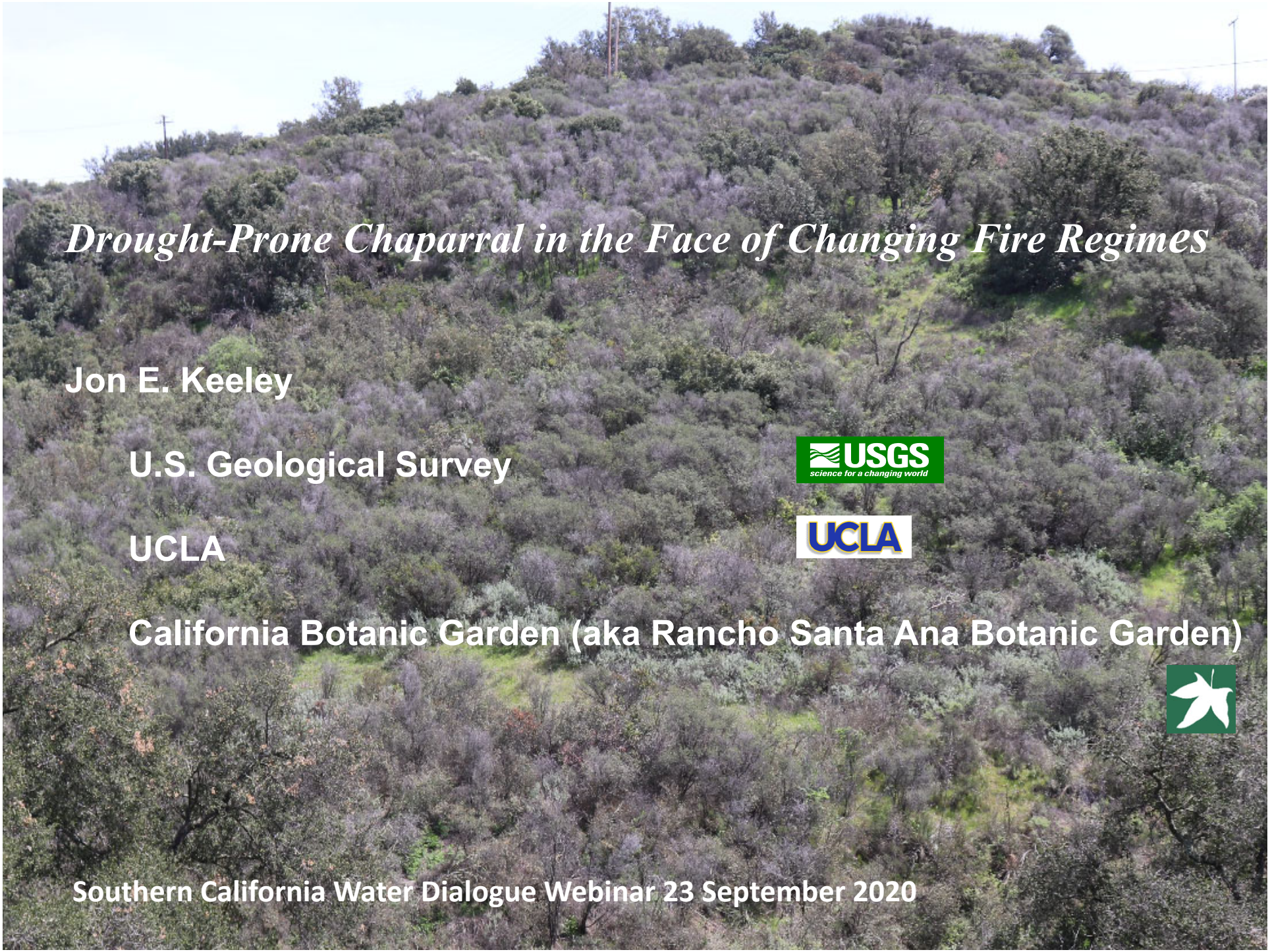


Drought-Prone Chaparral in the Face of Changing Fire Regimes

Jon E. Keeley

U.S. Geological Survey

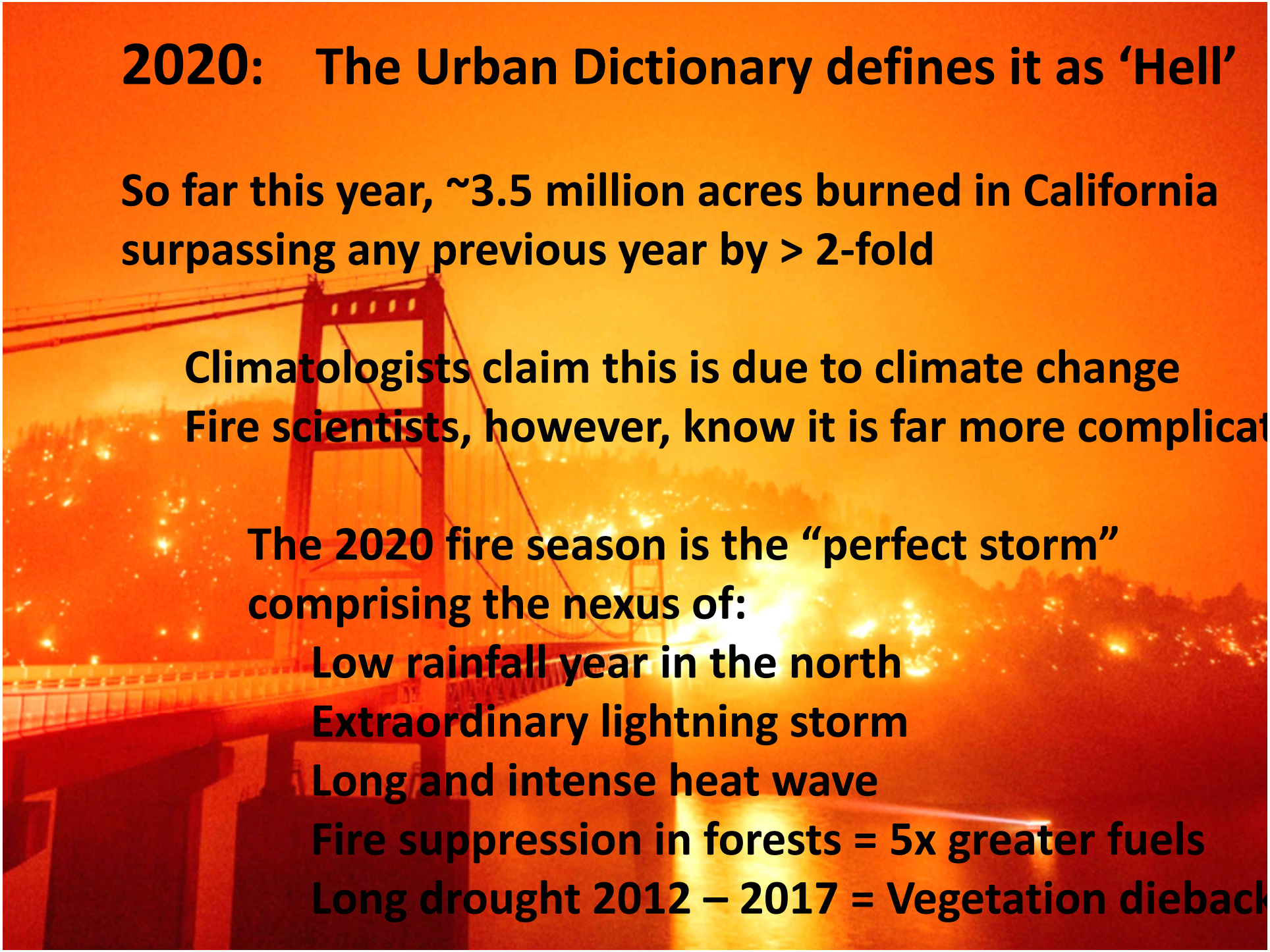
UCLA

California Botanic Garden (aka Rancho Santa Ana Botanic Garden)

Southern California Water Dialogue Webinar 23 September 2020


Since the year 2000, over 5 million hectares (12 .4 millior
have burned from wildfires in California.
This is double the area burned in the prior 20 years.
Largely driven by increased size of individual fires.
Additionally, destructiveness to people and
property has increased dramatically
blittle

2020: The Urban Dictionary defines it as ‘Hell’


2020: The Urban Dictionary defines it as 'Hell'
So far this year, ~3.5 million acres burned in California
surpassing any previous year by > 2-fold
Climatologists claim this is due to climate change
Fire scientists, however, know it is far more complicat
The 2020 fire season is the "perfect storm"
comprising the nexus of:
Low rainfall year in the north
Extraordinary lightning storm
Long and intense heat wave
Fire suppression in forests = 5x greater fuels
Long drought 2012 – 2017 = Vegetation dieback

