

*The Ever Changing Role of Climate  
and  
Weather in Chaparral Fire Regimes*

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# *Global Change and Vulnerability of Chaparral*

This is an issue that can not be understood without considering **FIRE**



NASA

*Smoke Driven by Offshore Flow of Santa Ana Winds December 2017*

THURSDAY, JUN 16, 2011 08:45 AM PDT

ADVERTISEMENT

# Global warming is burning down the American West

As wildfires ravage Arizona and Texas, it's time for us to take action on climate change before it's too late







## **Questions:**

**Will Anthropogenic Climate Change Alter Future Fire Regimes?**

**Do Other Global Changes Pose a Bigger Threat?**



## **Spoiler Alert:**

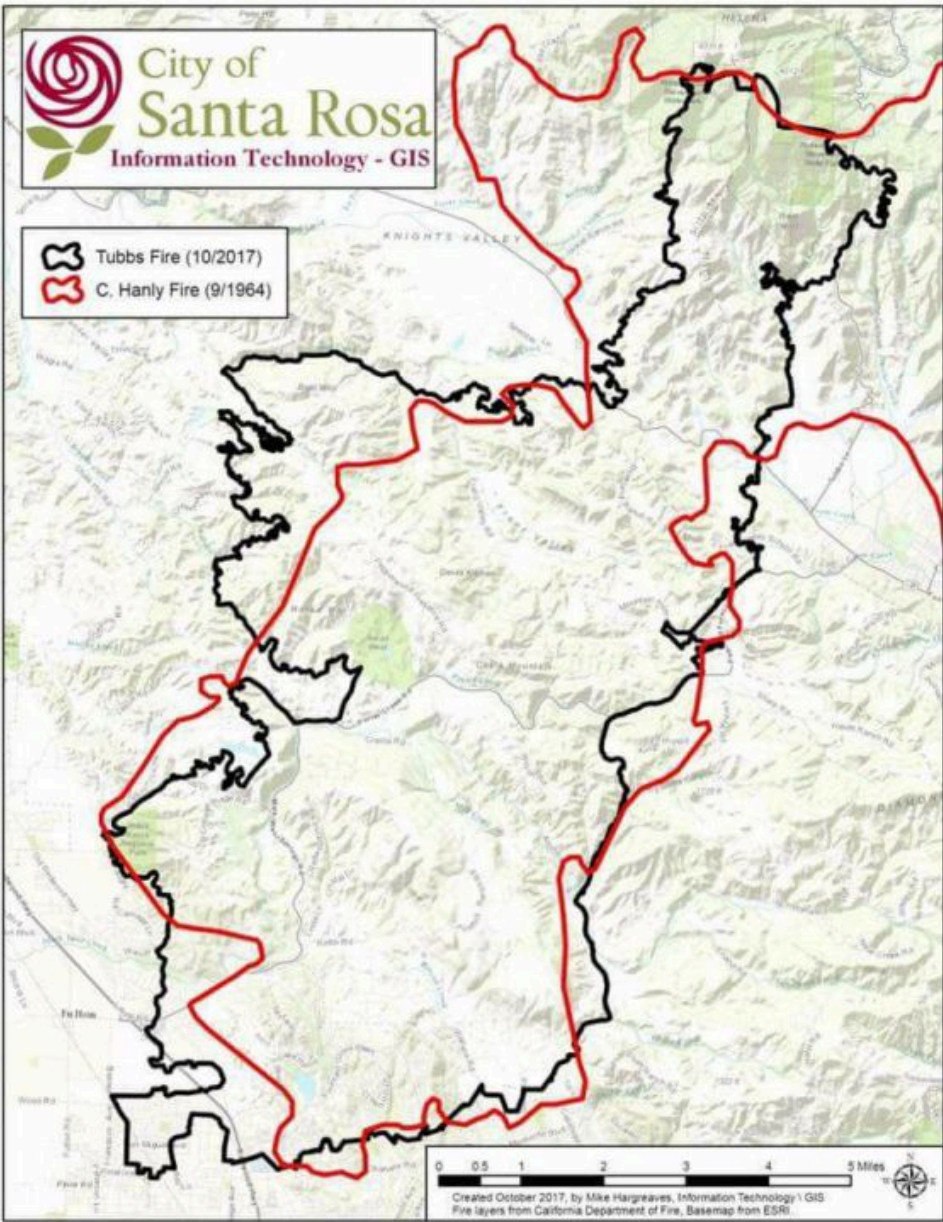
**Evidence to date suggests climate change may not have as significant effect as other global changes**

**Speculation suggests climate change may impact extreme winds (e.g., RRR)**

**Climate change will likely impact postfire recovery by favoring annual plants, limiting chaparral persistence and favoring type conversion**



