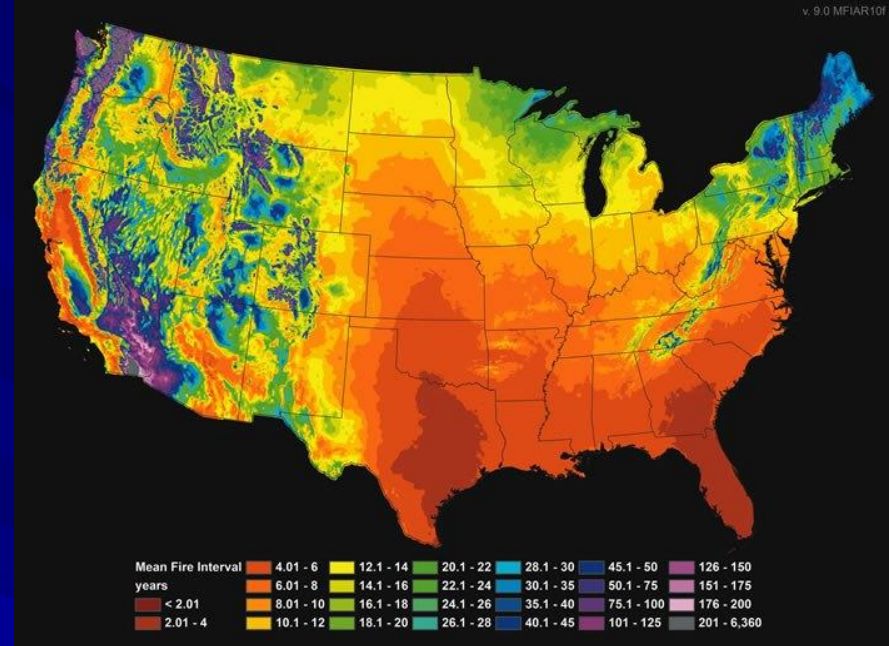


# (WILD) FIRE TRENDS



**Doug Cram**  
**Extension Fire Specialist**  
**Cooperative Extension Service**  
**College of Ag.**





# SOUTHWEST FIRE SCIENCE CONSORTIUM

A JFSP KNOWLEDGE EXCHANGE CONSORTIUM





- May 22
- Stephanie Mueller – Graduate Student NAU
- SWFSC Webinar
- Do trends in climate influence the increase in high severity wildfire in the Southwestern U.S. from 1984-2015?



- **Barb Satink Wolfson** – Program Coordinator
- **Dr. Andi Thode** – Principal Investigator
- Southwest Fire Science Consortium
- Northern Arizona University
- Tel: 928.523.1148
- [barbara.wolfson@nau.edu](mailto:barbara.wolfson@nau.edu)

**ONLY YOU CAN PREVENT FOREST FIRES**



**NO SERIOUSLY, I'VE BEEN FURLOUGHED**

December 22, 2018 – January 25, 2019 (35 Days)

75 YEARS



PREVENTING WILDFIRES



# $\Delta$ in the Fire Regime







# RANGER DISTRICT

## PREVENTING WILDFIRE IS...

### \$\$\$



## ... GOOD BUSINESS!



P51-04 U.S. Department of Agriculture • Forest Service

UMCOR Lompoc, CA



### REWARD OFFERED FOR INFORMATION

### MEXICAN GRAY WOLVES

Up to \$10,000 is offered for information leading to the apprehension of individuals responsible for the deaths of any Mexican gray wolves in New Mexico. Mexican gray wolves exist in the mountains of New Mexico and as wolf populations increase, encounters may increase.

Individuals with information on wolf deaths are requested to report it to the U.S. Fish and Wildlife Service, Office of Law Enforcement in Albuquerque, New Mexico. Those individuals will be kept anonymous.

Individuals with information they believe may be helpful should contact one of the following:

## NO Garbage Service



### You are now in Wolf Country

Ecological Mexican gray wolves are the part of the National Forest. Wolves are common throughout central (40-50 lbs.) but live in family groups of 2-4 individuals.

Although wolves are not aggressive towards humans in the wild, they will attack to defend. Wolves may look or react, such as growl and stare, as a threat to their territory. They may display aggression towards people, especially when hunting and raising young (April - August).

To minimize conflicts and make your stay here more enjoyable:

- ✓ Drive slowly for better visibility, leaving opportunities.
- ✓ Never feed or approach a wild animal such as a bear, lion, or wolf.
- ✓ Keep food and garbage in a secure place.
- ✓ Keep dogs under control at all times and leashed when possible.
- ✓ If wolves are near your camp:
  - Continue sleep in a tent or vehicle, if available.
  - Engage or harass against them, if necessary.

Mexican wolves are protected as an endangered species under a special "Nonlethal Experimental Rule".

#### You May:

- observe wolf

- photograph

- feed

- touch

#### You May Not:

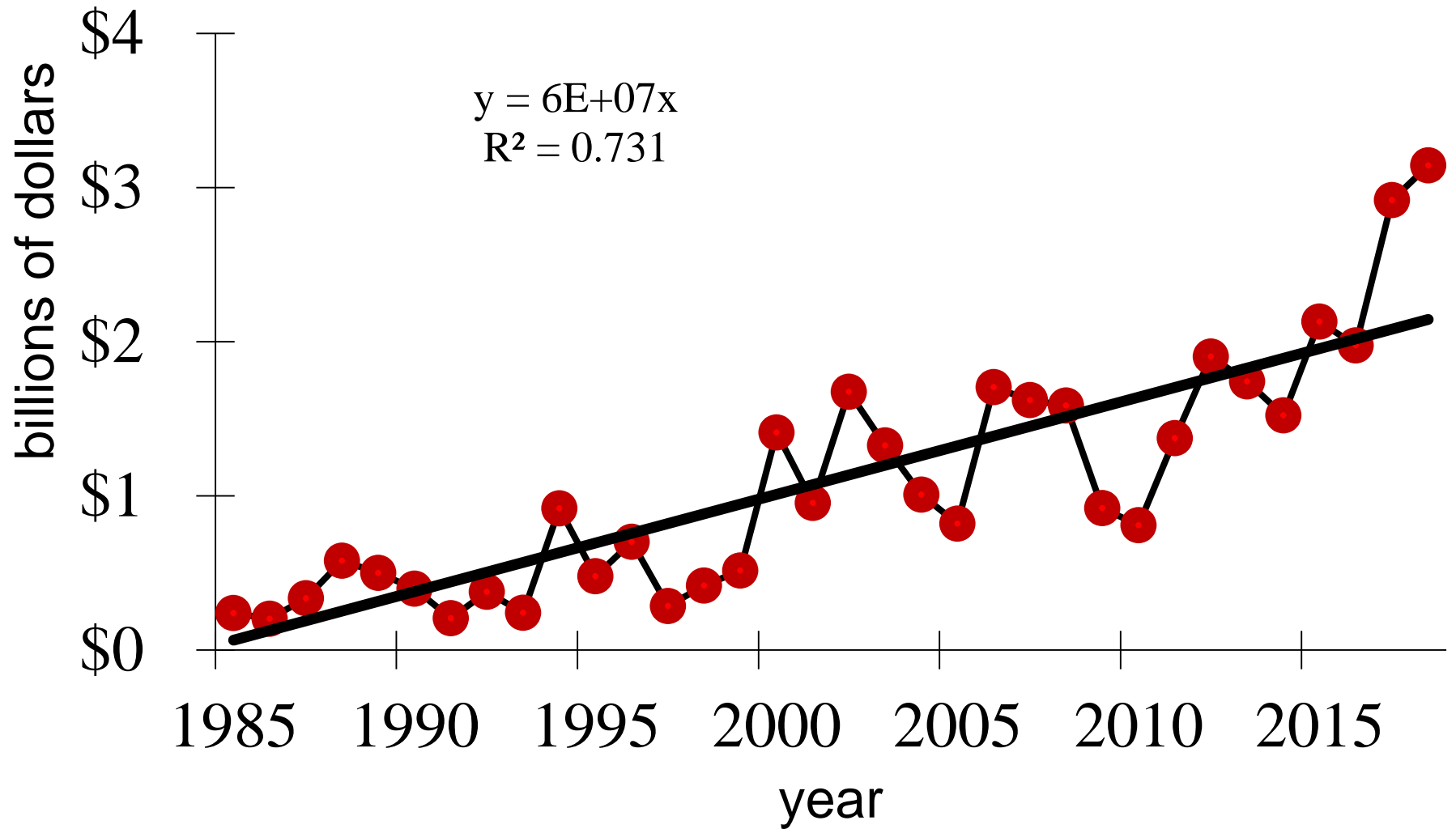
- intentionally harm, harass, or

- interfere with their behavior.

- use or apply a wolf attractant or

- feed any wolf.

# U.S. Wildfire Suppression Costs 1985 – 2018



Data from National Interagency Fire Center 2019

# RANGER DISTRICT

## BUT MANAGING WATERSHEDS IS ...



## ...A BETTER INVESTMENT!



P51-04 U.S. Department of Agriculture • Forest Service

UMCOR Lompoc, CA



### REWARD OFFERED FOR INFORMATION MEXICAN GRAY WOLVES

Up to \$10,000 is offered for information leading to the apprehension of individuals responsible for the deaths of any Mexican gray wolves in New Mexico. Mexican gray wolves exist in the mountains of New Mexico and as wolf populations increase, encounters may increase.

Individuals with information on wolf deaths are requested to report it to the U.S. Fish and Wildlife Service, Office of Law Enforcement in Albuquerque, New Mexico. Those individuals will kept anonymous.

Individuals with information they believe may be helpful should contact one of the following:

### NO Garbage Service



### You are now in Wolf Country

Ecological Mexican gray wolves are the part of the National Forest. Wolves are Common Nongame-mammal species (42-50 lbs.) that live in family groups of 2-4 individuals.

Although wolves are not aggressive towards humans in the wild, they will continue to attack. Wolves may feed on carcasses, such as livestock and feral, on a forest in their territory. They may display aggressive behavior toward people, especially when hunting and raising young (March - August).

To minimize conflicts and make your stay here more enjoyable:

- ✓ Drive slowly for better visibility, leaving space between vehicles.
- ✓ Never feed or approach a wild animal such as a bear, lion, or wolf.
- ✓ Keep food and garbage in a secure place.
- ✓ Keep dogs under control at all times and leashed when possible.
- ✓ If wolves are near your camp:
  - Camp dogs in a tent or vehicle, if possible.
  - Dig holes or burn holes under tents, if necessary.

Mexican wolves are protected as an endangered species under a special "Nonmammal Experimental Rule".

You May:

- remove wolf carcasses from the forest.
- use a rifle or wolf attack because it is not a wolf.

You May Not:

- intentionally shoot, wound, or kill a wolf or wolf pup.
- use a rifle or wolf attack because it is not a wolf.

Remember...

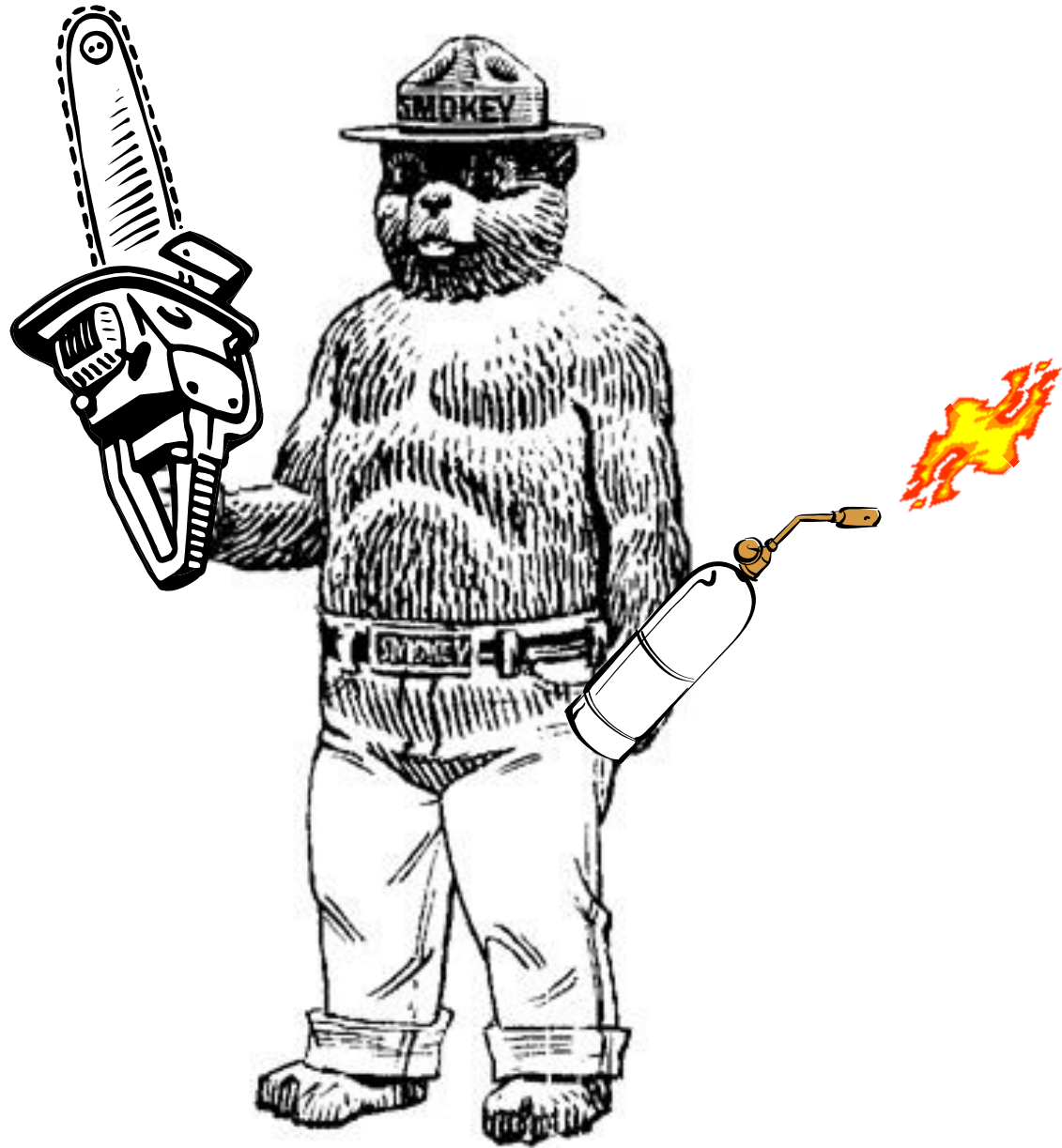


Only YOU can prevent forest fires...

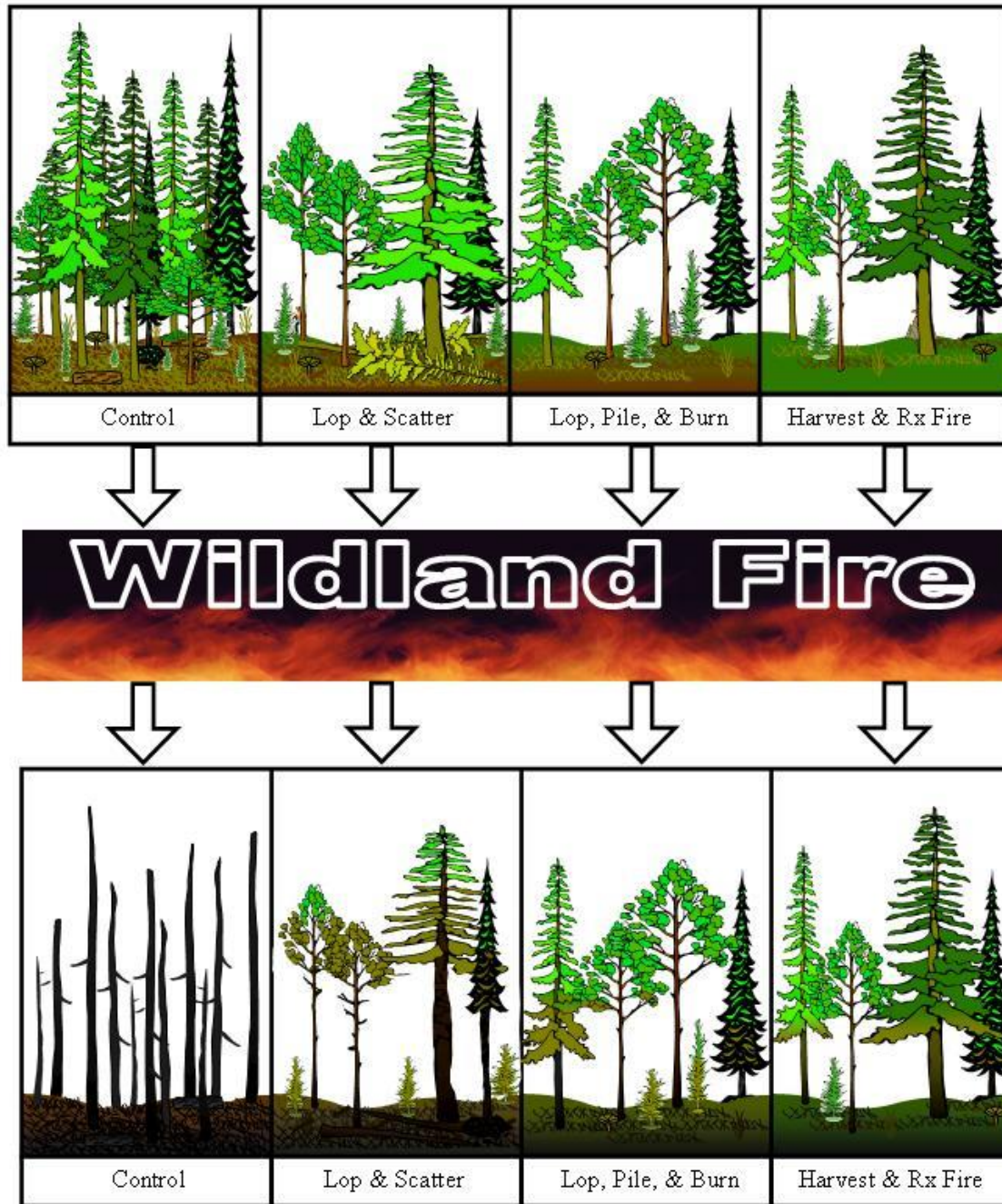
Remember...

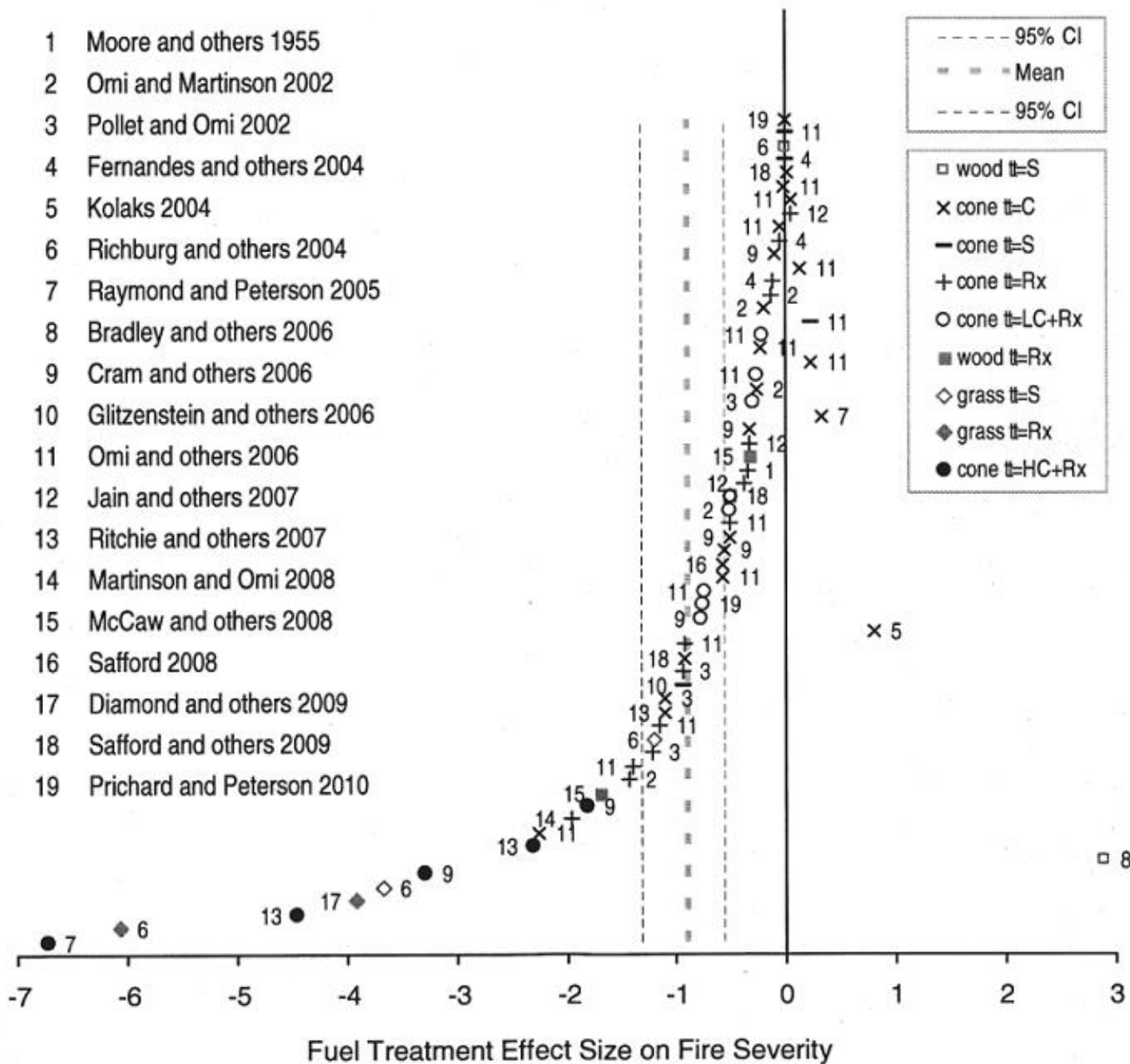


Only YOU can postpone forest fires...



But I can change fire behavior (and severity)!





(From Martinson & Omi 2013)



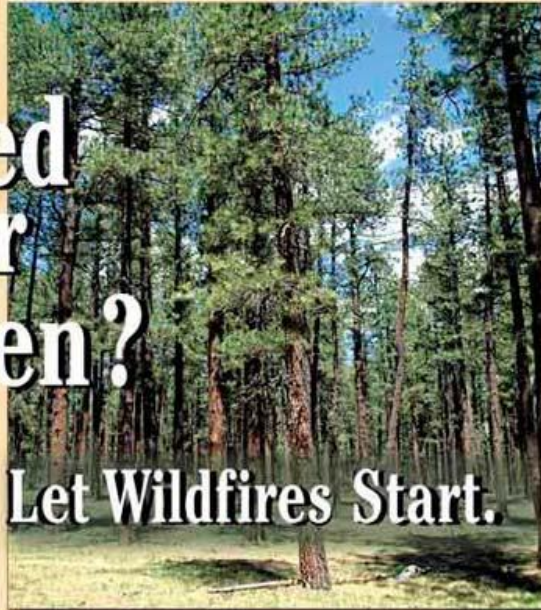
New Mexicans have  
to make tough choices...