2020: The Perfect Storm

Low rainfall year in the north

50% of normal led to summer vegetation less moisture

2020: The Perfect Storm

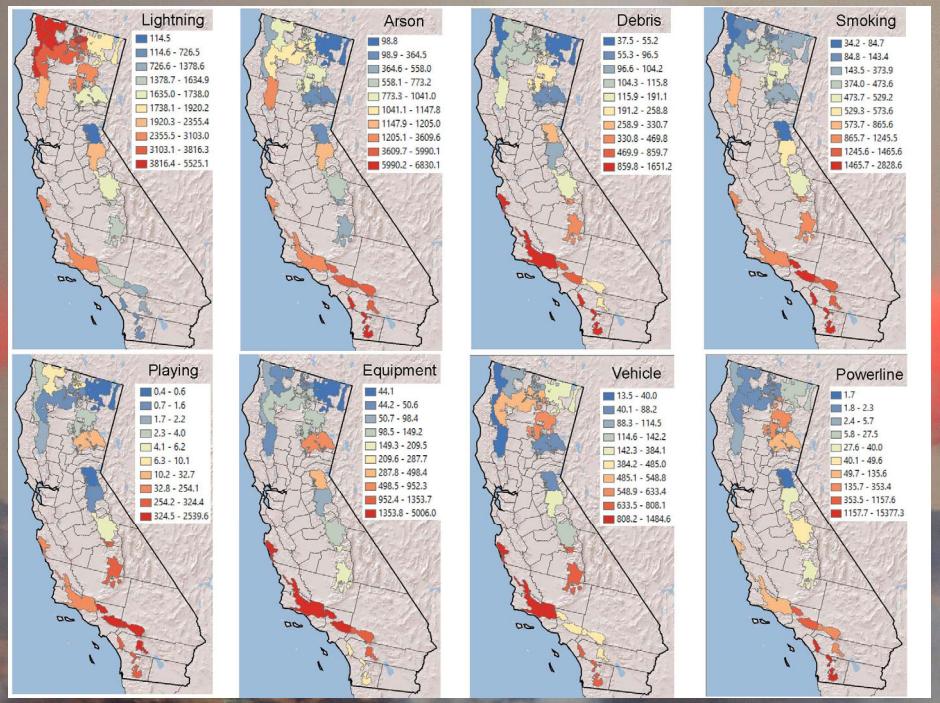
Low rainfall year in the north

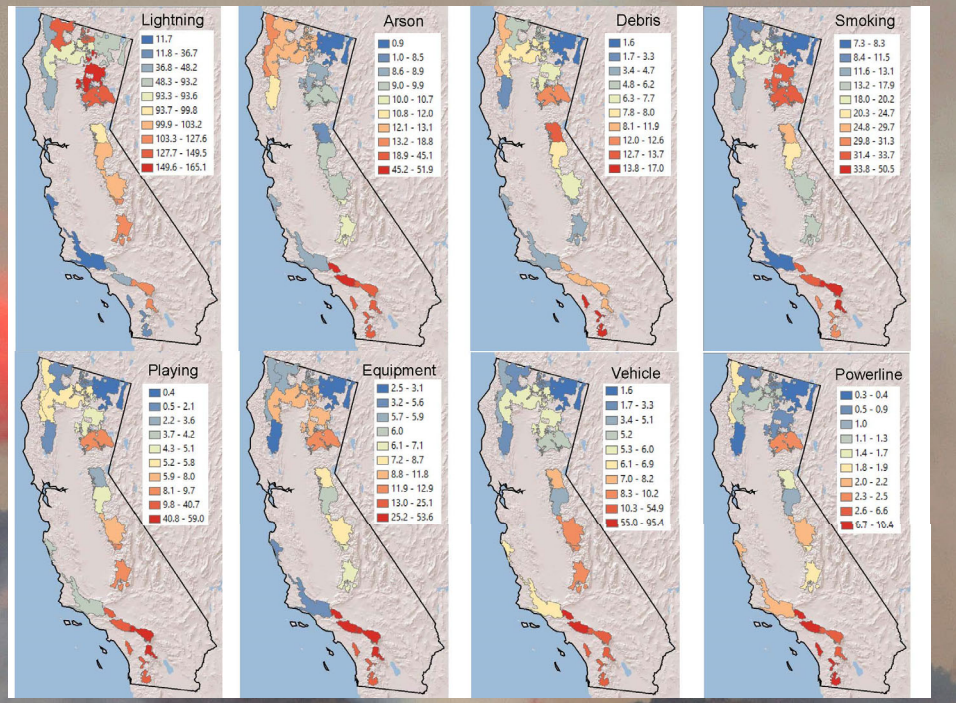
50% of normal led to summer vegetation less moisture

Massive dry-lightning storm in August > 5,000 fires

These lightning storms are decadal events

(2008 > 2000 fires and 1 million acres burned; also one in 1999)





2020: The Perfect Storm

Low rainfall year in the north

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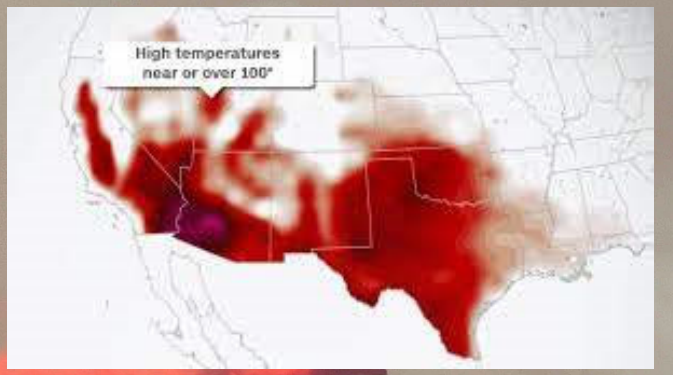
Massive dry-lightning storm in August

- > 5,000 fires
- These are decadal events (2008 > 1 million acres)



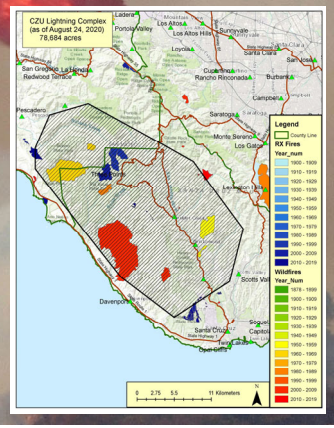
Long and intense heat wave in early September

- **Increased flammability**
- **Several high temperature records broken**

Fire suppression in forests = 5x greater fuels

- **Forest fire suppression has eliminate natural fires highly successful at putting out natural fires**

Long drought 2012 – 2017 = Vegetation dieback



The Perfect Storm

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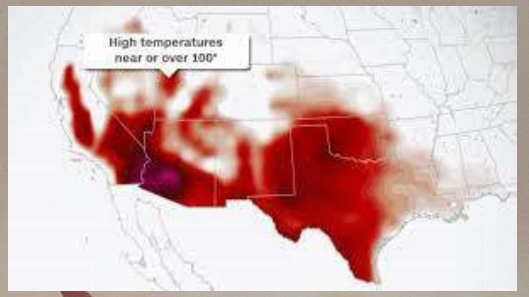

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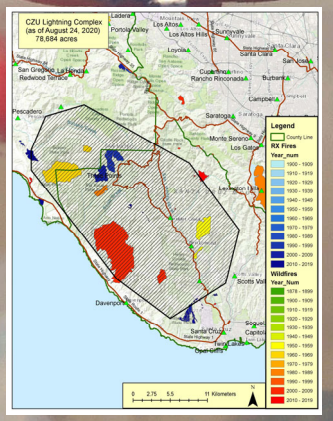