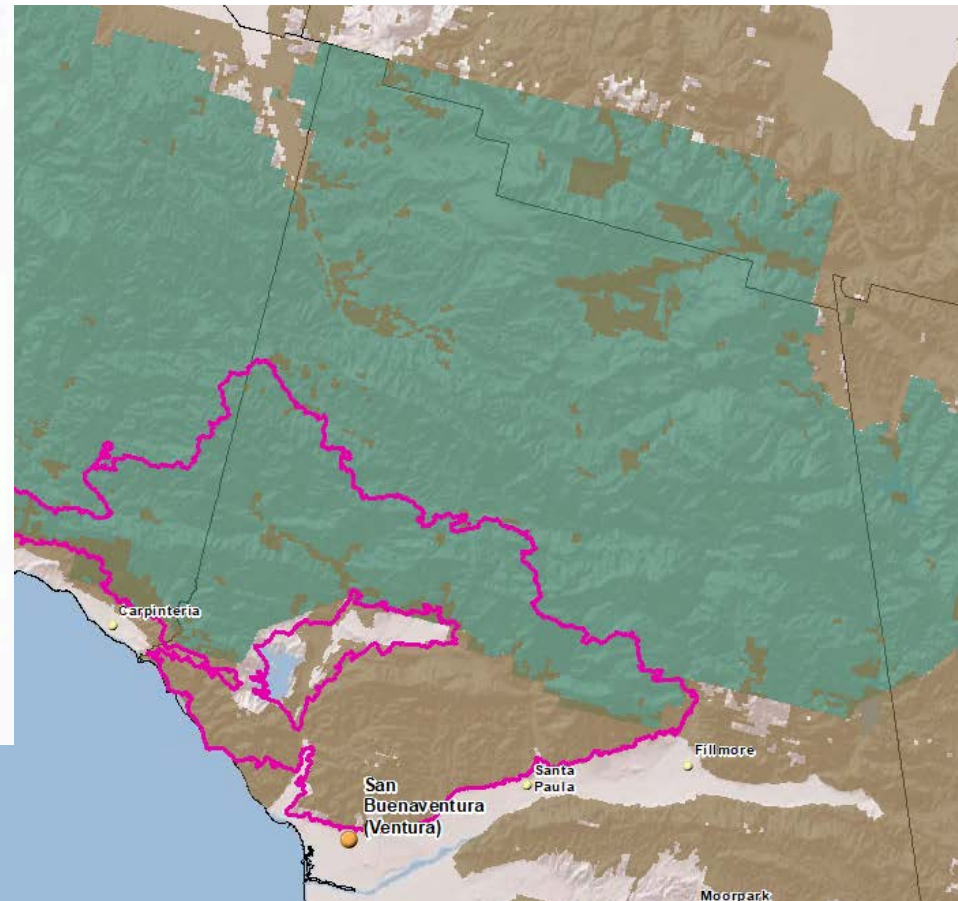
 Tubbs Fire (10/2017)  
 C. Hanly Fire (9/1964)



## 2017 Fire Season

**October: North Bay - greatest losses**

**December: Ventura - largest fire**



E&E NEWS

CLIMATE

# Scientists See Climate Change in California's Wildfires

Strong winds and months of record-high temperatures have fueled the destructive fires

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By Debra Kahn, Anne C. Mulkern, E&E News on October 12, 2017

