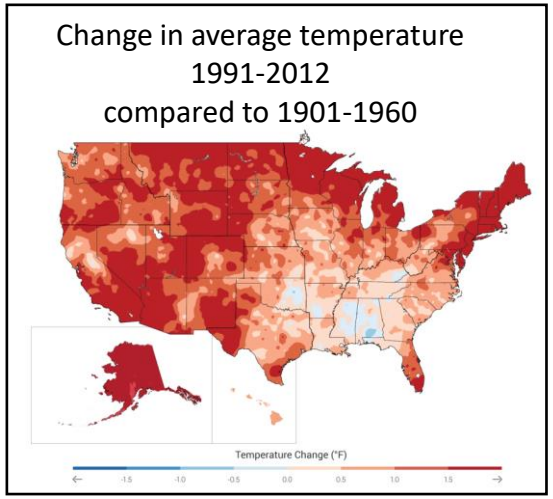
Data Sources: NIFC.gov; NOAA.gov

Recent trends in wildfires in the US: Warming



US annual temperatures have risen 1.3°-1.9°F since 1895.

Since the late 1970s, US has warmed faster than the global rate.

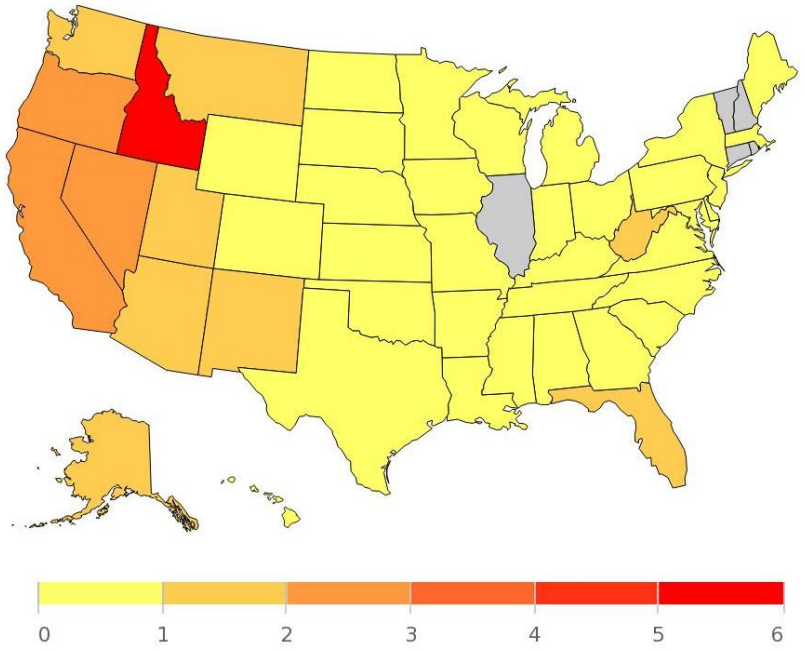


Sources: NIFC.gov; NOAA.gov; Climate Change Impacts in the United States: The Third National Climate Assessment report.

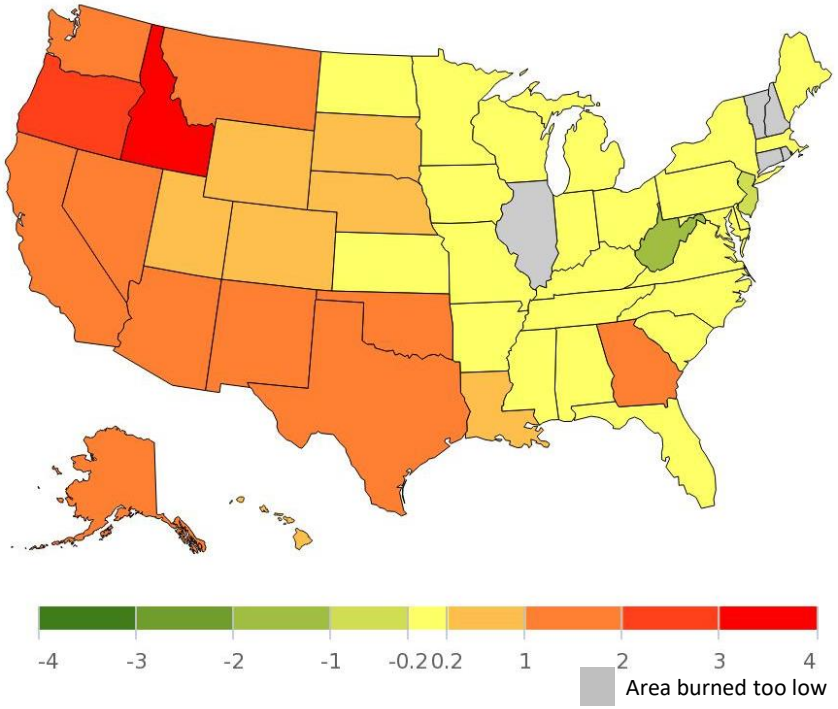
Recent trends in wildfires in the US: Western US

Majority of area burned is in the West

Average Annual Area Burned
by State 1984-2014



Change in Annual Area Burned
By State between 1984-1999 and 2000-2014



Increase in area burned in the West since 1970s is associated with:

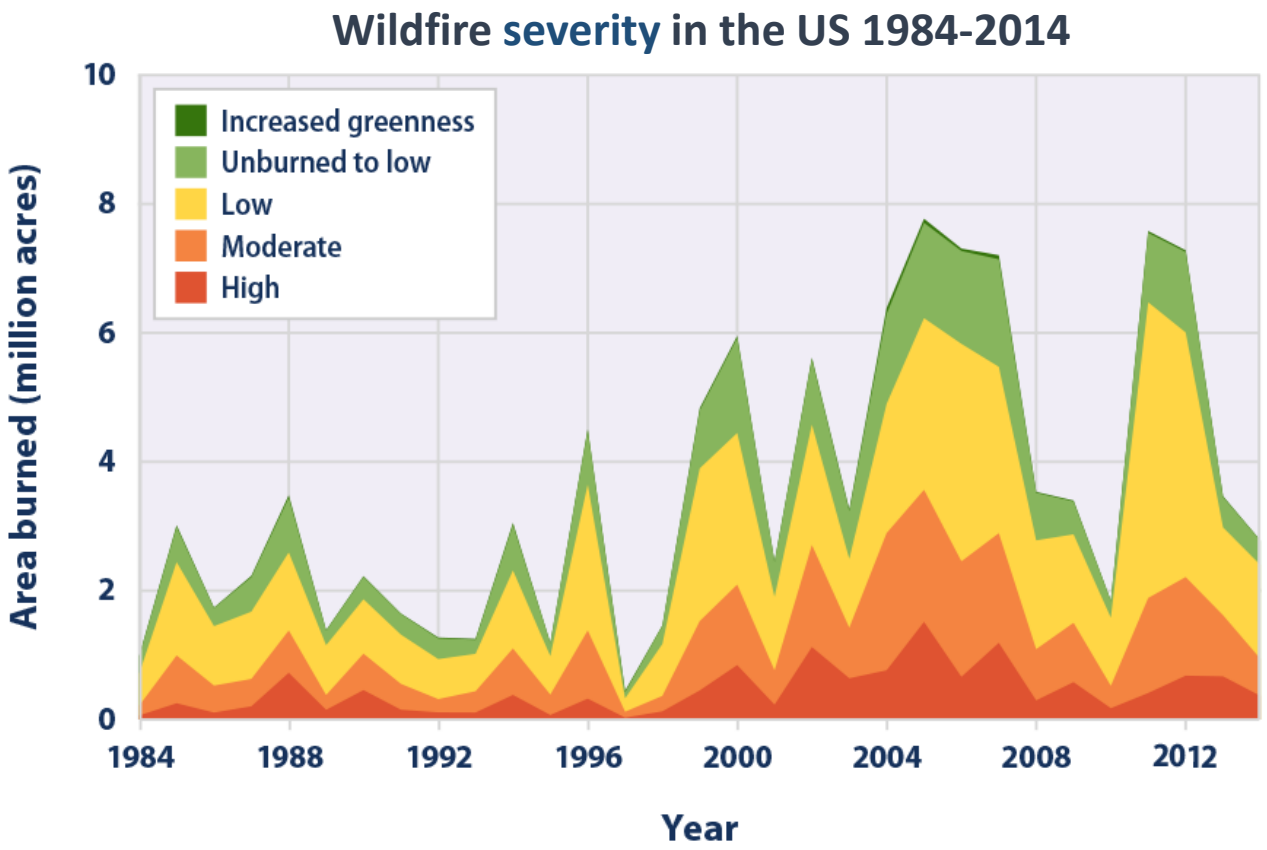
- **Warming almost 2° F**
- **Snowmelt 1-4 wks earlier**
- **Fire season ~3 months longer**

Source: EPA.gov; Union of Concerned Scientists. 2012. Infographic: Western Wildfires and Climate Change; Westerling 2016 Increasing western US forest wildfire activity: Sensitivity to changes in the timing of spring. Philos Trans R Soc Lond B Biol Sci 371(1696):20150178.

Recent trends in wildfires in the US: Severity

Most area burned is low severity

No relative increase in high severity



Data source: MTBS (Monitoring Trends in Burn Severity). 2016. MTBS data summaries. www.mtbs.gov/data/search.html.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.

