
Climate change and wildland fire in the Northern Rockies
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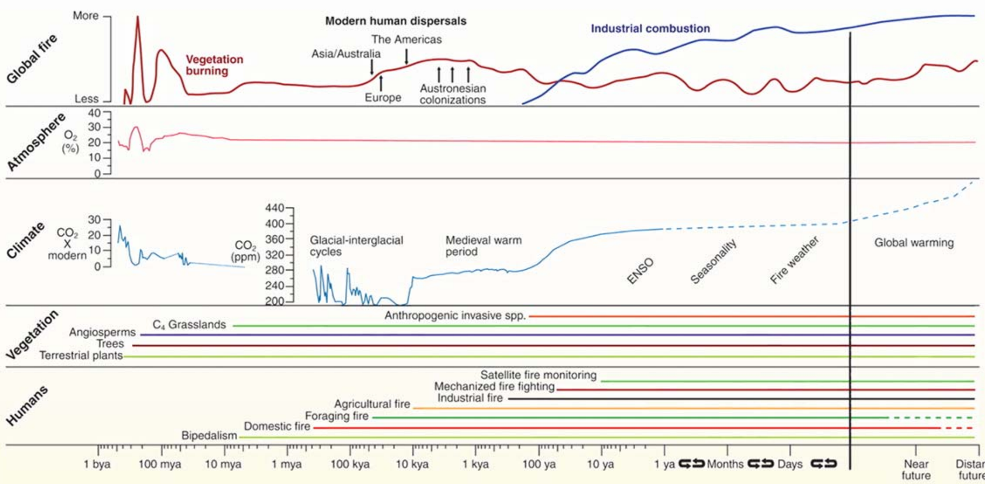
September 25, 2013
ROCKY MOUNTAIN RESEARCH STATION
FireLab
MISSOULA, MONTANA
Image Credit, EGB IMT 1

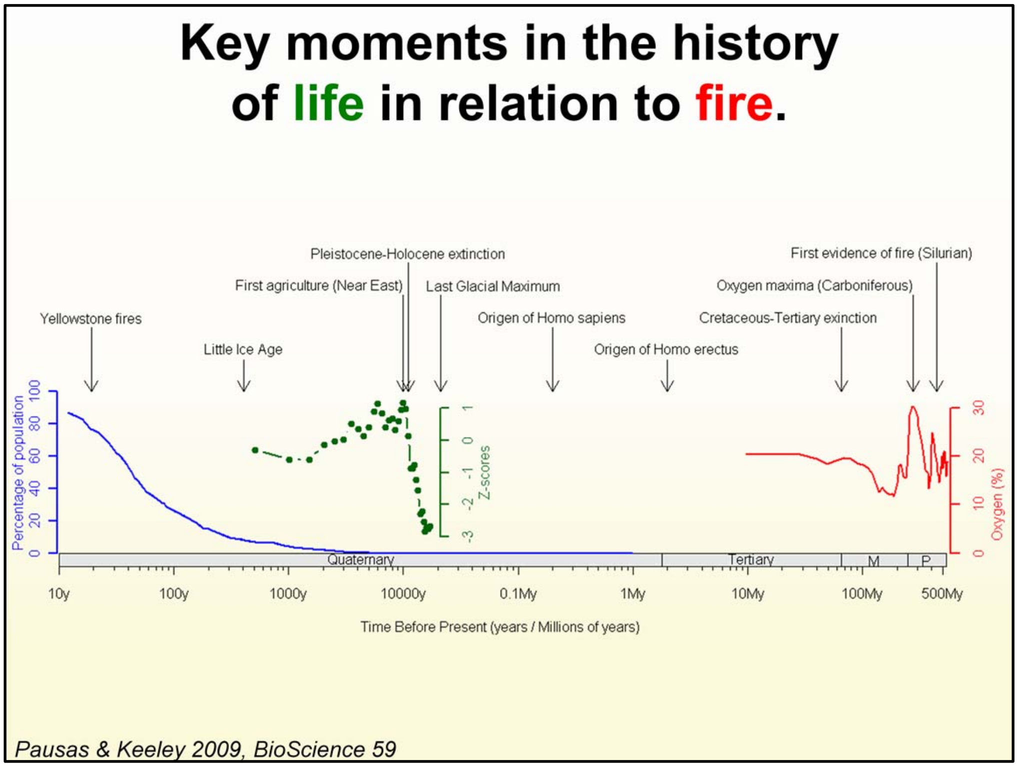


- Wildfires began soon after the appearance of terrestrial plants in the Silurian
  - (420 million years ago)
- Combustion occurs when atmospheric O2 levels > 13%

Source: Bowman et al., 2009

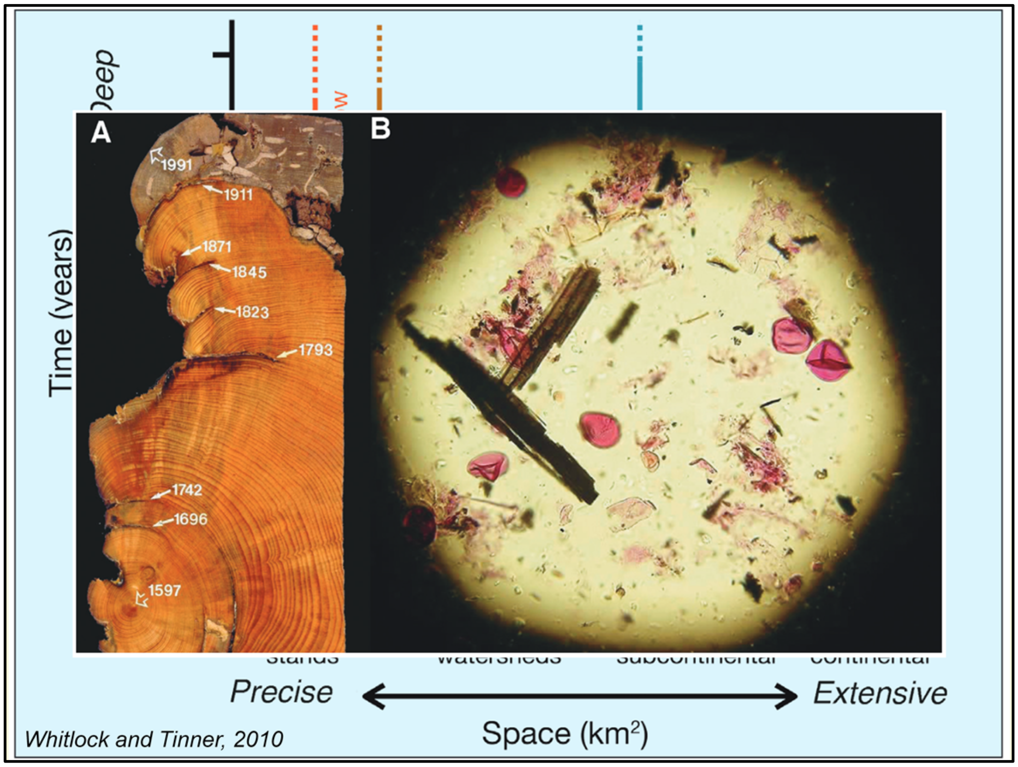
From Bowman et al., 2009:
Fossil charcoal indicates that wildfires began soon after the appearance of terrestrial plants in the Silurian [420 million years ago (Ma)]. Combustion occurs when atmospheric O_2 concentrations are above 13%, and variation in O_2 levels correlates with fire activity throughout Earth history. Many Permian coals contain large quantities (70%) of charcoal during a period when atmospheric oxygen was thought to have exceeded 30%, making even moist vegetation flammable. Counterintuitively, the burial of decay-resistant charcoal and organic matter following postfire erosion may have increased oxygen levels and caused long-term reduction of atmospheric carbon dioxide levels.

From Sommers et al. 2011, JFSP Report 09-2-01-09 :
Qualitative schematic of global fire activity through time, based on pre-Quaternary distribution of charcoal, Quaternary and Holocene charcoal records, and modern satellite observations, in relation to the percentage of atmospheric O_2 content, parts per million (ppm) of CO_2, appearance of certain vegetation types, and the presence of the genus *Homo*. (See supporting online text for data sources used.) Dotted lines indicate periods of uncertainty. (Bowman et al., 2009, http://www.sciencemag.org/content/324/5926/481.abstract)



Temporal position of key moments in the history of life (time in logarithmic scale) in relation to fire. (http://www.uv.es/jgpausas/papers/Pausas-Keeley-2009-BioScience_a-burning-story.pdf)

From Sommers et al. 2011, JFSP Report 09-2-01-09 :
Paleo-fire history studies provide an increasingly comprehensive record of fire variability and change linked to climate and ecosystem variability and change. The combustion process itself has not changed since land plants began to diversify and evidence of fire appeared during the Silurian period (443 to 417 Mya) of Earth history. Fire events have since been oxidizing biomass wherever vegetation grows. Fossil charcoal records, which had dated earliest fire to the late Devonian (417 to 354 Mya), now show that wildfires have been occurring on Earth for ~ 420 million years, since there was sufficient vegetation to serve as fuel and sufficient atmospheric oxygen to support the combustion process. Atmospheric O2 concentration has varied during the 540 million years of the Phanerozoic eon, resulting in significant variation in fire activity. Since terrestrial vegetation arose on Earth, the atmosphere has supplied the oxygen (current atmospheric O2 concentration of 21% exceeds the minimum 13% required for combustion), and the lightning (currently estimated as ~44 flashes per second occurring globally) ignition source needed for combustion to be supported. Paleoecology and paleoclimatogy studies combine to extend our understanding of antecedent conditions backward through the ~420 million years of Earth history where fire has functioned as a major shaper of ecosystem evolution.

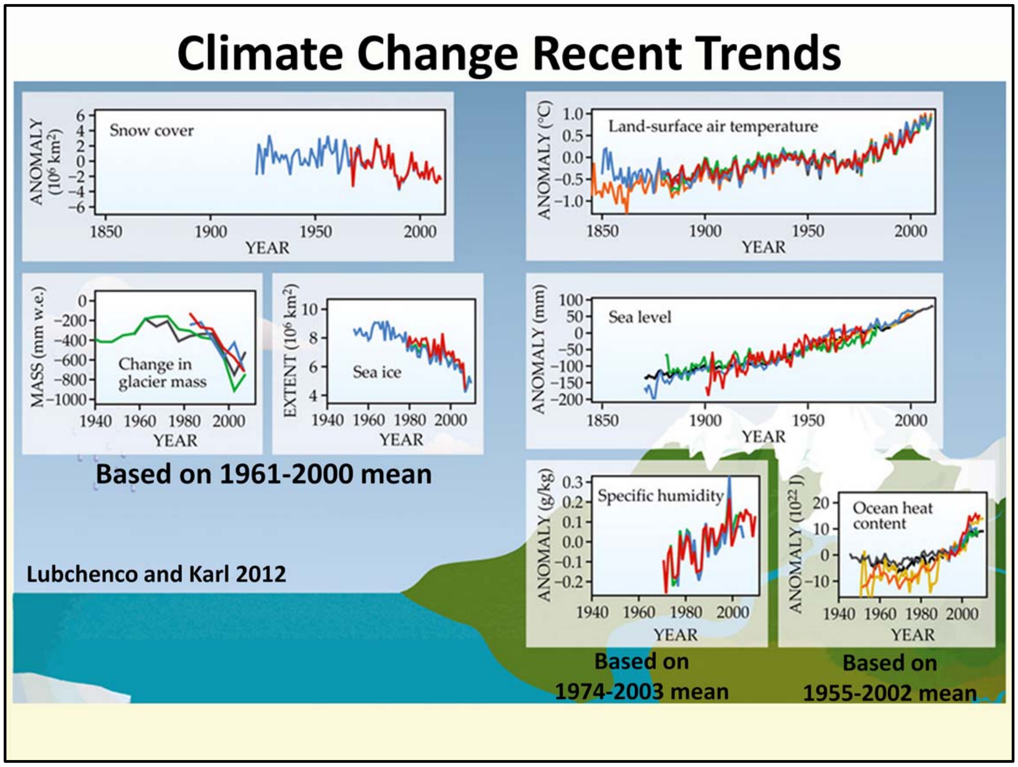


Whitlock and Tinner, 2010 (http://www.pages.unibe.ch/products/newsletters/2010-2/PAGESnews_18%282%29-hires.pdf)