Red  
or  
Green?



Red  
or  
Green?



Think Smart, Don't Let Wildfires Start.

"Know Before You Go" [www.nmfireinfo.com](http://www.nmfireinfo.com)



New Mexicans have  
to make tough choices...



Christmas,  
Please!



Red  
AND  
Green

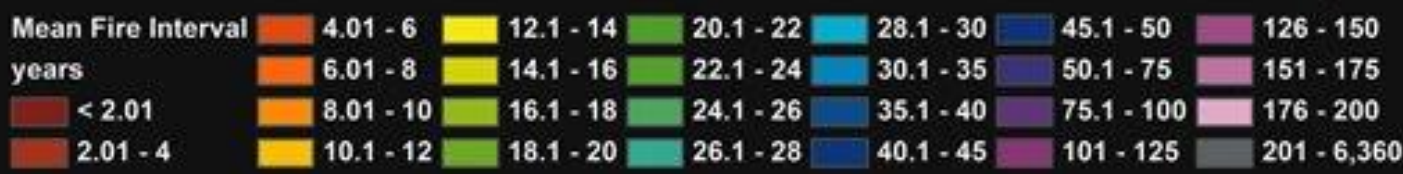
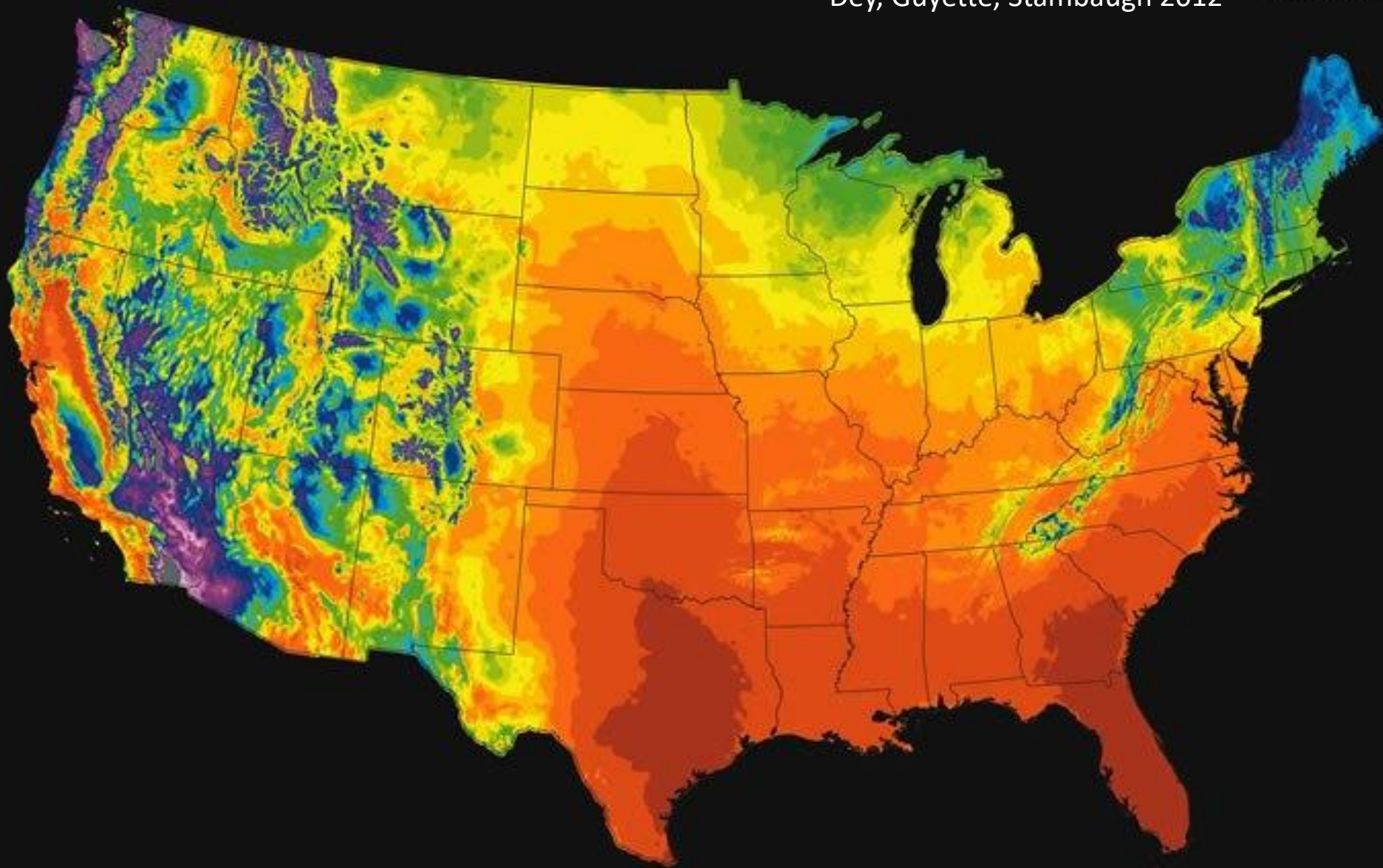
"Know Before You Go" [www.nmfireinfo.com](http://www.nmfireinfo.com)

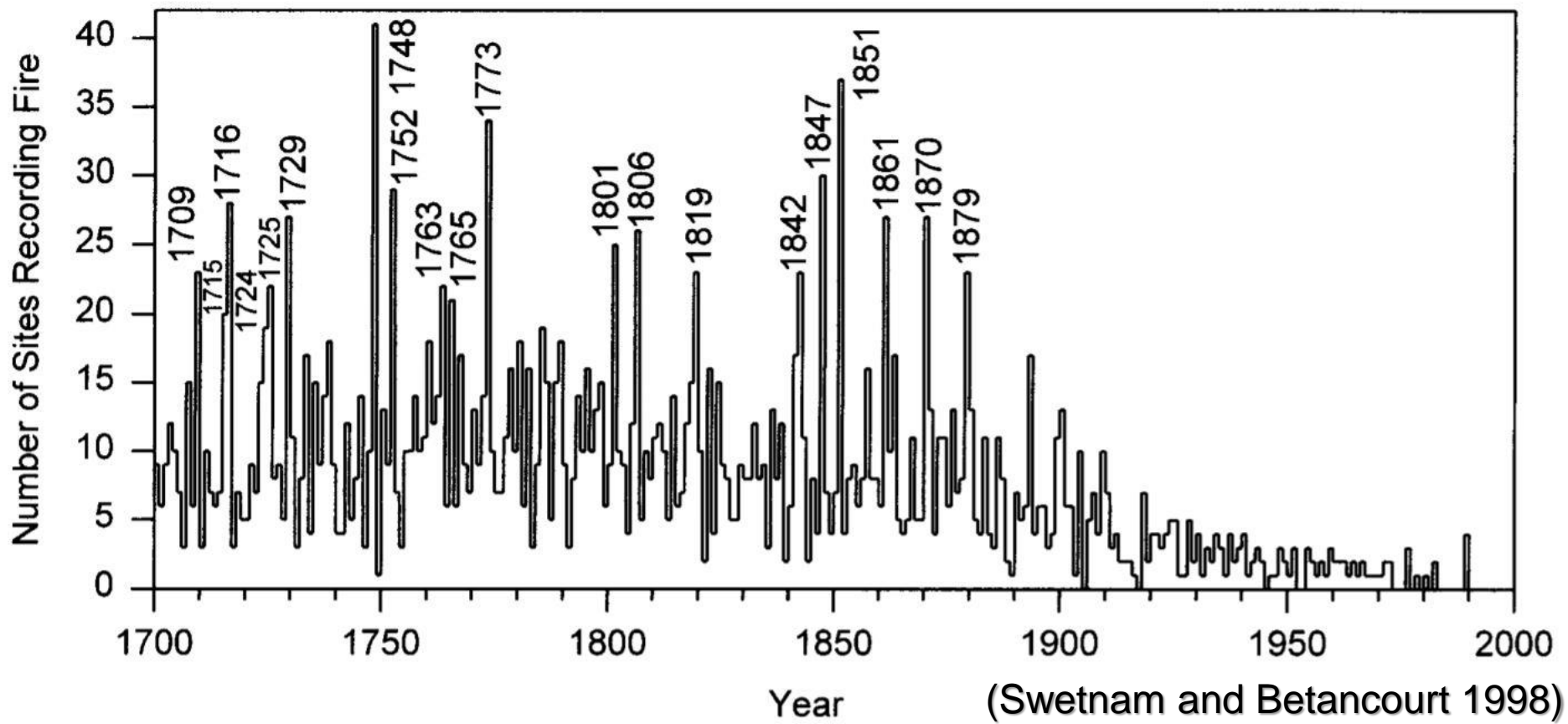
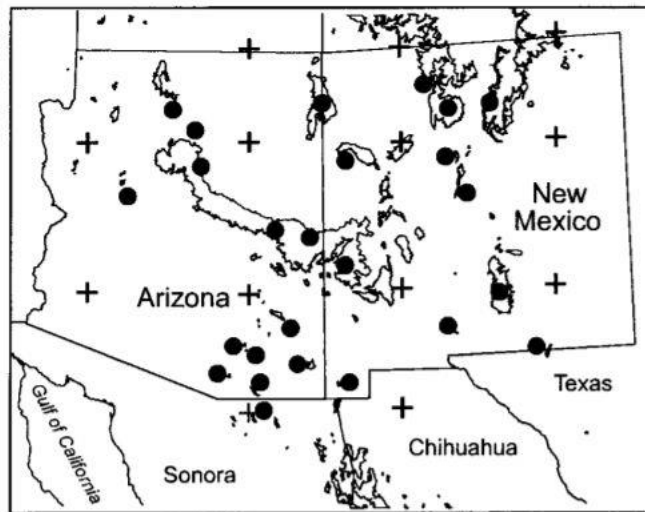


**Earth is a uniquely fire planet.  
Within our solar system, earth alone  
(probably) is suitable for fire (Stephen Pyne).**

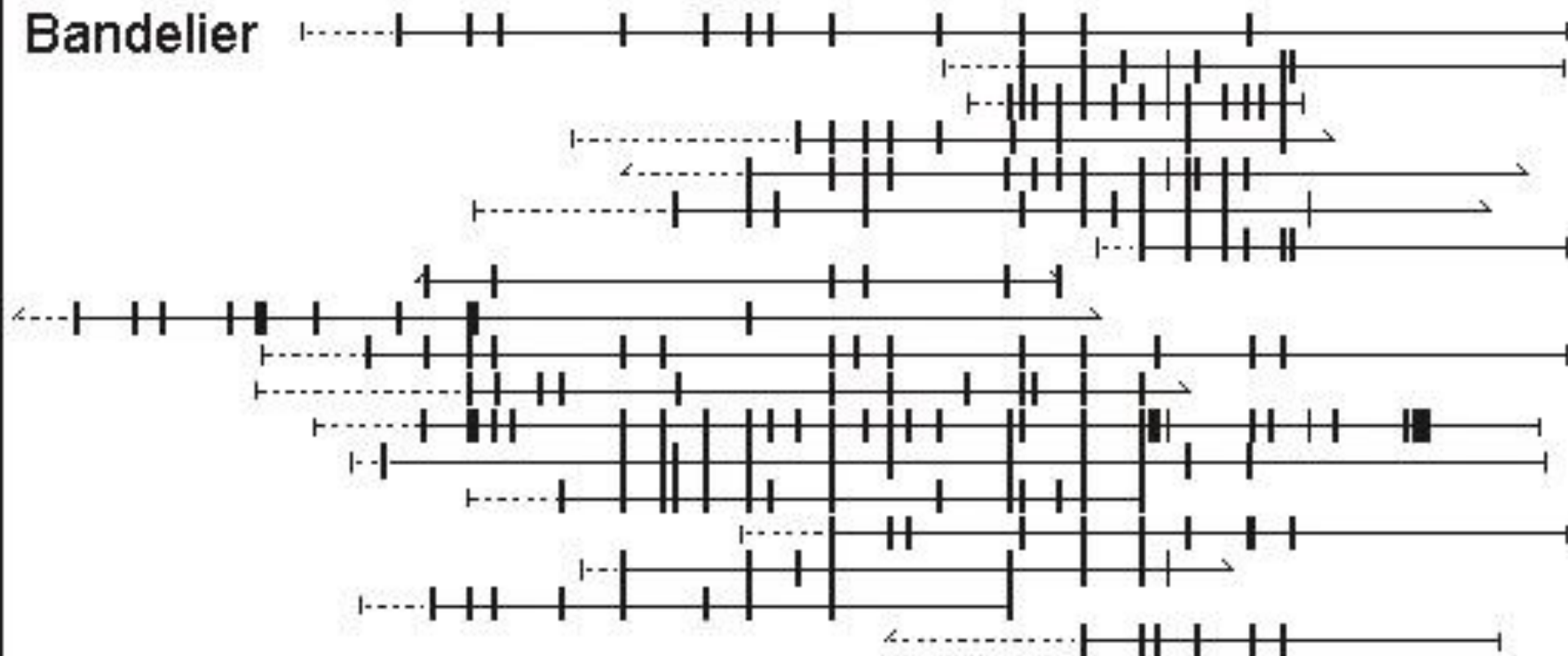


- Contains all the essential constituents
- The processes needed to mix them
- Suitable environment for their interaction

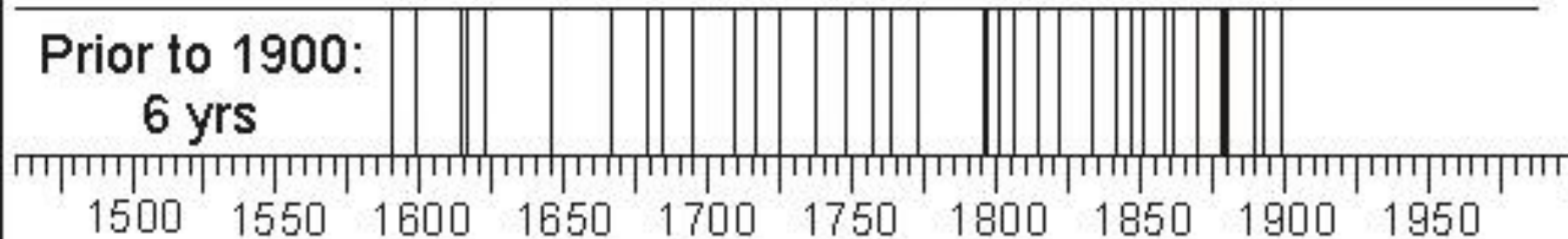


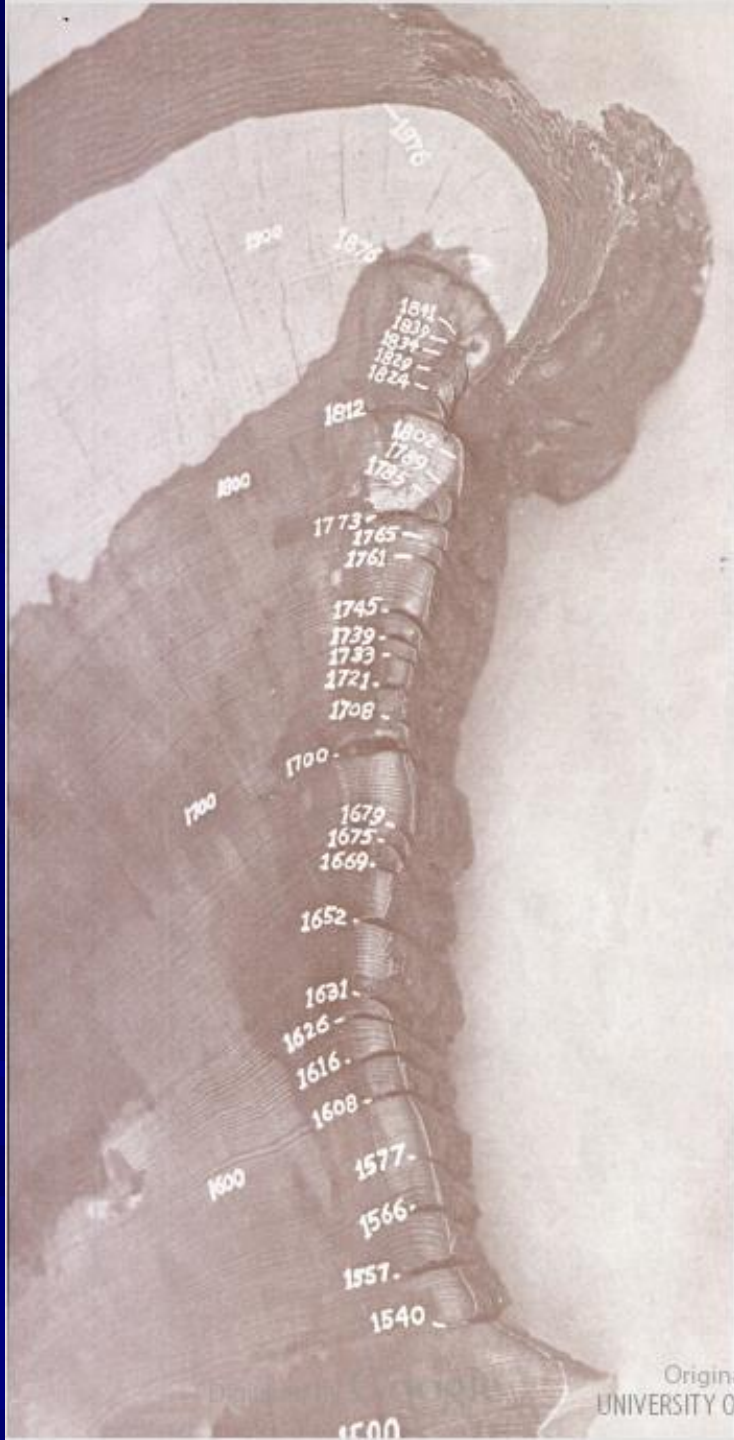


**Bandelier**



**Prior to 1900:  
6 yrs**





# Chimney Spring Forest Fire History

John H. Dieterich



Research Paper RM-220  
Rocky Mountain Forest and Range Experiment Station  
Forest Service  
U.S. Department of Agriculture

Original from  
UNIVERSITY OF MINNESOTA

475 yrs old

31 fire scars in 336 years

2.4 – 4.9 composite fire index

Dieterich 1980

# Fire Paradox





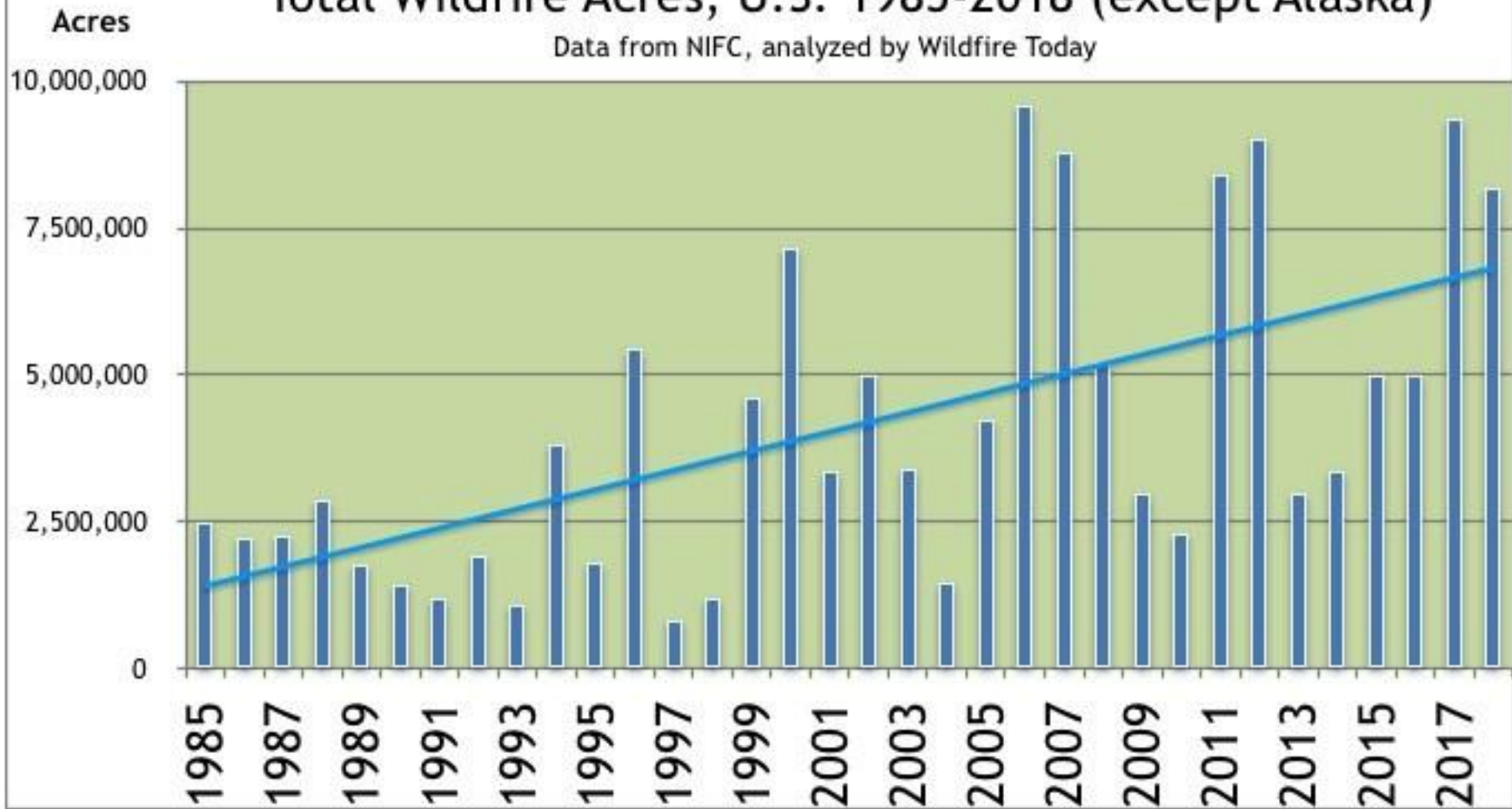
# National Interagency Fire Center

## Federal Firefighting Costs (Suppression Only)

Year	Fires	Acres	Forest Service	DOI Agencies	Total
1985	82,591	2,896,147	\$161,505,000	\$78,438,000	\$239,943,000
1986	85,907	2,719,162	\$111,625,000	\$91,153,000	\$202,778,000
1987	71,300	2,447,296	\$253,657,000	\$81,452,000	\$335,109,000
1988	72,750	5,009,290	\$429,609,000	\$149,317,000	\$578,926,000
1989	48,949	1,827,310	\$331,672,000	\$168,115,000	\$499,787,000
1990	66,481	4,621,621	\$253,700,000	\$144,252,000	\$397,952,000
1991	75,754	2,953,578	\$132,300,000	\$73,820,000	\$206,120,000
1992	87,394	2,069,929	\$290,300,000	\$87,166,000	\$377,466,000
1993	58,810	1,797,574	\$184,000,000	\$56,436,000	\$240,436,000
1994	79,107	4,073,579	\$757,200,000	\$161,135,000	\$918,335,000
1995	82,234	1,840,546	\$367,000,000	\$110,126,000	\$477,126,000
1996	96,363	6,065,998	\$547,500,000	\$153,683,000	\$701,183,000
1997	66,196	2,856,959	\$179,100,000	\$105,048,000	\$284,148,000
1998	81,043	1,329,704	\$306,800,000	\$109,904,000	\$416,704,000
1999	92,487	5,626,093	\$361,100,000	\$154,416,000	\$515,516,000
2000	92,250	7,383,493	\$1,076,000,000	\$334,802,000	\$1,410,802,000
2001	84,079	3,570,911	\$683,122,000	\$269,574,000	\$952,696,000
2002	73,457	7,184,712	\$1,279,000,000	\$395,040,000	\$1,674,040,000
2003	63,629	3,960,842	\$1,023,500,000	\$303,638,000	\$1,327,138,000
2004	65,461	8,097,880	\$726,000,000	\$281,244,000	\$1,007,244,000
2005	66,753	8,689,389	\$524,900,000	\$294,054,000	\$818,954,000
2006	96,385	9,873,745	\$1,280,419,000	\$424,058,000	\$1,704,477,000
2007	85,705	9,328,045	\$1,149,654,000	\$470,491,000	\$1,620,145,000
2008	78,979	5,292,468	\$1,193,073,000	\$392,783,000	\$1,585,856,000
2009	78,792	5,921,786	\$702,111,000	\$218,418,000	\$920,529,000
2010	71,971	3,422,724	\$578,285,000	\$231,214,000	\$809,499,000
2011	74,126	8,711,367	\$1,055,736,000	\$318,789,000	\$1,374,525,000
2012	67,774	9,326,238	\$1,436,614,000	\$465,832,000	\$1,902,446,000
2013	47,579	4,319,546	\$1,341,733,000	\$399,199,000	\$1,740,934,000
2014	63,212	3,595,613	\$1,195,953,000	\$326,194,000	\$1,522,149,000
2015	68,151	10,125,149	\$1,713,000,000	\$417,543,000	\$2,130,543,000
2016	67,595	5,503,538	\$1,603,806,000	\$371,739,000	\$1,975,545,000
2017	71,499	10,026,086	\$2,410,165,000	\$508,000,000	\$2,918,165,000
2018	58,083	8,767,492	\$2,615,256,000	\$528,000,000	\$3,143,256,000