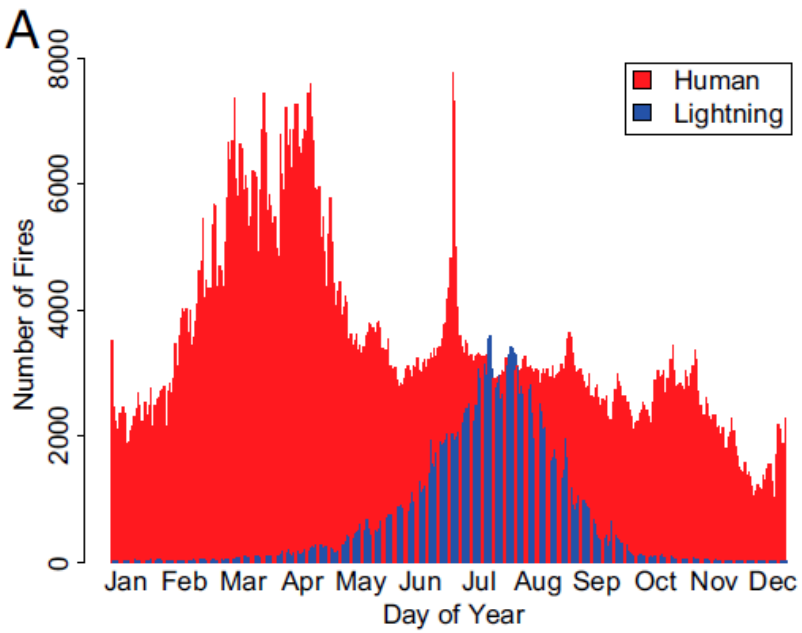
Wildfire severity in the US 1984-2014

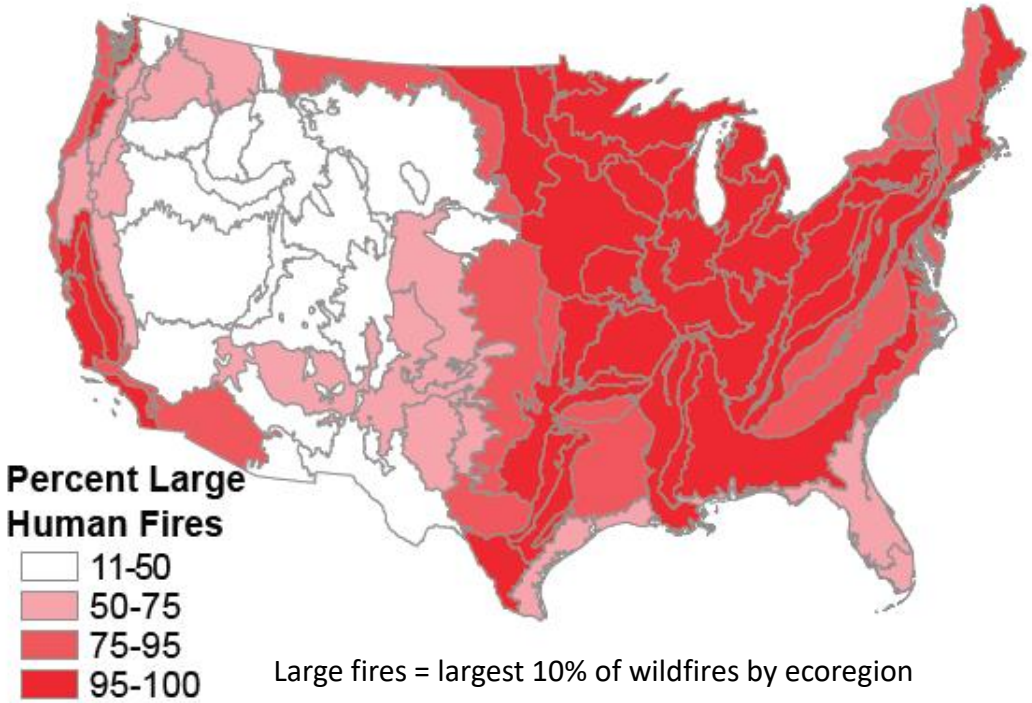
Incr. greenness	1%	
Unb. to Low	19%	
Low	45%	65%
Moderate	23%	
High	12%	35%

Source: EPA.gov/climate-indicators
www.MTBS.gov

Recent trends in wildfires in the US: Ignitions

Human-related ignitions: 84% of all wildfires and 44% of area burned 1992-2012





Large fires = largest 10% of wildfires by ecoregion

Source: Balch et al. 2017. Proceedings of the National Academy of Sciences. Human-started wildfires expand the fire niche across the United States.

Source: Nagy et al. 2018. Fire. Human-Related Ignitions Increase the Number of Large Wildfires across U.S. Ecoregions

Recent trends in wildfires in the US: Fuels build-up

Pre-fire suppression

Open dry pine forests
Pre-fire-suppression era =
Frequent low-severity fire

Fire suppression of
frequent low-severity fires
that kept forests open…

Today

…has led to in-growth of smaller
trees (**fuels build-up)** makes
high-severity fire likely in former
open, dry pine forests

Fuels build-up has occurred primarily in lower-elevation dry pine forests in the western US
not in moist forests and cool high-elevation forests.