**News Outlets proclaimed: *December wildfires are unheard of***

**6 December 1903 San Bernardino, 40,000 acres**

**31 December 1917 [unnamed] 10,000+ acres**

**26 December 1956 Sherwood/Zuma, 35,000 acres**

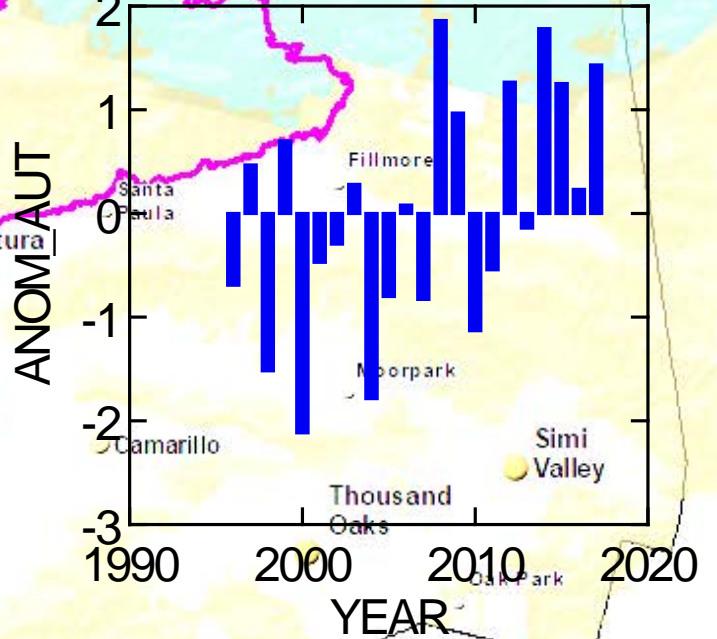
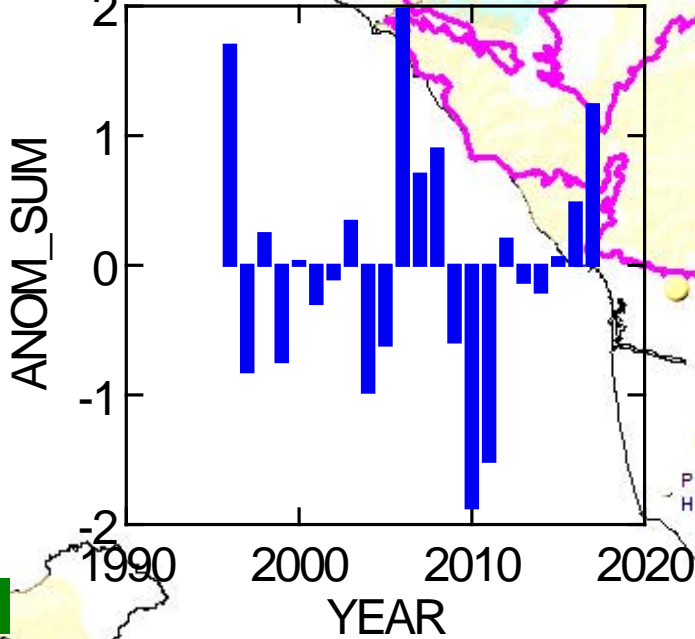
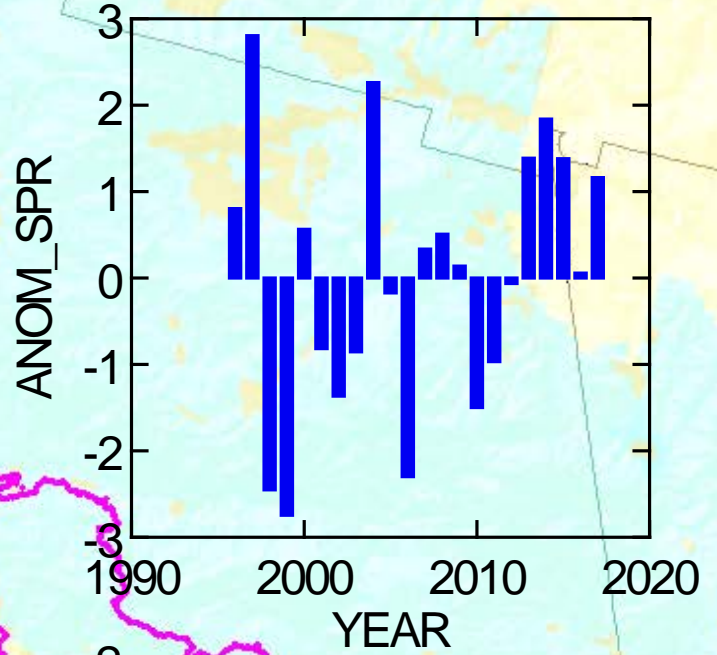
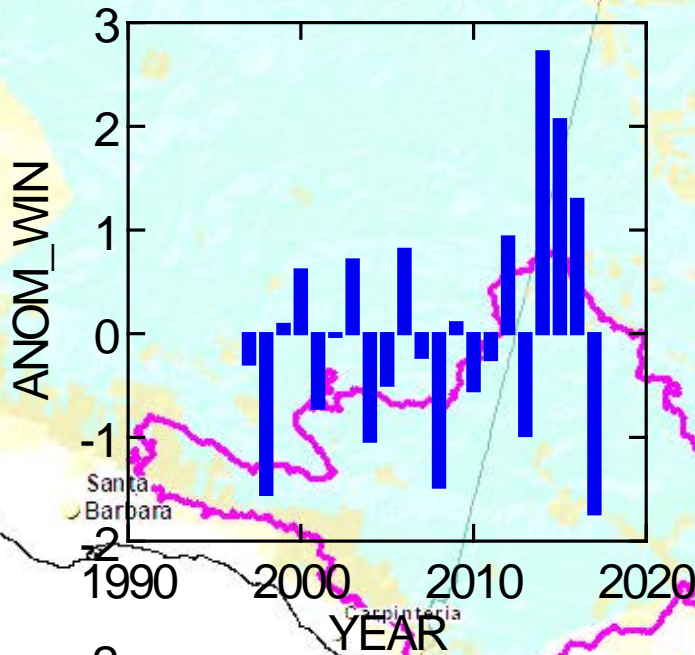
**3 December 1958 Malibu Lake, 18,000 acres**