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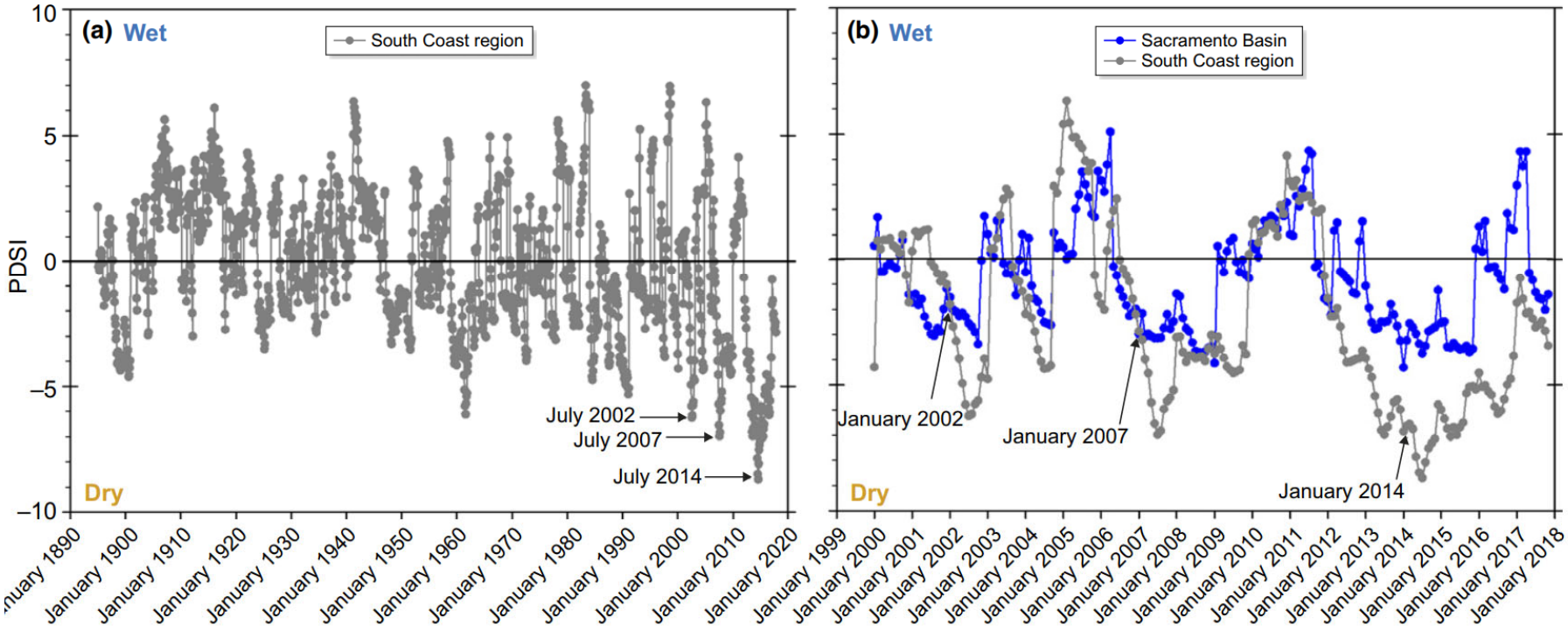
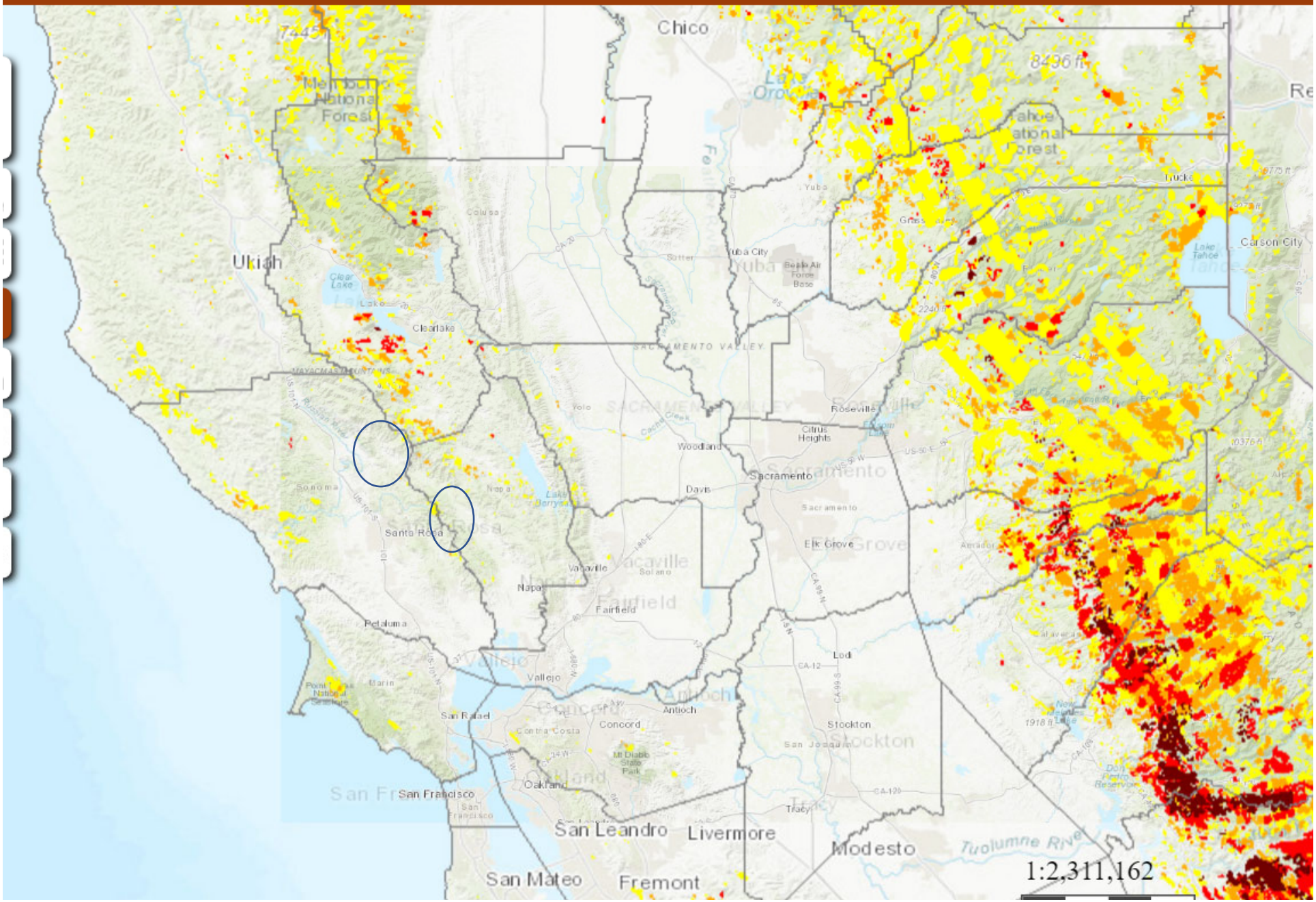
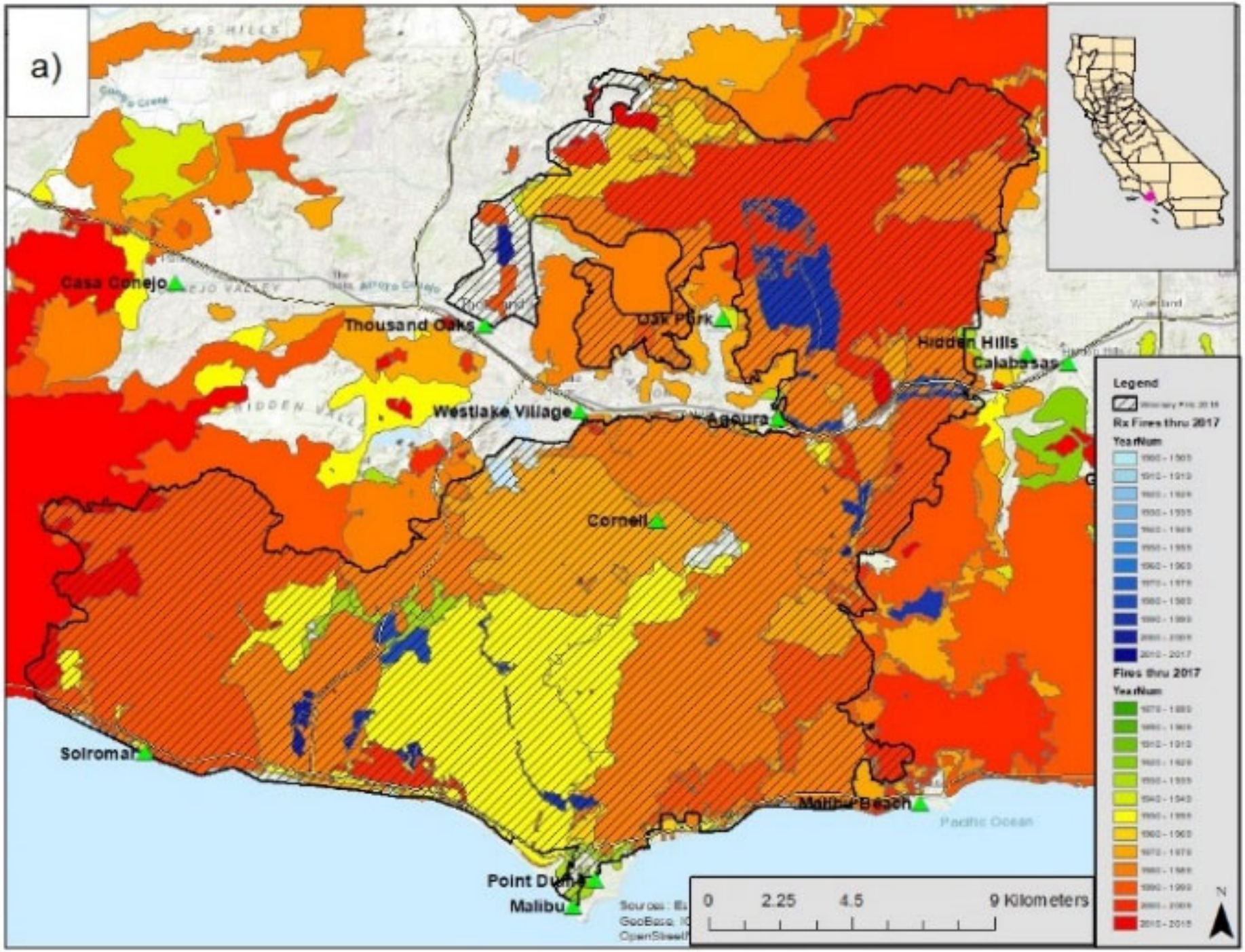


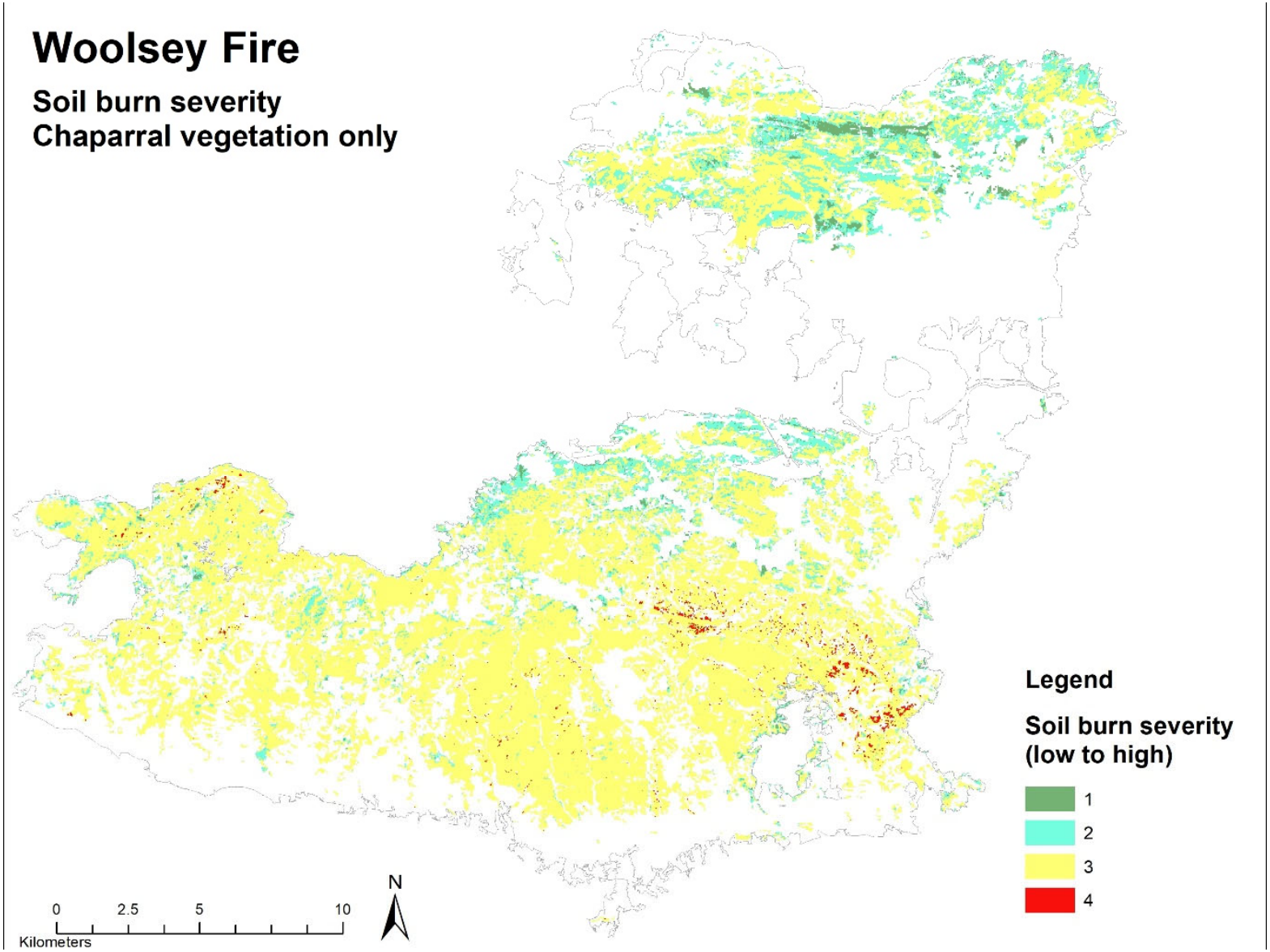
(Jacobsen & Pratt 2018)