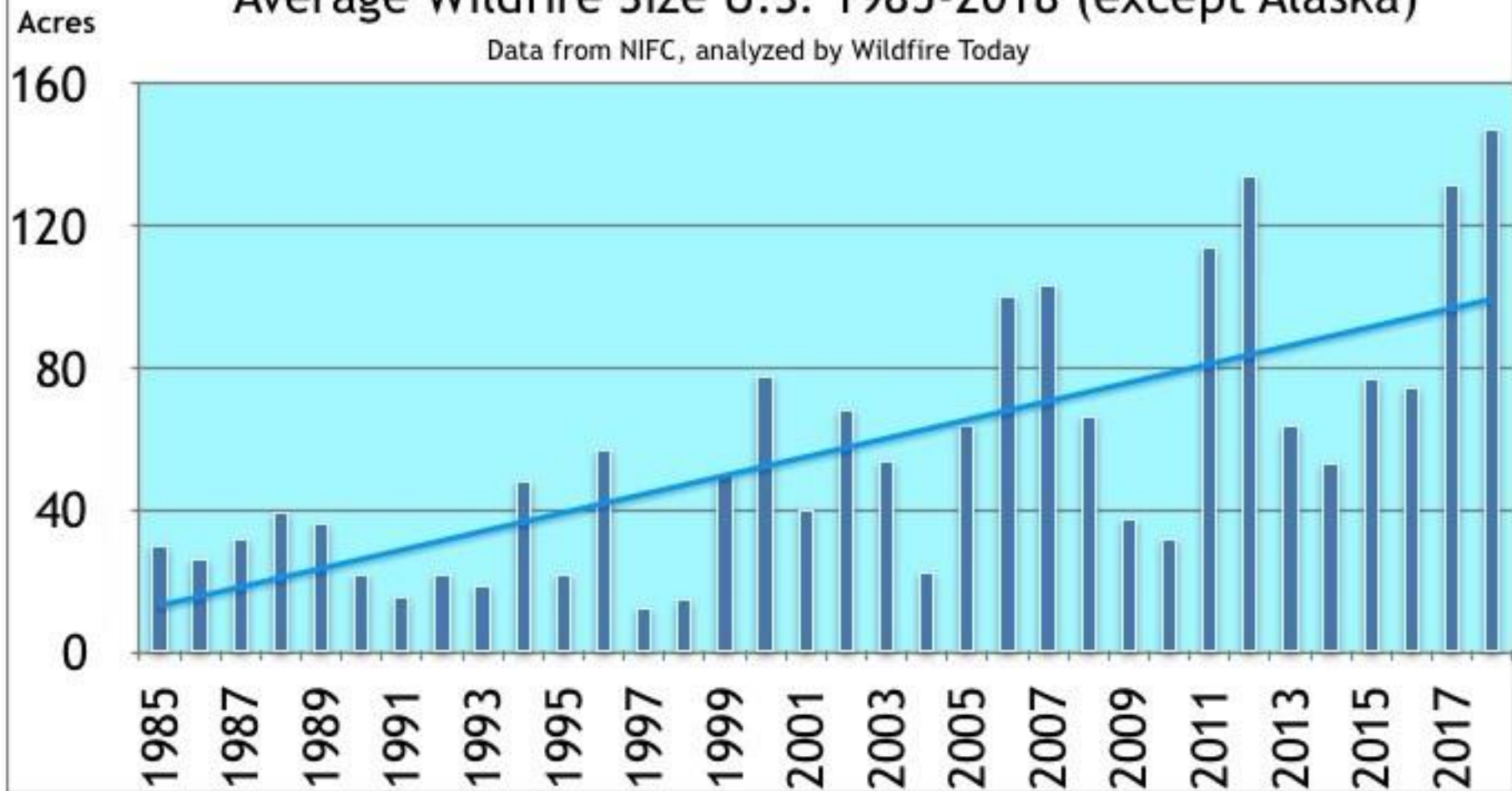
# Total Wildfire Acres, U.S. 1985-2018 (except Alaska)

Data from NIFC, analyzed by Wildfire Today



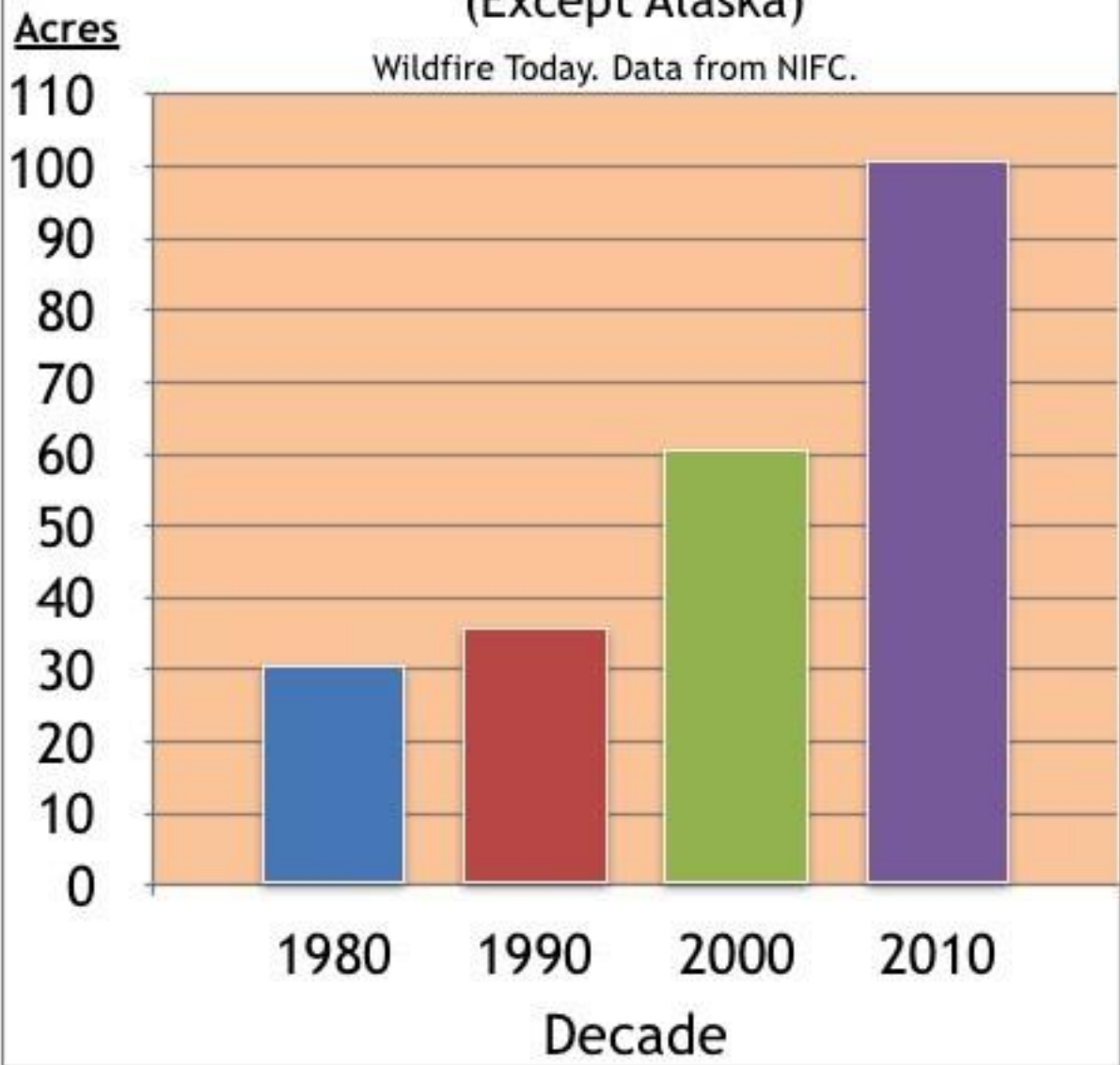
# Average Wildfire Size U.S. 1985-2018 (except Alaska)

Data from NIFC, analyzed by Wildfire Today

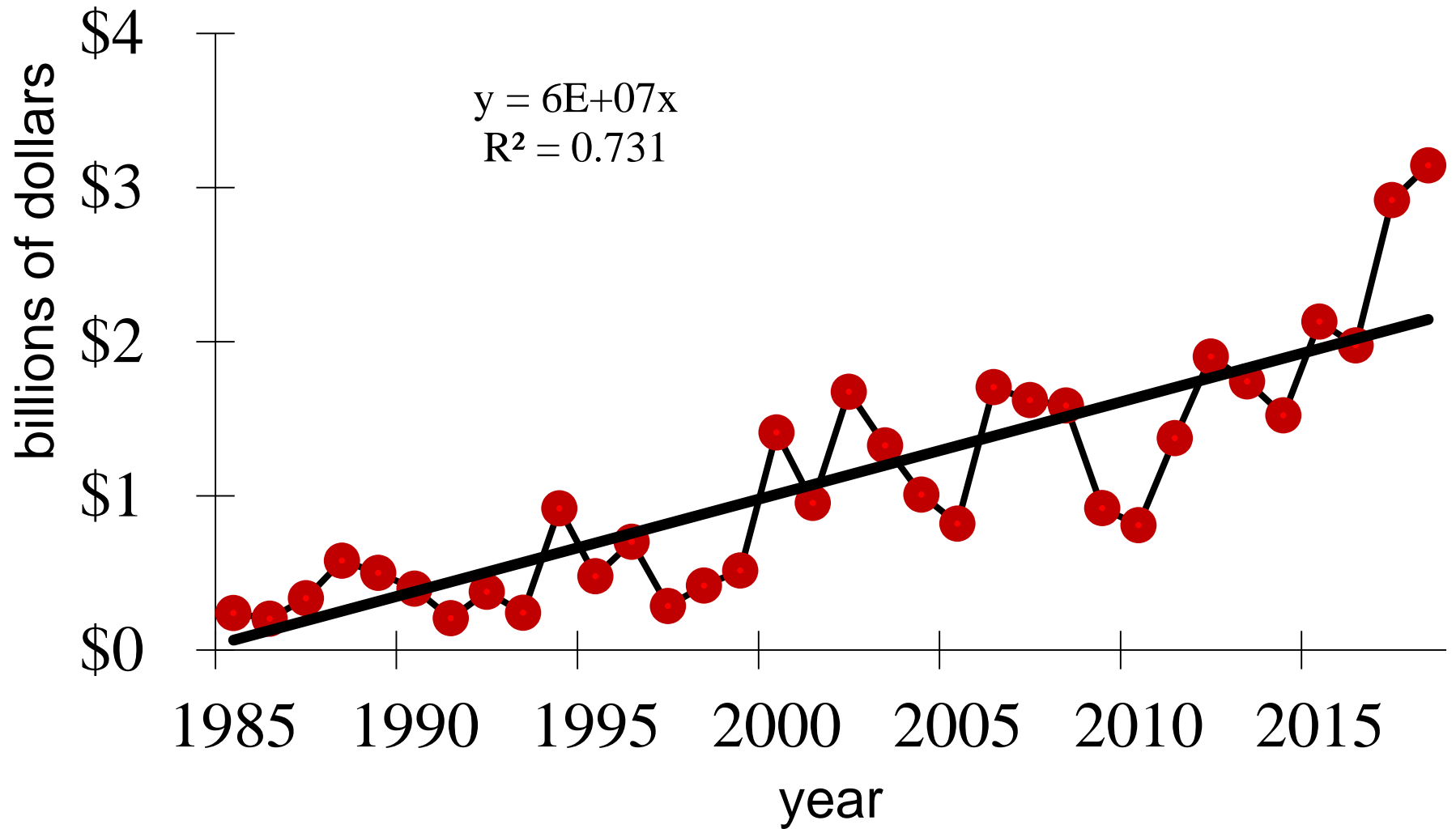


# Average size of wildfires in U.S. 1985-2018 (Except Alaska)

Wildfire Today. Data from NIFC.



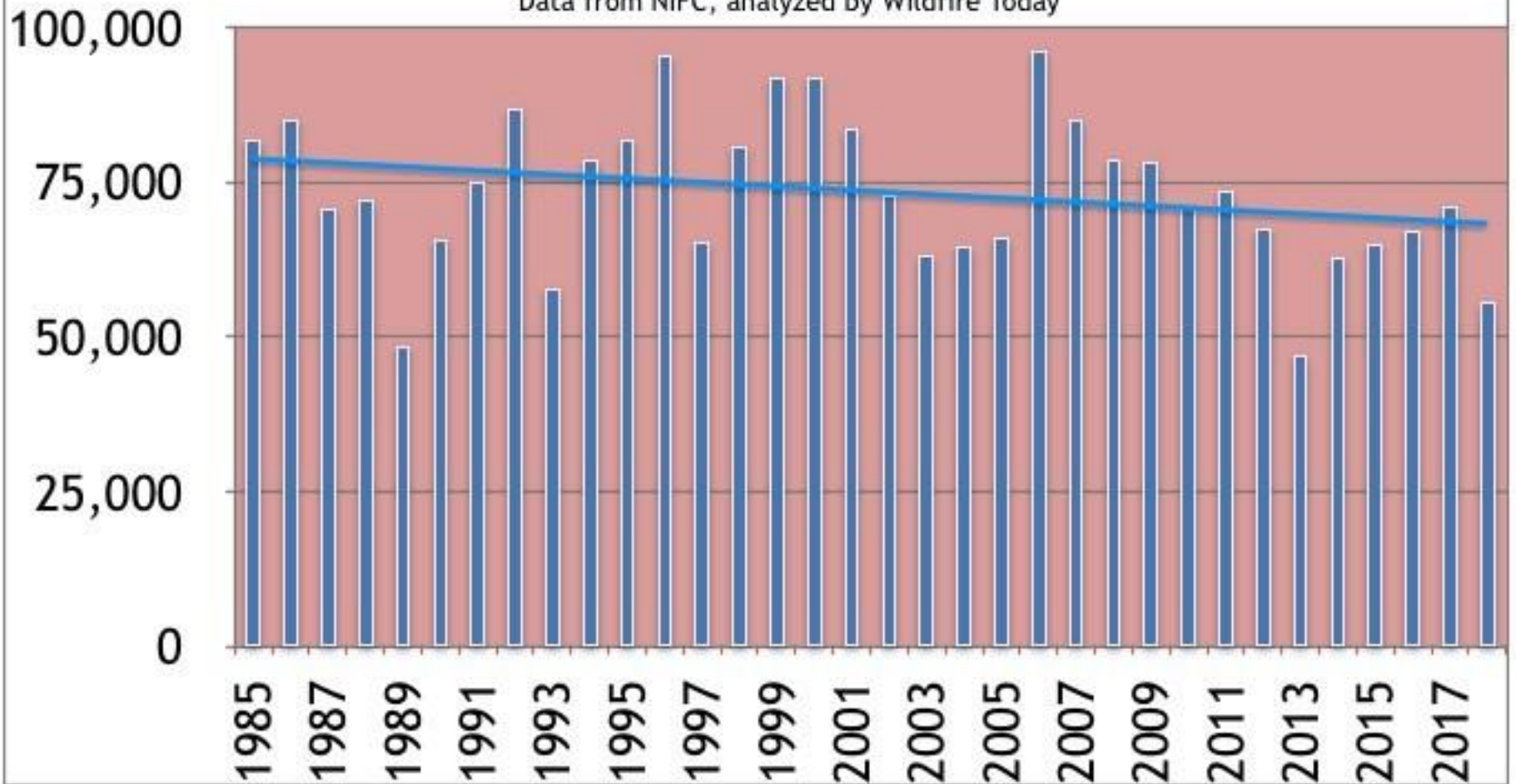
# U.S. Wildfire Suppression Costs 1985 – 2018



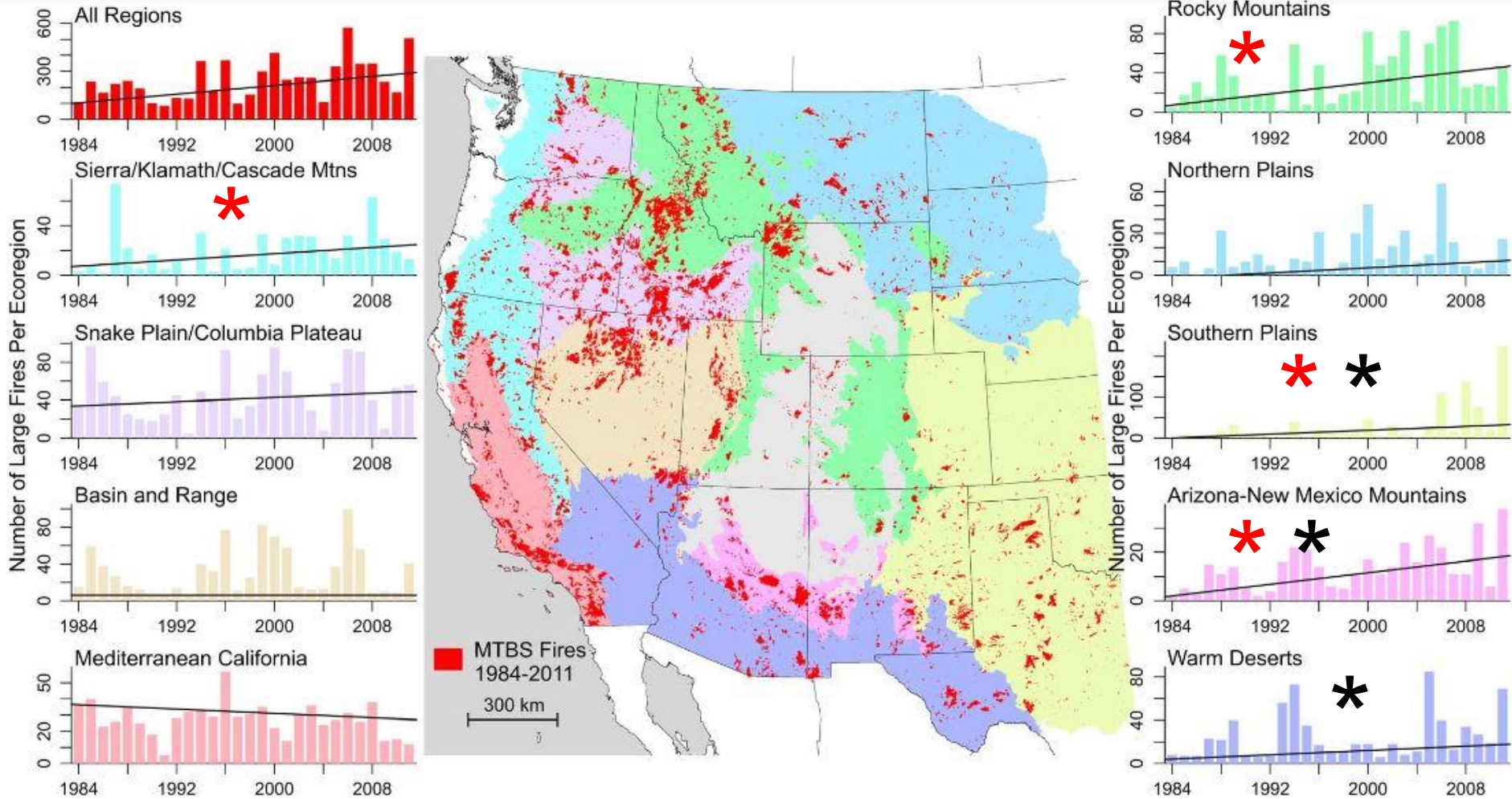
Data from National Interagency Fire Center 2019