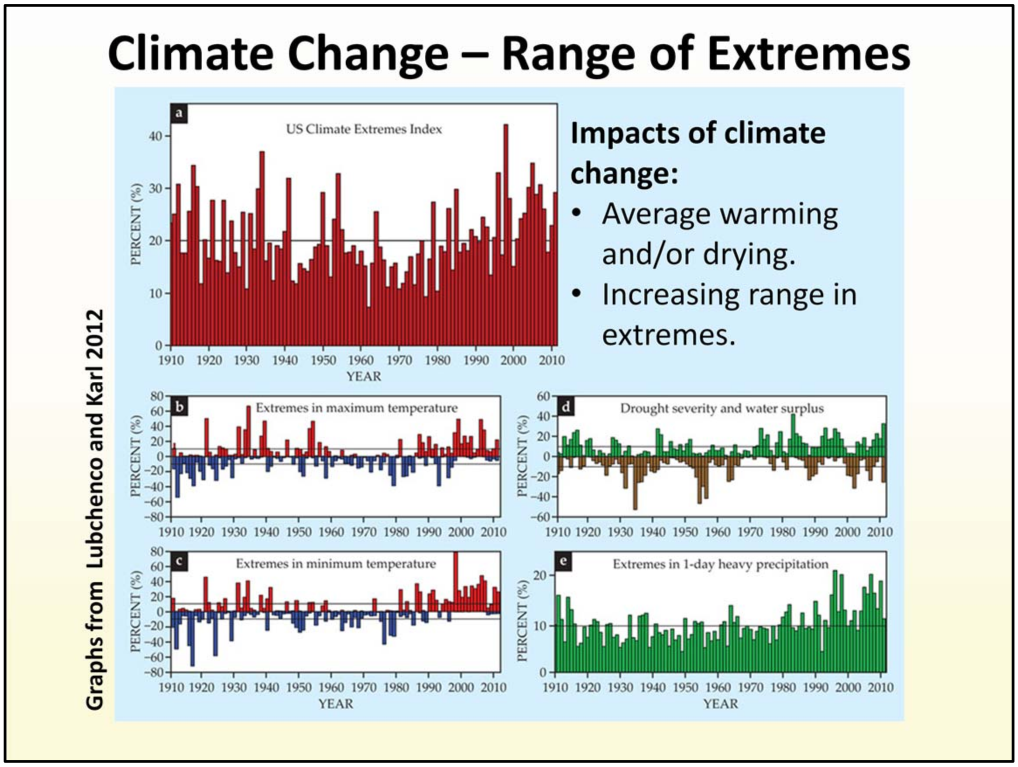
Paleofire science seeks to better understand fire's role in the Earth System by examining the causes and consequences of biomass burning on a variety of temporal and spatial scales, and is available from an array of archives that register fire at different scales and resolutions (modified from Gavin et al., 2007).

Tree ring and charcoal studies that describe fire history provide critical information on the long-term role of humans, climate and vegetation in natural fire regimes.
A) Cross-dated fire-scarred Pinus ponderosa sample recording numerous fire events (Photo: P. Brown, Rocky Mountain Tree-Ring Research).
B) Charcoal particles in sediments from a deforestation period in New Zealand, Bracken Fern spores are also evident (pink) (Photo: J. Wilmshurst, Landcare Research, NZ)

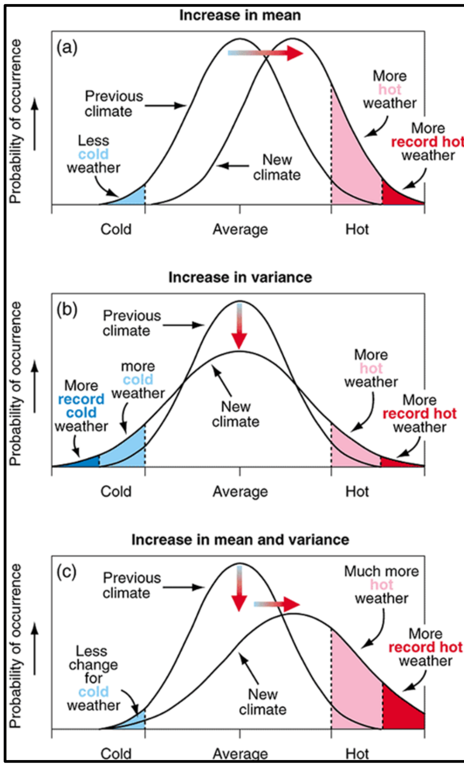
Changes in Fire-Related Climate Variables



http://dx.doi.org/10.1063/PT.3.1475



http://dx.doi.org/10.1063/PT.3.1475



Effect on **extreme** temperatures when

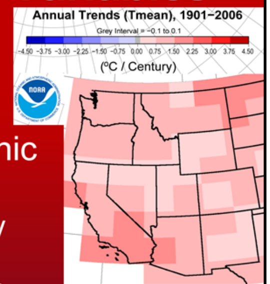
a) the mean temperature increases,
b) the variance increases, and
c) when both the mean and variance increase

for a normal distribution of temperature.

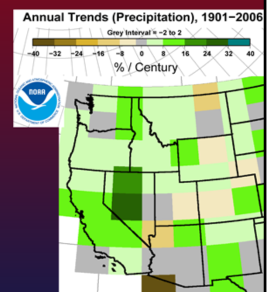
IPCC Working Group I, 2001

http://www.ipcc.ch/ipccreports/tar/wg1/fig2-32.htm

Changes in Fire-Related Climate Variables



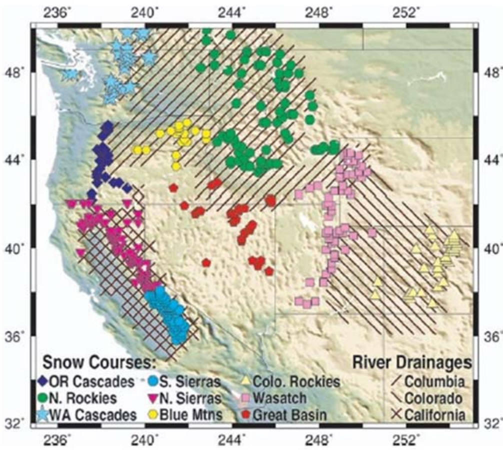
- **Maximum Temperature**
  - Increases in maximum and minimum temperature (JFM) attributed to anthropogenic climate change
    - 1950-1999: +1.86°C, cannot be fully explained by natural variability alone (Bonfils et al. 2008)
  - Six of ten years from 1998-2007 had annual average temperatures that fall in the hottest 10% of all years on record for the U.S. (Karl et al. 2008)

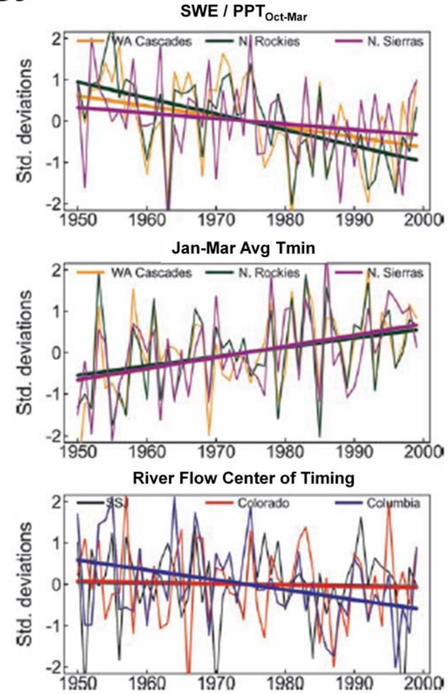


- **Precipitation**
  - More precipitation falling as rain instead of snow and earlier snowmelt
    - Only partially attributable to PDO, also resulting from longer-term climate shifts (Knowles et al. 2006)

Changes in the Hydrology of the Western U.S.

SWE / P = -2.4 to -7.9% / decade
Tmin = 0.28° to 0.43°C / decade
River CT = 0.3 to 1.7 days
earlier / decade





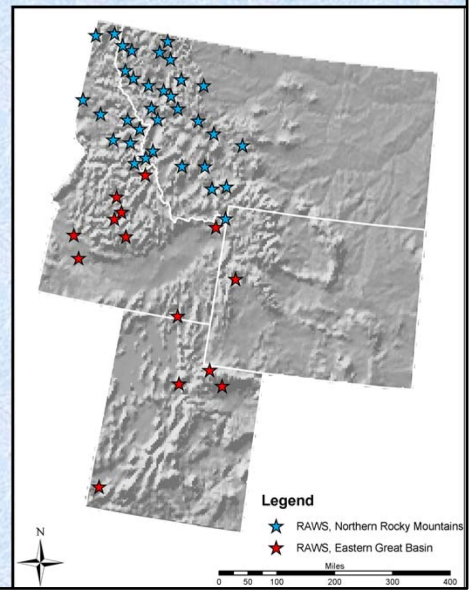
Barnett et al., 2008

Changes in Fire-Related Climate Variables

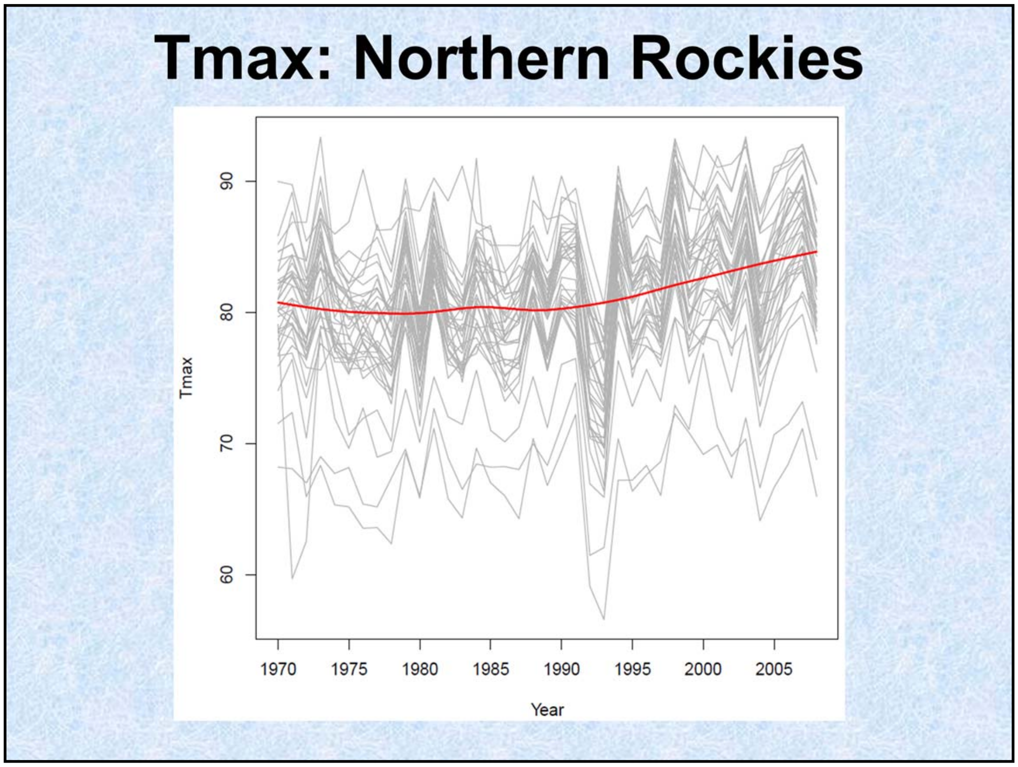
- **Relative Humidity**
  - No specific studies to attribute low RH to climate change
    - But, consistent with increased temperatures and reduced rainfall expected in some areas as a result of climate change
    - Lack of nighttime recovery
- **Wind Speed**
  - Not likely associated with current level of climate change
    - Local weather patterns have not changed significantly with climate change (e.g., Santa Ana winds).
    - This should change in the future as large scale synoptic patterns shift in response to increasing ocean temperatures.
  - However, <u>extremes</u> in tropical surface winds appear to be weakening (decreased frequency of strong wind events) in response to warming of tropical oceans (Gastineau and Soden 2011)
    - Results in increase in light wind events

Remote Automated Weather Station (RAWS) Selection

- 2 Geographic Areas
  - Northern Rockies (blue; 32 stations)
  - Eastern Great Basin (red; 14 stations)
- Predictive Services "Key RAWS"
- Minimum 30 years data
  - (Analysis included 1970-2008)
- <u>June - September</u>