**3 December 2006 Schekell, 13,600 acres**



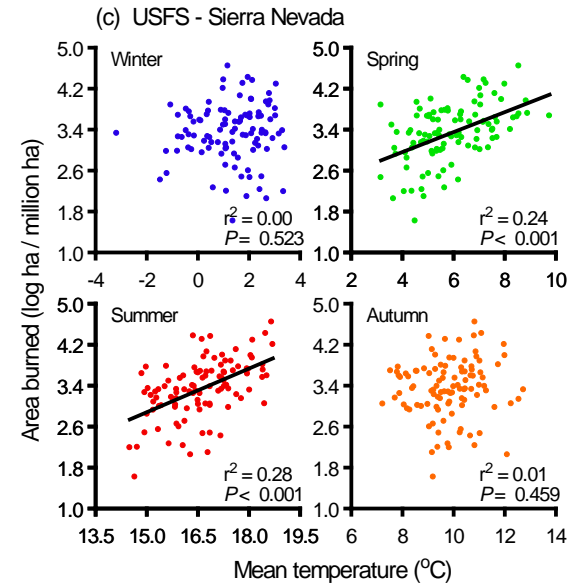
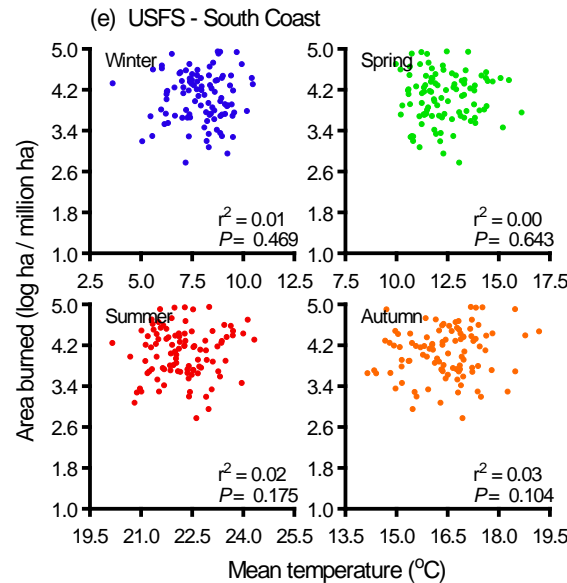
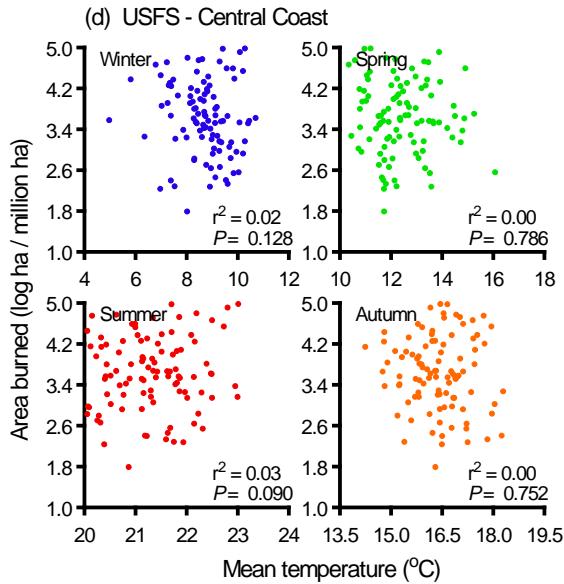
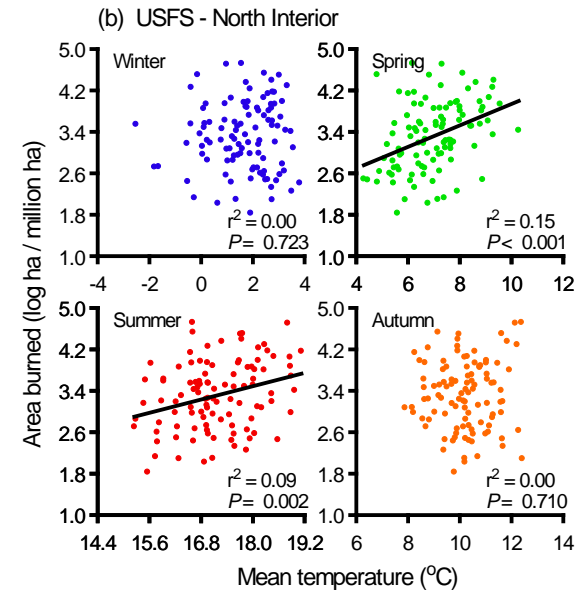
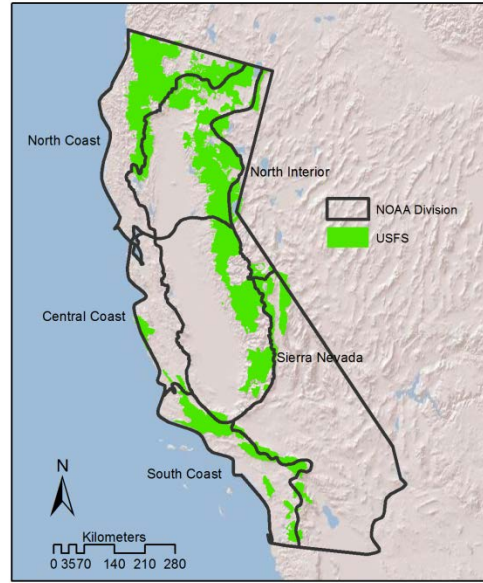
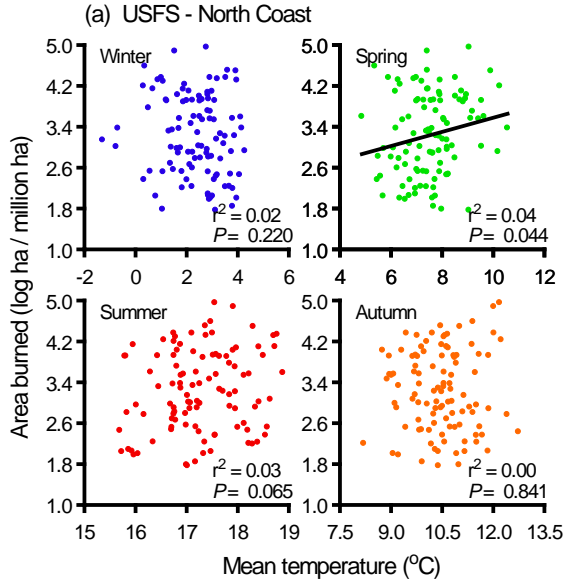


# Average Seasonal Temperature (°C, Cheeseboro RAWS site, DRI)

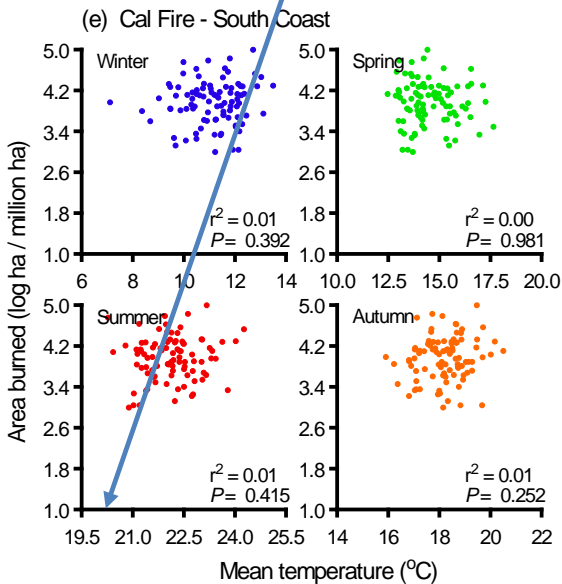
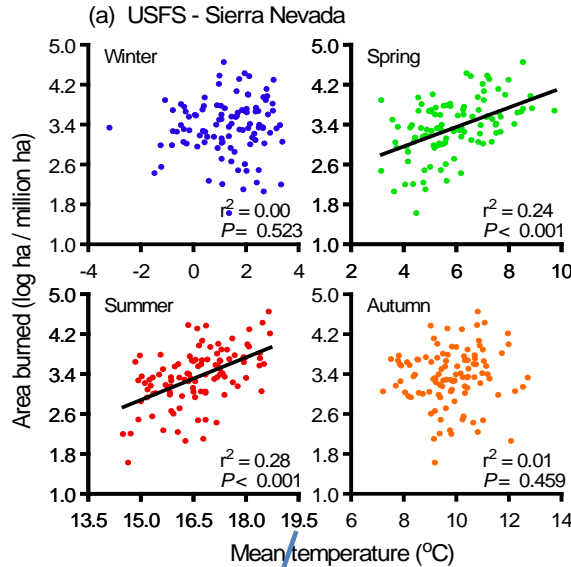
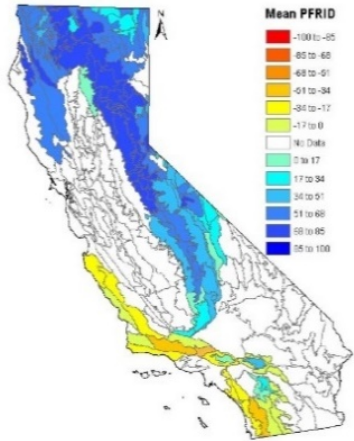