# Number of Wildfires, U.S. 1985-2018 (except Alaska)

Data from NIFC, analyzed by Wildfire Today



# Wildfires Greater than 1000 Acres, 1984–2011



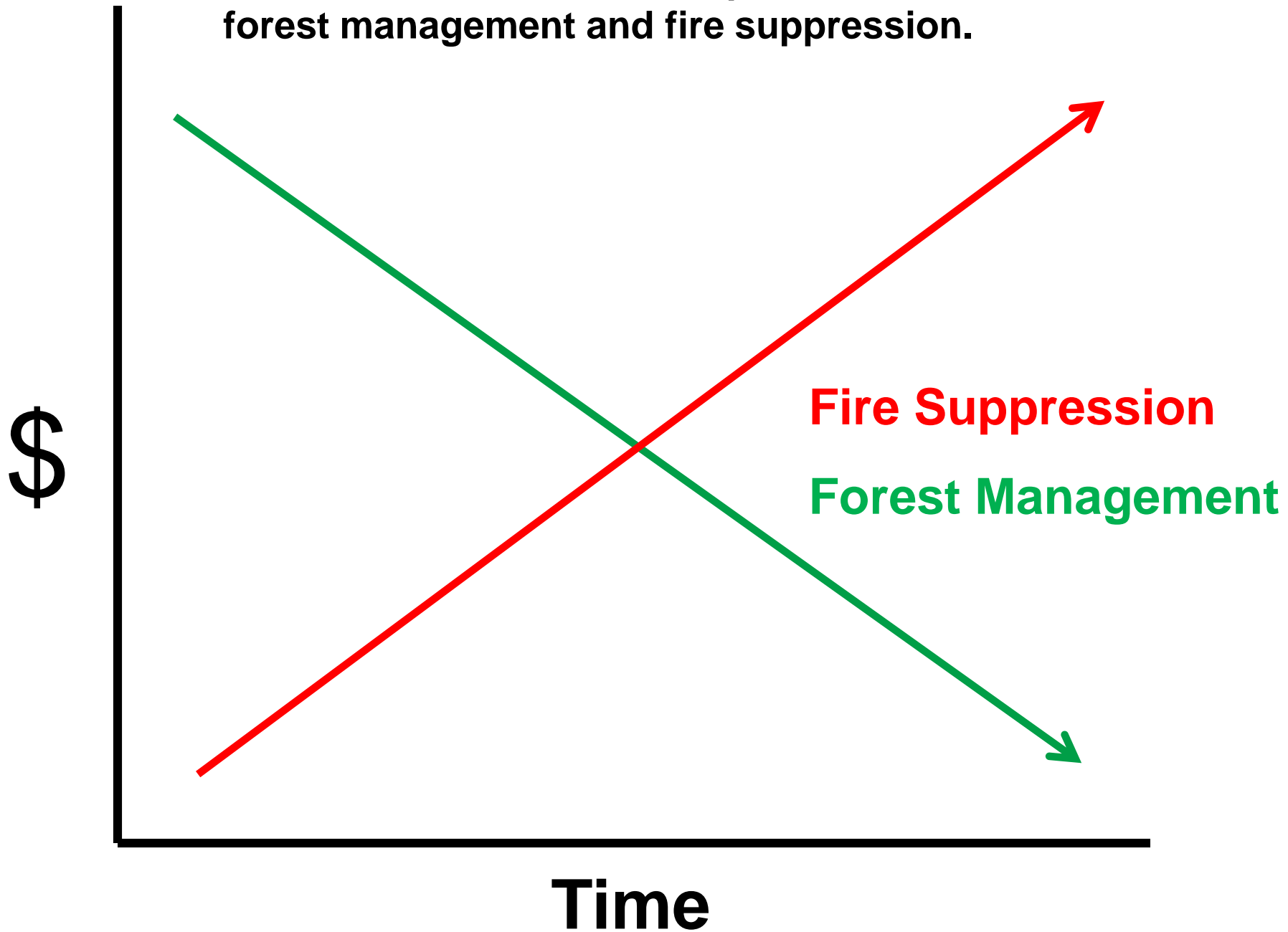
\* Number of large fires per year  $p < 0.05$

✱ Total fire area per year  $p < 0.05$

Dennison et al. 2014

Monitoring Trends in Burn Severity (MTBS) Project – Eidenshink et al. 2007

**General trends in federal expenditures related to forest management and fire suppression.**





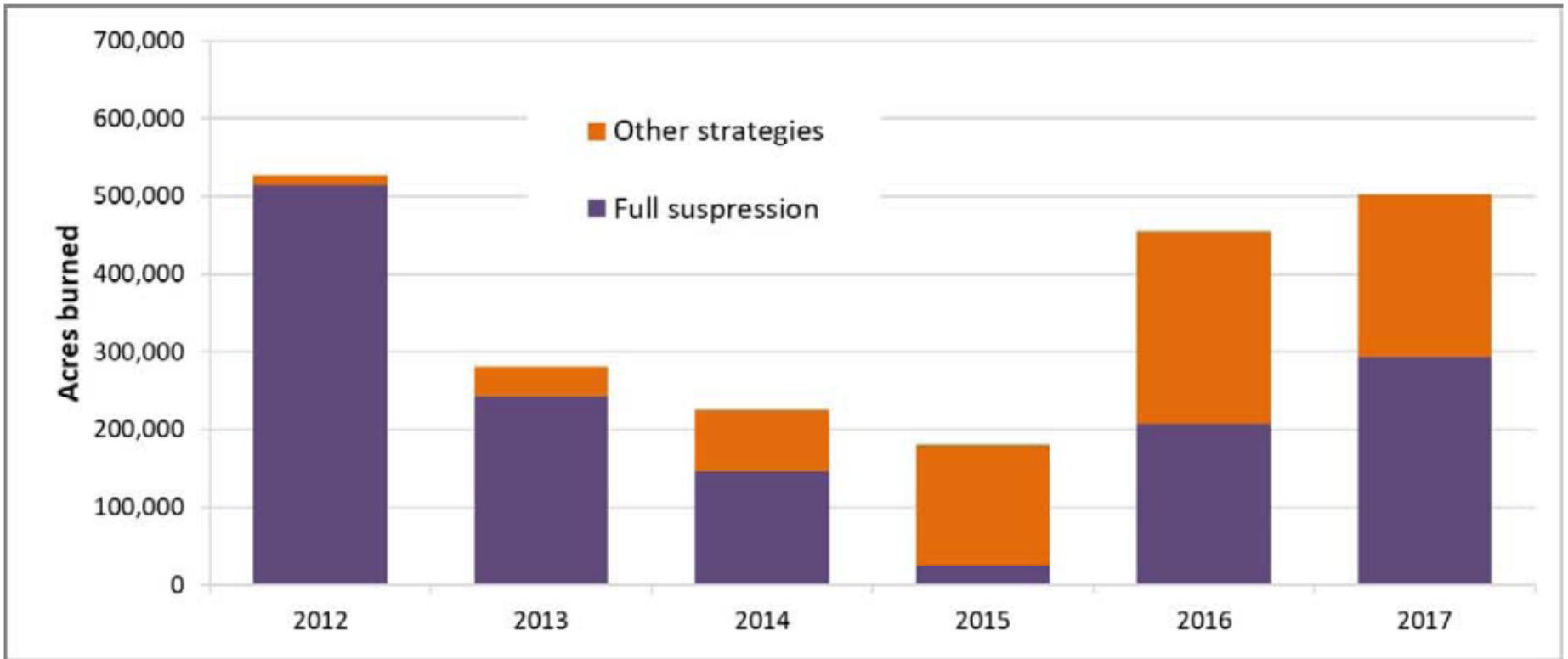


Figure 2. Acres burned by wildfires greater than 100 acres in Arizona and New Mexico, 2012 to 2017.<sup>5</sup>

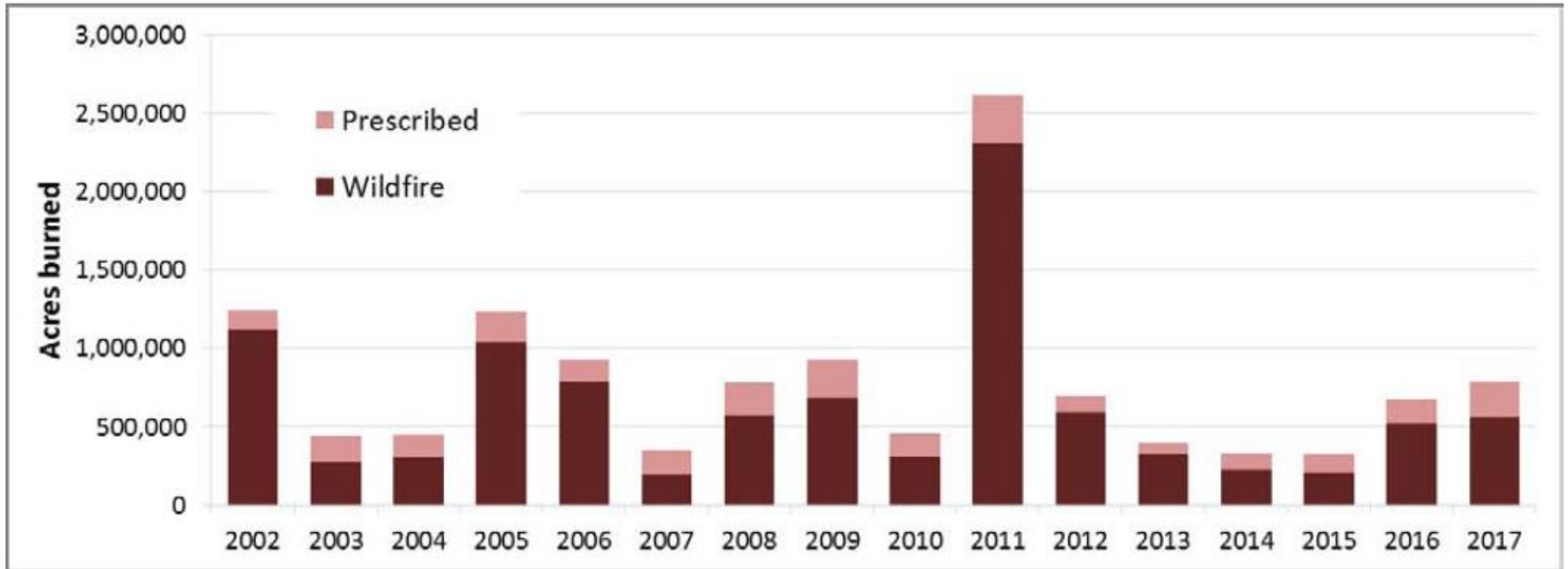


Figure 1. Wildfires and prescribed fires acres burned in Arizona and New Mexico, 2002 to 2017.<sup>4</sup>

# “New” Tool Based on Theory/Idea

- Wildland Fire Use
  - “Light burning” – early 1900s
  - “The switch in time that saved the pine” – Schiff 1962 based on USFS policy change in 1943 in the south (based on Chapman 1912).
  - “Natural prescribed fire” ~ 1971
  - “Scorched earth policy” – 1974 Jackson, WY
  - “Wildland fire use” - 1976
  - “Let burn” – Yellowstone 1988 (1.4 M ac)
  - “Managed wildfire for resource objectives” – 2016
  - “Fire” – 2018

# “New” Tool Based on Theory/Idea

- Wildland Fire Use in New Mexico

- 2017: 44,000 acres

vs.

- 2018: 1873 acres



Photo by Bruce Kilgore 1969

# “New” Tool Based on Theory/Idea

- Corral Fire, NM 2017 – 20,350 acres
- <1% High severity

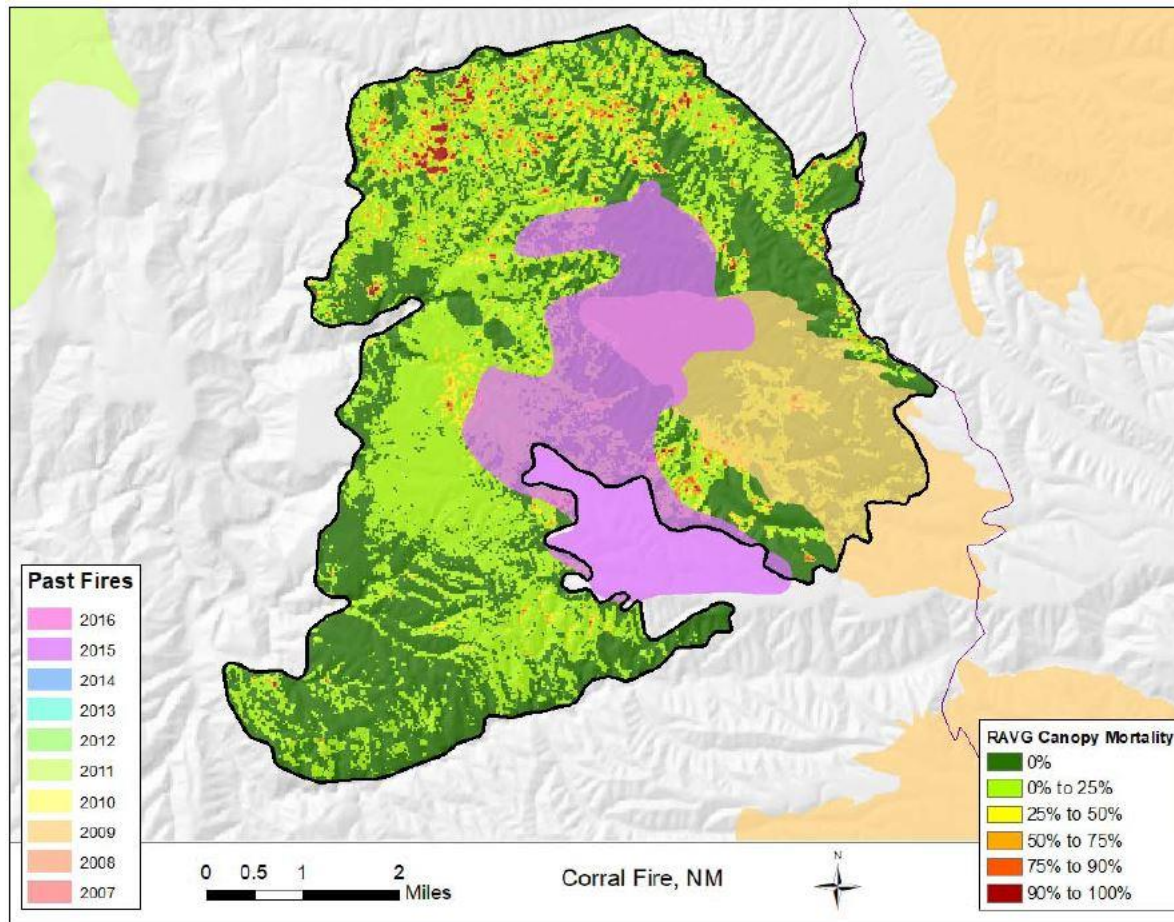
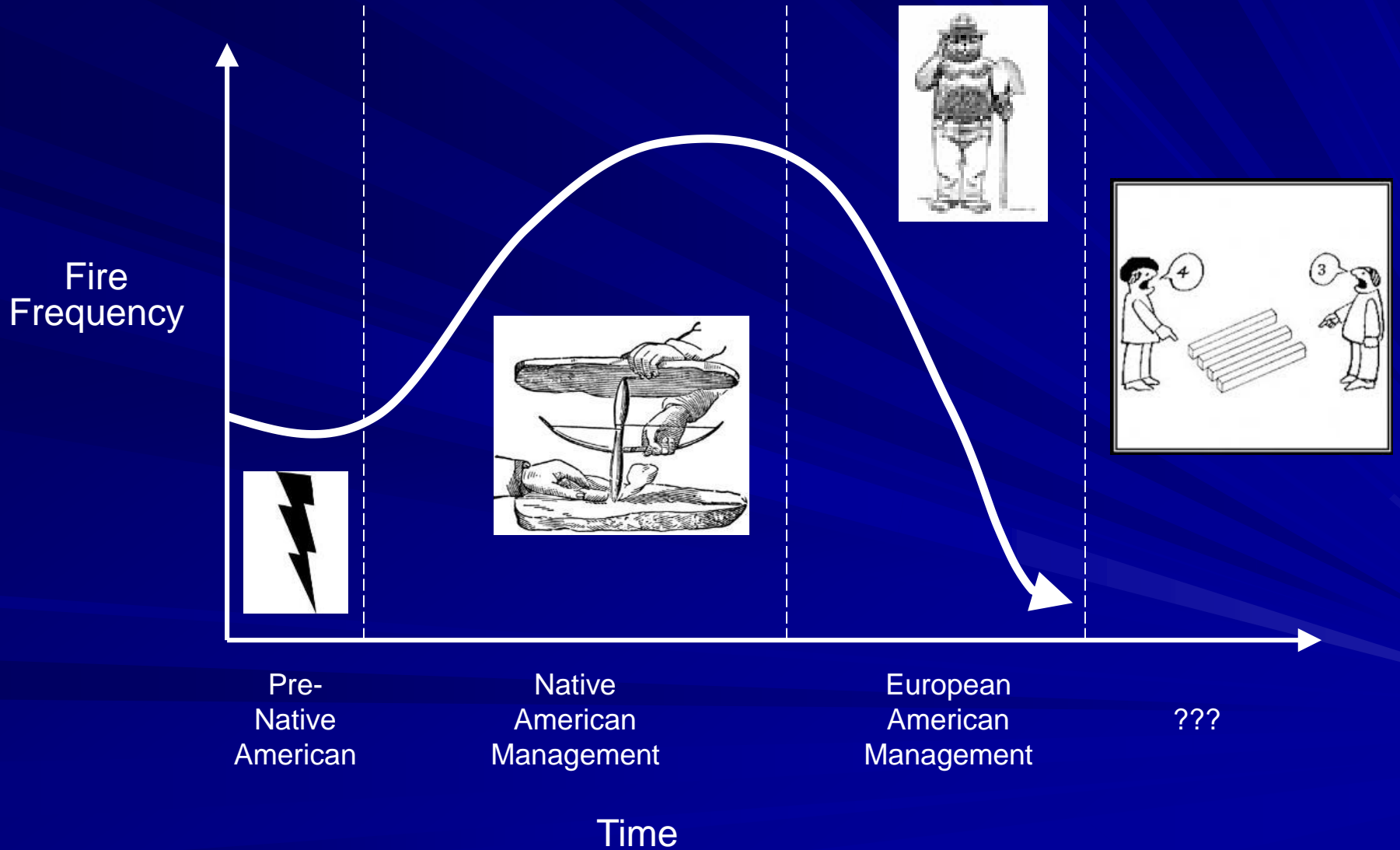
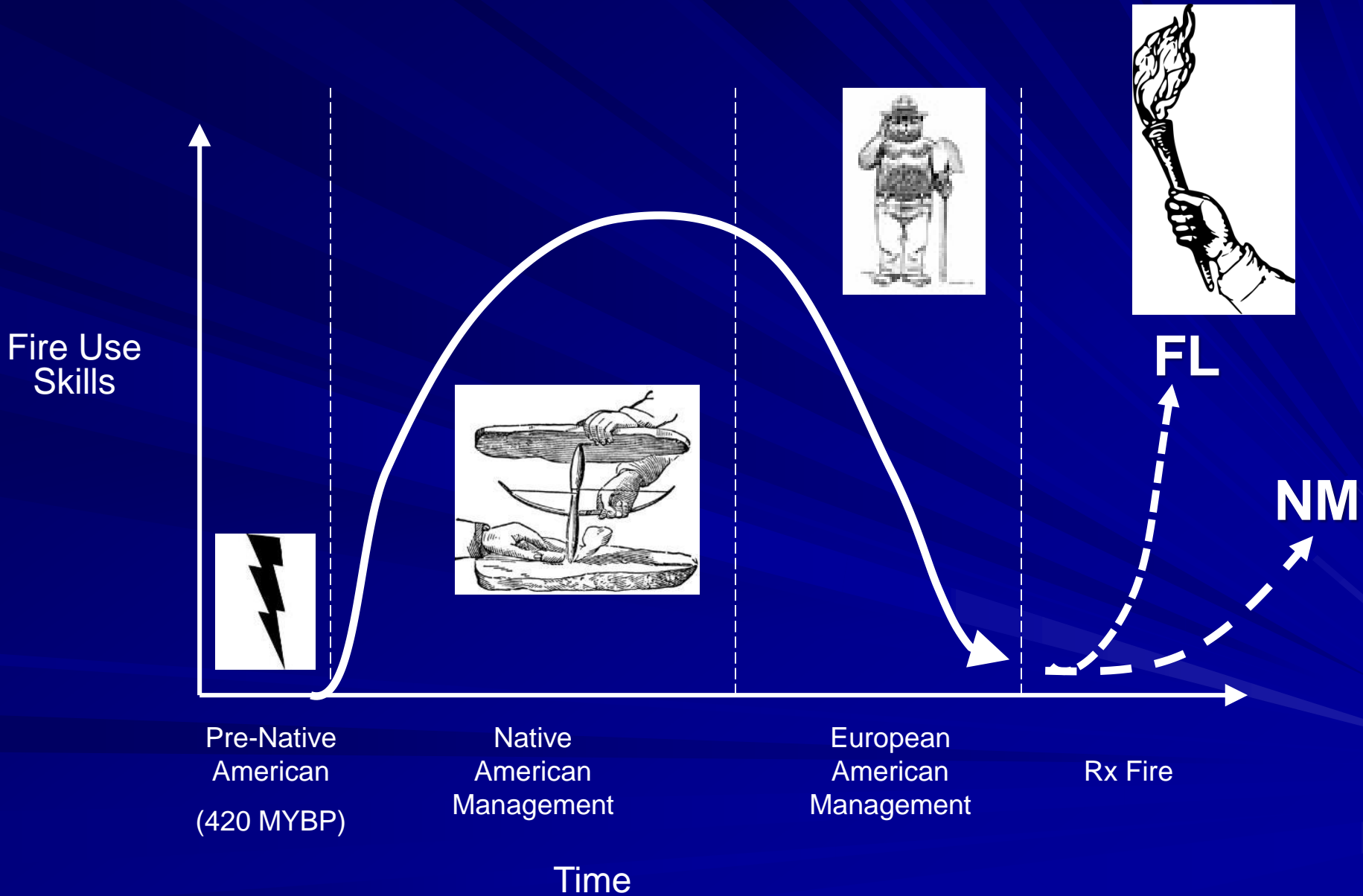


Figure 12. RAVG canopy mortality for the Corral Fire.