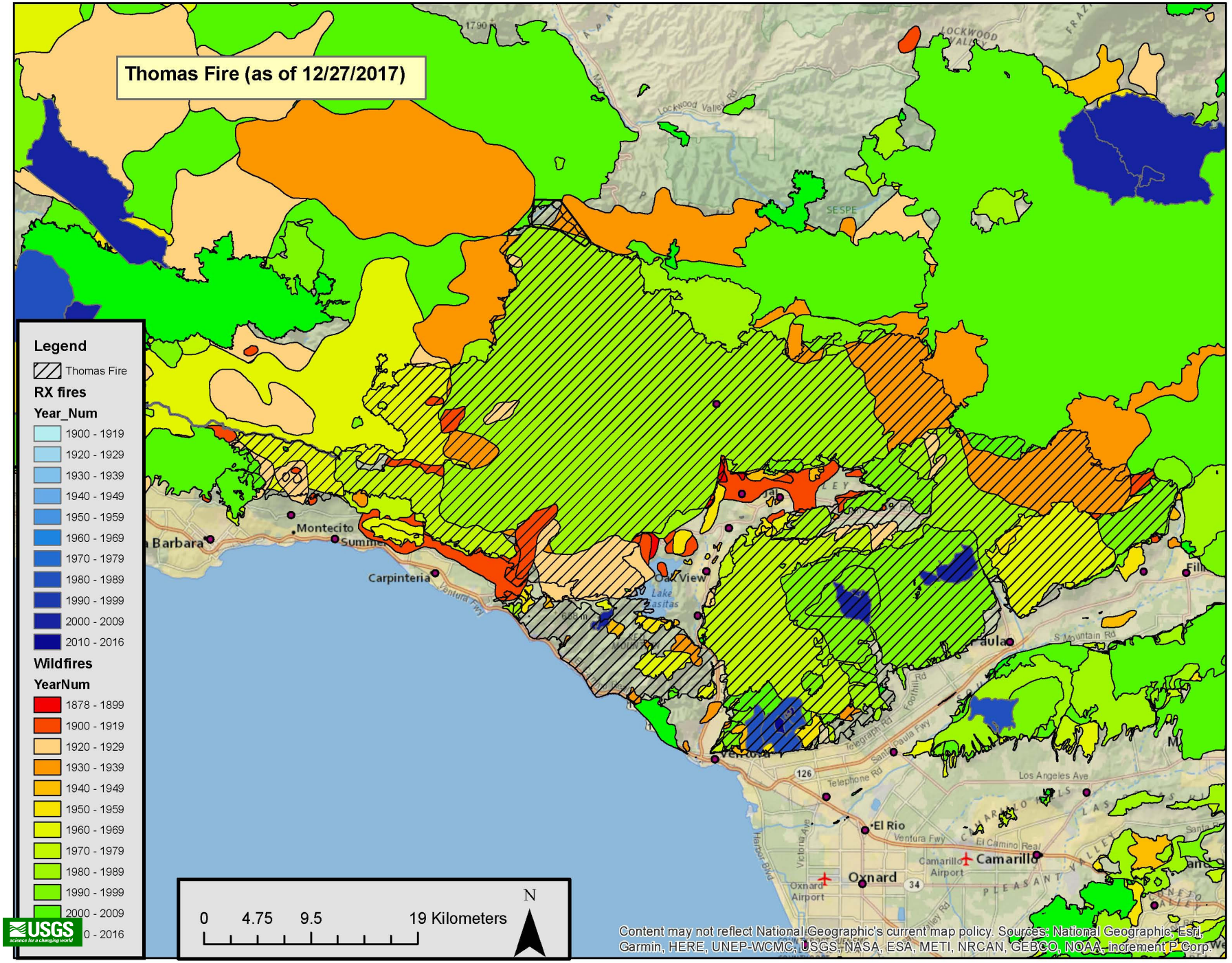

1899
1879
1874
1861
1847

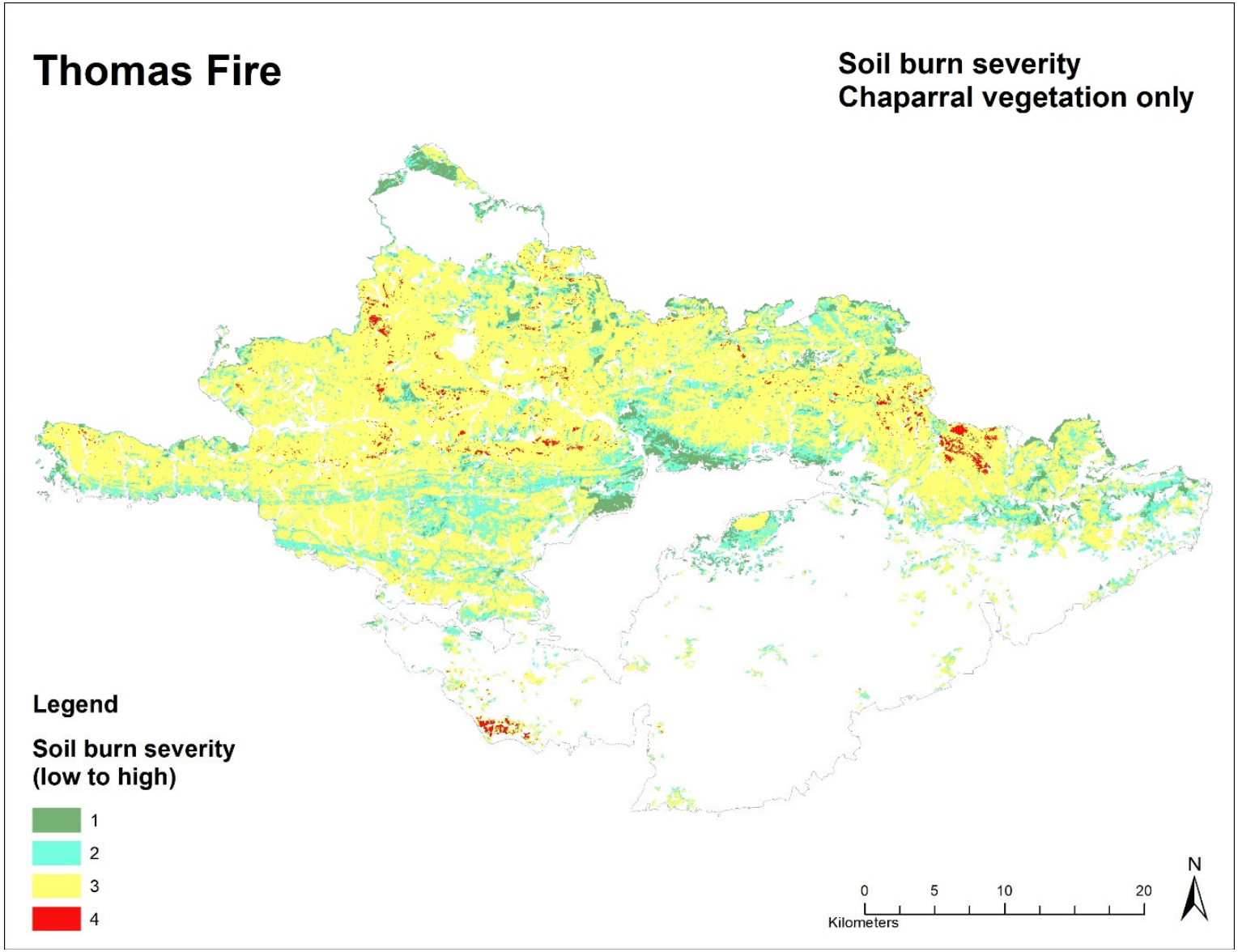
Tree Mortality Viewer



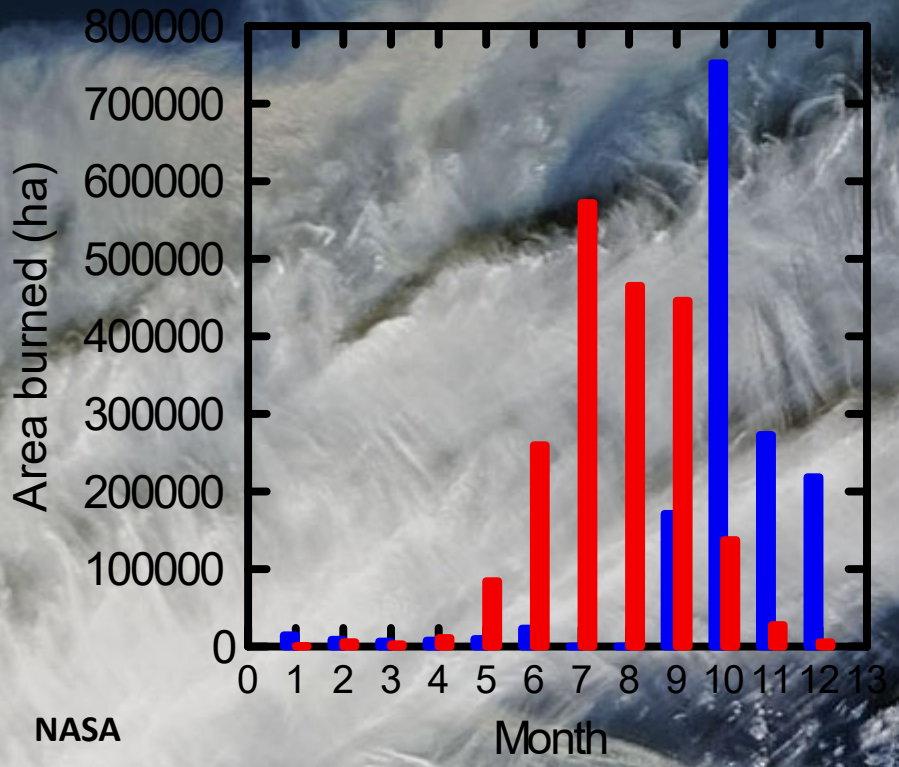

a)
Casa Conejo
Thousand Oaks
Oak Park
Hidden Hills
Calabasas
Westlake Village
Agoura
Cornell
Soiromar
Malibu Beach
Pacific Ocean
Point Dume
Malibu
Legend
Rx Fires thru 2017
YearNum
Fires thru 2017
YearNum
0
2.25
4.5
9 Kilometers
N


Woolsey Fire
Soil burn severity
Chaparral vegetation only
Legend
Soil burn severity
(low to high)
1
2
3
4
N
0
2.5
5
10
Kilometers

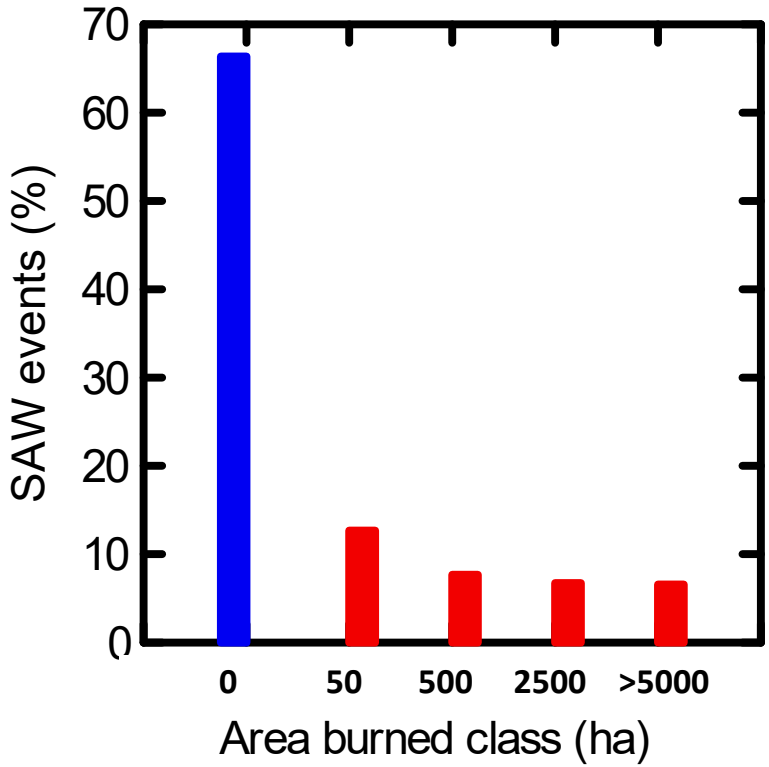

Thomas Fire (as of 12/27/2017)
Legend
Thomas Fire
RX fires
Year_Num
1900 - 1919
1920 - 1929
1930 - 1939
1940 - 1949
1950 - 1959
1960 - 1969
1970 - 1979
1980 - 1989
1990 - 1999
2000 - 2009
2010 - 2016
Wildfires
YearNum
1878 - 1899
1900 - 1919
1920 - 1929
1930 - 1939
1940 - 1949
1950 - 1959
1960 - 1969
1970 - 1979
1980 - 1989
1990 - 1999
2000 - 2009
0 - 2016
0 4.75 9.5 19 Kilometers
N
Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp
USGS
science for a changing world