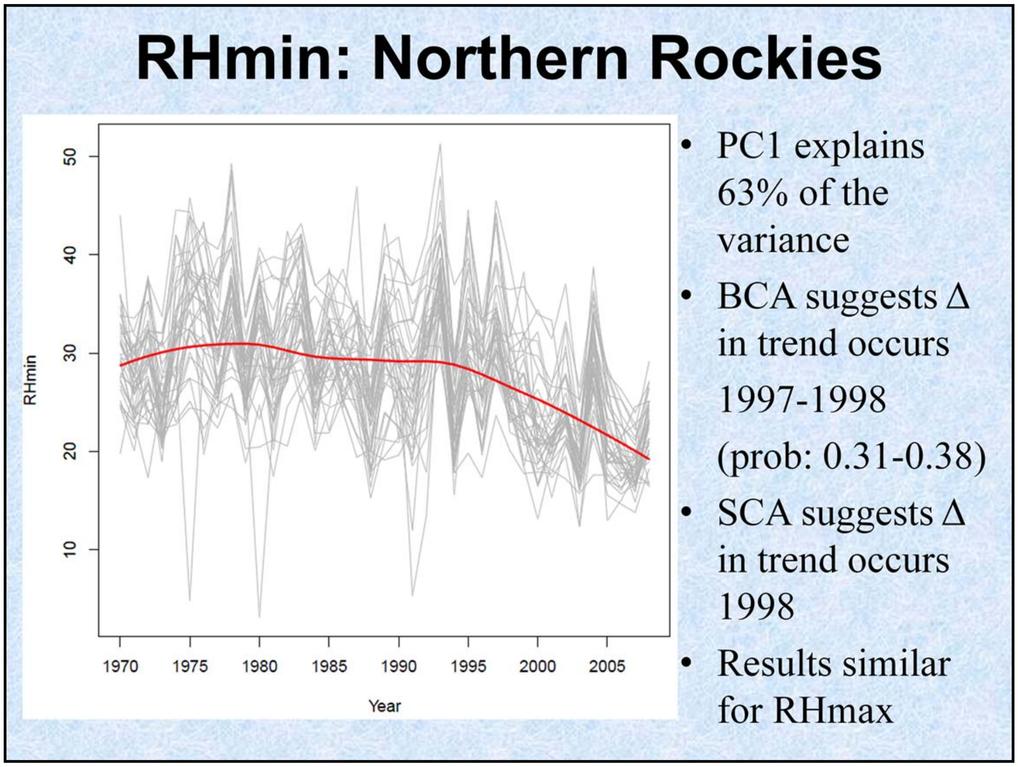
https://ams.confex.com/ams/9FIRE/webprogram/Paper192268.html



https://ams.confex.com/ams/9FIRE/webprogram/Paper192268.html

These are actual data values for Tmax (not the PC).
A low-s curve was fitted through the medians of the station data for each year.
All 32 stations are represented in this graph.

Remember, this is June-September data only!

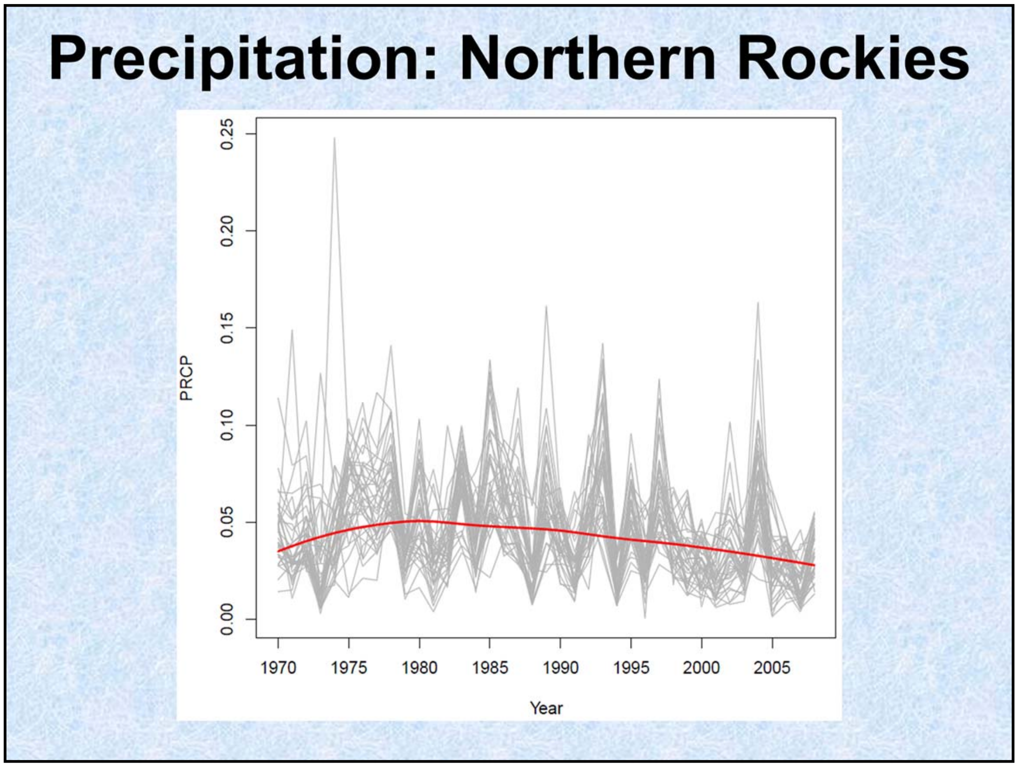


https://ams.confex.com/ams/9FIRE/webprogram/Paper192268.html

These are actual data values for RHmin (not the PC).
A low-s curve was fitted through the medians of the station data for each year.
All 32 stations are represented in this graph.

Remember, this is June-September data only!

The confidence interval supplied by SCA tend to agree with the dates found using BCA.

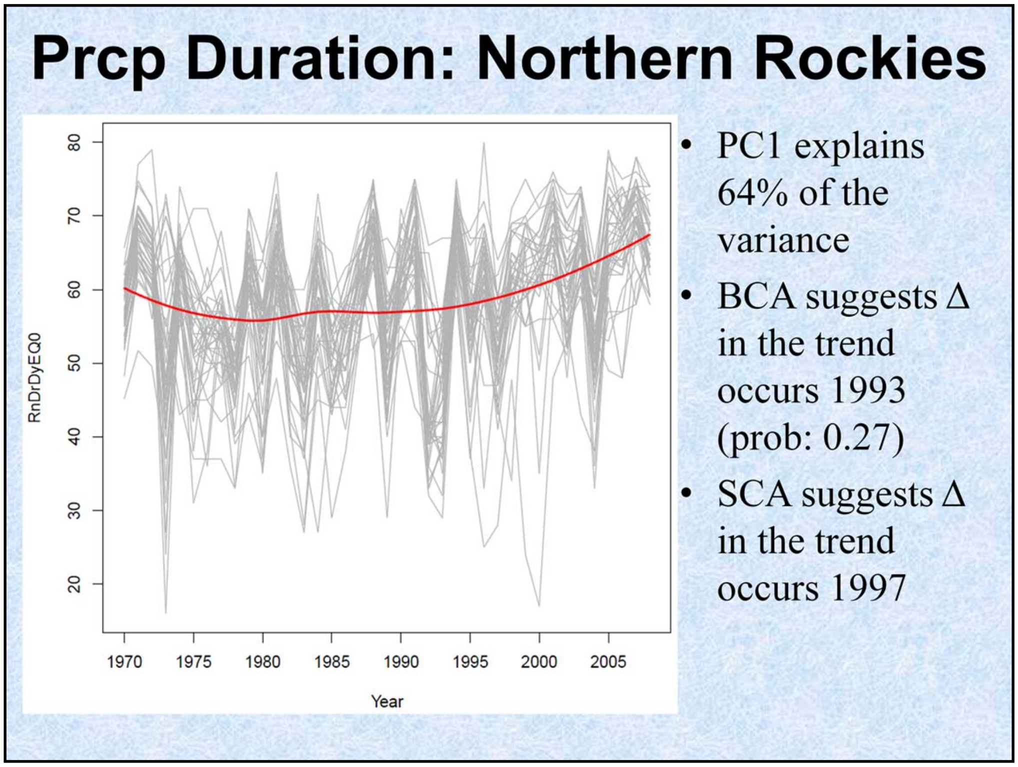


https://ams.confex.com/ams/9FIRE/webprogram/Paper192268.html

These are actual data values for Precipitation (not the PC)
A low-s curve was fitted through the medians of the station data for each year.
All 32 stations are represented in this graph.

No trends shown here.

Remember, this is June-September data only!

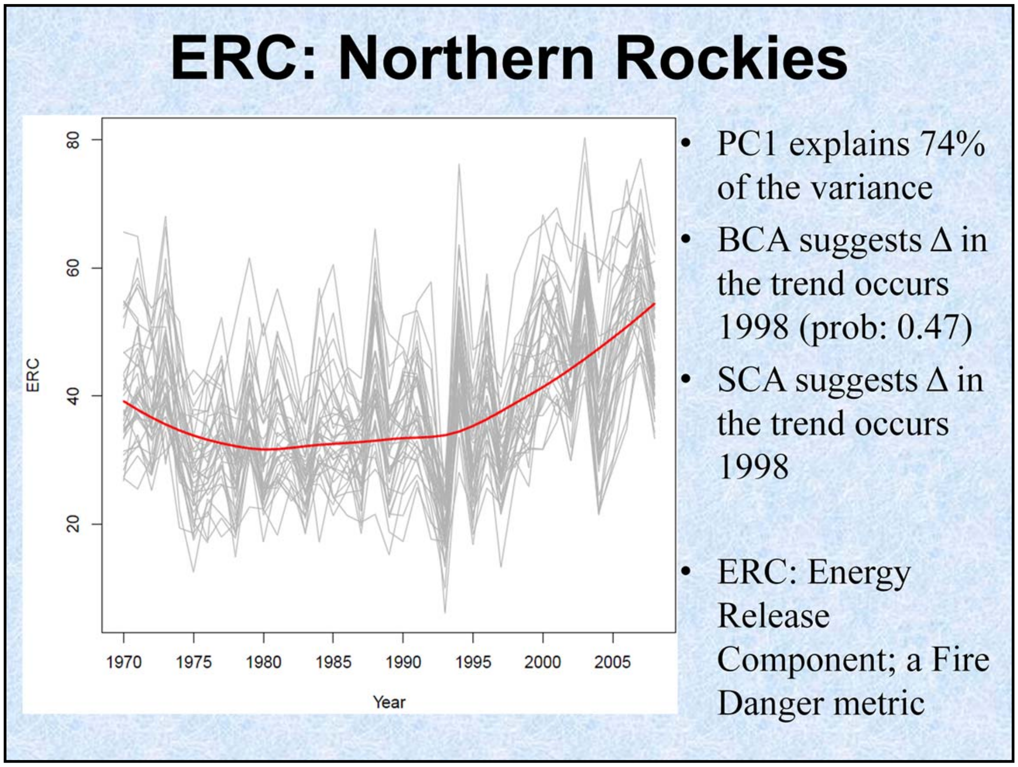


https://ams.confex.com/ams/9FIRE/webprogram/Paper192268.html

These are actual data values for RnDrHrsEq0 (not the PC); this variable is the total number of days in Jun-Sep with NO precipitation.
A low-s curve was fitted through the medians of the station data for each year.
All 32 stations are represented in this graph.

Remember, this is June-September data only!

We can’t discount the potential impact of ENSO and PDO on this cycle; something we hope to explore in the future.



https://ams.confex.com/ams/9FIRE/webprogram/Paper192268.html

These are actual data values for ERC (not the PC).
A low-s curve was fitted through the medians of the station data for each year.
All 32 stations are represented in this graph.

Remember, this is June-September data only!

The confidence interval supplied by SCA tend to agree with the dates found using BCA.