Recent trends in wildfires in the US: Severity

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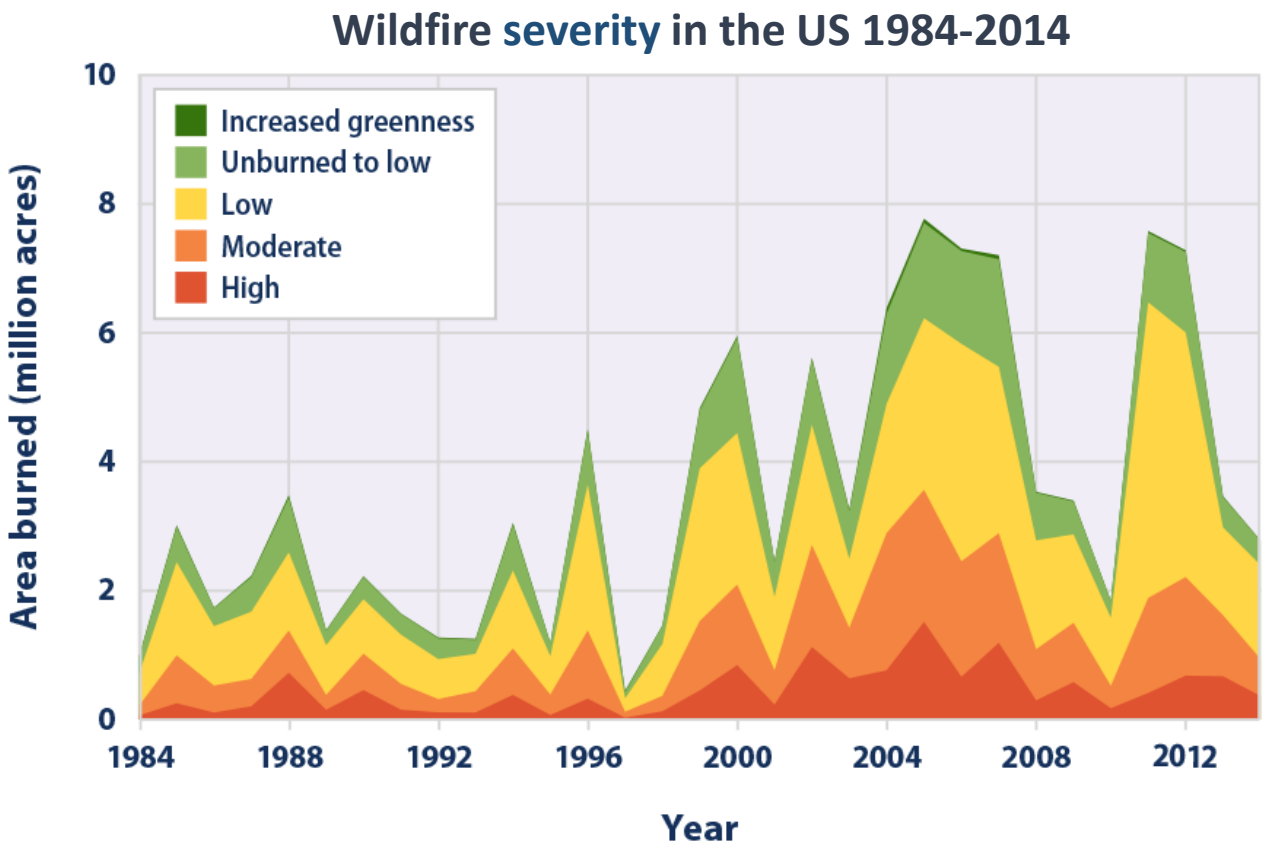

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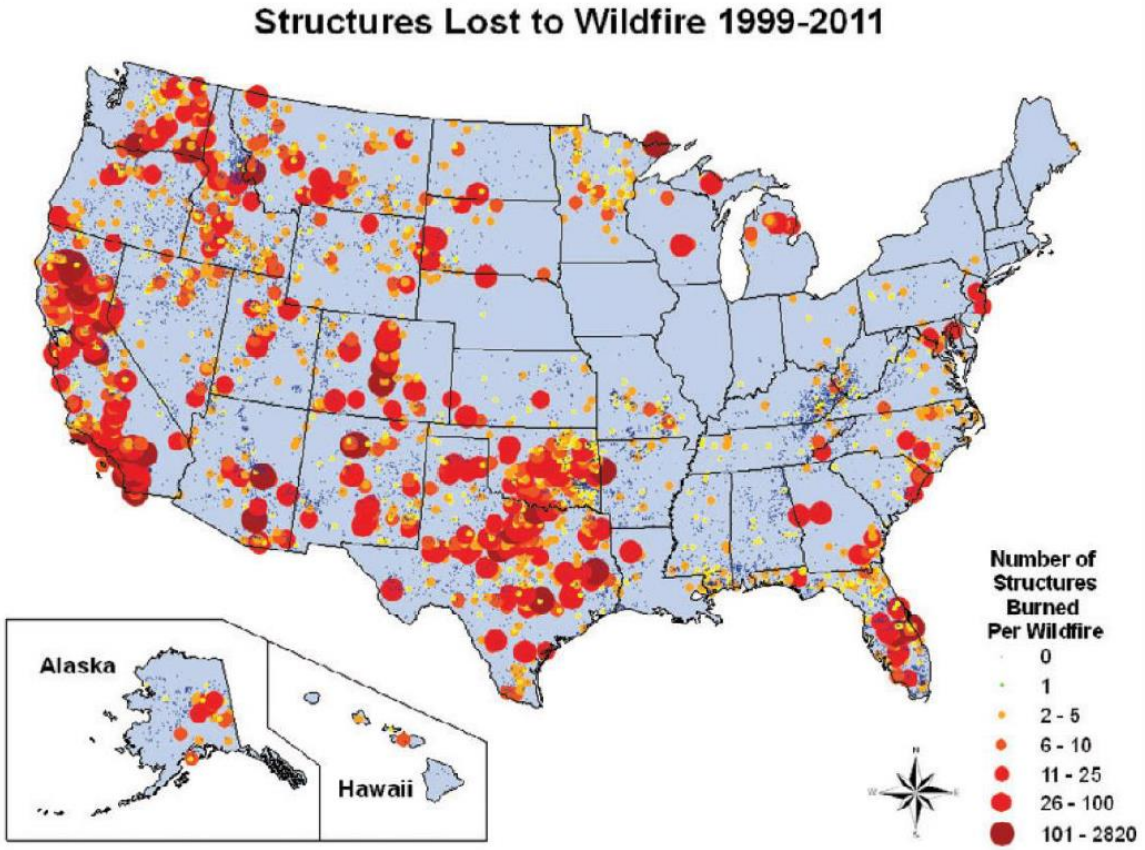
Wildfire impacts on people and homes

Wildland-urban interface (WUI): where houses and wildland vegetation meet or intermingle; 10% of conterm. US.