# USFS



# Why?



## Akaike IC regression models

Sierra Nevada (USFS)	r <sup>2</sup>	
1910 - 2013	0.39	Temp spr+Temp sum-Ppt spr
<b>Flammability-Limited</b>		
1910 - 1959	0.42	- Ppt spr - Ppt win
1960 - 2013	0.52	Temp spr + Temp sum

South coast (Cal Fire)	r <sup>2</sup>	
1919 - 2013	0.00	
1919 - 1959	0.00	
1960 - 2013	0.25	Prior ppt-Ppt aut -Ppt sum





# Global Warming and Future Fire Regimes



**Flammability-limited**  
(Productive Western Forests)

Global warming in spring and summer will contribute to increased frequency of large fires

Warming may exacerbate severity of droughts on fuel moisture and dieback



**Fuel-limited**  
(Western grasslands)

Global warming may reduce grass growth during years of high ppt, with potential for reducing fuel loads

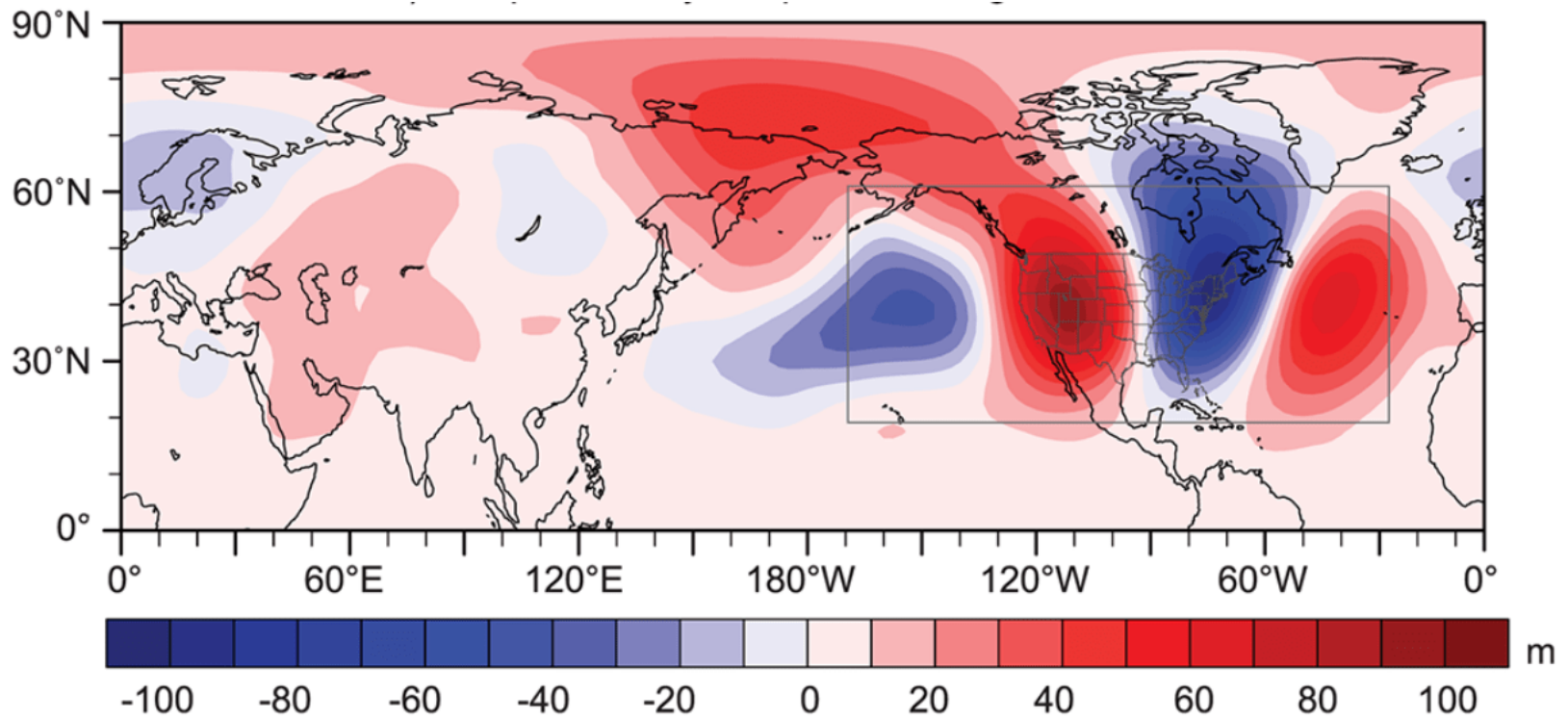


**Ignition-limited**  
(Cal/Grt-Basin shrublands)

Global warming may not directly impact fire regimes as other global changes such as population growth would have greater impact through increased ignitions  
e.g., Cal 2050 population growth expected to increase 50%