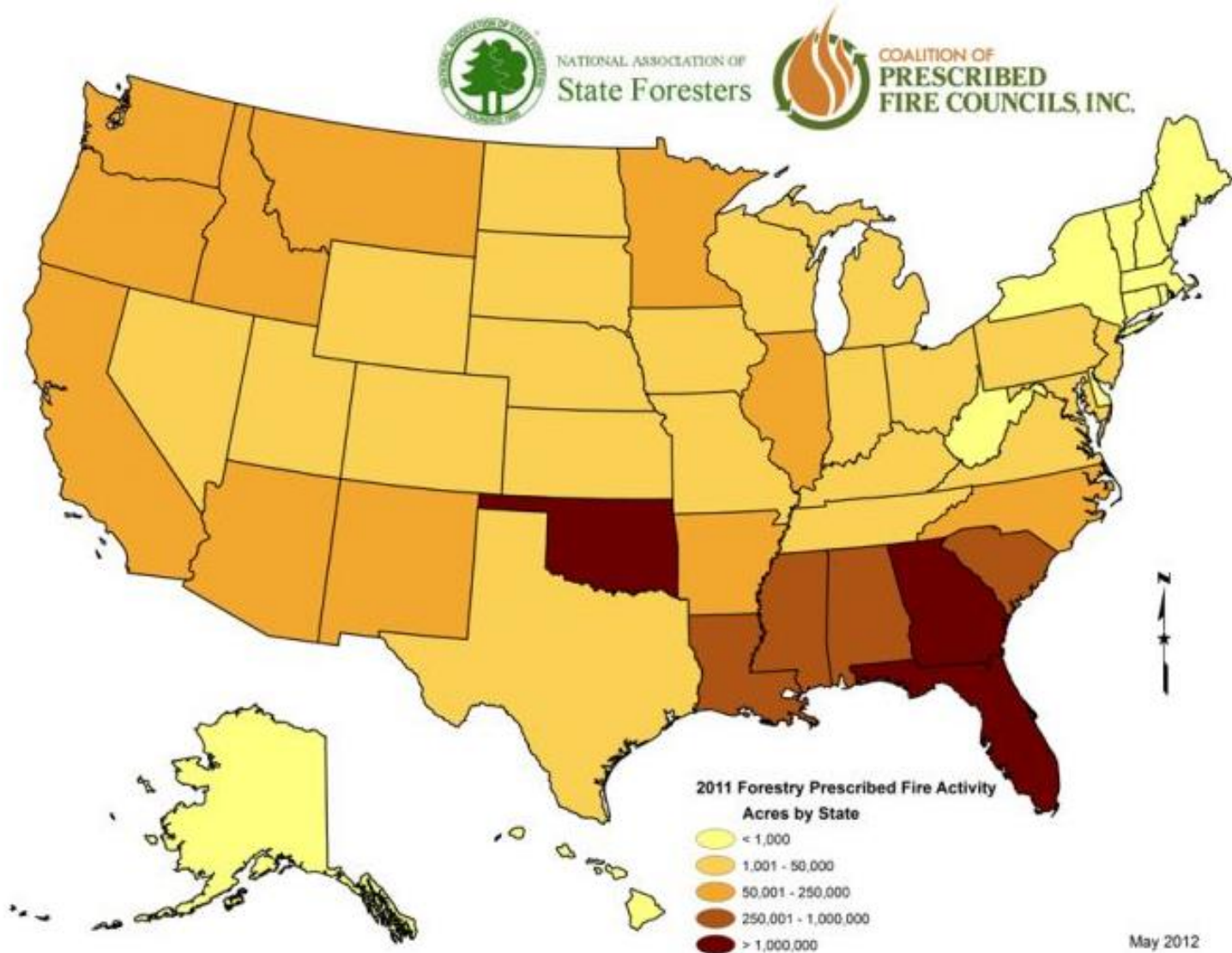
# Fire History



# Fire Use Skills

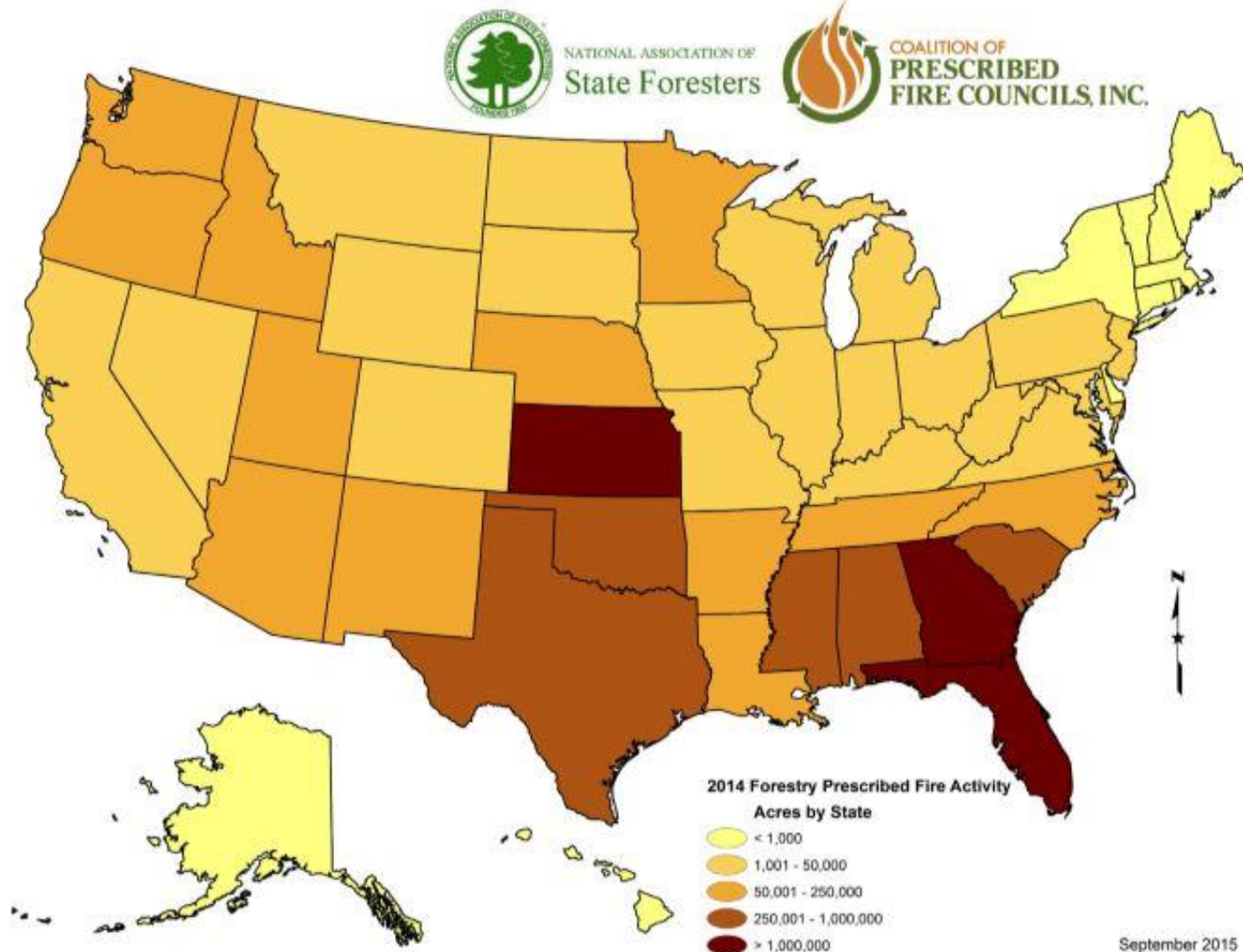


# 2011 Forestry Rx Fire Acres

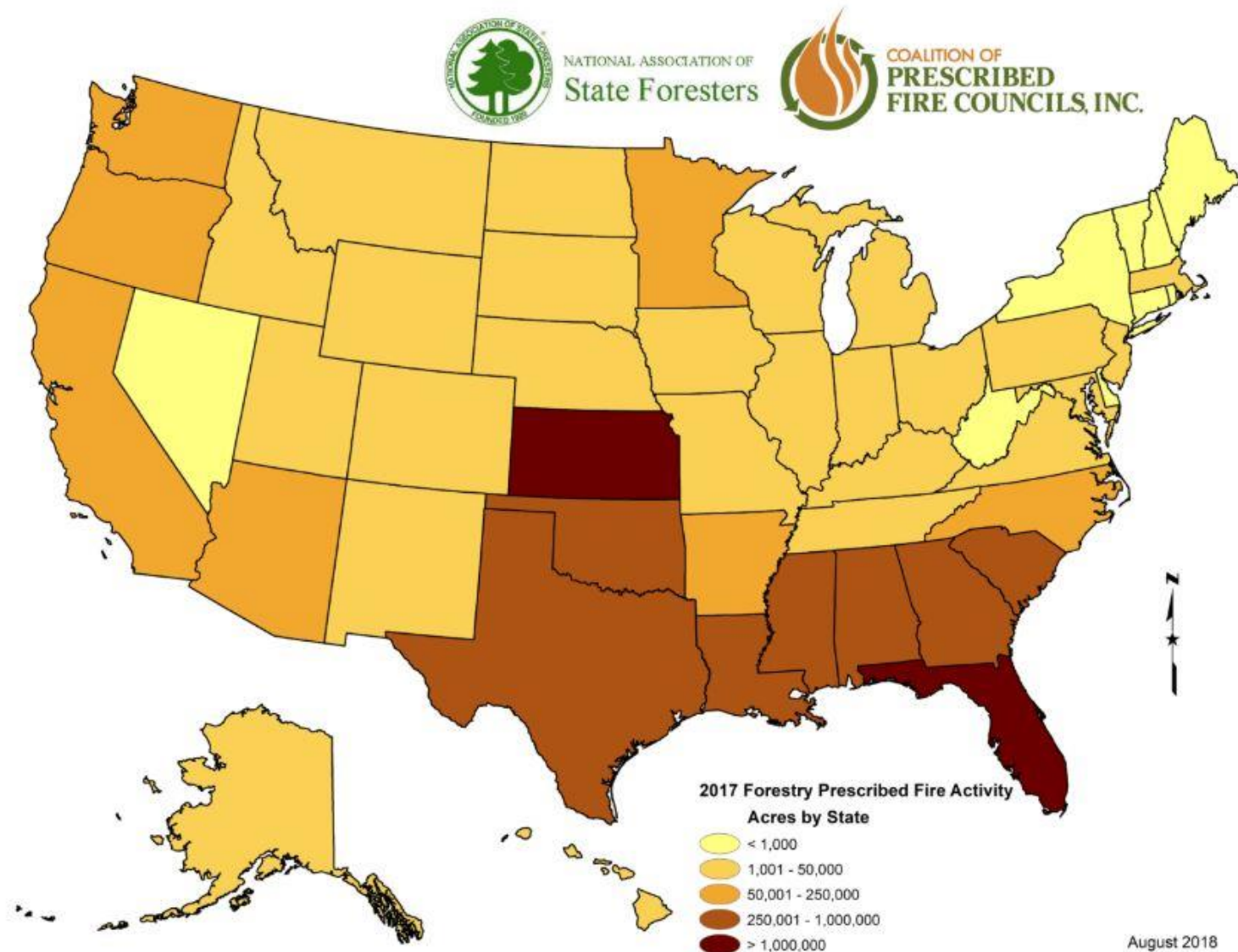




# 2014 Forestry Rx Fire Acres

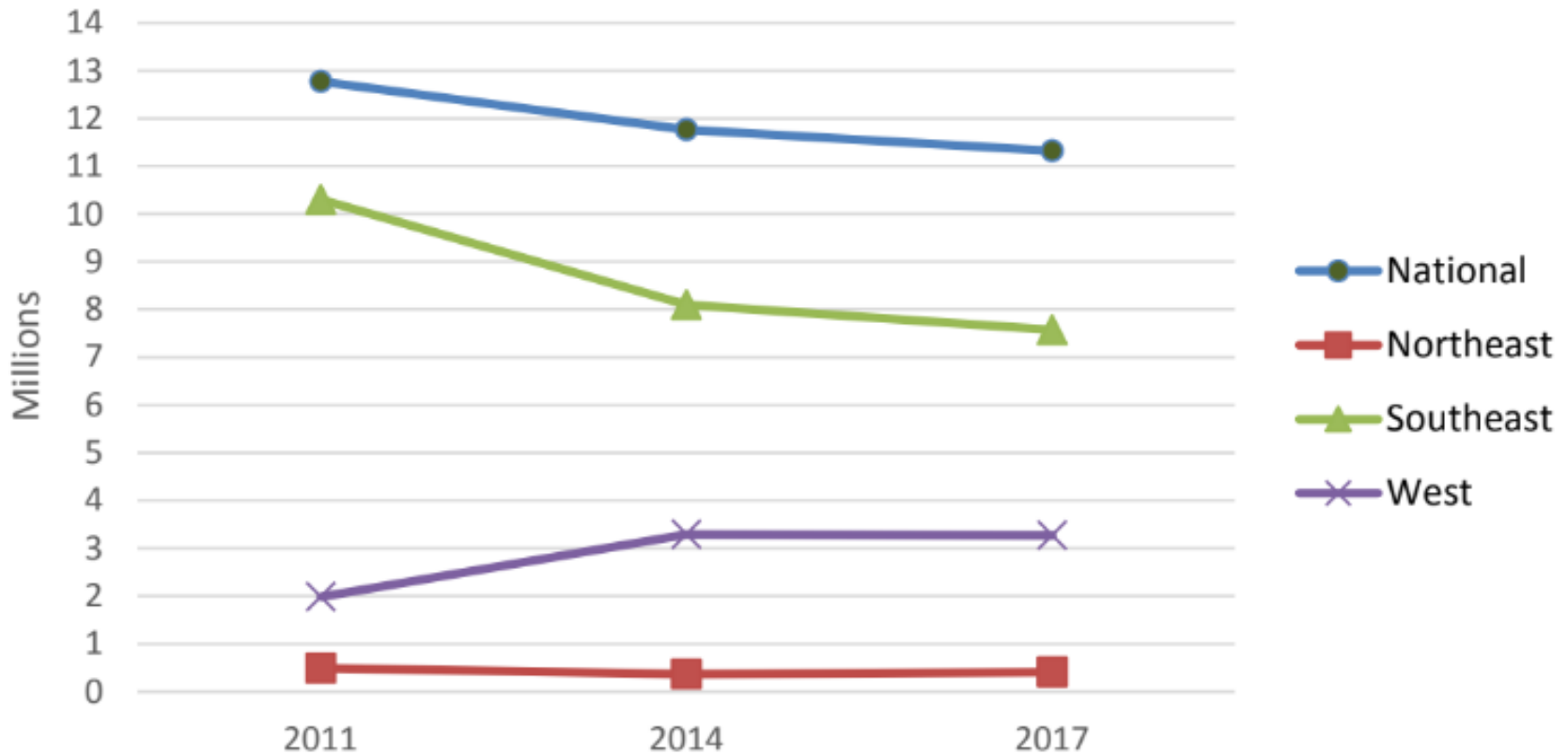


# 2017 Forestry Rx Fire Acres

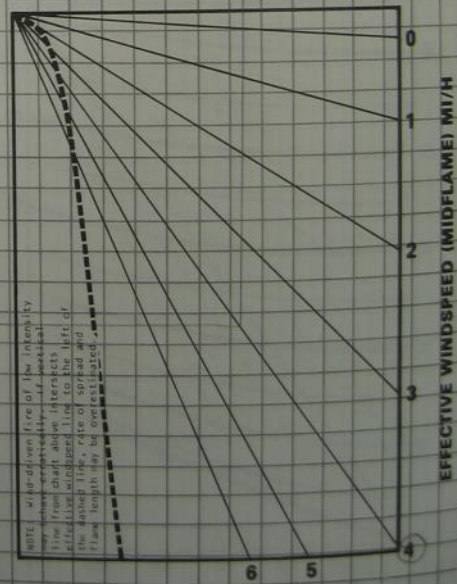
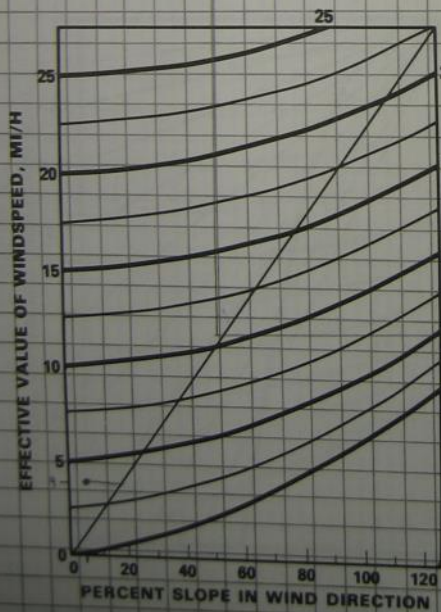
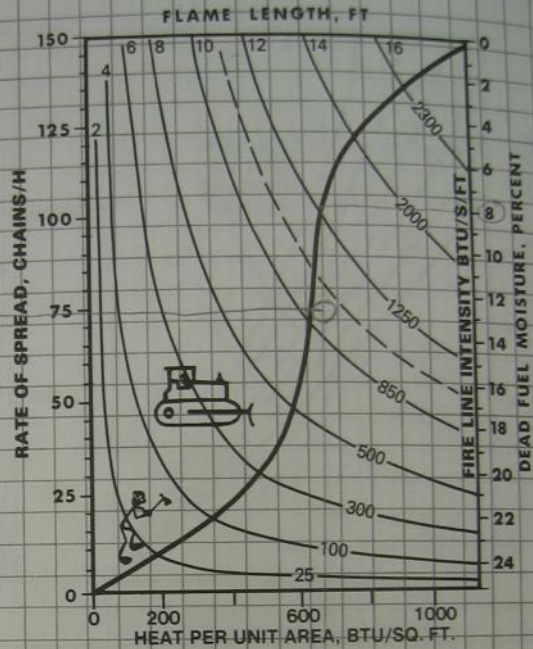
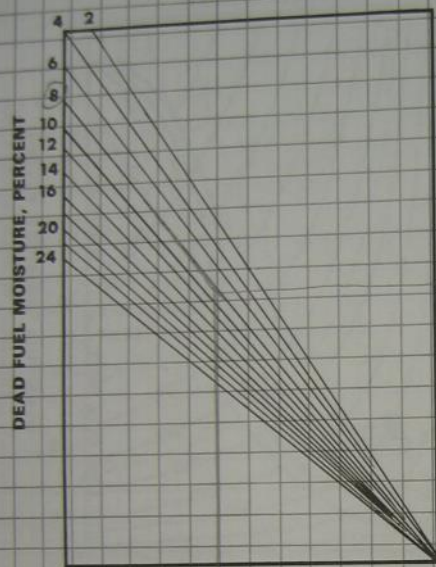


# National Rx Burning Trends

## National Prescribed Burning Trend



### 3. TALL GRASS (2.5 FT) - LOW WINDSPEEDS



# Impact of anthropogenic climate change on wildfire across western US forests

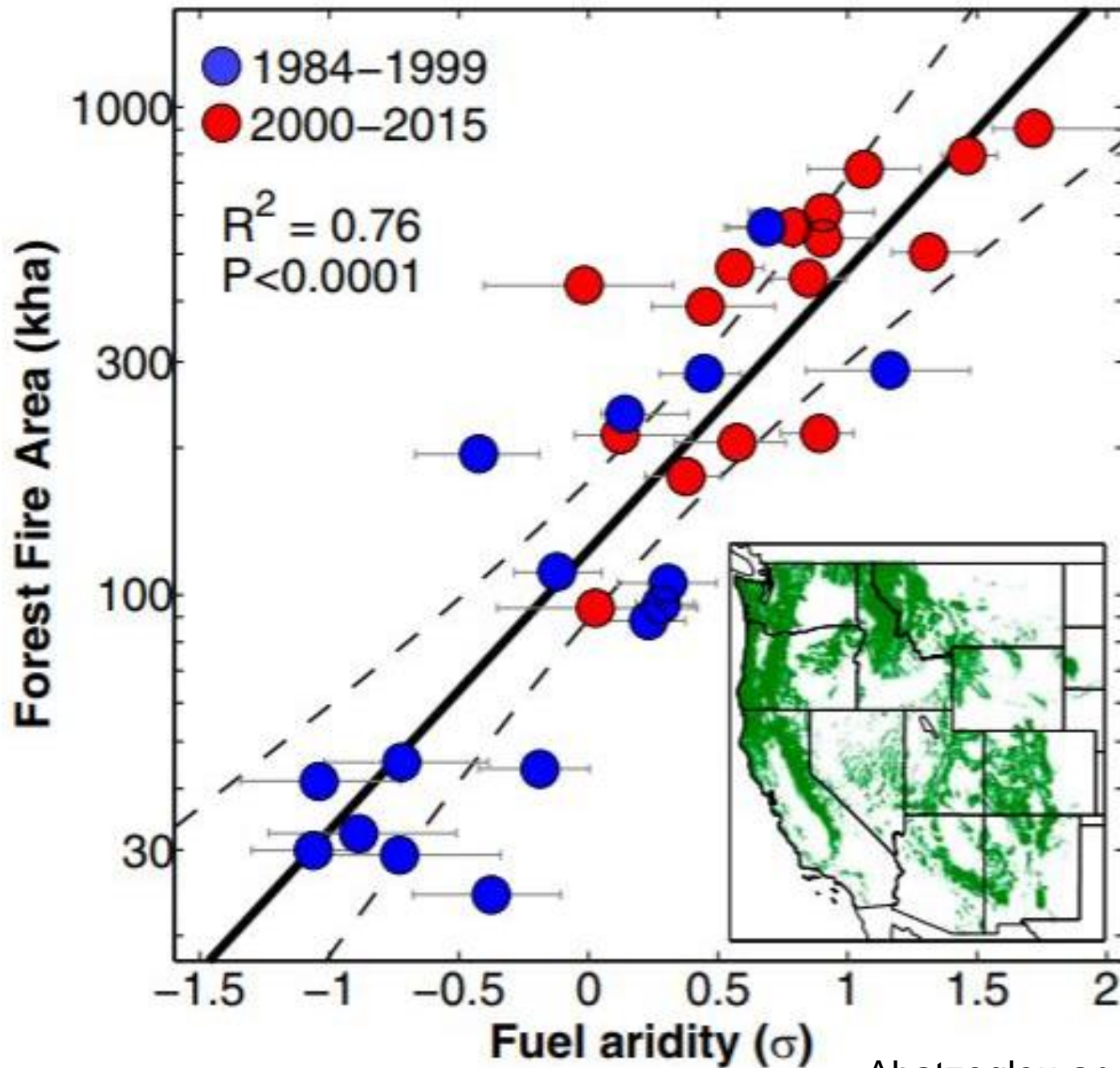
John T. Abatzoglou<sup>a,1</sup> and A. Park Williams<sup>b</sup>