1990-2010 WUI: # of homes grew 41% to 43.4 million, land area grew 33% to 770,000 km2.



From 2000-2016, more than 3,000 U.S. communities had a 100+ acre wildfire within 10 miles of town.
-Headwaters Economics

1.8M homes in the western U.S. are currently at high to extreme risk of wildfire damage, totaling $500B in property value. -CoreLogic

Continued WUI growth will further increase human exposure to wildfires and human-related ignitions

Source: Radeloff et al. 2018. Proceedings of the National Academy of Sciences. Rapid growth of the US wildland-urban interface raises wildfire risk. Gollner et al. 2015. Pathways for Building Fire Spread at the Wildland Urban Interface. Fire Protection Research Foundation. Botts and Lindfors. 2016. CoreLogic Wildfire Hazard Risk Report http://arcg.is/0iGDSD. https://headwaterseconomics.org/dataviz/communities-wildfire-threat/

Wildfire impacts on people and homes

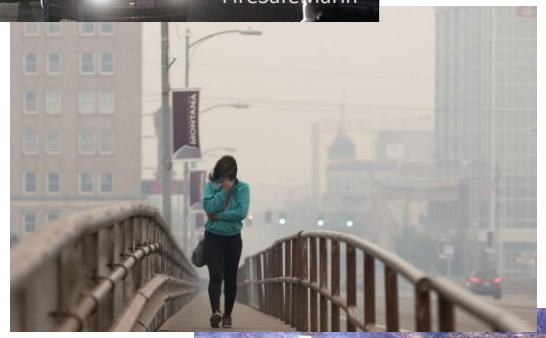
Protecting people and homes is costly and dangerous.

Both the costs and risks of wildfire continue to rise.

Half of the cost of wildfire is ultimately borne by the community. -Headwaters Economics

Evacuations

Smoke impacts



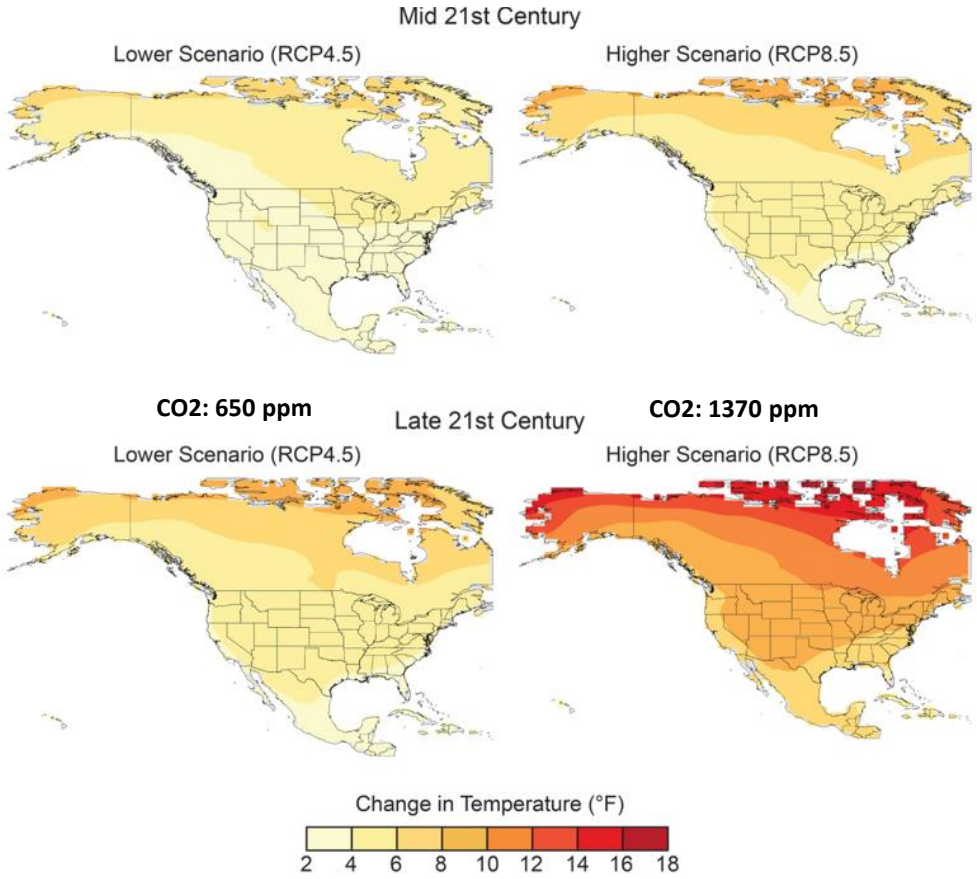
Postfire flooding and debris flows

Sources: www.bloomberg.com/news/features/2018-03-01/why-is-california-rebuilding-in-fire-country-because-you-re-paying-for-it. Smoke impacts: Liu et al. 2017. Climatic Change. Particulate air pollution from wildfires in the Western US under climate change 138:655-666. USGS postfire debris-flow hazards: landslides.usgs.gov/hazards/postfire_debrisflow/index.php

Climate change impacts on wildfires

Since 1985 >50% of the increase in area burned by wildfire in western US forests is attributed to anthropogenic climate change. Continued warming will increase wildfires in coming decades.