Thomas Fire
Soil burn severity
Chaparral vegetation only
Legend
Soil burn severity
(low to high)
1
2
3
4
0
5
10
20
Kilometers
N

And, in southern California, the 2020 Fire Season has only begun:



NASA


70
60
50
40
30
20
10
0
SAW events (%)
0
50
500
2500
>5000
Area burned class (ha)

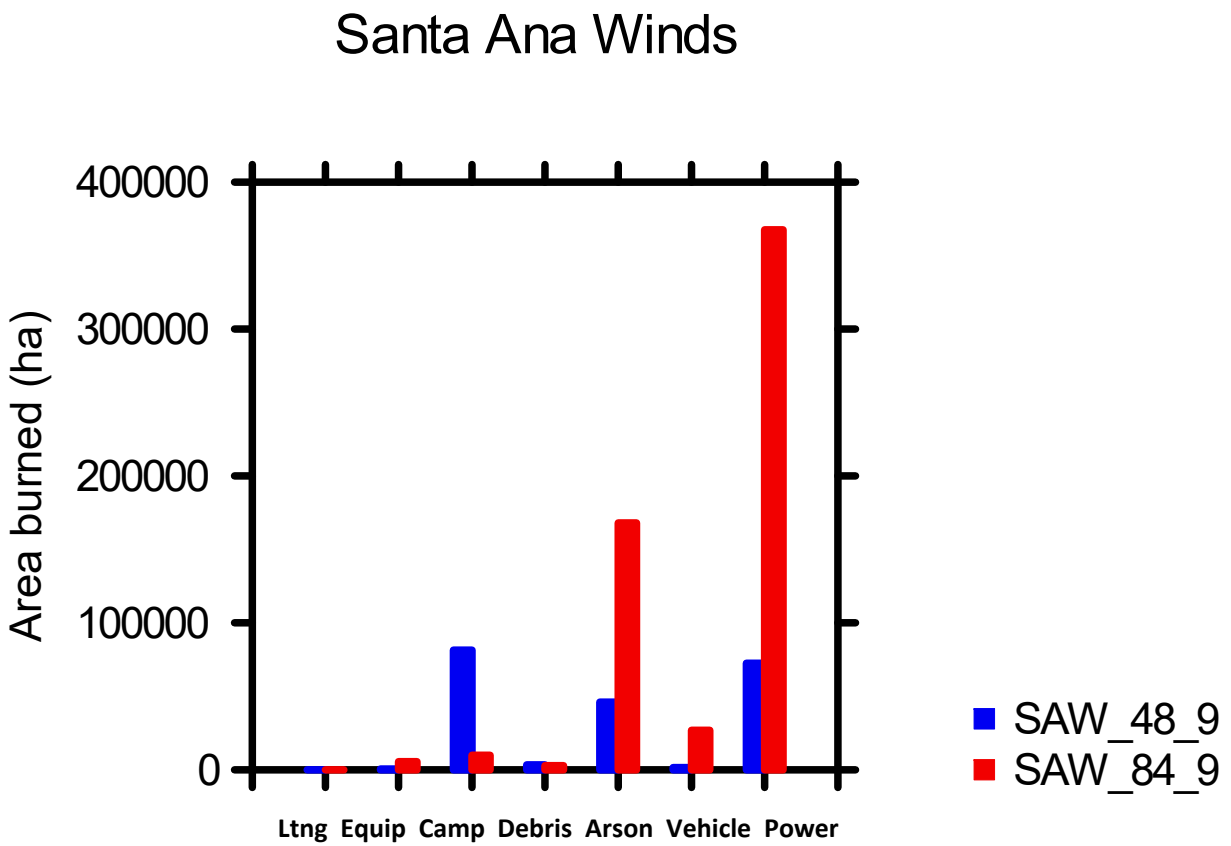
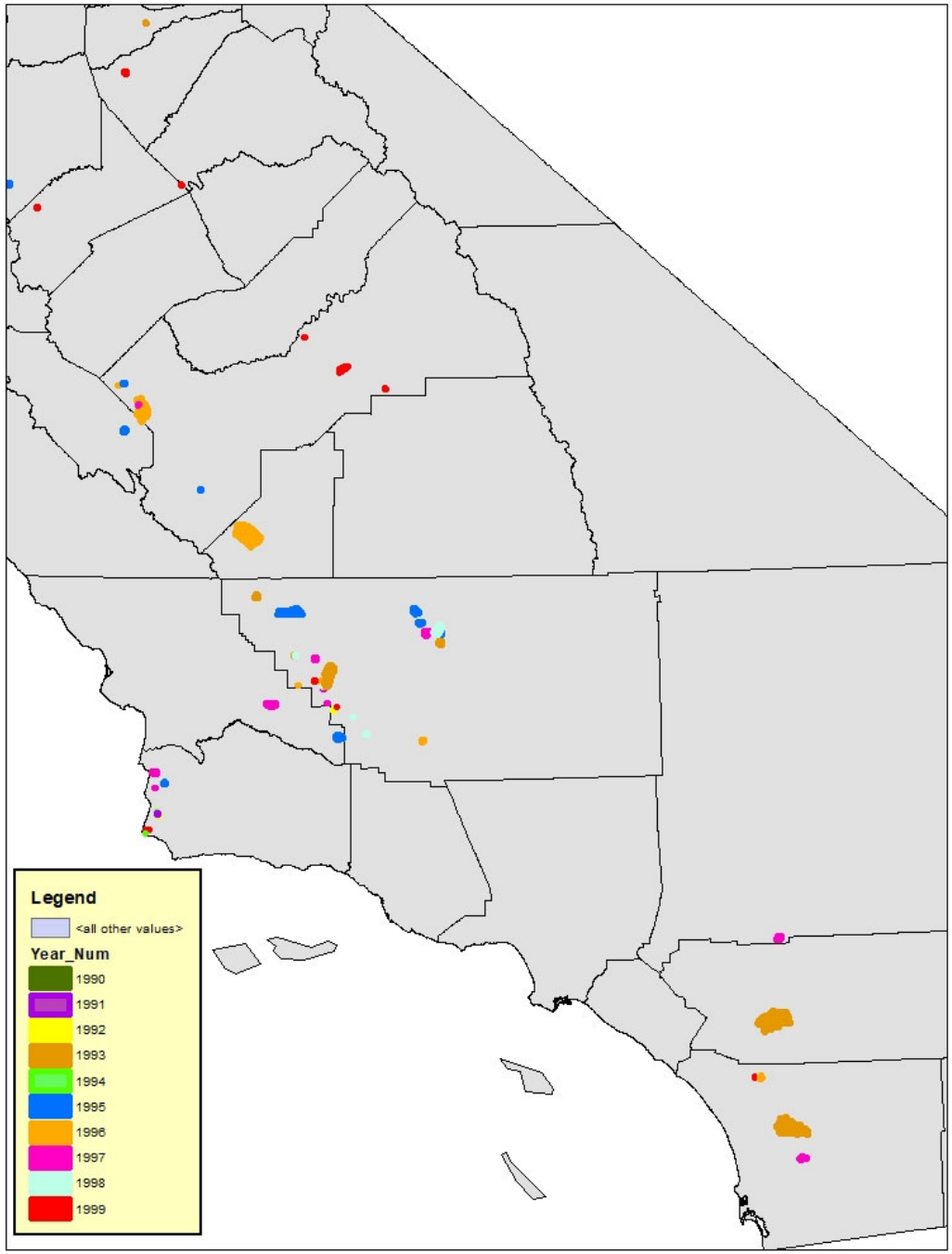
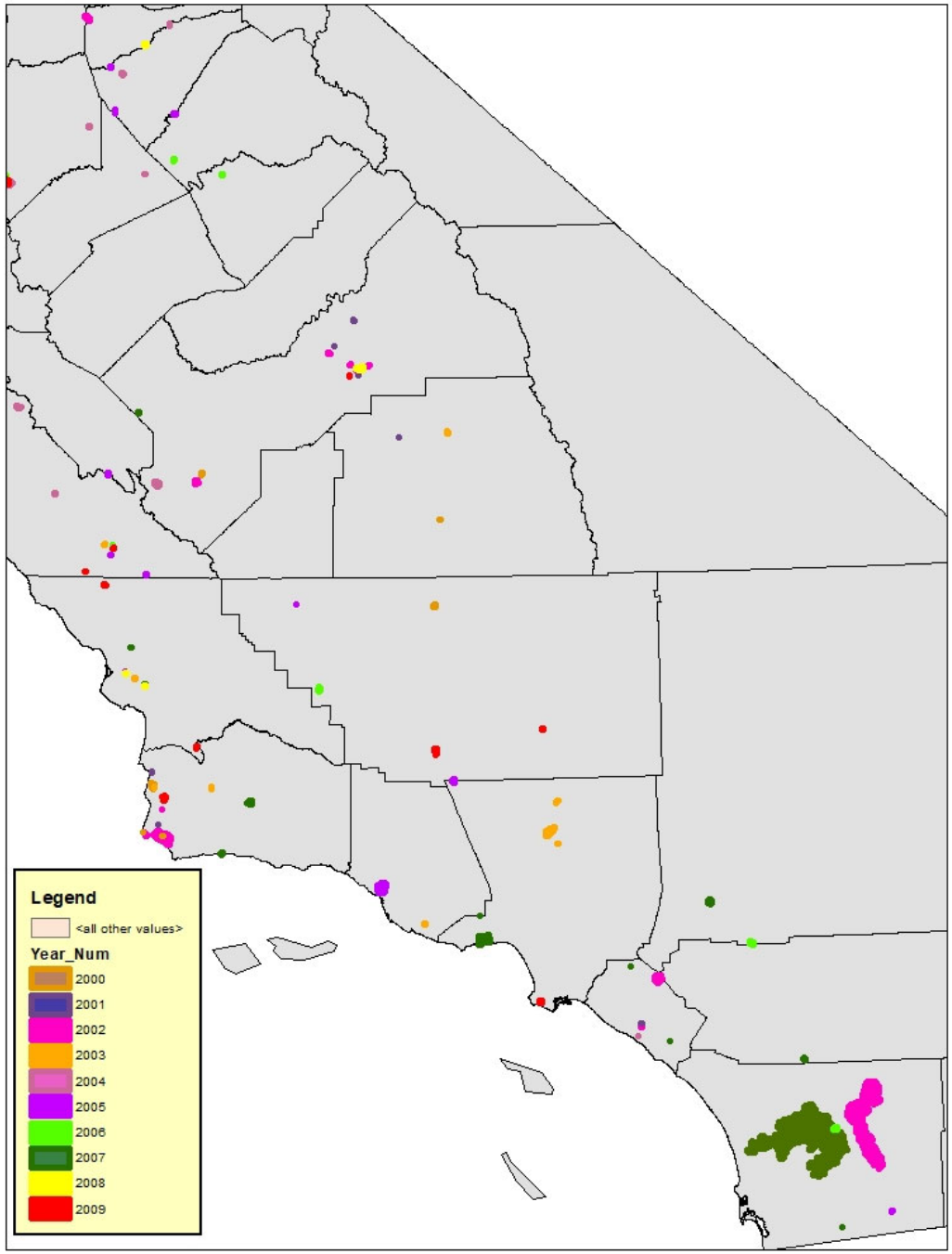
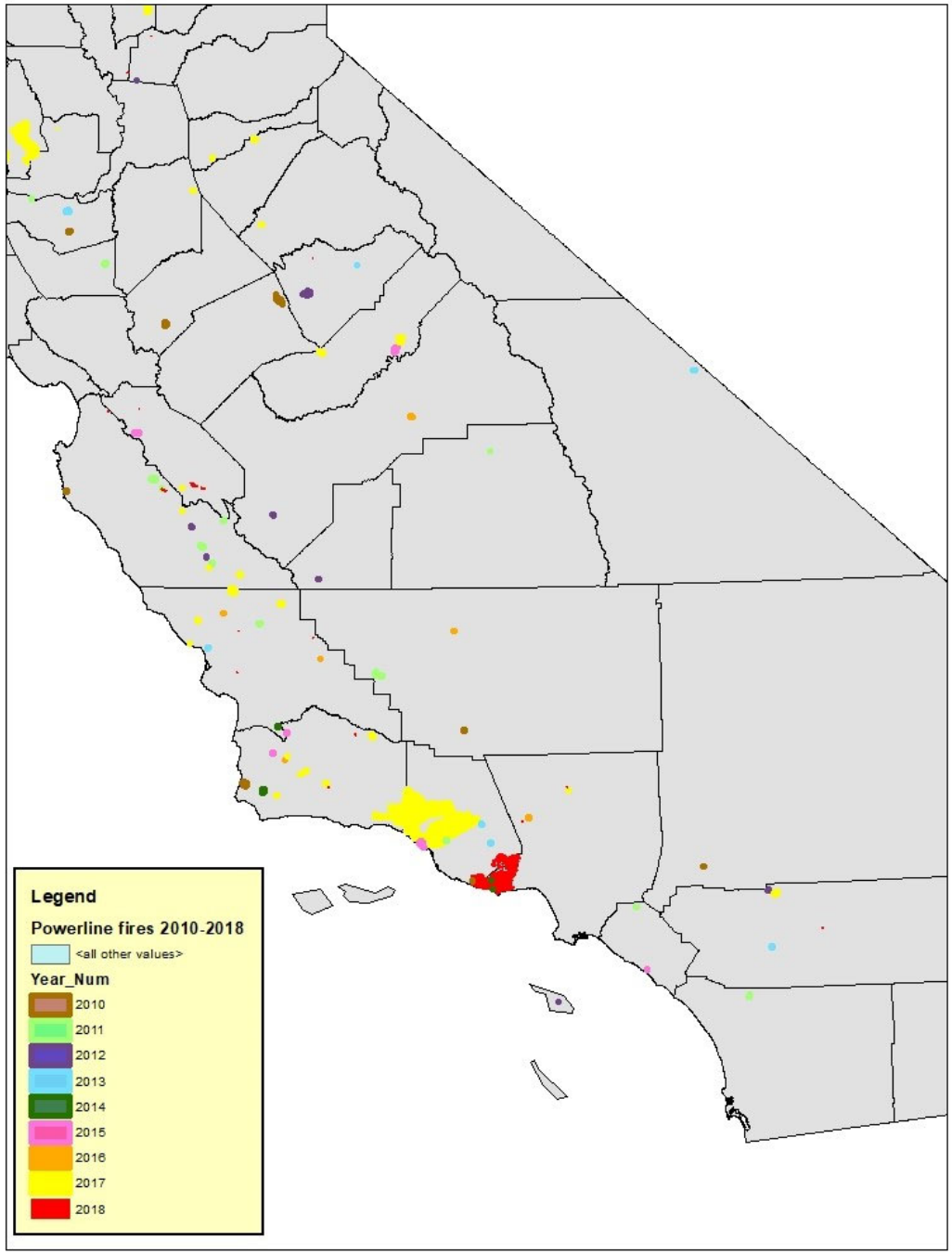