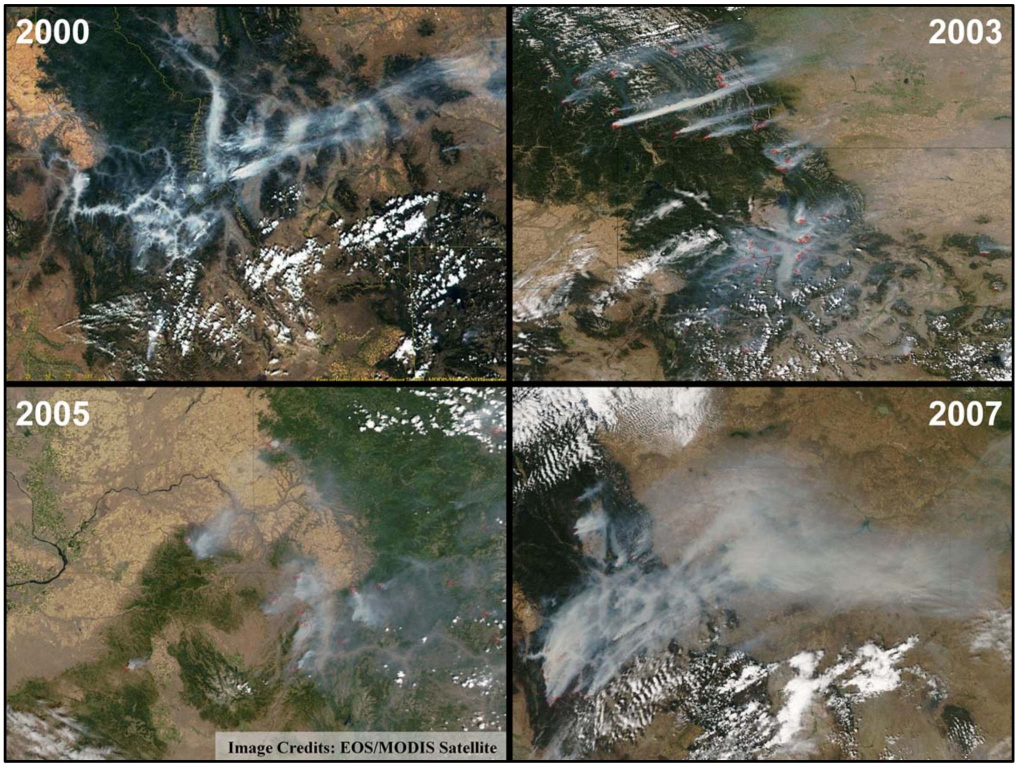

Changes in Wildland Fire
Lightning over the Beaver Jack Fire, from Hells Half Acre Lookout in the Frank Church Wilderness, 9 August 2005
© Mark S. Moak, 2005

Understanding Fire

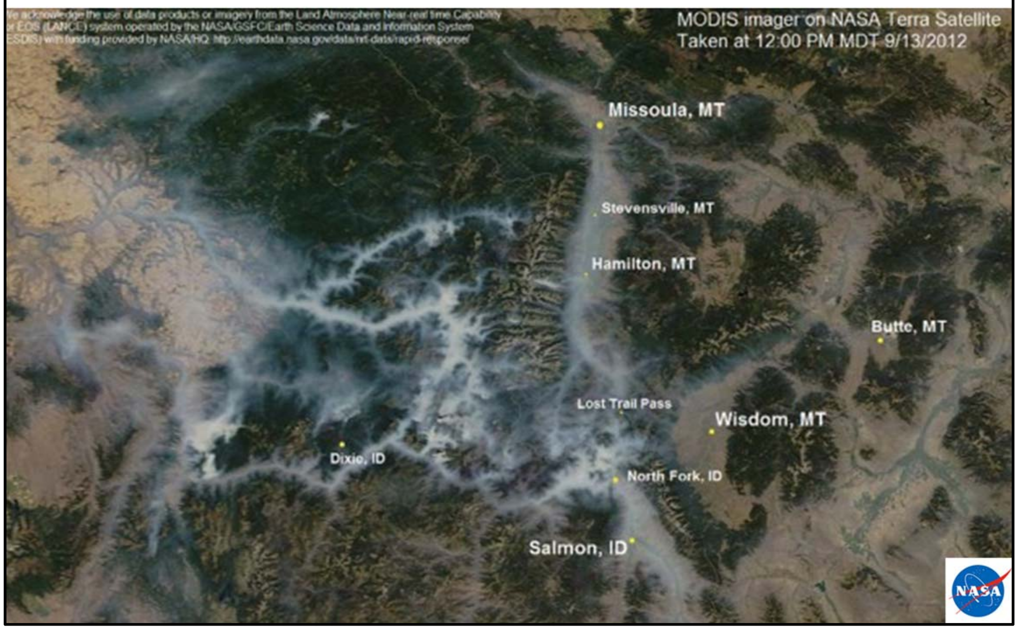
- U.S. Fire Return Interval = 24 years (Frost 1998)
  - Varies widely by region
- Many projections indicate increasing burned area
  - At some point, fire becomes self-limiting
- Western U.S. ecosystems largely fire-adapted
  - Fire is stochastic
  - Ideal: landscape mosaic
  - Resilient landscapes
  - What is the appropriate response to fire?

Photo Credit: Mick Harrington, USFS
Kootenai National Forest, 1 year post-burn

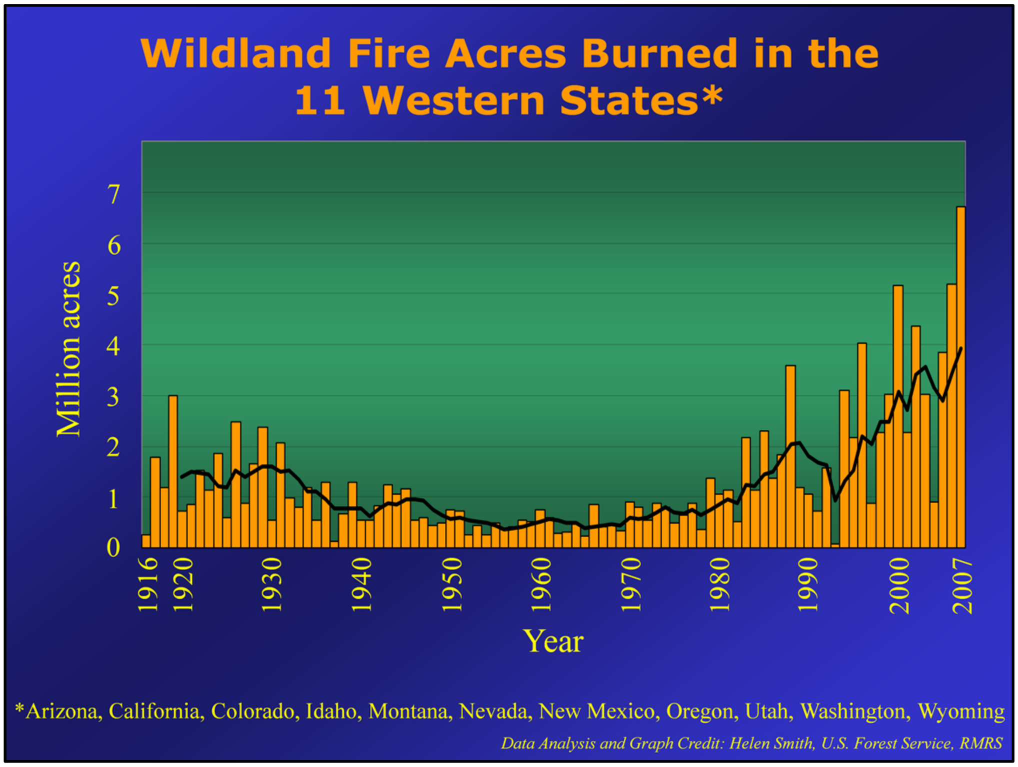

Fire Regimes
On a local to regional scale, fire regimes may be affected by
• terrain features,
• slope exposure,
• management regimes,
• landscape pattern, and
• ignition loads (both from lightning and from human impacts)


2000
2003
2005
2007
Image Credits: EOS/MODIS Satellite

Smoke



We acknowledge the use of data products or imagery from the Land Atmosphere Near-real time Capability for EOS (LANCE) system operated by the NASA/GSFC/Earth Science Data and Information System (ESDIS) with funding provided by NASA/HQ. http://earthdata.nasa.gov/data/nrt-data/rapid-response/
MODIS imager on NASA Terra Satellite
Taken at 12:00 PM MDT 9/13/2012
Missoula, MT
Stevensville, MT
Hamilton, MT
Butte, MT
Lost Trail Pass
Wisdom, MT
Dixie, ID
North Fork, ID
Salmon, ID

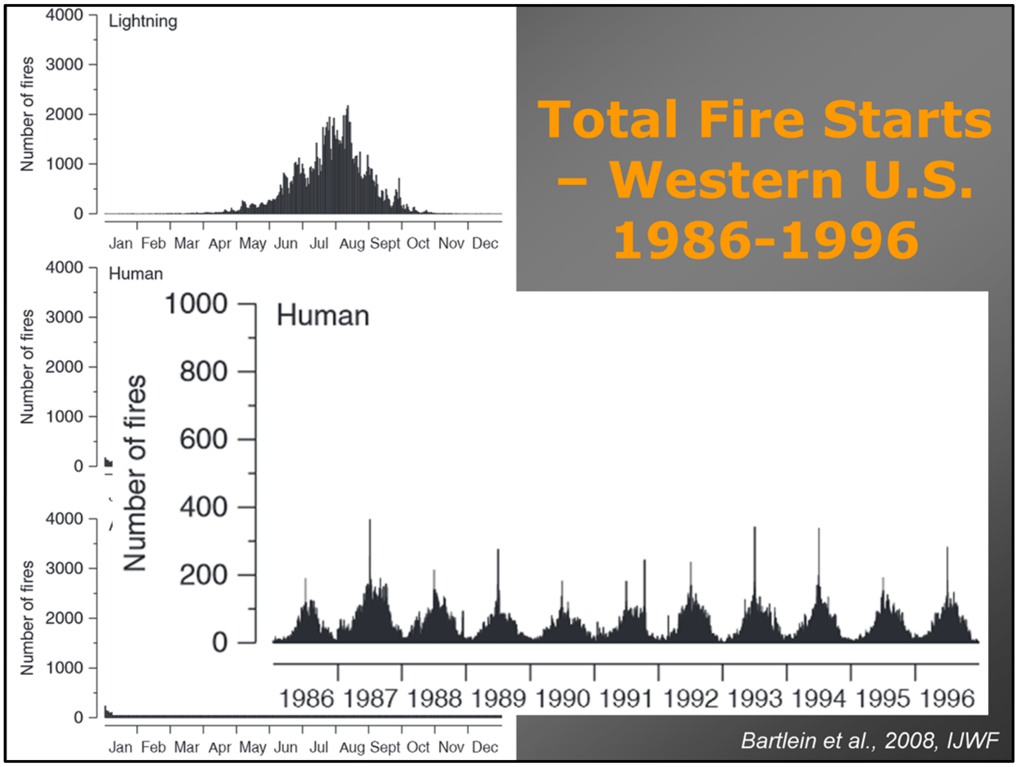


Since 1986:

- Western Fire Season 78 days longer
- 4-fold Increase in Fires > 1000 acres
- 6-fold Increase in Acres Burned
- Increase > in Forests above 6500 ft

From Littel: The mid-20th century decline and subsequent in crease in annual west-wide wildfire area burned (WFAB) fit a hypothesis of increasingly effective fire suppression and fuel accumulation, but evidence from paleo and modern fire histories indicates the combined influence of climate, vegetation, land use, and land management is likely a strong contributor to total variation in WFAB, with regional and local differences in the relative influences of these factors producing the aggregated response.

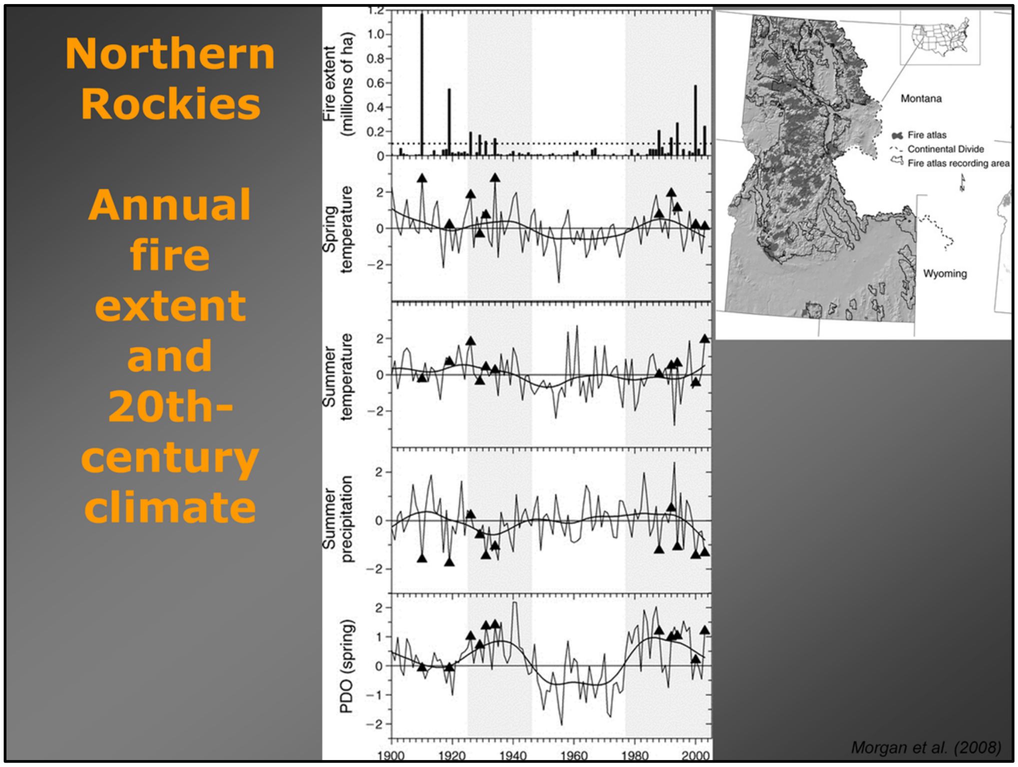
Dry, warm conditions in the seasons leading up to and including the fire season are associated with increased WFAB in most ecoprovinces, particularly in the northern and mountain ecoprovinces (low precipitation and high ET deplete fuel moisture over larger than normal areas)....increase probability of ignition and potential for fire spread



We used the daily fire-start data from the 1986–96 National Fire Occurrence Database as described in Hardy et al. (2001) and Schmidt et al. (2002), available at http://www.fs.fed.us/fire/fuelman/ (accessed 4 January 2008).