Projected changes in average temperatures relative to 1976-2005 period



April 2018
CO2: 410 ppm

U.S. annual ave temp. has increased by 1.3°-1.9°F since 1895.

Projected mid-century warming 2-4 °F, depending on emissions scenario.

Sources: Abatzoglou JT, Williams AP (2016) Impact of anthropogenic climate change on wildfire across western US forests. Proc Natl Acad Sci USA 113(42):11770–11775.
Climate Change Impacts in the United States: The Third National Climate Assessment report. NOAA NCDC / CICS-NC. https://science2017.globalchange.gov/chapter/executive-summary/

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Wildfire management policy

Wildfire suppression:

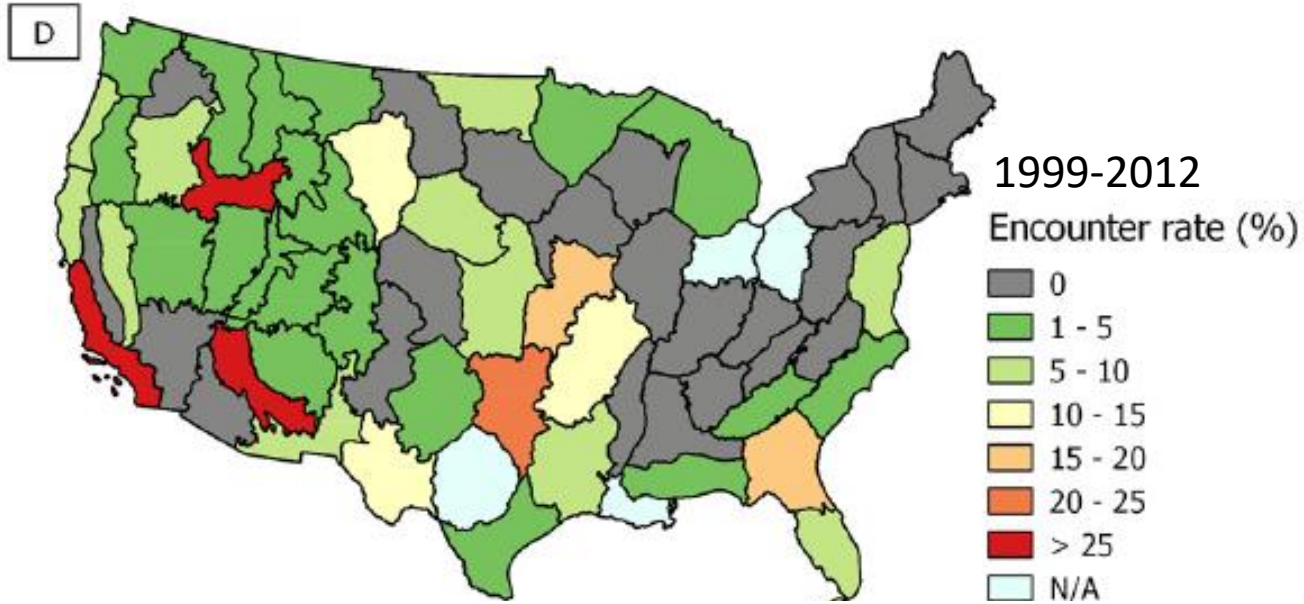
- Majority of wildfires are suppressed.
- Suppression costs exceed 50% of the Forest Service budget in recent years.
- Suppression costs are rising: highest federal suppression costs in 2017 ($2.9B).

The FY2018 Omnibus Appropriations Bill funds annual federal wildfire suppression expenditures above the 10-year average in 2015 starting in 2020 to help cover rising costs of suppression.

Wildfire management policy

Wildfire mitigation: reduce wildfire severity, not wildfire prevention

Federal fuel reduction treatments (prescribed fire, thinning): $500M per year.



Very few treated areas encounter subsequent wildfire (<1% per year on ave).
Fuel treatments are unlikely to have broad-scale impacts on fire severity or area burned.

Source: Barnett et al. 2016. Forests. Beyond Fuel Treatment Effectiveness: Characterizing Interactions between Fire and Treatments in the US.
Schoennagel et al. 2017. Proceedings of the National Academy of Sciences. Adapt to wildfire in western North American forests as climate changes. www.pnas.org/cgi/doi/10.1073/pnas.1617464114

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Strategies for adaptation to wildfire

Adaptation: when people and ecosystems adjust and reorganize in response to changing fire regimes to reduce future vulnerability as climate continues to change.

- Build better
- Thin better
- Burn better

Schoennagel et al. 2017. Proceedings of the National Academy of Sciences. Adapt to wildfire in western North American forests as climate changes. www.pnas.org/cgi/doi/10.1073/pnas.1617464114

Adapting to wildfire: build better

Every $1 spent on wildfire mitigation saves $4 in wildfire disaster recovery costs.