<b>Year</b>	<b>Fire</b>	<b>County</b>	<b>Month</b>	<b>Acres</b>	<b>SA (days)</b>	<b>Drought (mons)</b>
<b>1889</b>	<b>Santiago Cyn</b>	<b>Orange/R/SD</b>	<b>Sep</b>	<b>308,900</b>	<b>3</b>	<b>12</b>
<b>1932</b>	<b>Matilija</b>	<b>Sta Barbara</b>	<b>Sep</b>	<b>219,900</b>	<b>5</b>	<b>23</b>
<b>1970</b>	<b>Laguna</b>	<b>San Diego</b>	<b>Sep</b>	<b>174,200</b>	<b>3</b>	<b>14</b>
<b>1985</b>	<b>Wheeler #2</b>	<b>Ventura</b>	<b>Jul</b>	<b>122,800</b>	<b>-</b>	<b>7</b>
<b>2003</b>	<b>Cedar</b>	<b>San Diego</b>	<b>Oct</b>	<b>270,575</b>	<b>3</b>	<b>54</b>
<b>2006</b>	<b>Day</b>	<b>Ventura</b>	<b>Sep</b>	<b>161,850</b>	<b>2</b>	<b>12</b>
<b>2007</b>	<b>Zaca</b>	<b>Sta Barbara</b>	<b>Jul</b>	<b>240,425</b>	<b>-</b>	<b>20</b>
<b>2007</b>	<b>Witch</b>	<b>San Diego</b>	<b>Oct</b>	<b>198,175</b>	<b>2</b>	<b>17</b>
<b>2009</b>	<b>Station</b>	<b>Los Angeles</b>	<b>Aug</b>	<b>166,600</b>	<b>-</b>	<b>32</b>
<b>2017</b>	<b>Thomas</b>	<b>Ventura/SB</b>	<b>Dec</b>	<b>281,890</b>	<b>10</b>	<b>72</b>



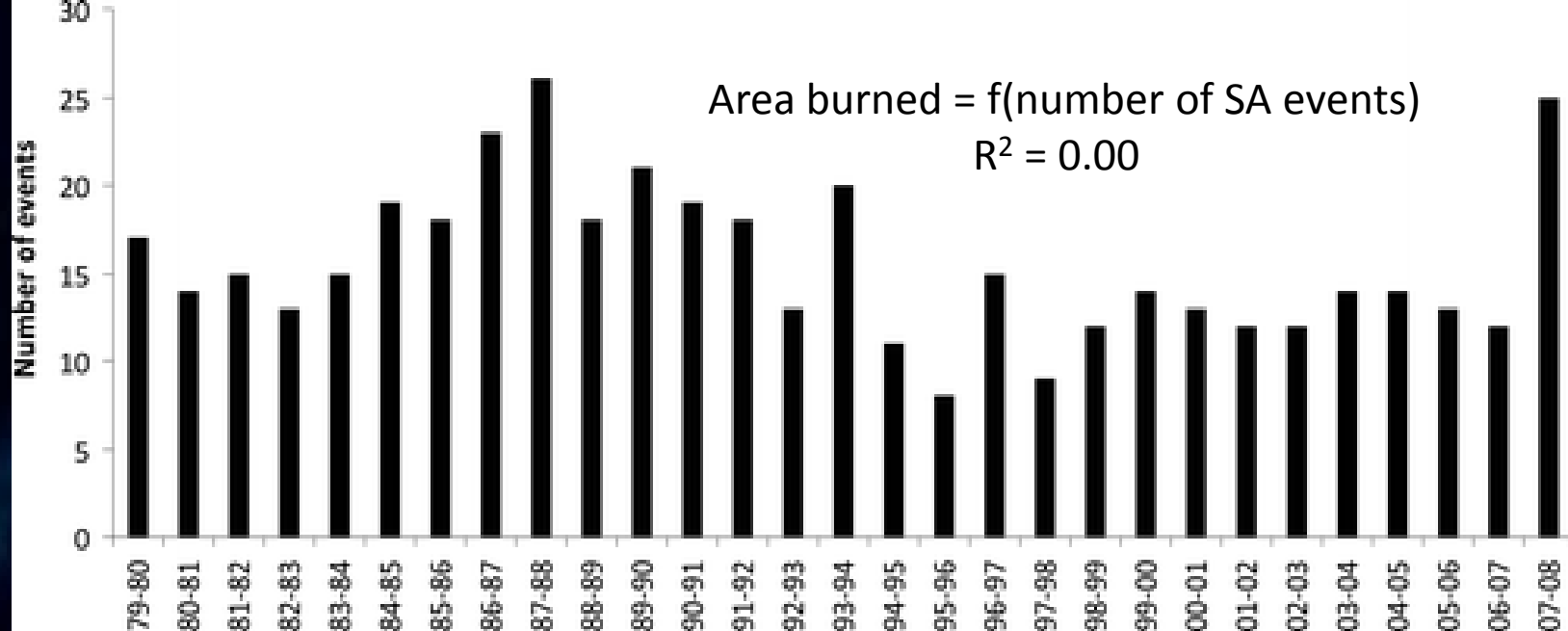


*Dec 4, 2017*

*“In the coming days, a remarkably persistent weather pattern will begin to develop across North America and adjacent ocean regions. Characterized by strong high pressure near the West Coast and low pressure over the Eastern Seaboard, this ‘quasi-stationary’ high amplitude atmospheric wave pattern will essentially become locked in place for a least the next 2 weeks. ... ”*