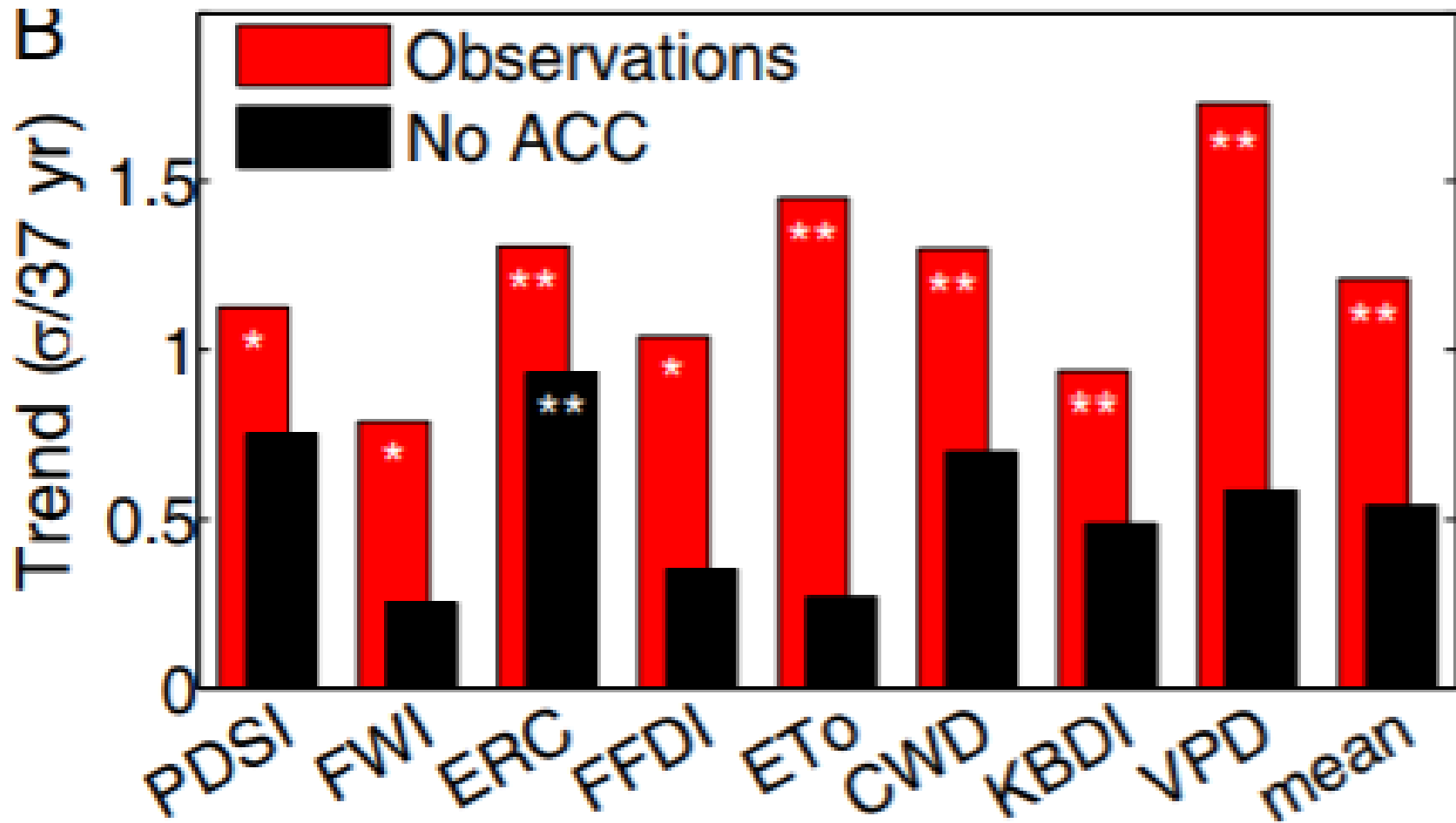
<sup>a</sup>Department of Geography, University of Idaho, Moscow, ID 83844; and <sup>b</sup>Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964

Edited by Monica G. Turner, University of Wisconsin–Madison, Madison, WI, and approved July 28, 2016 (received for review May 5, 2016)

**Increased forest fire activity across the western continental United States (US) in recent decades has likely been enabled by a number of factors, including the legacy of fire suppression and human settlement, natural climate variability, and human-caused climate change. We use modeled climate projections to estimate the contribution**

considering eight fuel aridity metrics that have well-established direct interannual relationships with burned area in this region (1, 8, 24, 25). Four metrics were calculated from monthly data for 1948–2015: (i) reference potential evapotranspiration (ET<sub>o</sub>), (ii) VPD, (iii) CWD, and (iv) Palmer drought severity index





**PSDI: Palmer Drought Severity Index**

**FWI: Fire Weather Index**

**ERC: Energy Release Component**

**FDI: McArthur Forest Fire Danger Index**

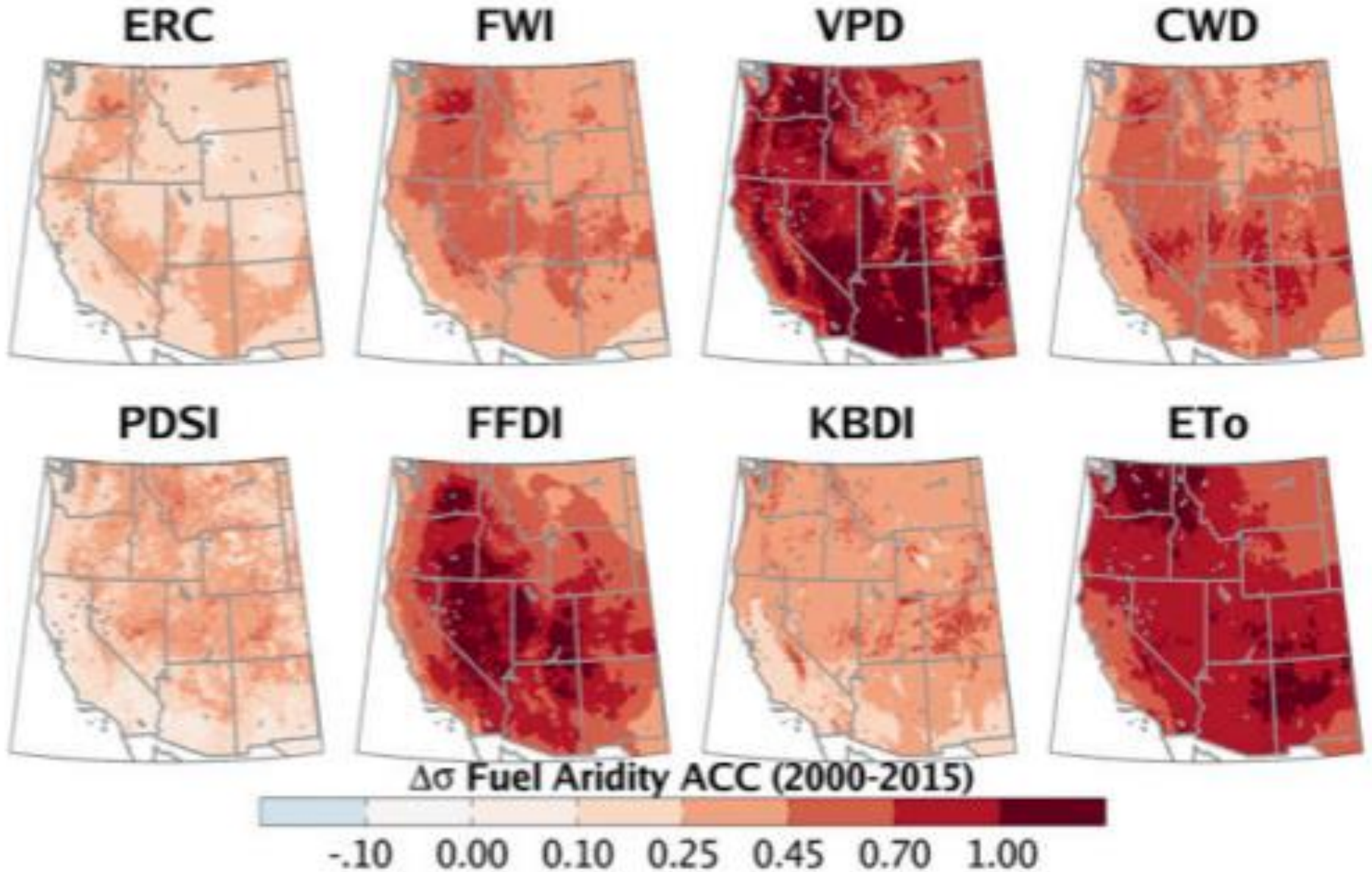
**Eto: Potential Evapotranspiration**

**CWD: Climate Water Deficit**

**KBDI: Keetch-Byram Drought Index**

**VPD: Vapor Pressure Deficit**

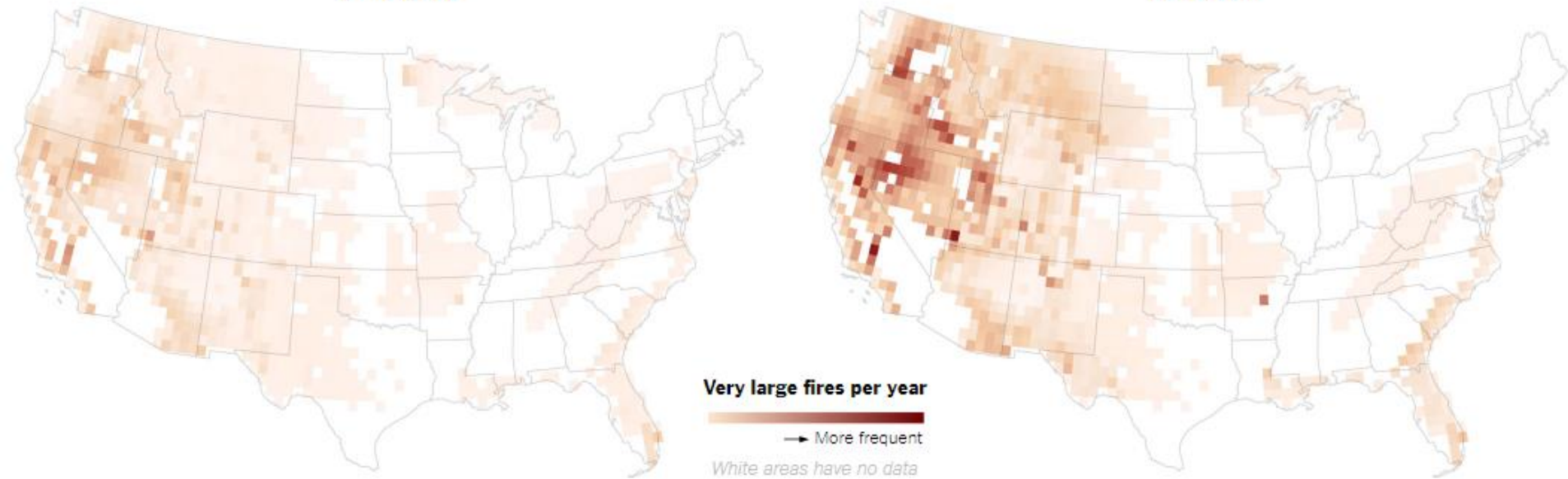
# Change in Fuel Aridity due to Anthropomorphic Climate Change





1971-2000

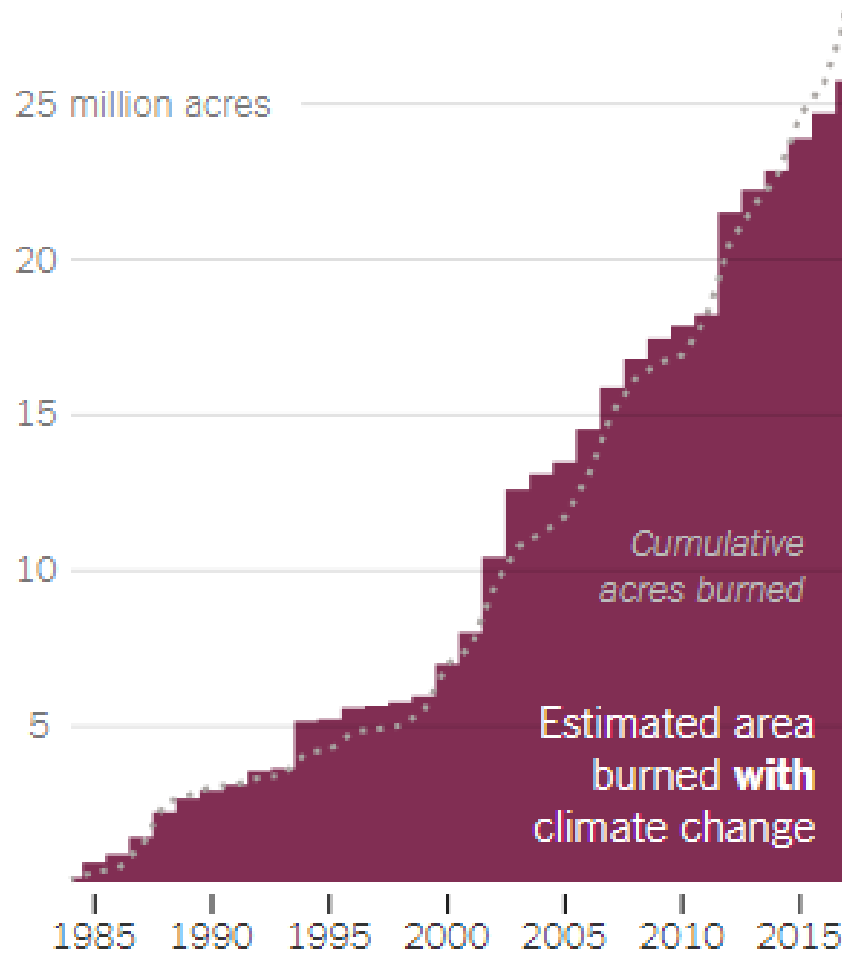
2041-2070



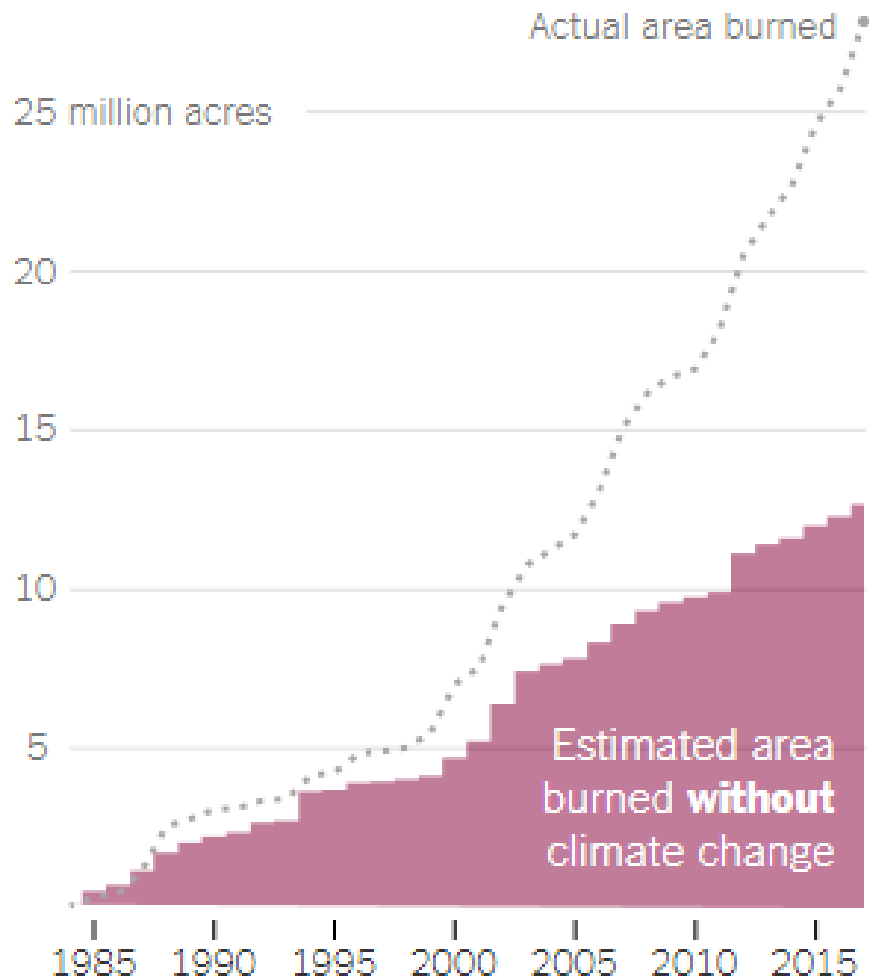
Source: International Journal of Wildland Fire

Abatzoglou and Williams 2016

# Impact of anthropogenic climate change on wildfire across western US forests.

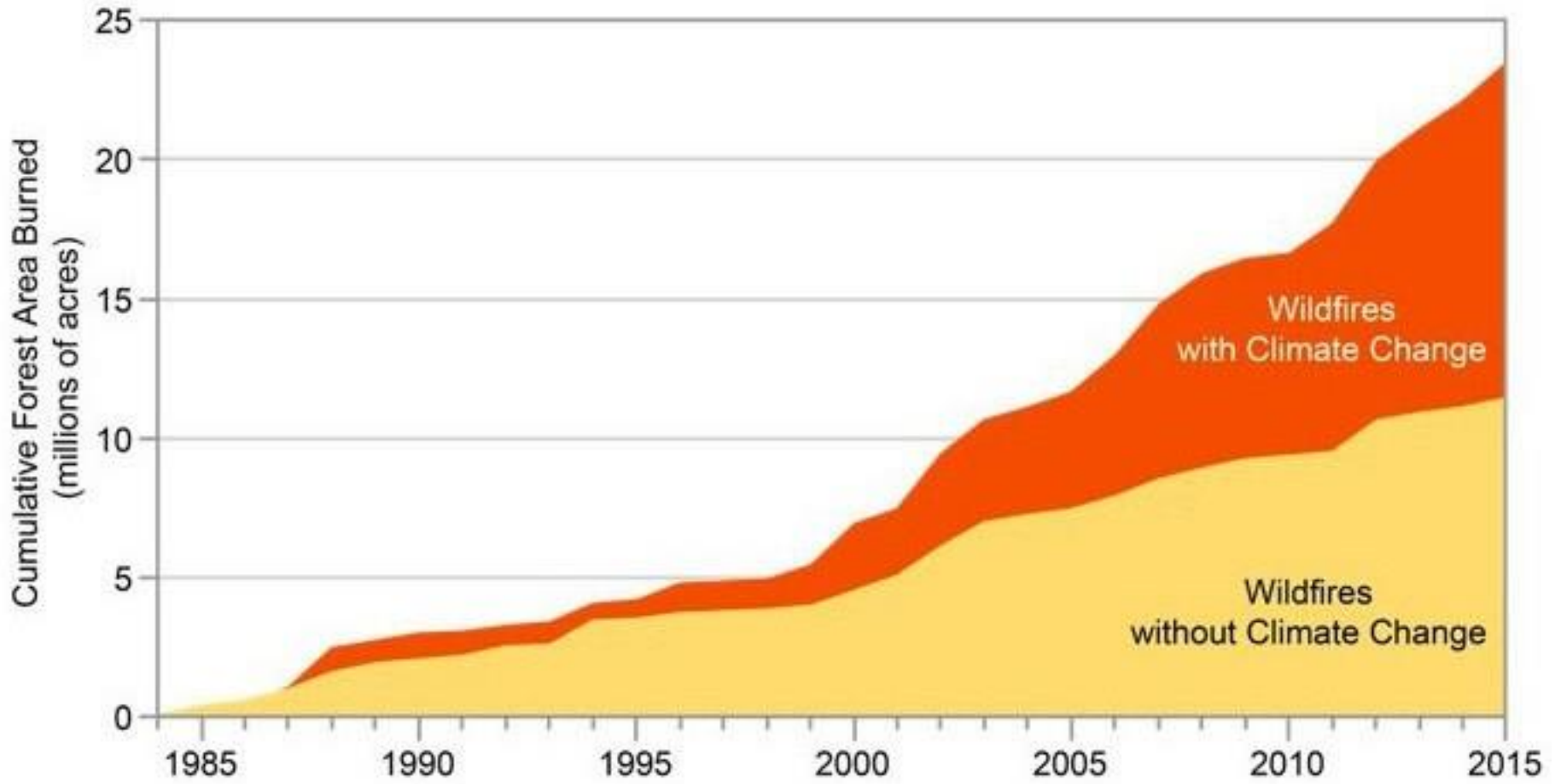


# Impact of anthropogenic climate change on wildfire across western US forests.



Effect of extra 3F°:  
20,400 square miles:  
12.8 million acres:





1948 San Miguel Rd

Santa Rosa, California

Google, Inc.

Street View - Mar 2016



Image capture: Mar 2016 © 2018 Google United States Terms Report a problem

**NM**  
**STATE**

All About Discovery!™

New Mexico State University

aces.nmsu.edu

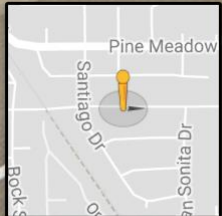


1948 San Miguel Rd

Santa Rosa, California

Google, Inc.