-National Institute of Building Sciences

Recent disaster mitigation expenditures:

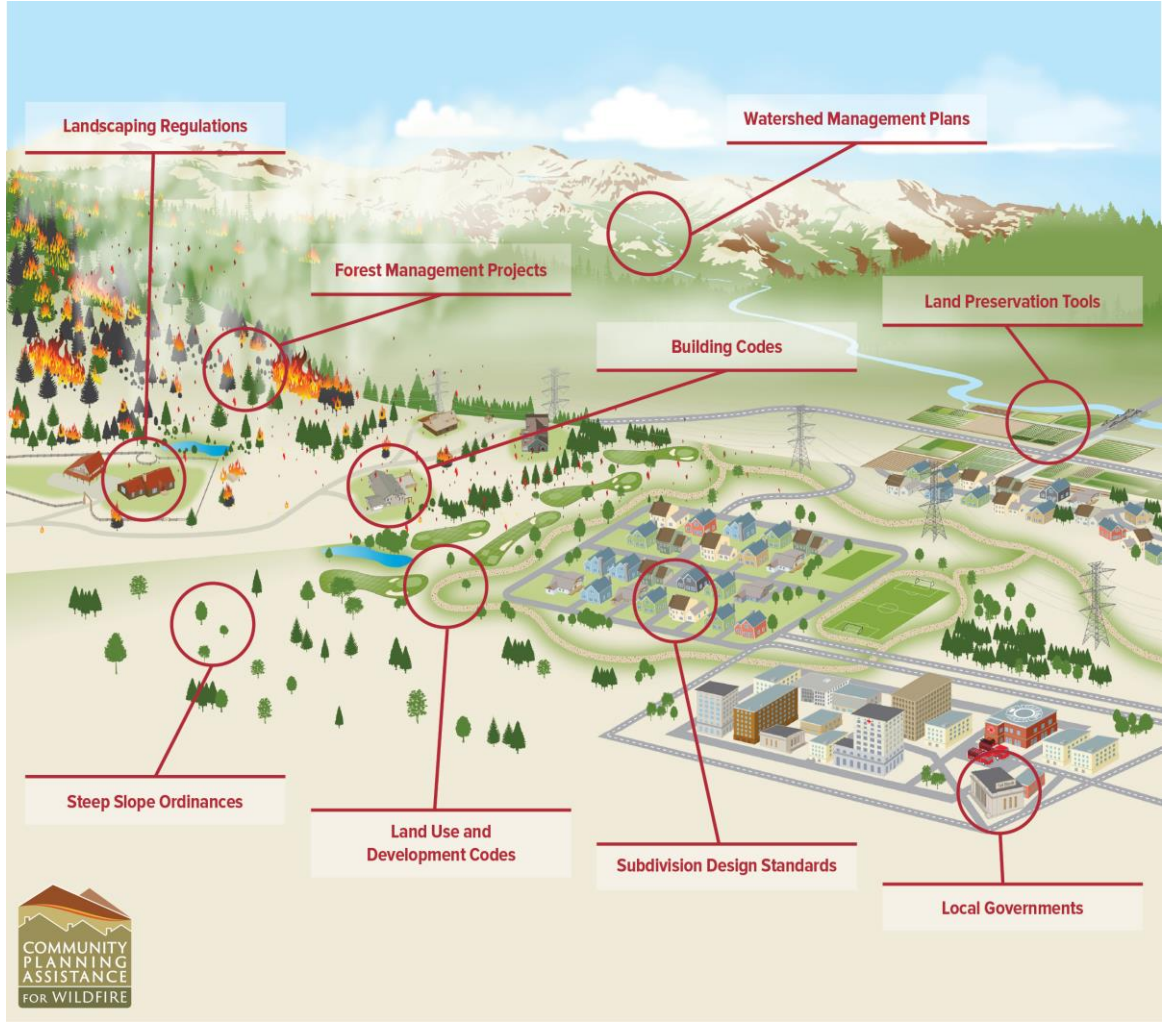
$12B allocated to future hurricane and wildfire risks,
the largest single allocation in the U.S. for hazard mitigation (Bipartisan Budget Act of 2018)

$249M to FEMA's Pre-Disaster Mitigation Grant Program (PDM) in FY2018 ,
three times the average annual appropriation to PDM over the past 15 years.

Adapting to wildfire: build better

Integrate wildfire planning into regulations, codes and ordinances.

- Restrict development in high fire-prone areas.
- Retrofit old homes and build new homes to withstand ignition, require defensible space.
- Reduce wildland fuels and create fuel breaks on private lands in and near communities. 70% of WUI is private.



More info at: https://planningforwildfire.org/
https://headwaterseconomics.org/wp-content/uploads/wildfire_homes_solutions_presentation.pdf

Adapting to wildfire: build better

Penalize decisions that raise wildfire risk

Shift more wildfire protection cost and responsibility to state, local, and private jurisdictions.

Shift fire fighter responsibility away from poorly mitigated or sited homes.

Increase insurance premiums or revoke insurance to homes in high-fire risk areas.