***New Insights into the Ridiculously Resilient Ridge & North American Winter Dipole***

Daniel Swain



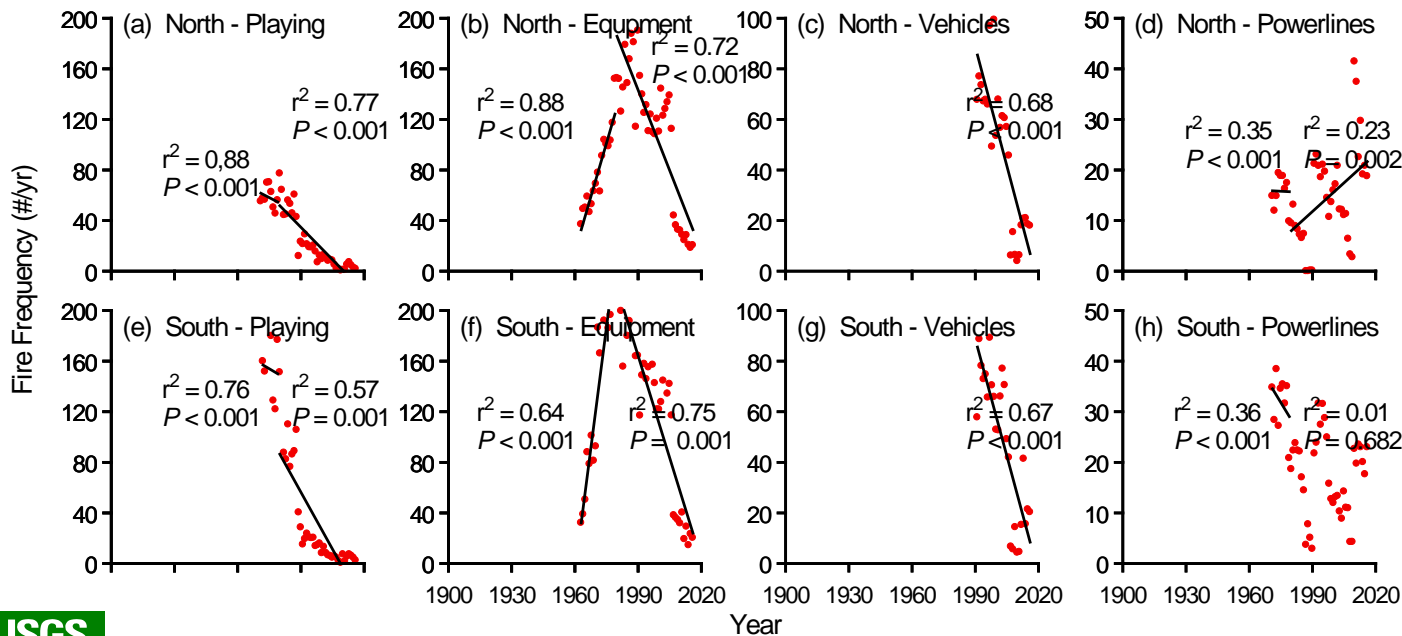
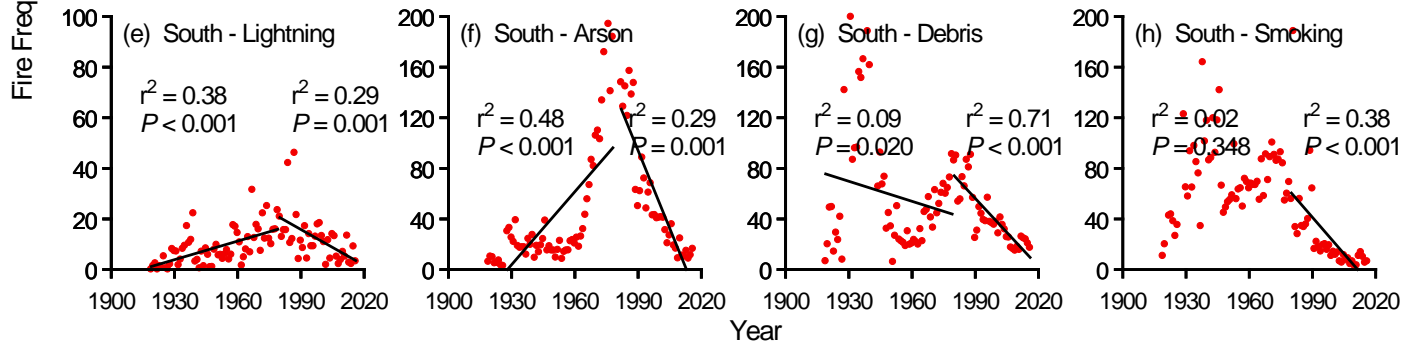
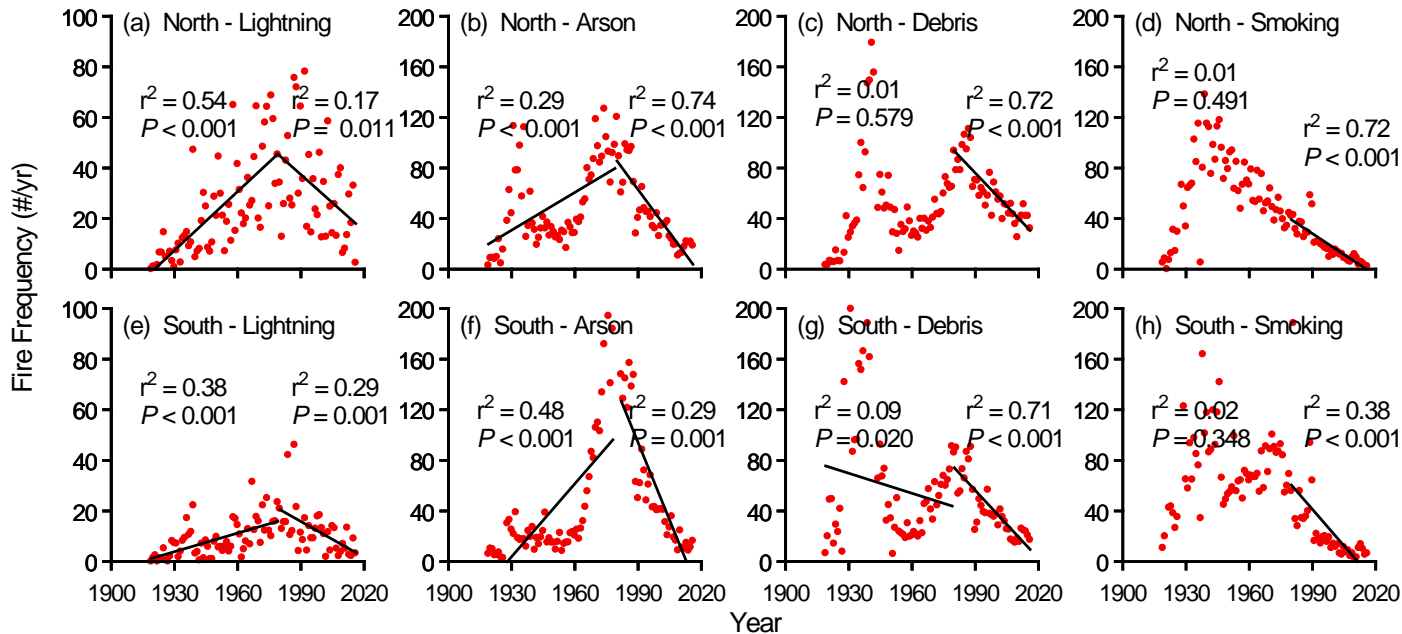