These data consist of records of the locations of individual fires, the date when each was first reported, and, for most records, the ultimate size and the date when the fire was considered to have been controlled (but not necessarily extinguished). A subset of the full dataset was extracted containing 332 404 records, including 116 489 fires caused by lightning and 197 617 fires caused by humans west of 102◦W (the region depicted in Fig. 1). Further discussion of the nature of these daily fire-start records is provided by Hardy et al. (2001), the review by Westerling et al. (2003), and in an assessment of the quality of such point-location data by Brown et al. (2002).

There are several problems that exist in these data, including duplication of fire-start records, records with fire-end dates without fire-start dates, over-representation of fires through reporting by multiple agencies, and others. We removed the obvious duplicated records, and believe that the visualisations of the data presented here are robust, reflecting real patterns in nature as opposed to artefacts attributable to data collection or processing.

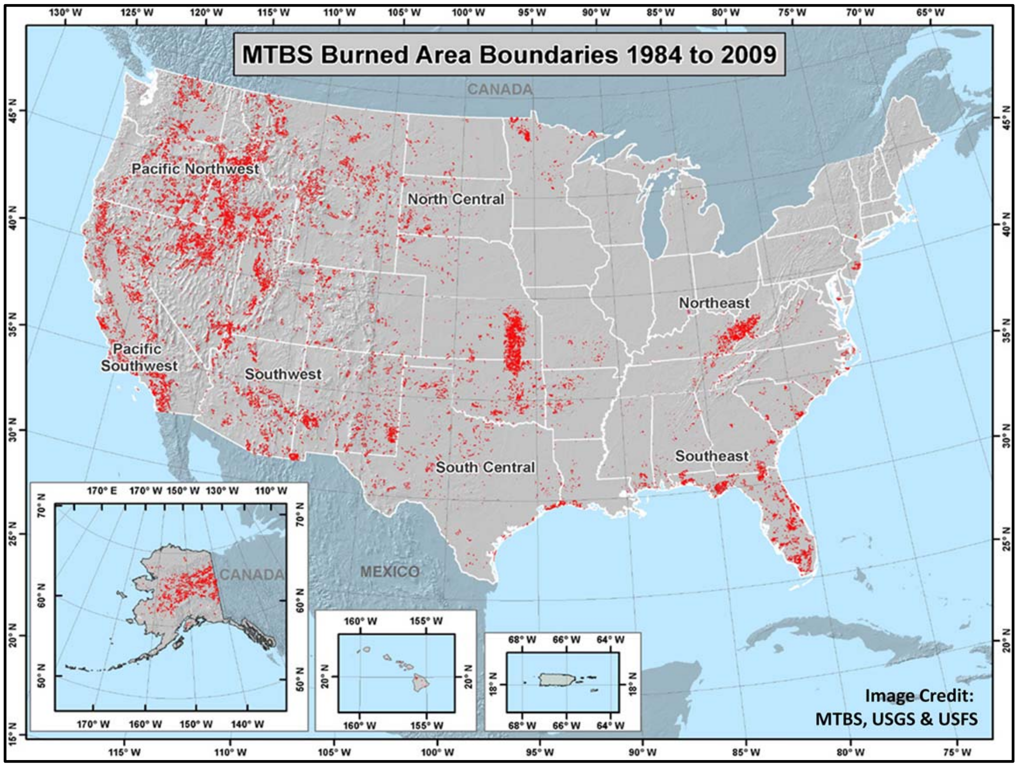


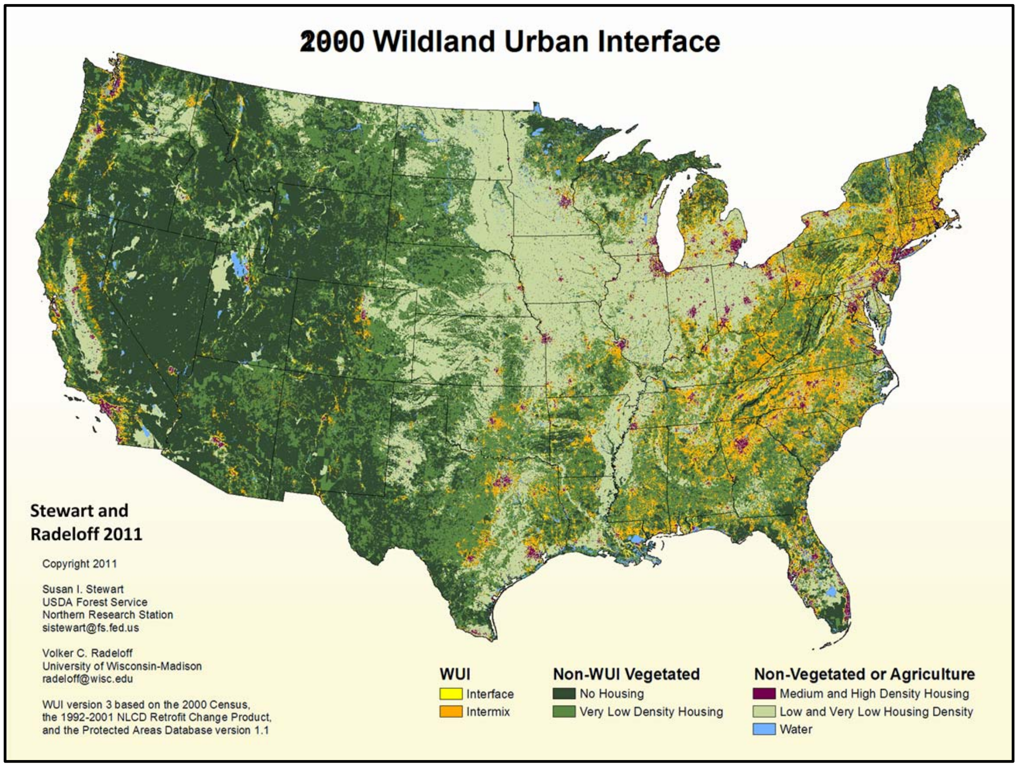
From Sommers et al. 2011, JFSP Report 09-2-01-09 :
Annual fire extent and 20th-century climate in the northern Rockies. The 11 years exceeding the 90th percentile in annual fire extent (102 314 ha, horizontal dotted line) were identified as regional fire years (top) and indicated with triangles in the other plots. Normalized spring temperature (March–May), summer temperature (June–August), and summer precipitation were averaged over the five climate divisions covered by this study. Heavy lines are smoothed climate data that retain 50% of the variance at periods of 25 years. Positive phases of the Pacific Decadal Oscillation (PDO) are shaded (Mantua et al. 1997). Source: Figure 3, Morgan et al. (2008).

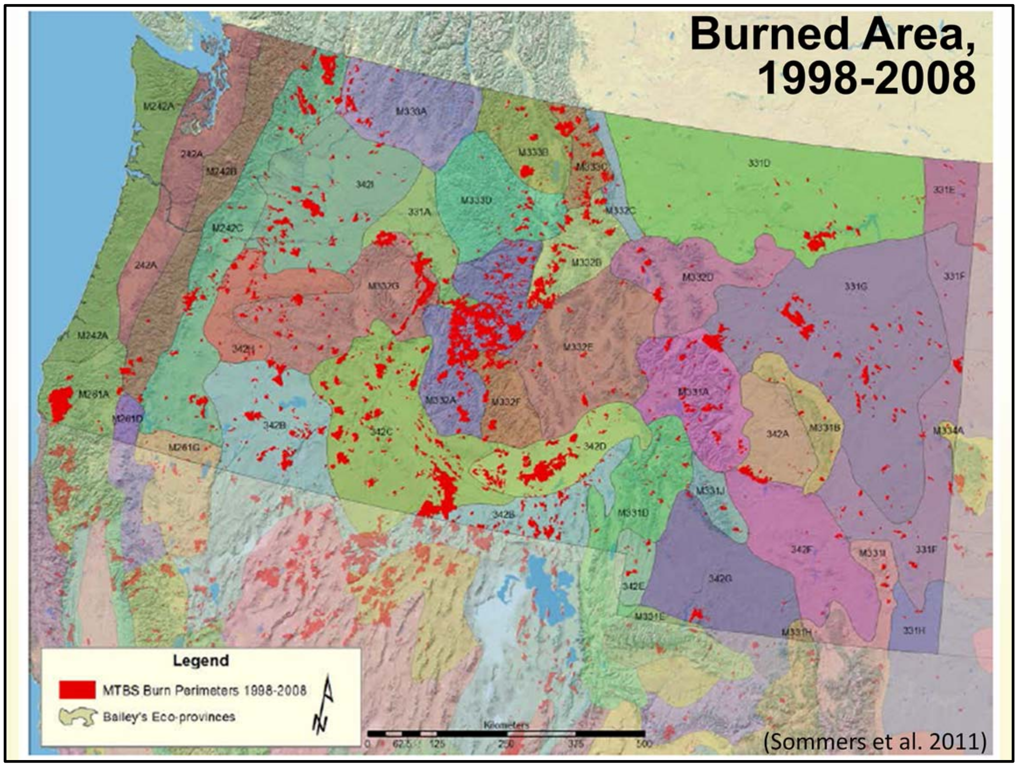
Go to Wildfire/Climate Graph at

http://www.climatecentral.org/news/drought-fueled-wildfire-near-yosemite-rages-on-16394

CLIMATE CENTRAL

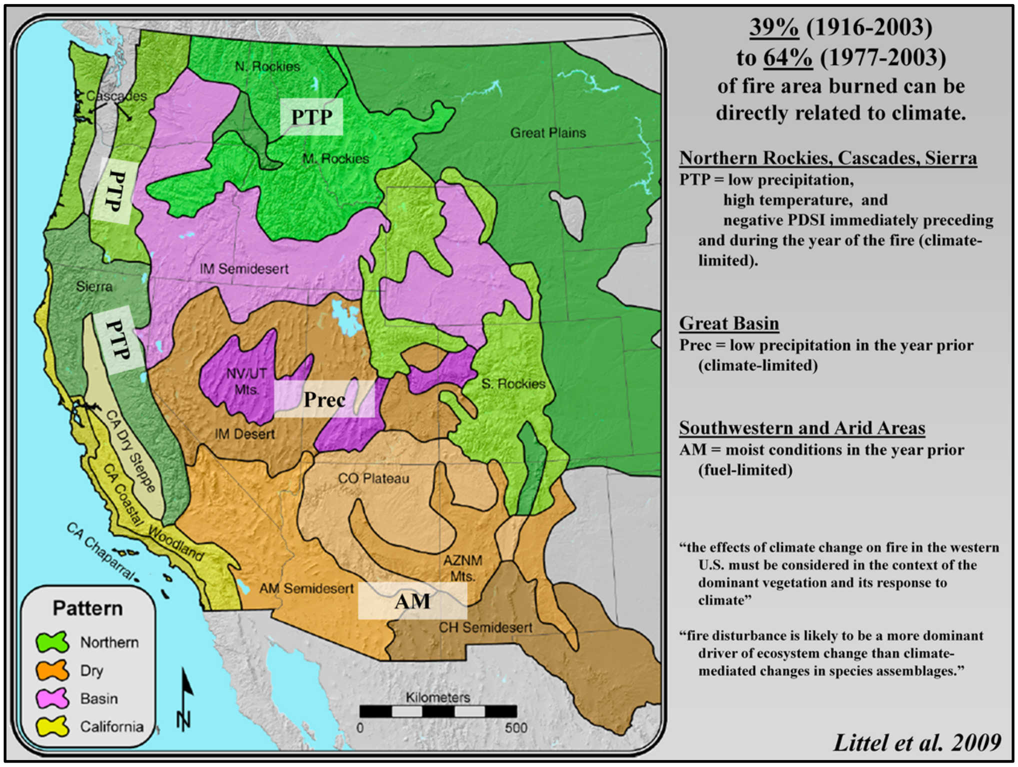

MTBS Burned Area Boundaries 1984 to 2009
CANADA
Pacific Northwest
North Central
Northeast
Pacific Southwest
Southwest
South Central
Southeast
MEXICO
Image Credit:
MTBS, USGS & USFS