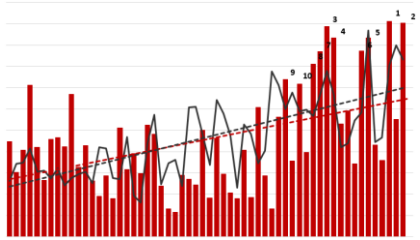
Reward decisions that reduce wildfire risk

Tax breaks for reducing fire hazards and vulnerability before wildfires occur.

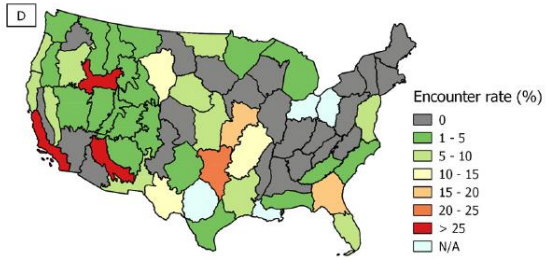
Grants to communities to become fire-adapted.

Adapting to wildfire: thin better

Federal forest thinning cannot significantly alter regional increases in area burned or home loss on private land.



Thin areas that burn frequently to reduce fire severity, help ecosystems adapt to warming, and reduce carbon losses from wildfire.



Thin on private land in and around communities to help firefighters directly defend homes and neighborhoods where ignitions are highest.

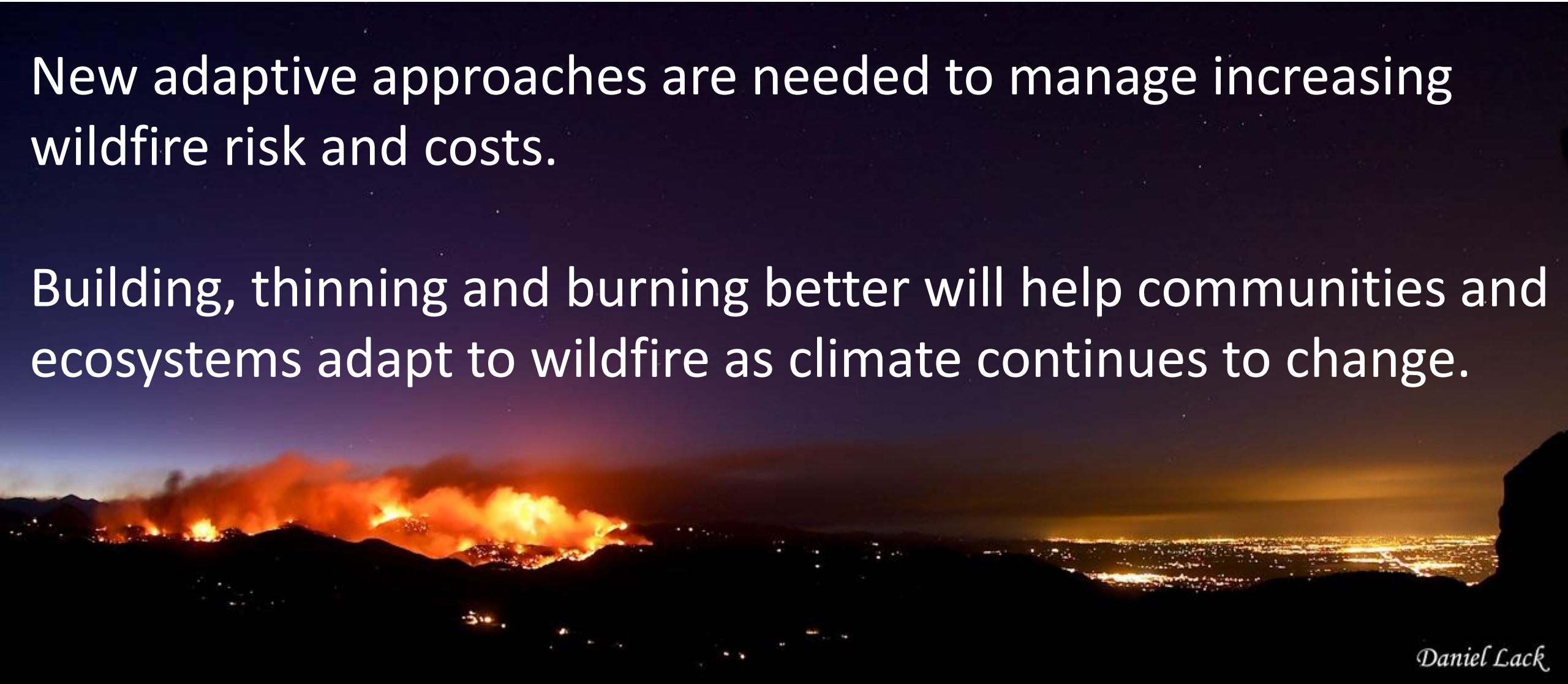
Adapting to wildfire: burn better

Allow more prescribed fires and remote wildfires to burn in ecosystems that have evolved with fire to help minimize the severity and size of future fires.

Reduce the number of human-related ignitions, especially in the WUI, where people and property are at high risk.

Promote public awareness of the inevitability of wildfire, a key feature of adapting to increasing fire in the West.

Recent trends and strategies for adaptation to wildfire in the US



New adaptive approaches are needed to manage increasing wildfire risk and costs.

Building, thinning and burning better will help communities and ecosystems adapt to wildfire as climate continues to change.