Santa Ana Winds
Area burned (ha)
400000
300000
200000
100000
0
Ltng
Equip
Camp
Debris
Arson
Vehicle
Power
SAW_48_9
SAW_84_9

Fig. 10


Legend
<all other values>
Year_Num
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999


Legend
<all other values>
Year_Num
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009


Legend
Powerline fires 2010-2018
<all other values>
Year_Num
2010
2011
2012
2013
2014
2015
2016
2017
2018

Foehn Winds:

70mph gusts & RH < 10%

Autumn (every year in California)

less predictable in other regions, but foehn winds in Rocky Mtns and wind driven fires occur in the East, e.g. Chimney Tops Fire (Gatlinburg 2016 14 deaths/1,684 structure losses)

USGS science for a changing world


2017 Fire Season
99,000 ha (245,000 acres) 44 fatalities
10,000 structures
Redwood Complex
Lobo Fire
McCourtney Fire
Sulphur Fire
Tubbs Fire
Nuns Fire
Partrick Fire
Atlas Fire
37 Fire
San Francisco
California
Lion Fire

Fog Returning?

REDWOOD EMPIRE — Fair except local morning coastal fog; coastal winds northwest 10-25 mph. Low humidity. Highs and lows: Ukiah 104 and 58; Santa Rosa 96 and 53. (Statistics, Page 2.)

Telephone LIberty 6-2020

THE PRESS DEMOCRAT

The Redwood Empire's Leading Newspaper

SANTA ROSA, CALIFORNIA — The City Designed for Living — THURSDAY AFTERNOON, SEPTEMBER 24, 1964

HOME

10 cent

Dry Winds Pose Threat To Empire Fire Lines

North State Fires Total 83,000 Acres

The Redwood Empire situation today looked relatively good—but continued bad weather and several vicious fires posed constant threats.

In all, the Division of Forestry said, 2,400 men are working out of division fire camps on Northwestern California fires since Saturday a total of 83,000 acres have been burned over.

No break in the hot, dry weather and high, gusty winds was in sight; predictions were for 100 degree-plus temperatures and ridge winds peaking at 50 the blaze, the current battle in the rugged, rocky ridges east and west of Mount St. Helena lookout.

Small aerial tankers are operating from the ridge-top at Angwin airport, bombing the fire in the brushy ridges while ground crews attempt to encircle the blaze.

Containment is not expected until tomorrow morning "at the earliest."

That fire started Saturday on the eastern slopes of Mount St. Helena. It broke out Sunday and

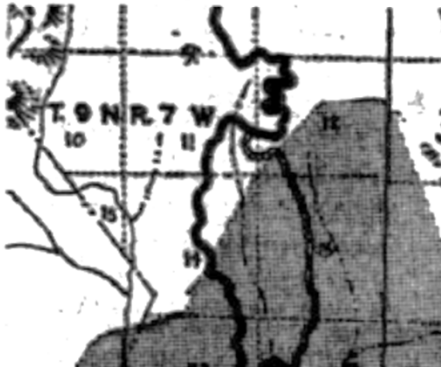
50 Homes Believed Lost to Flames

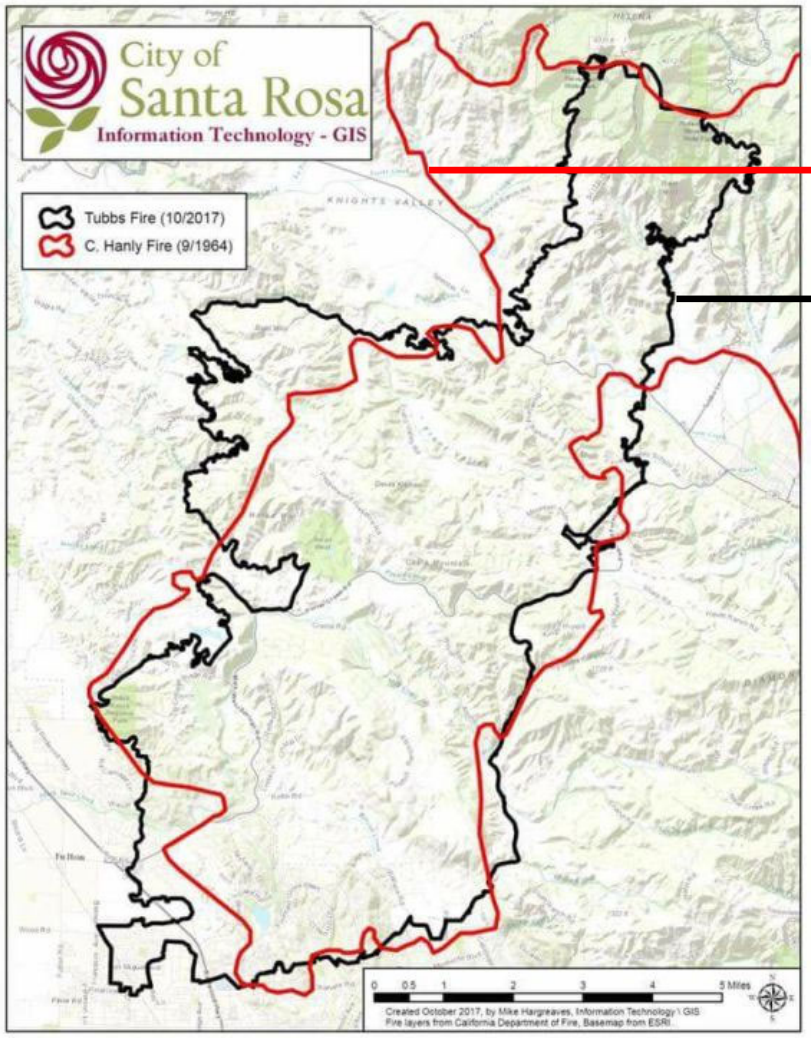
A deadly formula of high winds, soaring temperatures and dry timberlands today force-fed out-of-control tains northeast of Kenwood continued to elude control.