2000 Wildland Urban Interface
Stewart and Radeloff 2011
Copyright 2011
Susan I. Stewart
USDA Forest Service
Northern Research Station
sistewart@fs.fed.us
Volker C. Radeloff
University of Wisconsin-Madison
radeloff@wisc.edu
WUI version 3 based on the 2000 Census, the 1992-2001 NLCD Retrofit Change Product, and the Protected Areas Database version 1.1
WUI
Interface
Intermix
Non-WUI Vegetated
No Housing
Very Low Density Housing
Non-Vegetated or Agriculture
Medium and High Density Housing
Low and Very Low Housing Density
Water



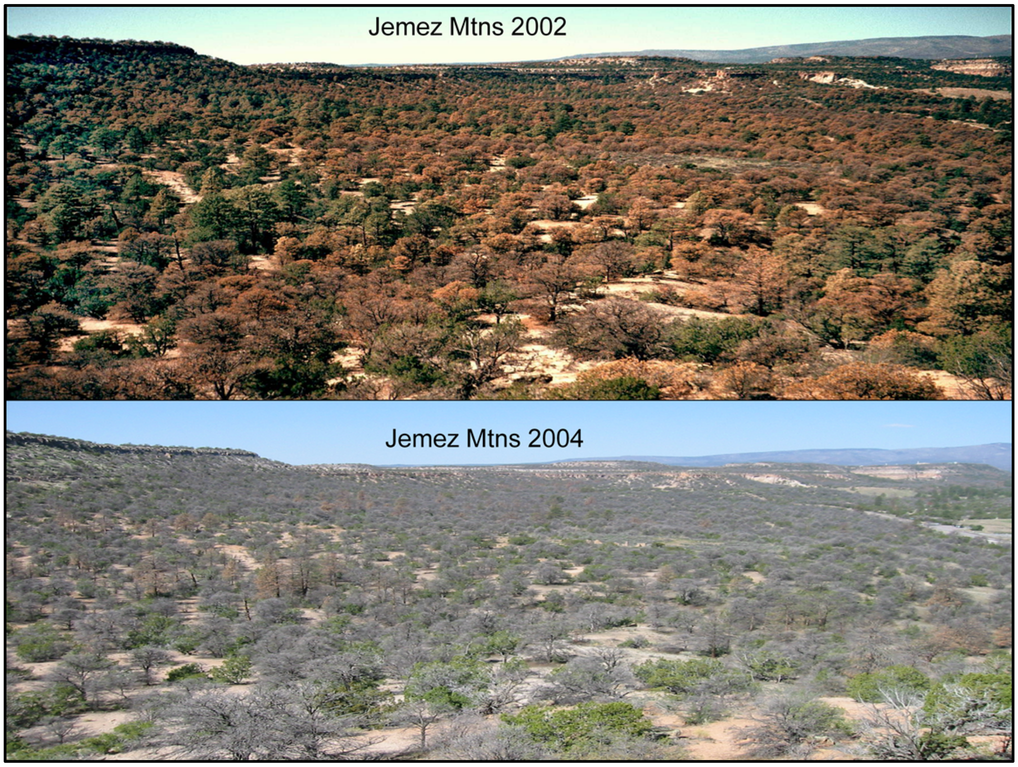
Cumulative burned areas in the northwestern US from 1998 through 2008, overlaid on Bailey's ecoprovinces and sections. Burn perimeter data from the Monitoring Trends in Burn Severity database. (Sommers et al. 2011, JFSP Report 09-2-01-09)

Photo: Fire Scar, Joshua Tree National Park, Faith Ann Heinsch



Climate-limited ecoprovinces may be less influenced by fuel treatment than fuel-limited ecoprovinces (at least for area burned, if not fire severity).

"lack of skill in predicting future patterns of precipitation (spatial and seasonal) represents a large source of uncertainty for ecoprovinces that are largely sensitive to precipitation and drought."



Dying *Pinus edulis*, Jemez Mtns, October 2002

Fuels and Fuel Treatments

- Treatment
  - Fire will be part of the landscape
  - Effective treatments must control type of fire
    - Fuels reduction
    - Prescribed fire
    - Pile burning

Keane 2008. RMRS-RP-70

Photo Credits: Mick Harrington, USFS

Fuel Treatments

Landscape Changes

- Invasive Species
  - Cheatgrass

Photo Credit: Wikimedia Commons

Landscape Changes

- Species changes
  - Lodgepole pine (serotiny)

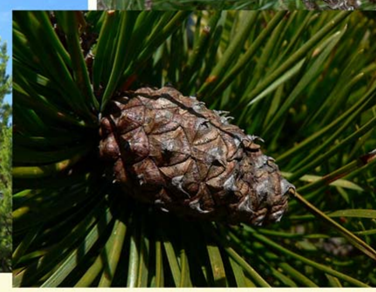


Photo Credits: Wikimedia Commons

Landscape Changes

- Species changes
  - Woody encroachment or species shifts

Photo Credit: Yellowstone National Park Archives (1958)

Photo Credit: Art Sikkink (2008)

Landscape Changes

- Mountain Pine Beetle
  - Natural cycle, but large area involved
  - Drought, warmer winters, aging forests
  - Safety issue in the WUI

Photo Credits:
U.S. Forest Service

Areas in orange were affected by the mountain pine beetle in Canada, 1999–2010, and the U.S., 2005–20 (projected). *Source: http://www.nytimes.com/interactive/2011/10/01/science/earth/forests.html?ref=earth.*

JFSP Fire Science Digest, Issue 12, 2012

Map: http://www.firescience.gov/Digest/FSdigest12.pdf
Pine beetle picture: http://www.uwyo.edu/uwag/News/May2011/pine_bettle.html

- Red needles are about <u>10x drier</u> than green needles
  - Attacked trees can show moisture/chemical changes before color change occurs
- Red needles ignite ~<u>3x faster</u>
- Red needle trees release more heat, faster
- Structural changes of fuels still not completely described

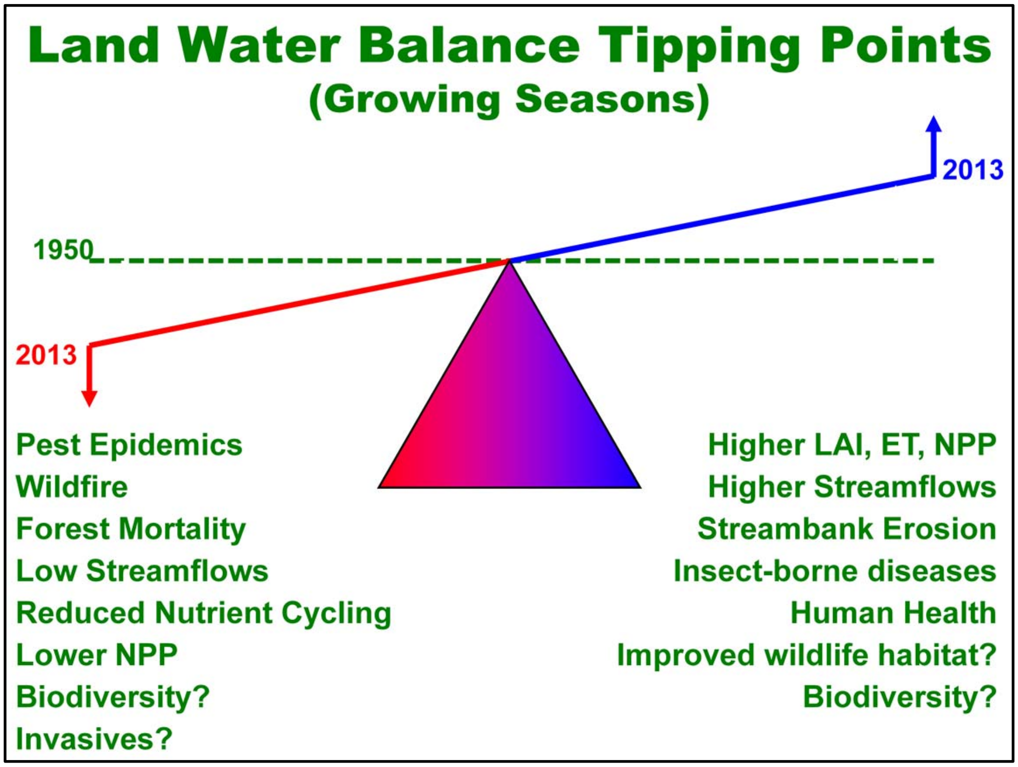
- Longer <u>spotting</u> distances observed from single tree torching
  - ¼ mile from red needle trees
  - ½ mile from grey stage trees
- Higher <u>probability of ignition</u> with more receptive fuels
- Larger <u>safety zones</u> required due to larger potential heat release

Research: Matt Jolly and Russ Parsons, Fire Lab
Photos:
Red Stage: University of Wyoming, May 2011
Grey Stage: JFSP Fire Science Digest, Issue 12, 2012

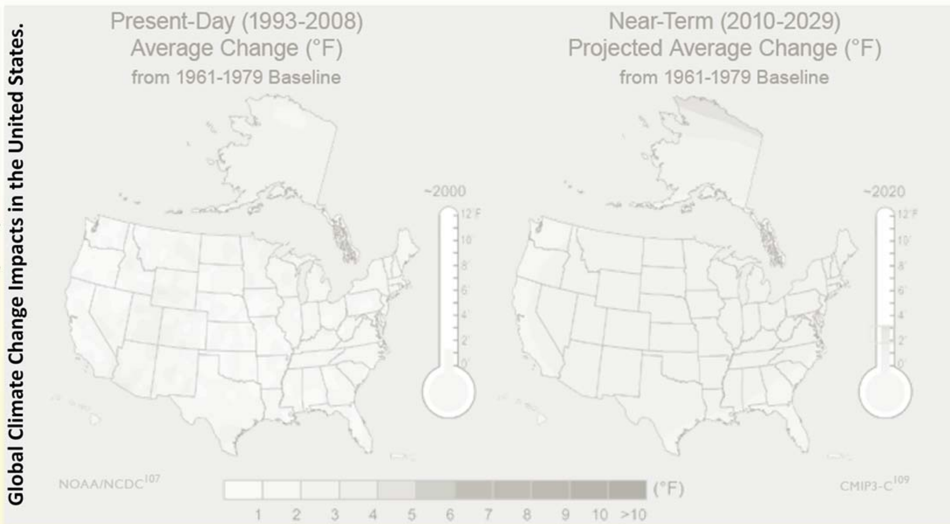
Clint Kyhl

A beetle-killed spruce-fir forest at the gray stage in Colorado's Willow Creek Pass.

Information: http://www.beetles.mt.gov/MPBForum/PDFs/JollyMortalityFlammability.pdf
Map: http://www.firescience.gov/Digest/FSdigest12.pdf
Pine beetle picture: http://www.uwyo.edu/uwag/News/May2011/pine_bettle.html

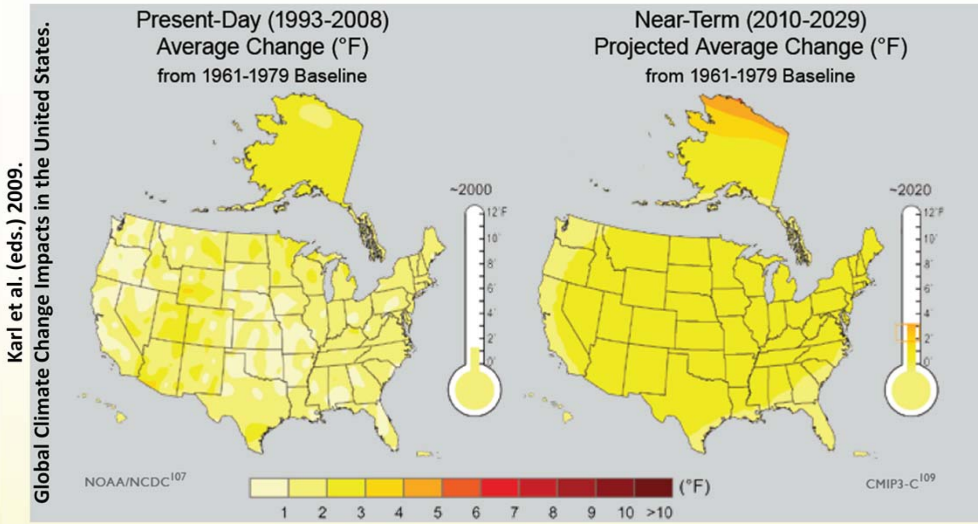

Land Water Balance Tipping Points
(Growing Seasons)
2013
1950
2013
Pest Epidemics
Wildfire
Forest Mortality
Low Streamflows
Reduced Nutrient Cycling
Lower NPP
Biodiversity?
Invasives?
Higher LAI, ET, NPP
Higher Streamflows
Streambank Erosion
Insect-borne diseases
Human Health
Improved wildlife habitat?
Biodiversity?