Street View - Mar 2016



Google

Image capture: Mar 2016 © 2018 Google United States Terms Report a problem



All About Discovery!™

New Mexico State University

aces.nmsu.edu



Fires destroyed an area of the Coffey Park neighborhood in Santa Rosa, Calif. Before: Google Earth; After: California Highway Patrol, via Reuters



All About Discovery!™

New Mexico State University

[aces.nmsu.edu](http://aces.nmsu.edu)



**NM**  
**STATE**

All About Discovery!™

New Mexico State University

[aces.nmsu.edu](http://aces.nmsu.edu)





All About Discovery!™

New Mexico State University

[aces.nmsu.edu](http://aces.nmsu.edu)

# 66,000 acres high-severity burn



Photo by Craig Allen, USGS

**The future promises to be messy, but it has always been messy. Fire doesn't make for clarity. The world seen through flames flickers and smudges. But it's a better world than one without. - Stephen Pyne**





# Contact Information



Doug Cram

~~Assistant~~ Associate Professor & Extension Fire Specialist

Cooperative Extension Service

New Mexico State University

575-646-8130

[dcram@nmsu.edu](mailto:dcram@nmsu.edu)





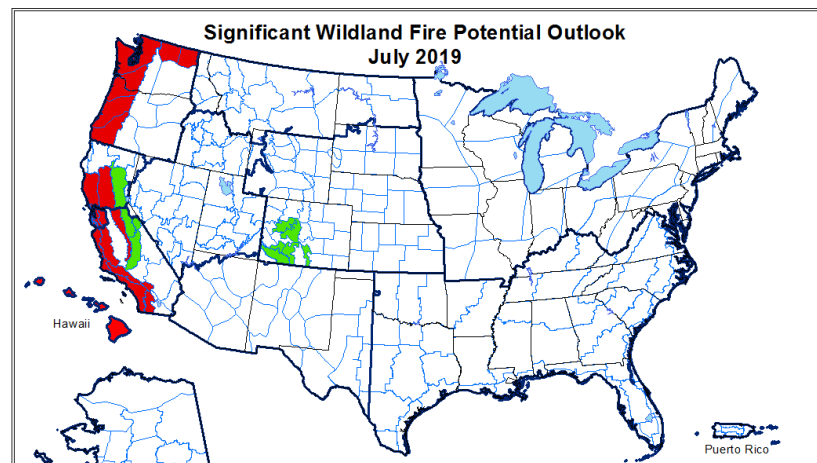
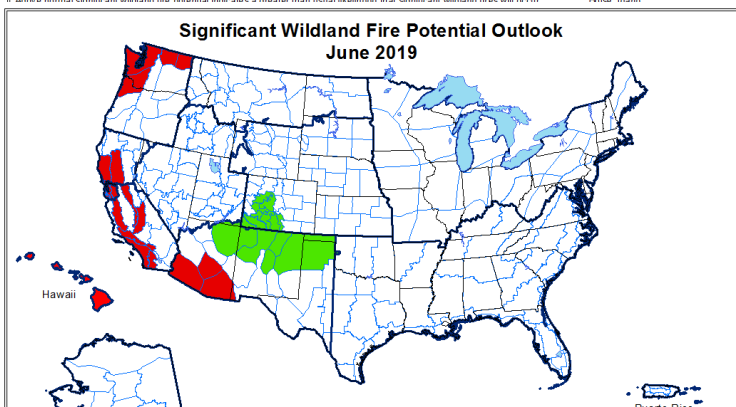
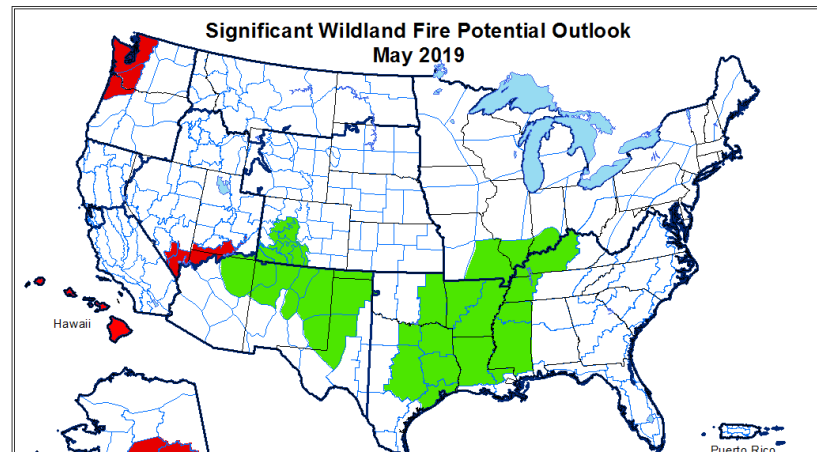
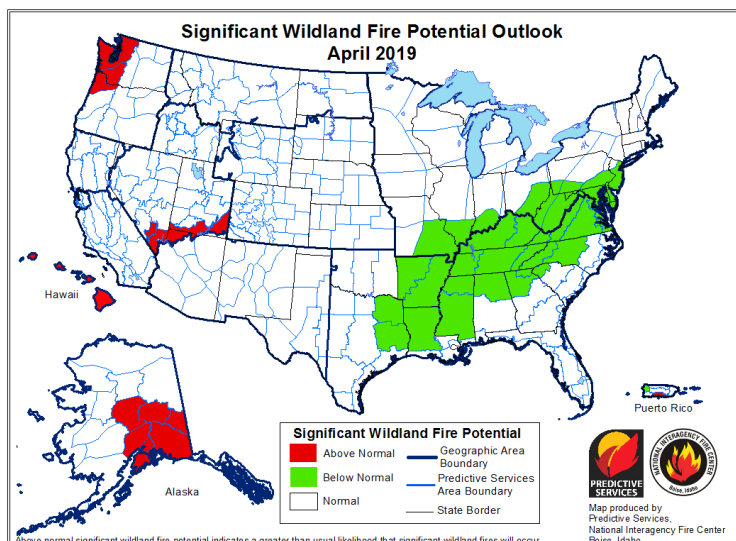
# National Significant Wildland Fire Potential Outlook

Predictive Services  
National Interagency Fire Center



Issued: April 1, 2019  
Next Issuance: May 1, 2019

## Outlook Period – April, May, June and July 2019



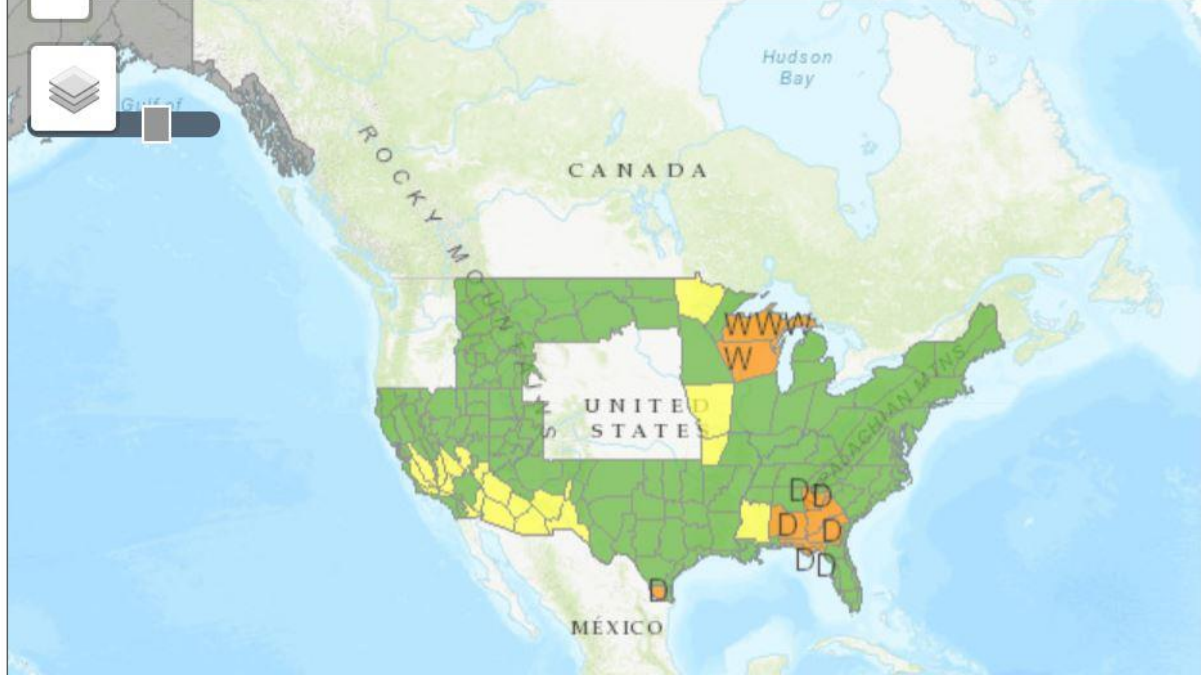
# NATIONAL 7-DAY SIGNIFICANT FIRE POTENTIAL

Login

## Geographic Area

- National
- Alaska
- California North Op
- California South Op
- Eastern Area
- Great Basin
- Northern Rockies
- Northwest
- Rocky Mountain
- Southern Area
- Southwest

Map navigation controls including zoom in (+), zoom out (-), and a date selector showing a 7-day period from Thursday 04/25 to Thursday 05/02.



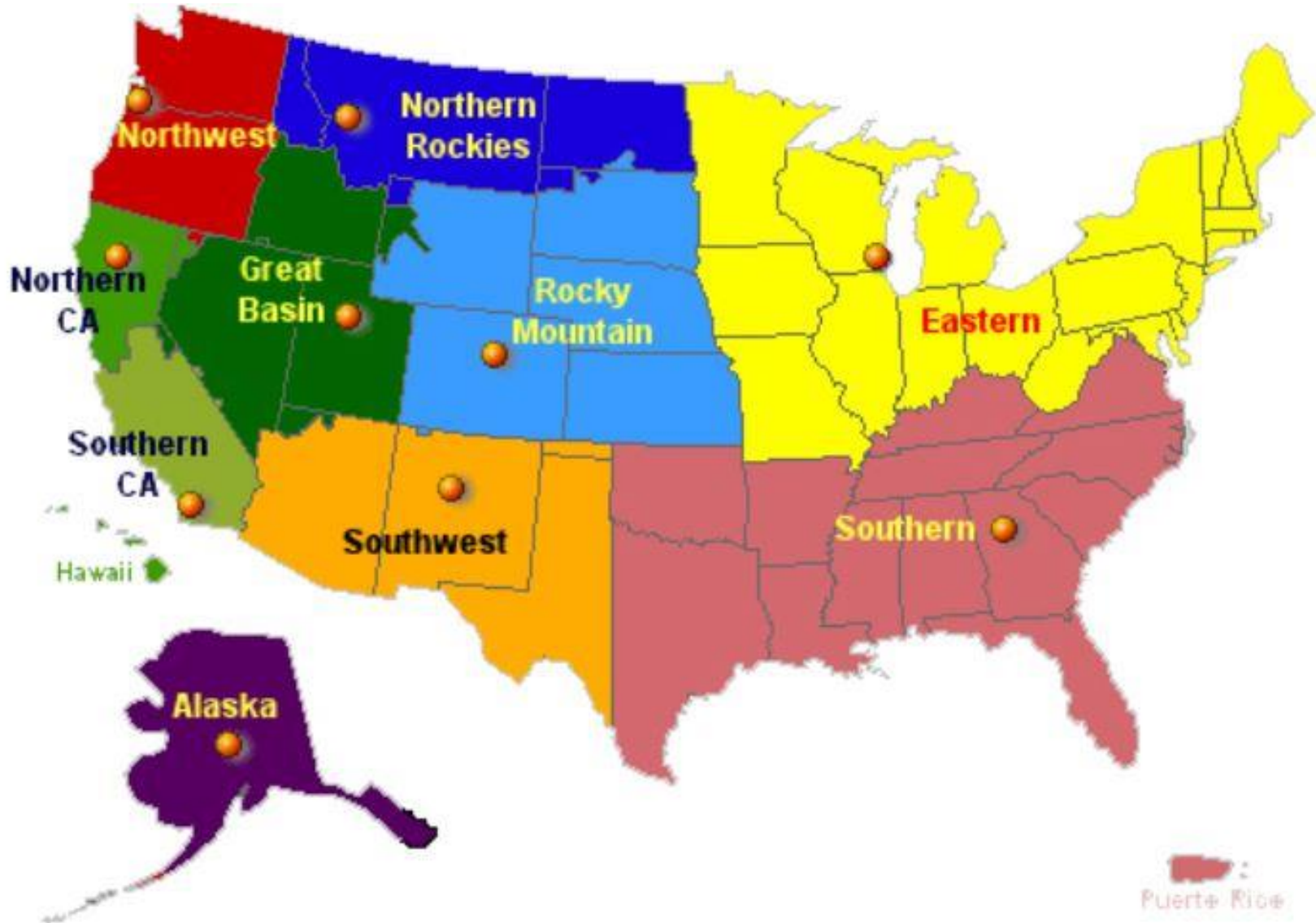
## Significant Fire Potential

- No Data
- Little or no risk.
- Low risk
- Moderate risk

## High Risk Triggers

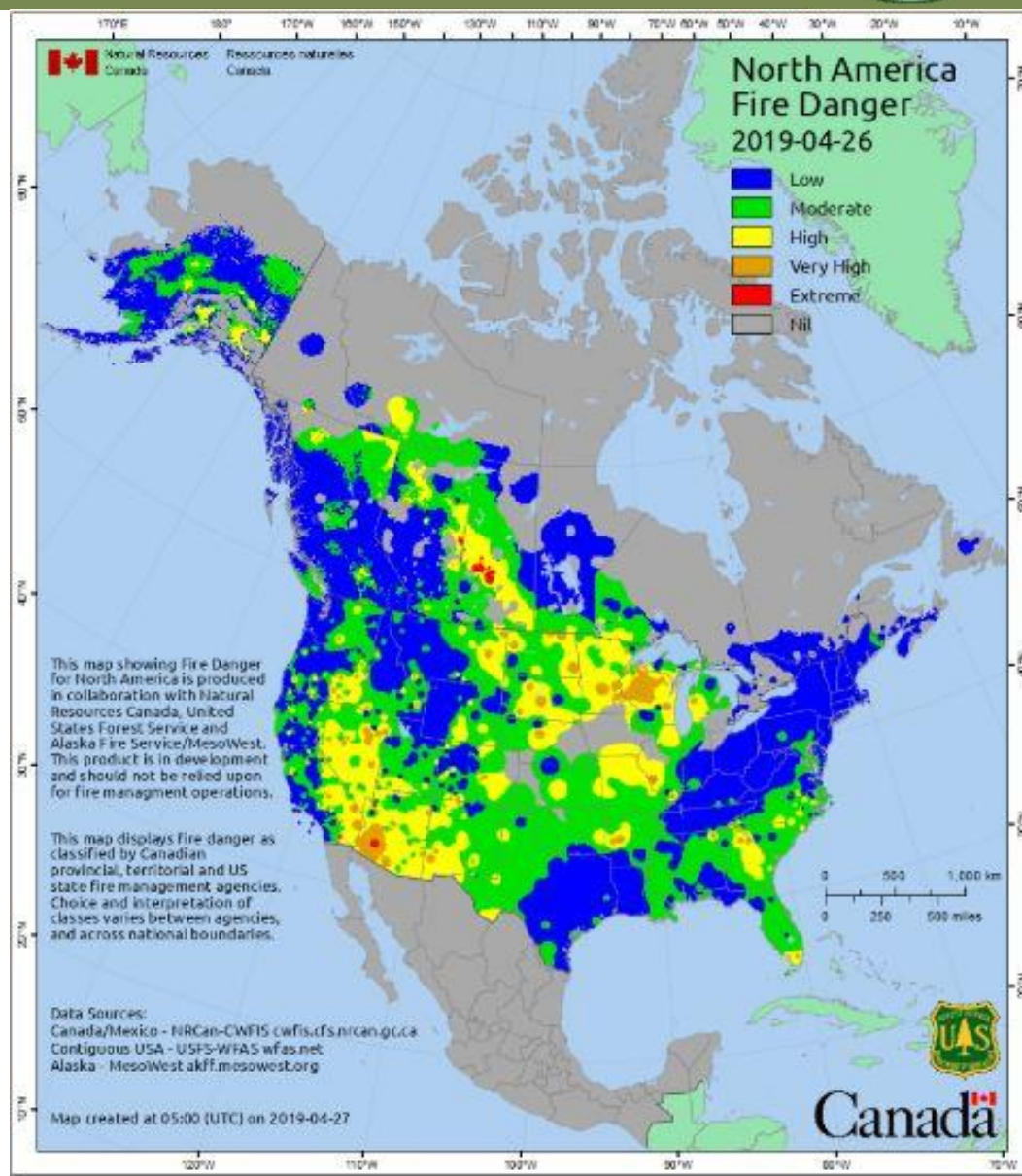
- D D
- W W
- H H
- U U
- L L
- R R

# Geographic Predictive Services



Each unit produces fire weather, fire danger, and fire potential reports.

Fire Potential / Danger  
Weather Data  
Moisture / Drought  
Geographic Area Data  
Experimental Products  
And more...





# TREX:

## Prescribed Fire Training Exchanges

- The Nature Conservancy | Forest Stewards Guild | State Land Office | Southwest Fire Science Consortium
- Luera | Chama | Las Trampas | Black Lake
- Forest & Grasslands
- Annual events
- Targeting burners and landowners
- Opportunity to build hands-on experience



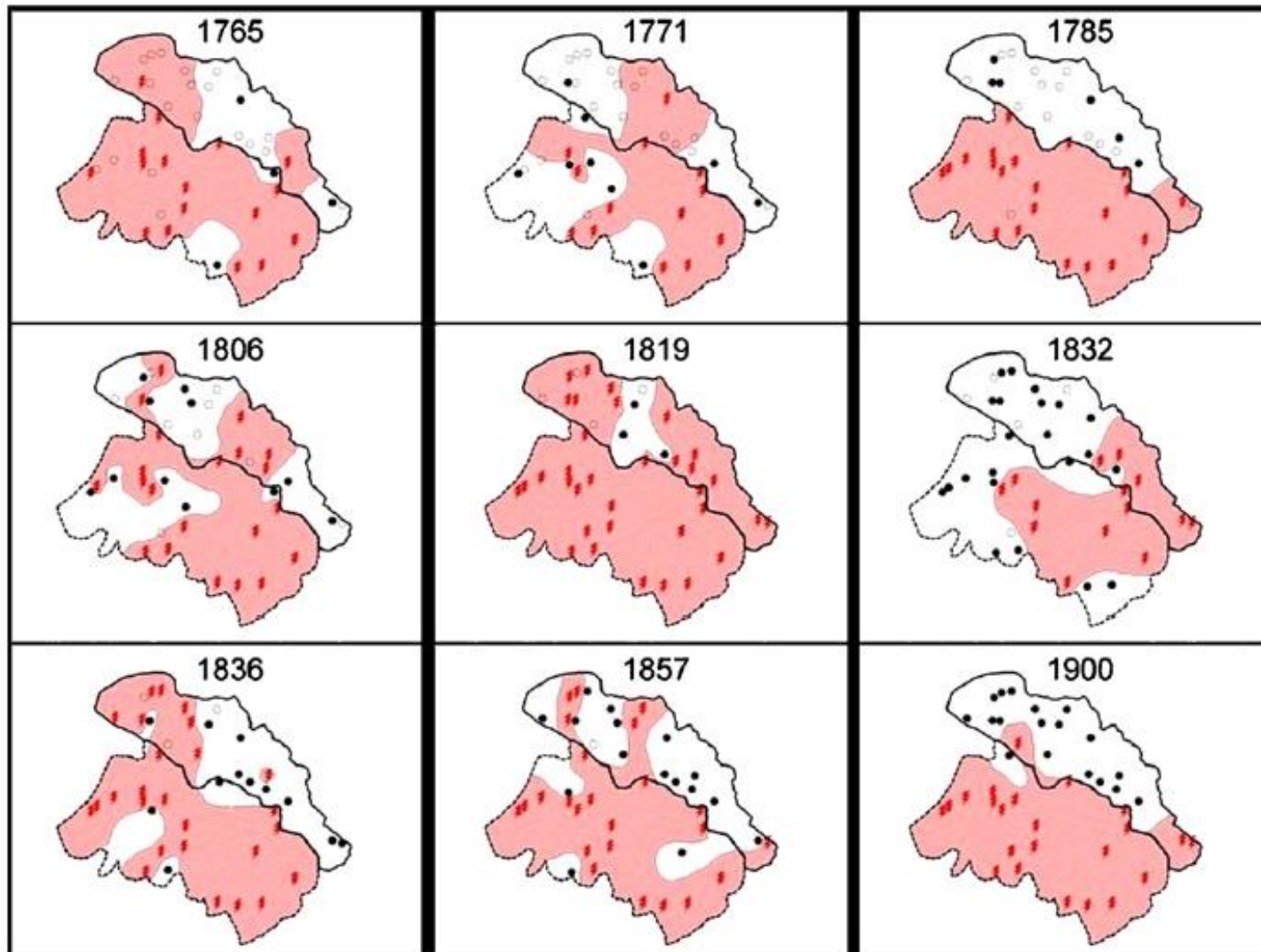
# Growing Season Burning - OSU



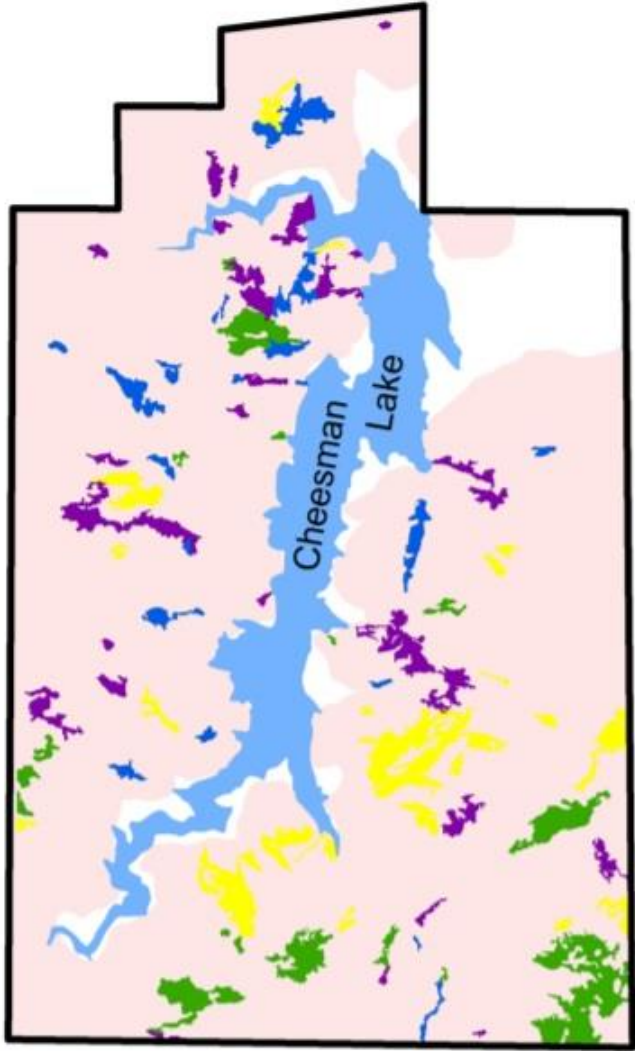
# Patch Burning - OSU

41 trees

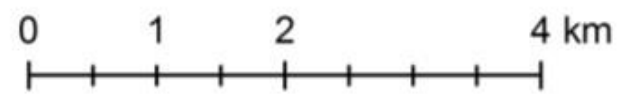
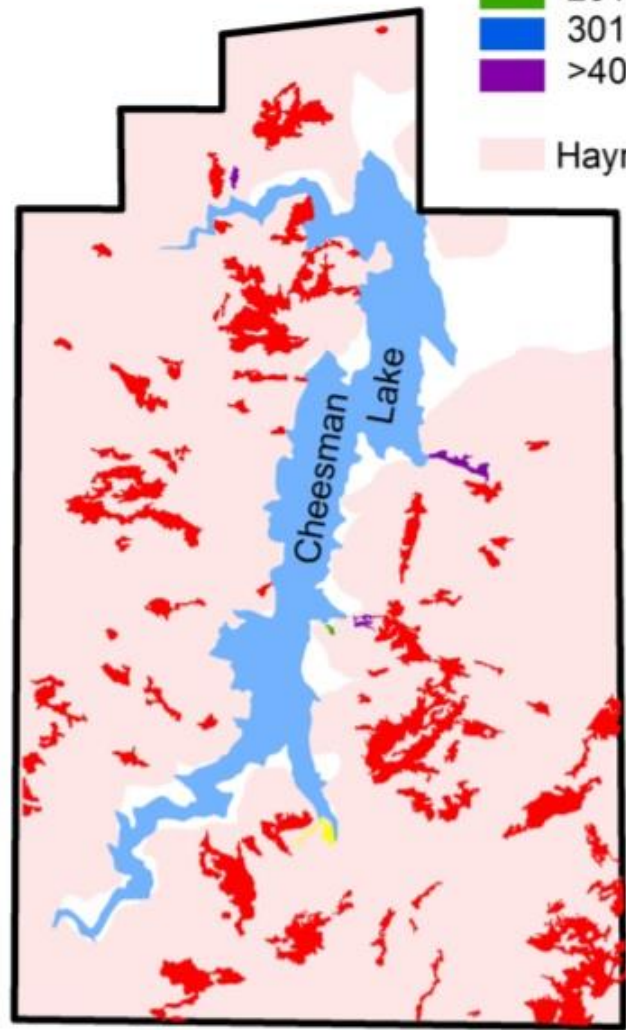
135 years