Winds kicking up to 80 miles an hour splashed the flames

No relief from the extreme fire danger in the Redwood Empire is in sight, according to the weatherman.

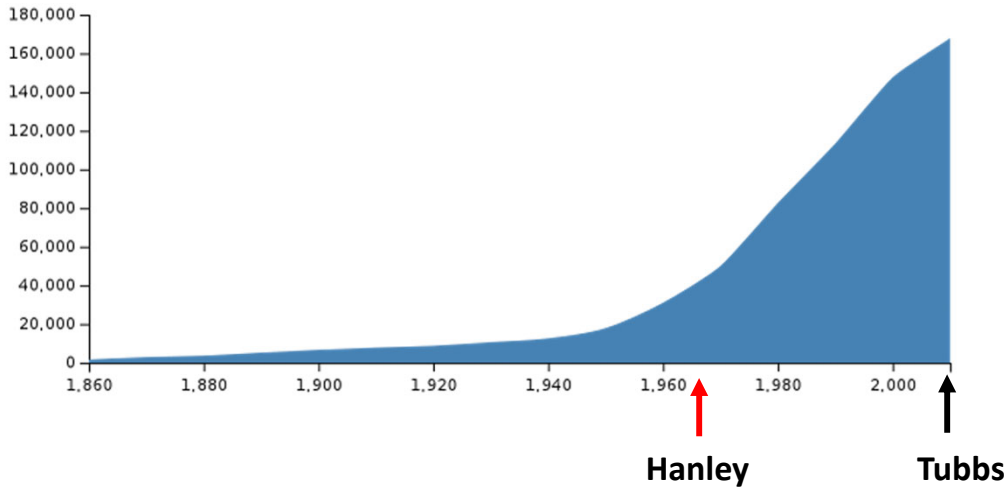
Joe Ganser, fire weather supervisor from Sacramento who is serving with a mobile fire weather unit at St. Helena, said no change in the



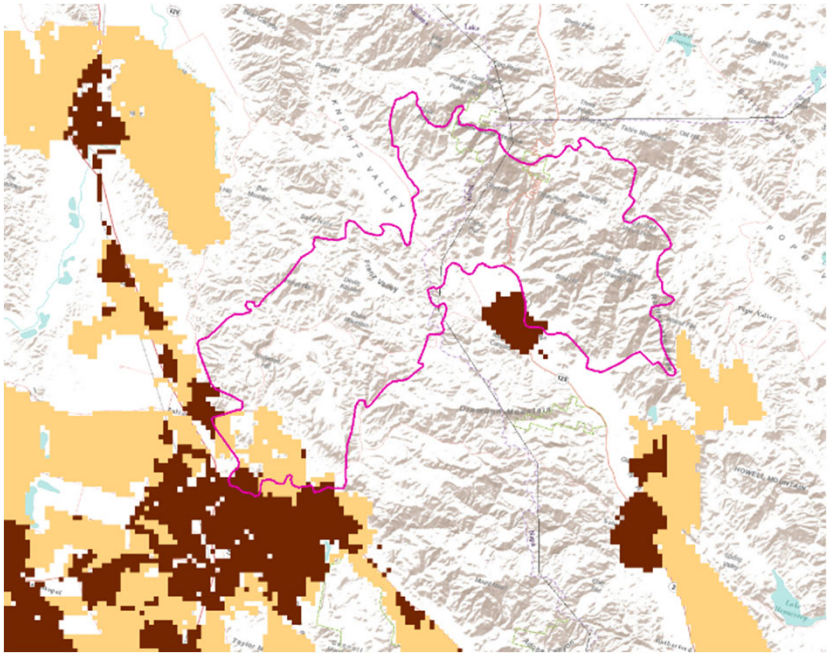


1964 **Hanley Fire** 83,000 acres
(no fatalities/~100 structures lost)

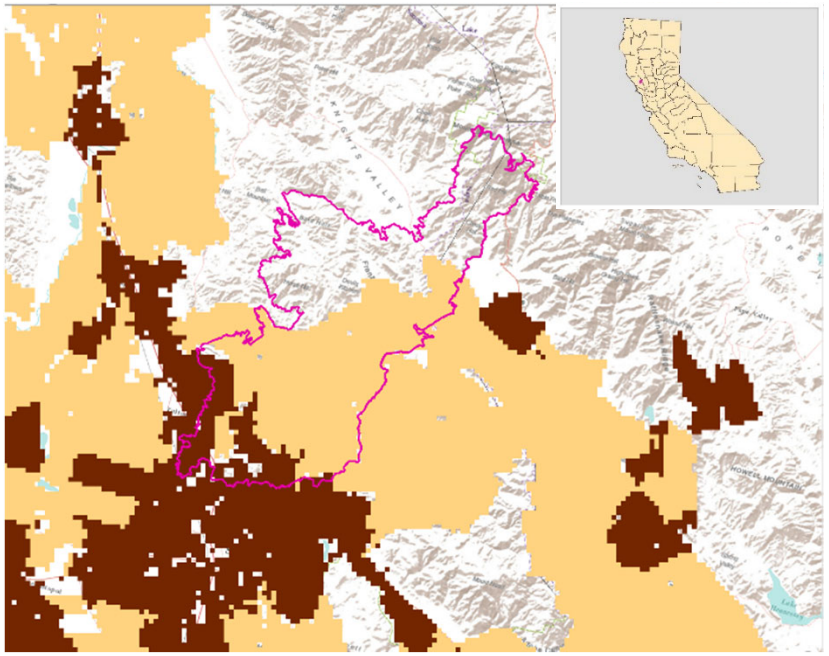
2017 **Tubbs Fire** 36,800 acres
(22 fatalities / 5,643 structures lost)



a) 1964 Hanly Fire



b) 2017 Tubbs Fire



Low-density housing development

High-density housing development

Powerline ignited fires in California

1981 – 1999	0	2000 – 2018
112,830 acres		553,919 acres

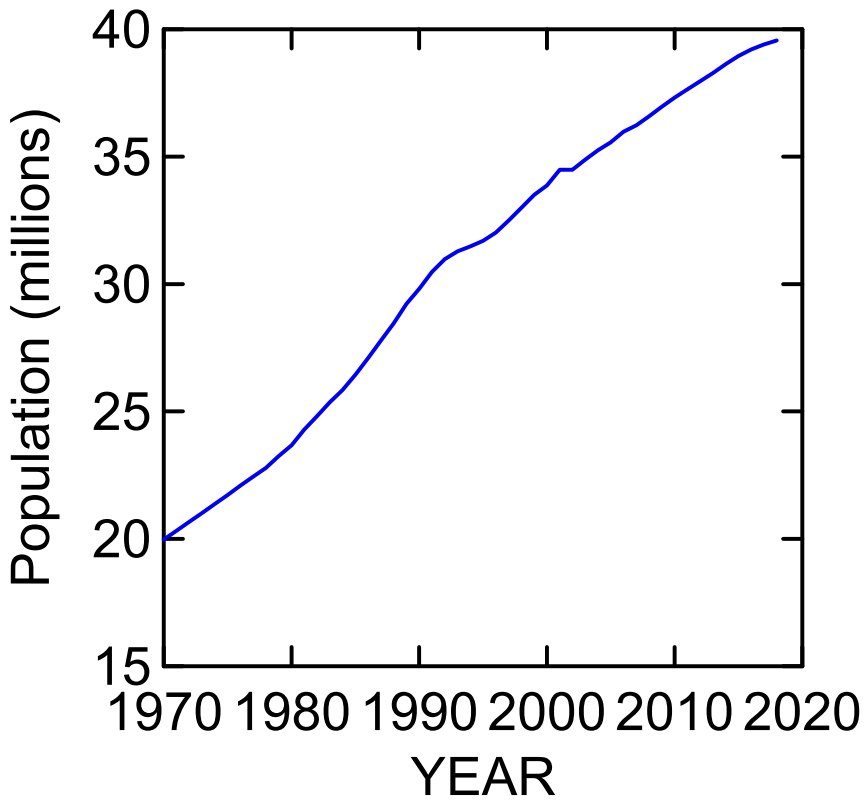
USGS science for a changing world

Since the year 2000 there has been a doubling in area burned over the prior 2 decades

Although there has been ~ 0.4 ^{o}C increase in temperature there is little to no evidence climate is a major factor

Human ignitions are clearly a factor and there has been an additional 6 million people added to the state

2050 60mil



Population growth increases probability of an ignition during a severe wind event

Population growth increases the number of people at risk

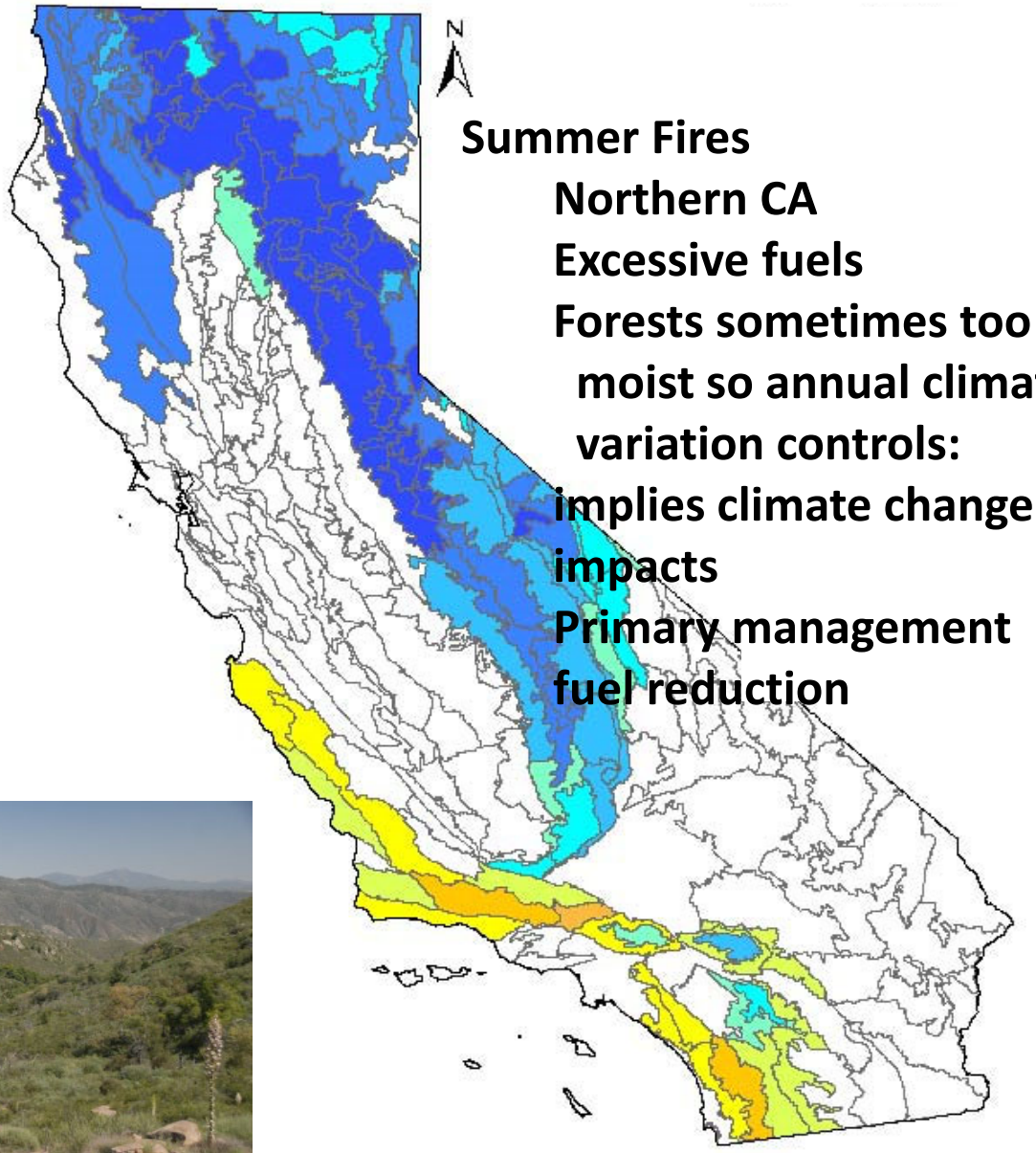
Collectively, these lead to increased losses of lives and property