***“The problem is not fire.***

***The problem is people in the wrong places.”***

***-Roger Kennedy, Former Director NPS, “Wildfire and America”***







# Forecasting Future Fire Regimes



*Flammability-limited*



*Fuel-limited*



*Ignition-limited*

## Complications:

→ Type-conversions due to  $\Delta$ s fire frequency & direct climate impact on vegetation



Photos: Monica Turner



Photo: R.H. Halsey

# Forecasting Future Fire Regimes



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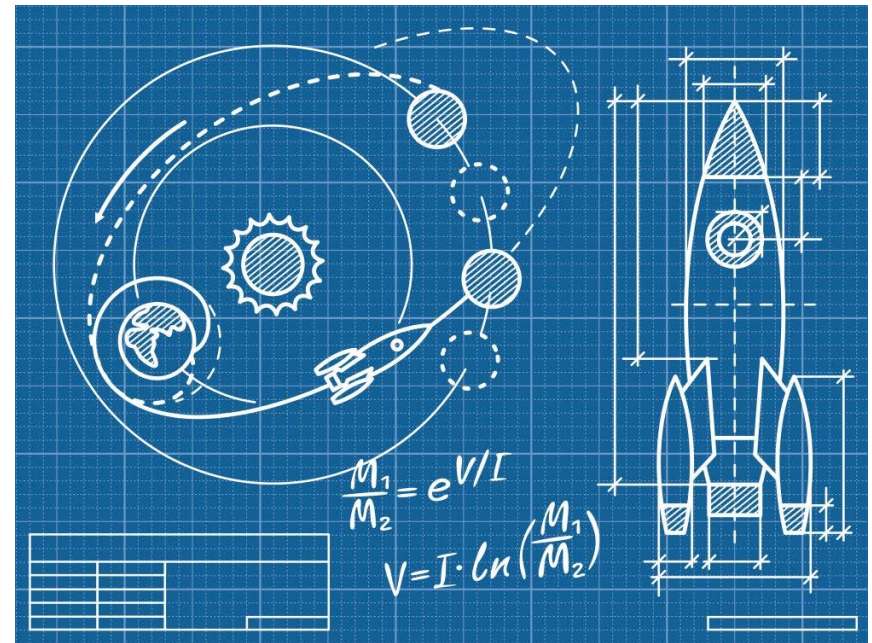
- Type-conversions due to  $\Delta$ s fire frequency & direct climate impact on vegetation and thus changes in limiting factors, ie flammability, fuels, ignitions
- **Fire-climate models have changed in the last century and likely change in future**
- **Precipitation may increase, or decrease, or occur with greater variability**
- **Increased CO<sub>2</sub> increases WUE, potentially offsetting drought impacts on plants**
- **As climates change, new combinations of temperature and ppt w no analogue**
- **Novel ecosystems are to be expected**
- **Impact will depend on order, timing and magnitude of many contingencies**
- **These statistical models will likely need to be replaced by mechanistic models**



# ***Predicting Future Fire Regimes & Impacts on Vegetation is Not Rocket Science***

**... It's Far More Complicated**

**[This is not hyperbole, e.g. Apollo predicts to the minute the arrival of a space craft 400,000 km away from Earth]**



***In conclusion: Anyone who says they have a grasp on how climate change will impact future fire regimes possesses an impressive level of optimism.***



# The Poetry of D.H. Rumsfeld

—Feb. 12, 2002, Department of Defense news briefing

## The Unknown

*As we know,  
There are known knowns.  
There are things we know we know.  
We also know  
There are known unknowns.  
That is to say  
We know there are some things  
We do not know.  
But there are also unknown unknowns,  
The ones we don't know  
We don't know.*