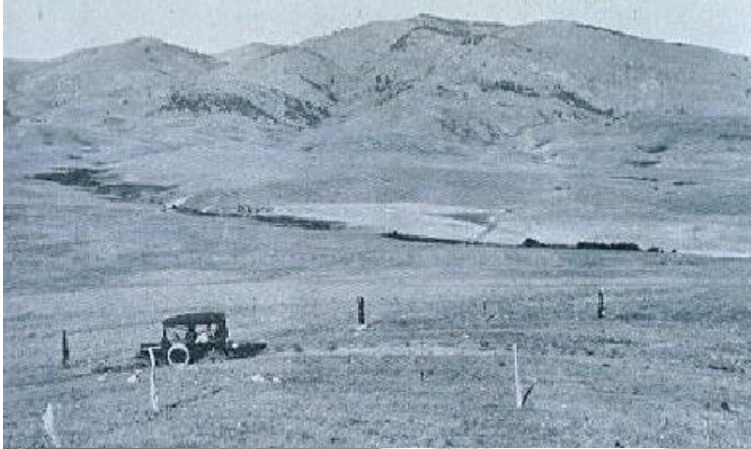


(a) Pre Hayman Fire



(b) Post Hayman Fire





1917  
←



1918  
→



1959



1998



# Ponderosa Pine Succession

## 88 Years of Change in Ponderosa Pine Forest



1909



1948



Large pine cut ~ 1952

1968



1989



1997



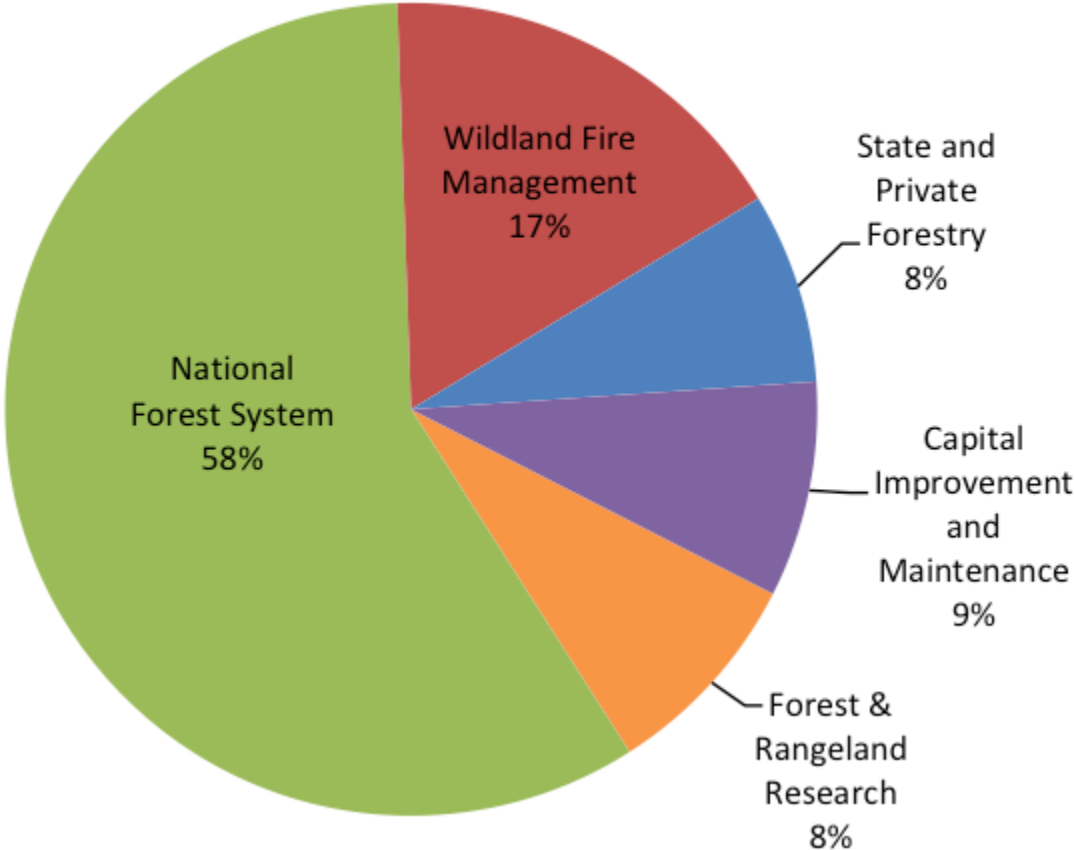
Adjacent Forest 1997

Photos taken from one point show changes resulting from fire exclusion, removal of large pines and ecosystem management treatments in the 1990's.

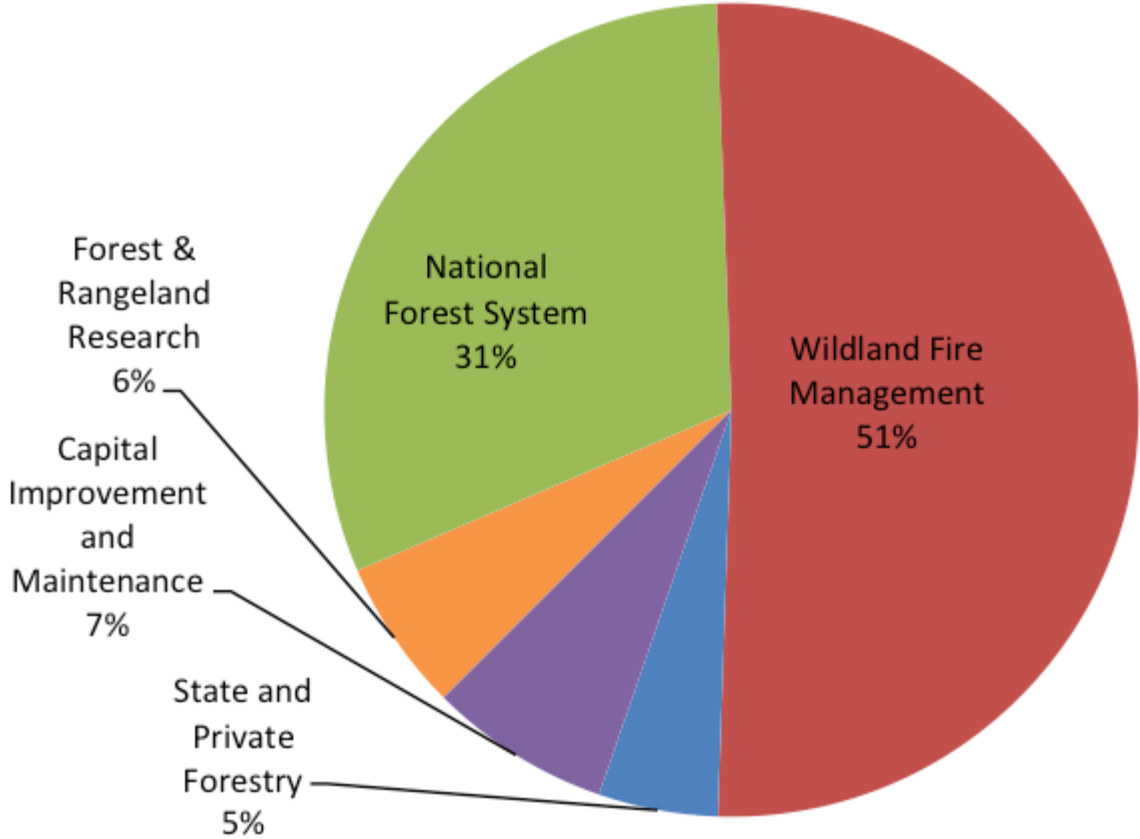
Photo point location, Bitterroot National Forest ~ Produced by the Fire Effects Unit, Rocky Mountain Research Station, Missoula, Montana ~ for General Technical Report-RMRS-GTR-23, March 1999

Photos from RMRS-GTR-23

### Forest Service Appropriations by Fund FY 1995



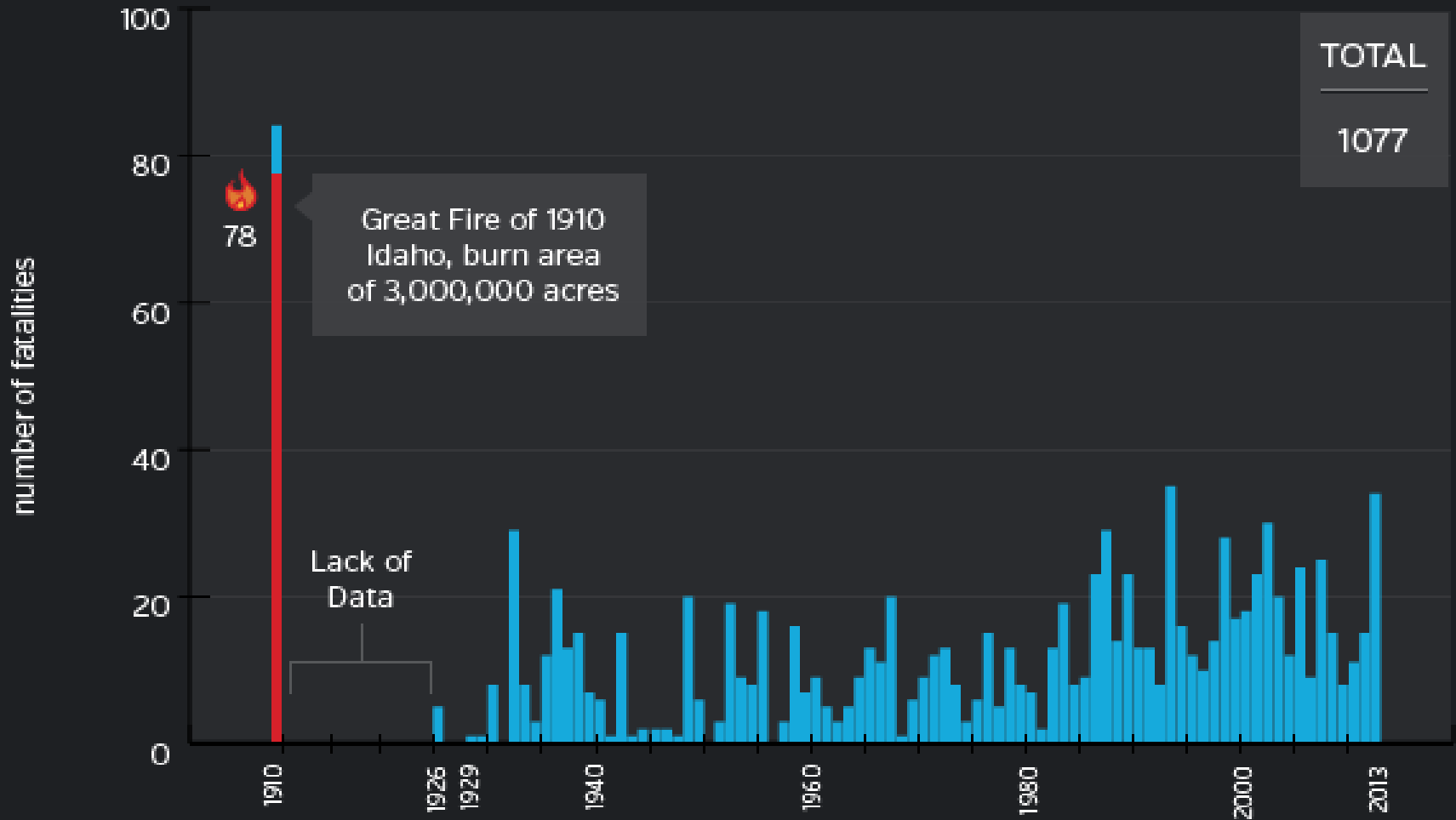
# Forest Service Appropriations by Fund FY 2014





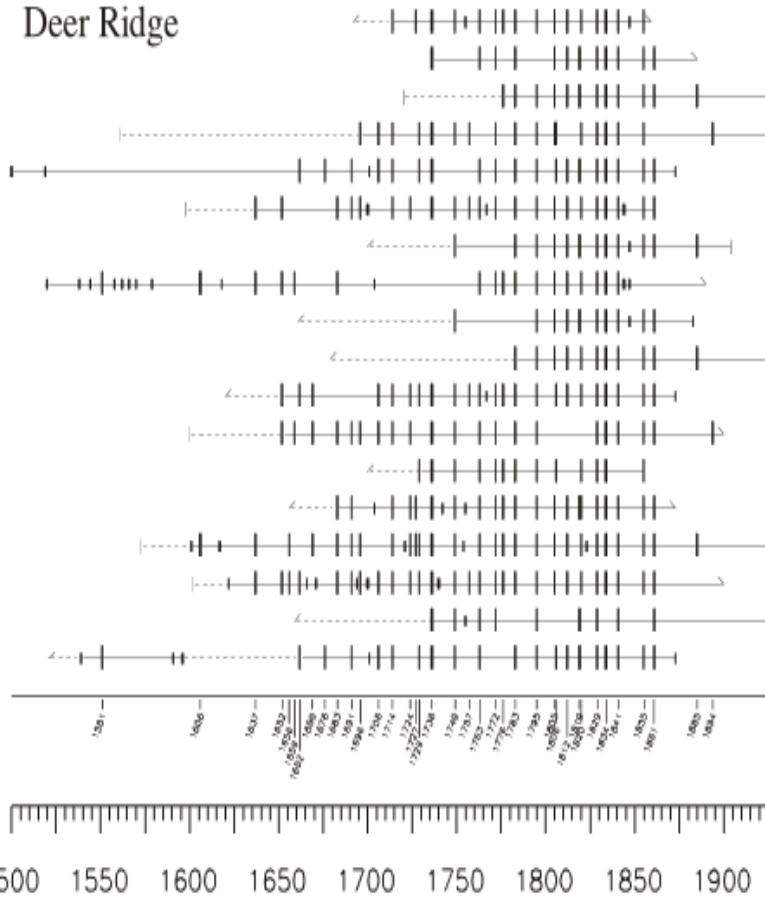


# U.S. Wildfire Fatalities by Year 1910-2013



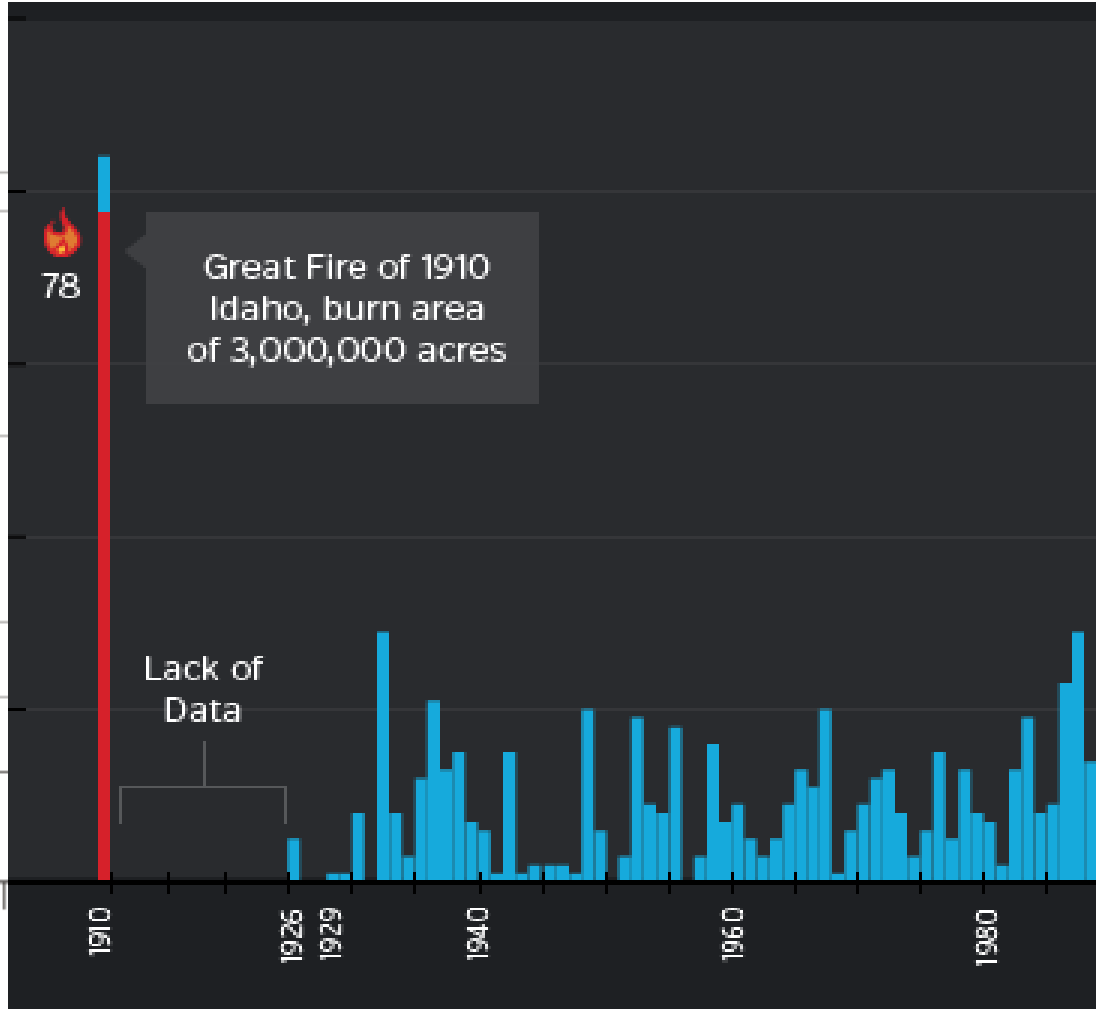
Source: National Interagency Fire Center

# Deer Ridge



Great Fire of 1910  
Idaho, burn area  
of 3,000,000 acres

Lack of  
Data



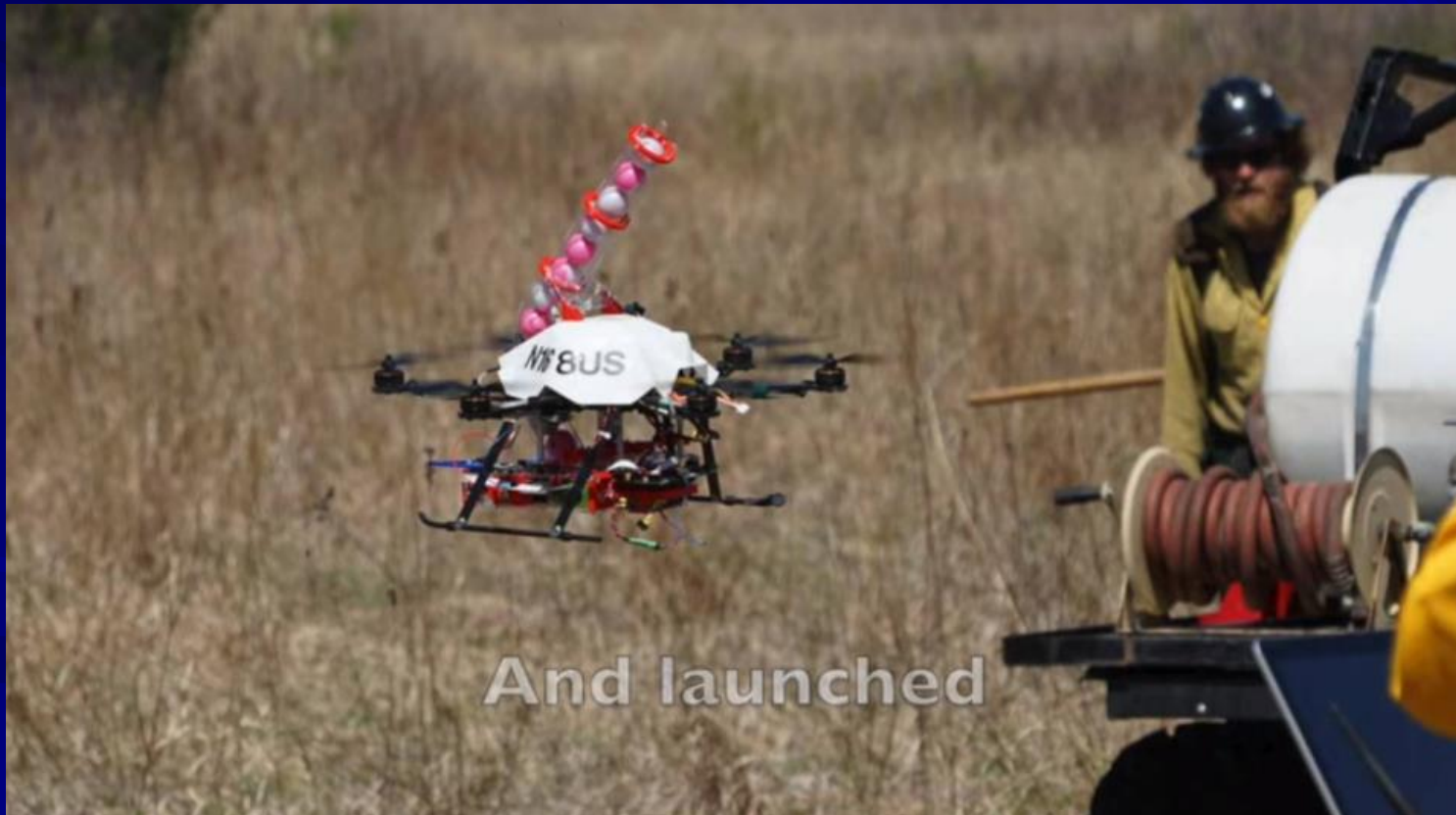
# Latest Rx Fire News/Research/Equipment

- Drone Use & Rx Fire



# Latest Rx Fire News/Research/Equipment

- Drone Use & Rx Fire



# U.S. Wildfire Acres 1985 – 2018