USGS science for a changing world

Summary: California has 2 fire regimes

Fires/million ha

475 (45%)



Summer Fires

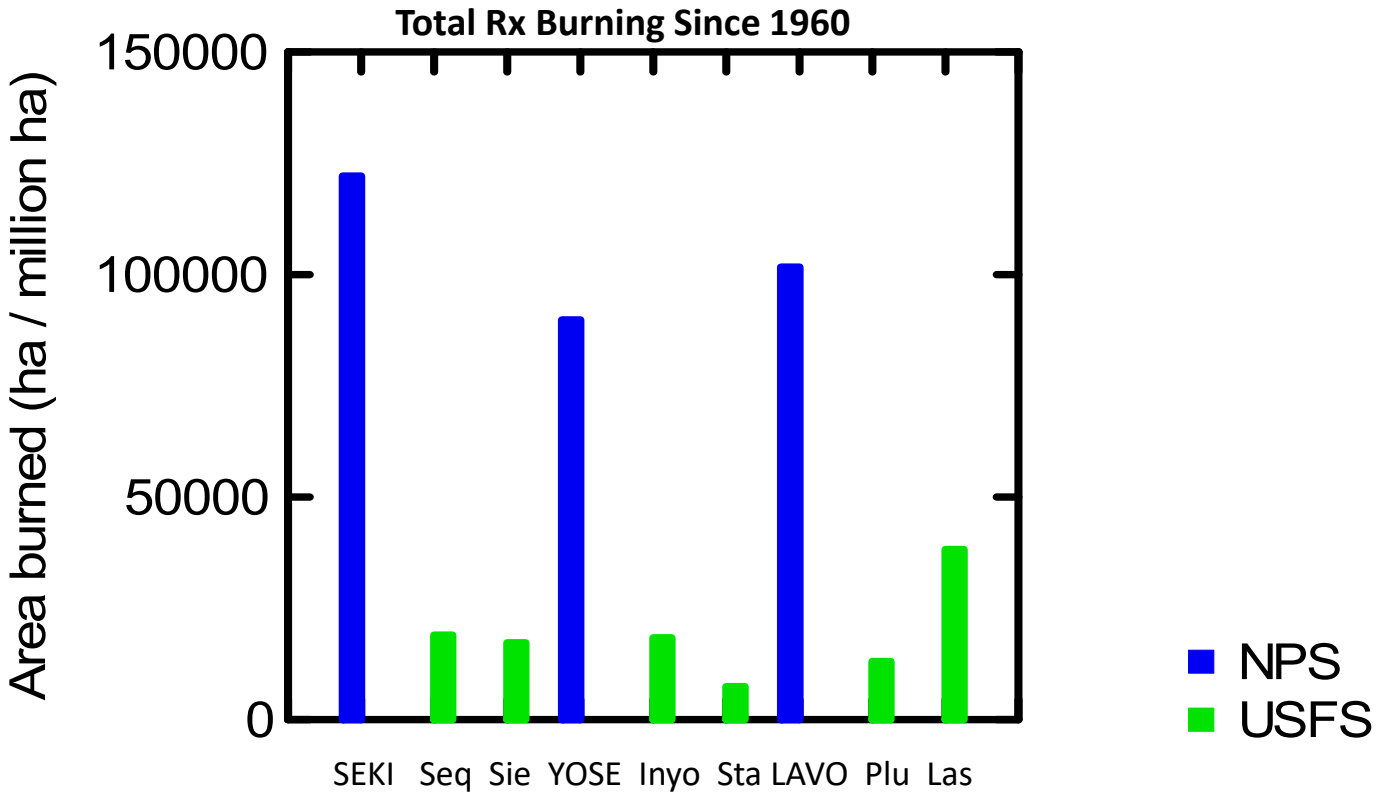
Northern CA

Excessive fuels

Forests sometimes too moist so annual climate variation controls: implies climate change impacts

Primary management fuel reduction

4788 (99%)

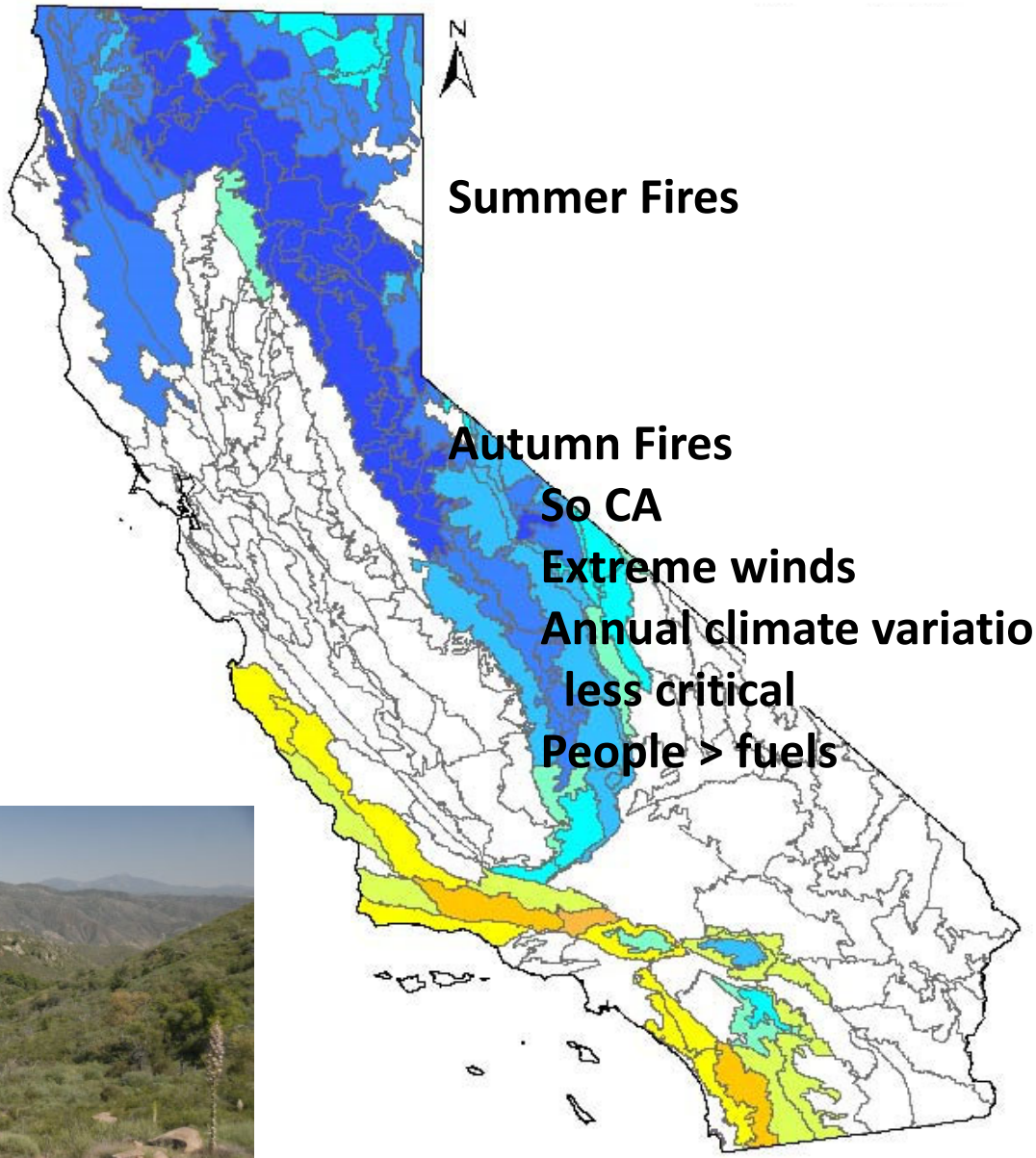


In addition to planned burns, parks have utilized natural fires "prescribed natural fires"

Summary: California has 2 fire regimes

Fires/million ha

475 (45%)



Summer Fires

Autumn Fires
- **So CA**
- **Extreme winds**
- **Annual climate variation less critical**
- **People > fuels**

4788 (99%)

The 5 Ps of Wind-Dominated Fires:

1) ***People:*** This is more a people problem than a fuel problem. 100% of these fires are ignited by people and increased fires since 2000 may be due to an additional 6 million people; population growth is likely more or a threat than global warming.
2) ***Prevention:*** Rather than focusing on fuel treatments we need put much greater emphasis on fire prevention. However, it is not just a numbers issue; ignitions have declined radically since the mid-1980s, but area burned has increased.
   In the last decade the majority of large fires have been ignited by powerline failures. Option: shut down power grid during high wind events.
3) ***Prediction*****:** These are due to extreme wind events and real time prediction of wind patterns and communicating to agencies and homeowners could save lives.
4) ***Planning*****:** Community planning needs to give fire similar recognition as other hazards. We have limited ability to control earthquakes and floods, so we have zoning restrictions. Fires have been perceived as controllable, but history reveals we are vulnerable. There is a need for greater focus on fire-zoning and consideration of replacing community planning with regional planning.
5) ***Protection:*** Most homes burn from embers and thus reducing litter on roofs, fine-mesh eve vents, double-pane windows and roof sprinklers will provide a significant reduction in housing losses. ***Fuel treatments around homes is critical but needs to be focused on the 'house out',*** i.e., greatest effort near homes and less as one moves further into the wildlands. Reducing fuels within 100' is sufficient and further clearance is of doubtful value.