“Near” Future Projections



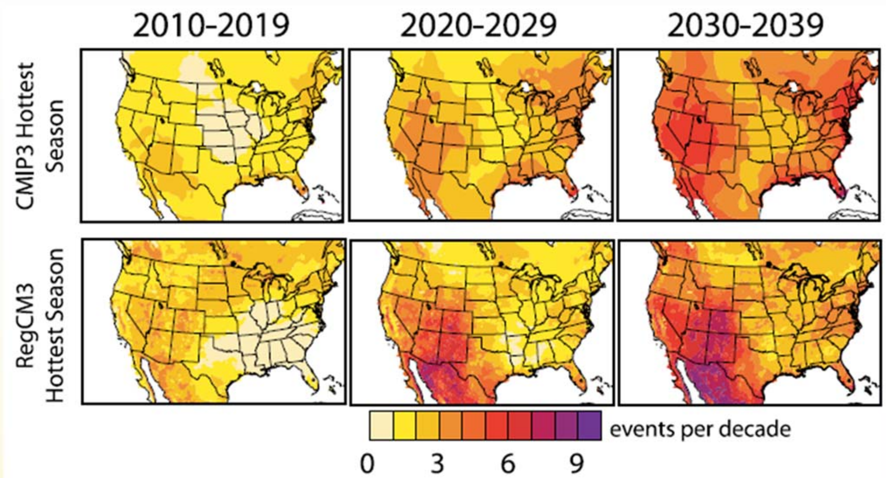
Karl et al. (eds.) 2009.
Global Climate Change Impacts in the United States.

Near-Term Climate 2010-2029



- Many climate projections produced for 2050-2100

Near-Term Climate 2010-2029



Number of times the hottest season of
1951-1999 was exceeded in each decade

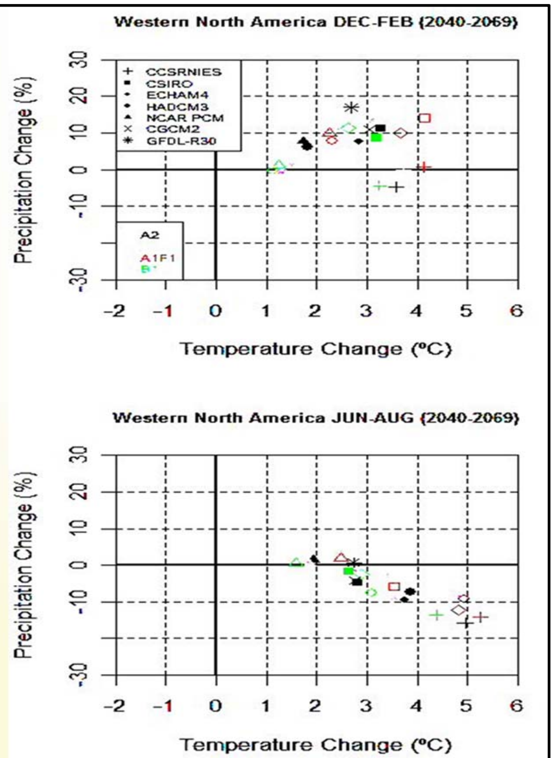
Diffenbaugh and Ashfaq. 2010. Intensification of hot extremes in the United States. Geophysical Research Letters.

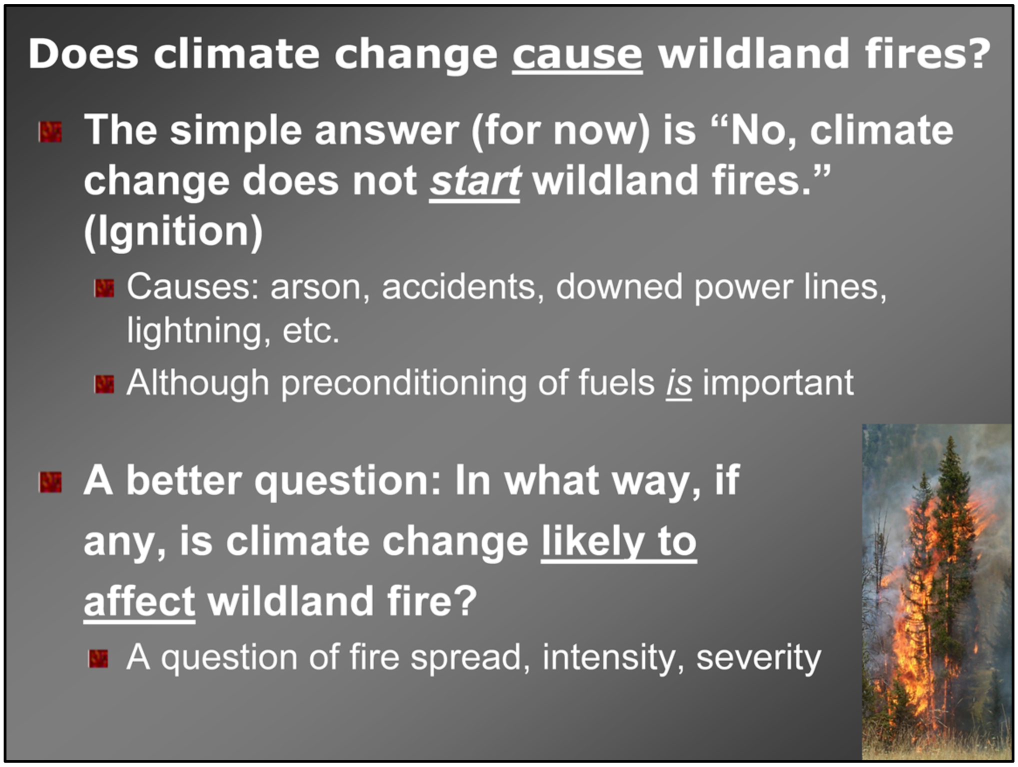
IPCC 4th Assessment GCMs

All Year
3°C (5.4°F) warmer

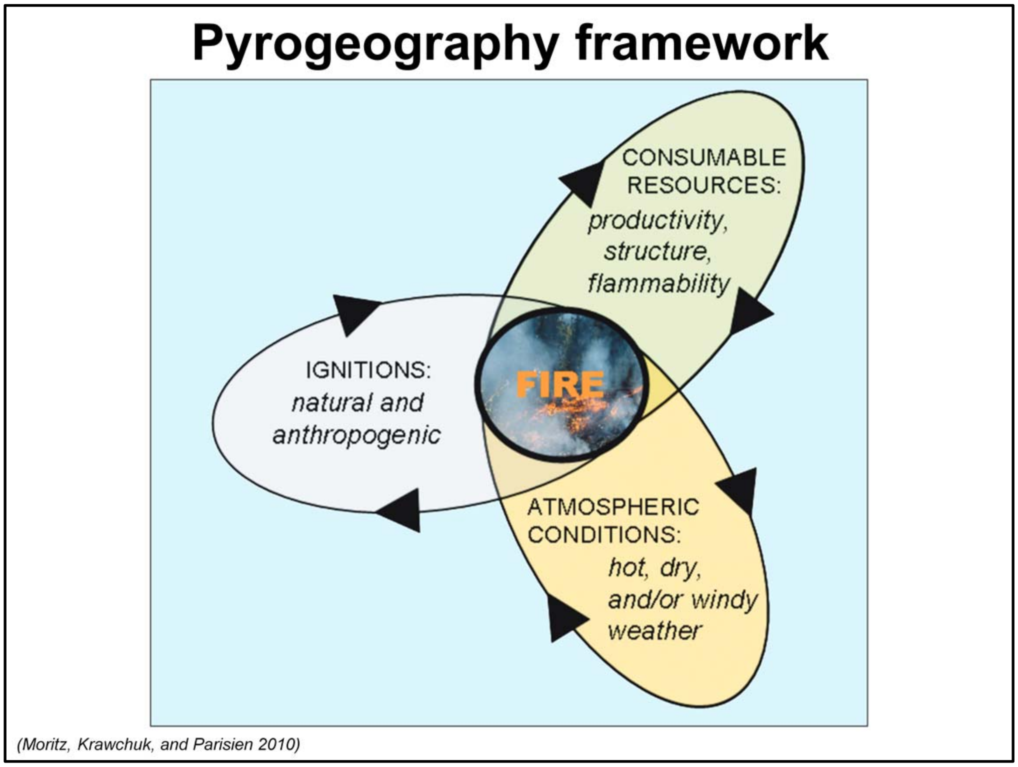
BUT
Winter – wetter

Summer – drier



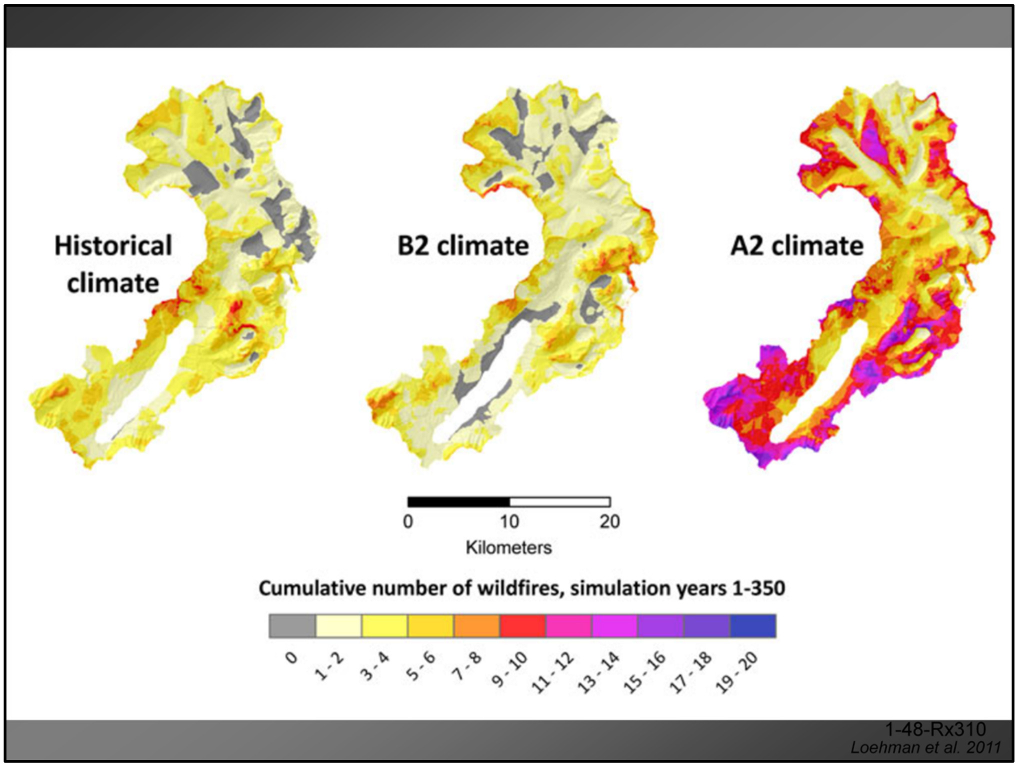


Littel: Strong relationships exist between climate and fire across the western U.S., but the nature of those relationships varies with climate/vegetation.
Strongest relationships are similar when the earlier part of the 20th century is considered, indicating that climate has been an important determinant of area burned for much of the century.



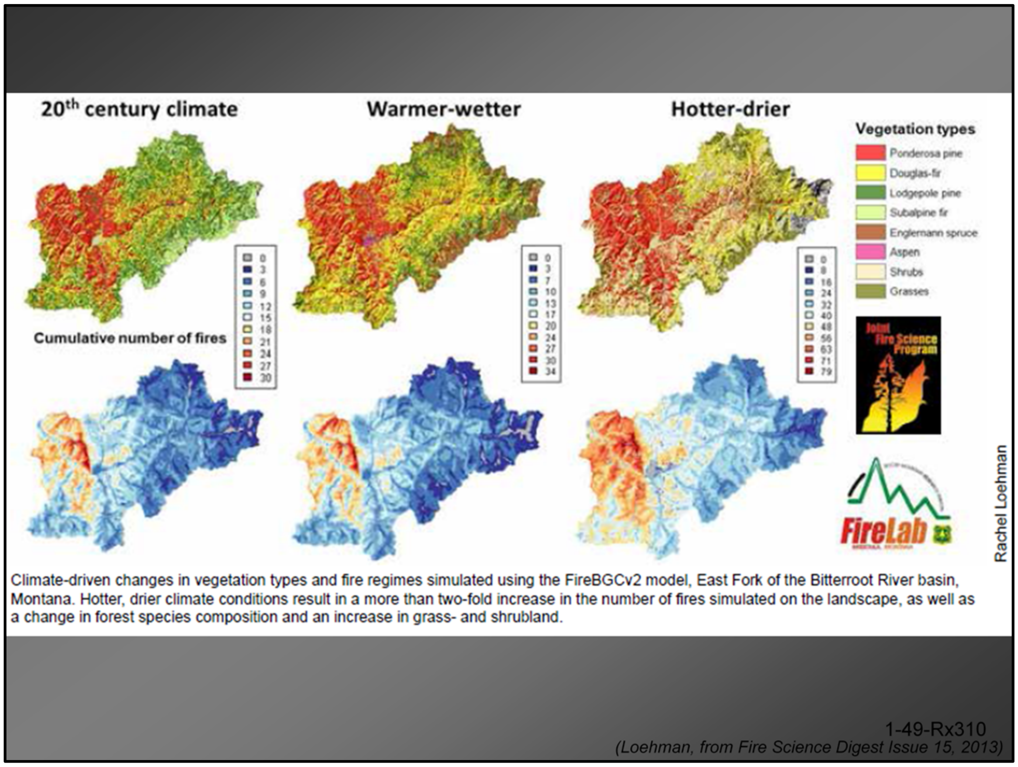
http://www.pages-igbp.org/products/newsletters/2010-2/PAGESnews_18%282%29-hires.pdf (p. 83)

From Sommers et al. 2011, JFSP Report 09-2-01-09 :
Pyrogeography framework includes vegetation resources to consume, atmospheric conditions, and ignition agents. Each of these components is spatially and temporally variable, as illustrated by arrows, and it is their coincidence that results in fire activity. Variation in their coincidence generates different fire regime types (e.g., frequent low intensity surface fire versus infrequent high intensity crown fire). Source: (Max A. Moritz, Krawchuk, and Parisien 2010)



http://www.fs.fed.us/rm/pubs/rmrs_p063/rmrs_p063_176_189.pdf

From Sommers et al., 2011:
Cumulative number of wildfires, based on simulation modeling for on the McDonald drainage of Glacier simulation landscape for historical, B2, and A2 climate scenarios over a 350-year simulation period. Projections for this study region under the B2 scenario are for warmer, wetter summer conditions (+2.1 °C, +24 percent precipitation) and warmer but slightly drier winters (+1.8 °C, -1.0 percent precipitation). The A2 scenario projects hotter, drier summers (+6.7 °C, -34 percent precipitation) and warmer, wetter winters (+2.5 °C, -11 percent precipitation) than at present. From Figure 9 in Loehman et al. 2011



Rather than downscaling global climate model predictions for particular areas, they ran the FireBGCv2 landscape fire and vegetation model (see sidebar) with incremental shifts in temperature and precipitation, from warm, to hot and dry, to wet future climates. Model results highlighted two key issues. First, projected climate changes might create inhospitable conditions for some tree species, leading to new forest types or structures in some landscapes. Second, increases in fire frequency or area burned—changes that happen under warmer, drier conditions— can catalyze changes in species composition or reduce forest cover altogether.

For all three landscapes, the researchers found that annual area burned increases as temperature increases, which will accelerate mortality for a variety of tree species. “Fire makes a huge difference on the landscape,” says Rachel Loehman, a research scientist at the Missoula Fire Sciences Laboratory. “If and when they burn, in forests already affected by climate-related stressors like drought and mountain pine beetle epidemics, fires can cause a forested landscape to shift to a grassland or shrubland.”

These findings hold true even for scenarios with increased precipitation. While increased precipitation can offset increases in temperature, when temperatures increase by 5-6º C, increases in moisture don’t buffer the effects of warmer temperatures.

Fire and Climate Change

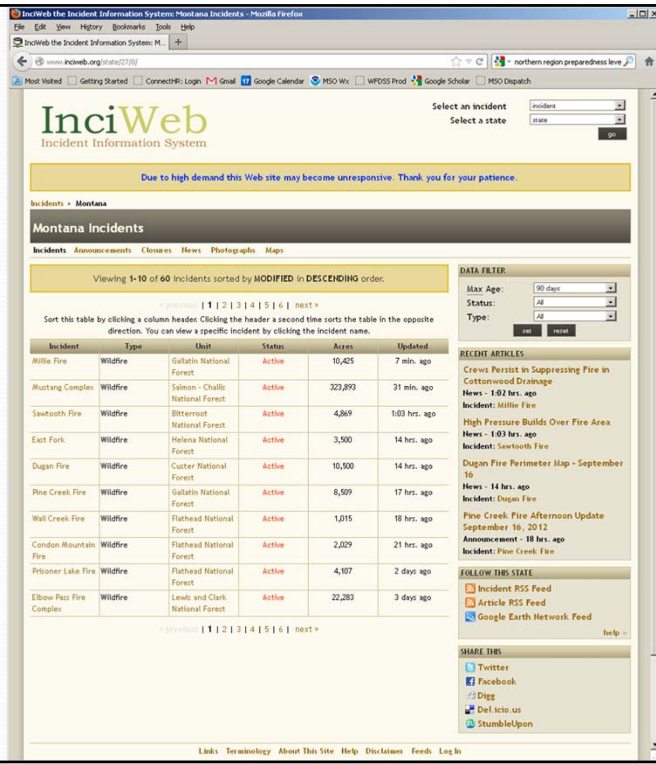
- Aspects of fire will be affected by changes in climate
  - Based on past response to climate change
- Fire will be a catalyst for change in vegetation,
  - more rapid change than would be expected from changes in temperature and moisture availability?
  - may be more important than the direct effects of climate change
- Fires may be more frequent where climate warms, especially boreal forests

Fire and Climate Change

- Changes in regional and local fire regimes will be affected by
  - changes in ignition (lightning),
  - vegetation change and
  - land use patterns and land management practices.
- Climate change appears likely to affect lightning
  - Lightning producing convective storms are expected to become more frequent and intense
  - One study suggests
    - 30% increase in lightning activity for warmer climate and
    - 24% decrease in global lightning activity for the colder climate.
    - Implies an approximate 5–6% change in global lightning frequencies for every 1°C global warming/cooling


Select Regional Fires, 2012-2013
Image Credit, EGB IMT 1

www.inciweb.org



D. Haggstrom, courtesy of SNAP and ACCAP

A smoke column develops during an experimental burn outside of Fairbanks, Alaska.

D. Haggstrom, courtesy of SNAP and ACCAP

Taken immediately after an experimental burn outside of Fairbanks, Alaska, this image shows the effects of fire inside and outside a fuels treatment plot.

(Fire Science Digest Issue 15, 2013)

http://www.firescience.gov/Digest/FSdigest15.pdf

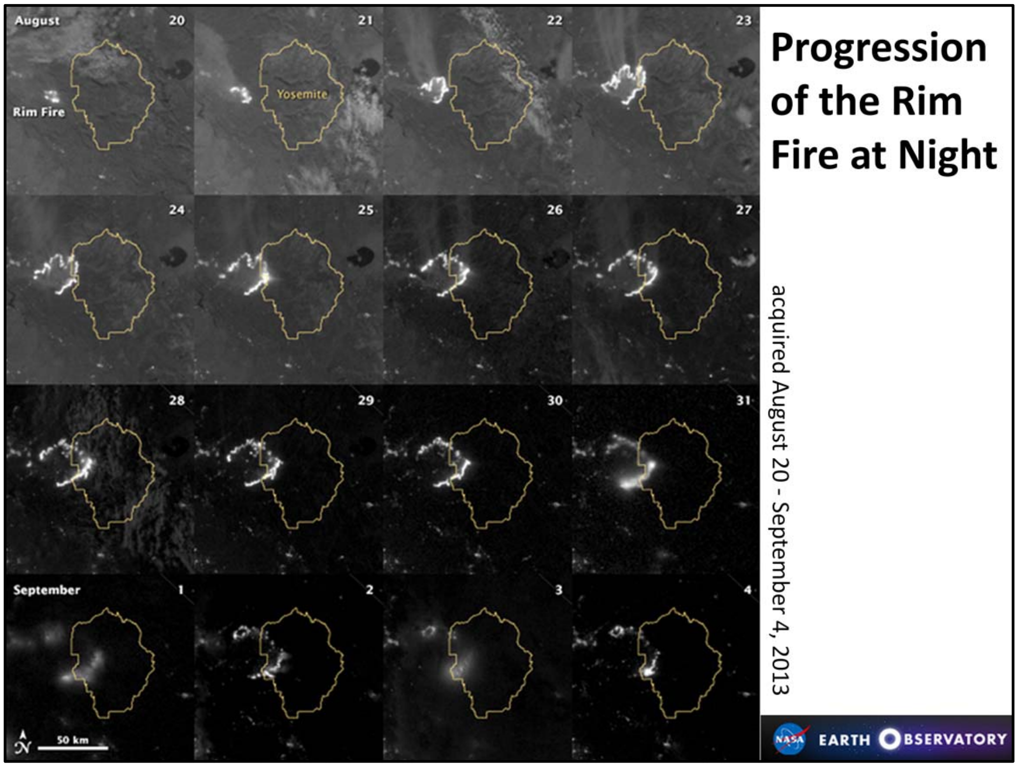
Wye Fire, Blackfeet Agency
January 04, 2012, Human, 12,000 Acres

Facebook, Browning Fire page

Butler Fire, Lolo NF
July 30, 2012, Lightning, 70 Acres

Elevation Mountain Fire, Montana DNRC
August 21, 2012, Lightning, 877 Acres

Photo: http://www.climatecentral.org/news/drought-fueled-wildfire-near-yosemite-rages-on-16394
Inciweb: http://inciweb.nwcg.gov/photos/CASTF/2013-08-17-1950-Rim/picts/2013_09_24-21.26.23.708-CDT.jpeg

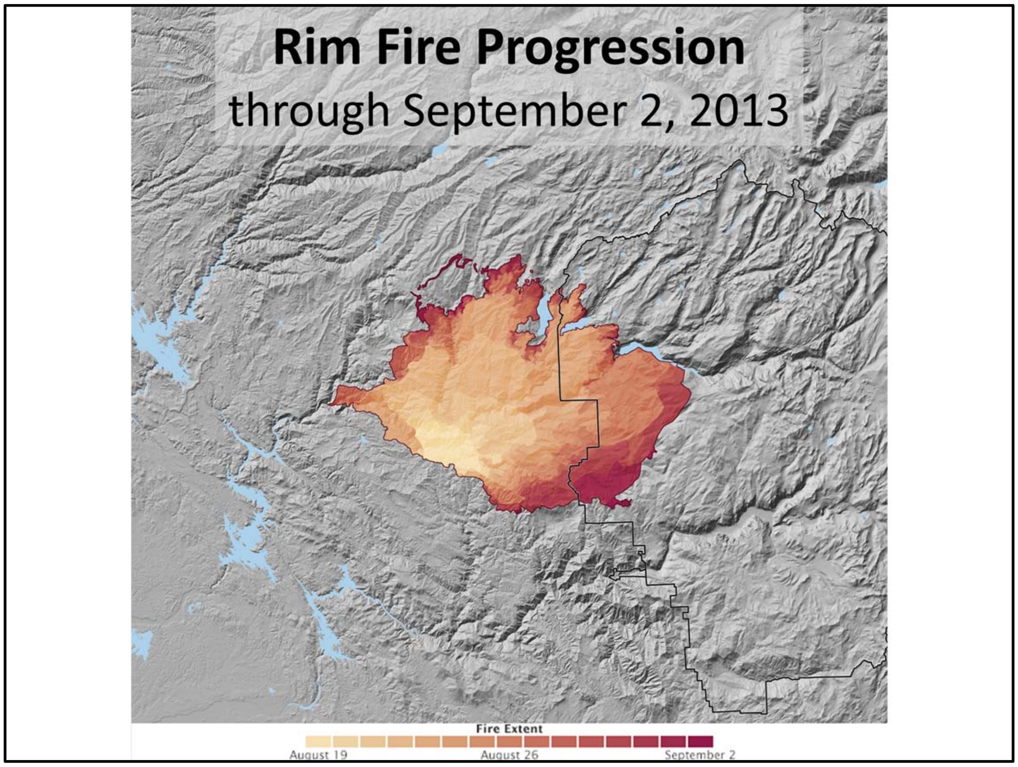


Progression of the Rim Fire at Night : Natural Hazards, NASA Earth Observatory
http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=82004&src=nha

The winter of 2012–2013 was among the driest on record for California, setting the stage for an active fire season. By September 6, 2013, the Rim Fire had made its way into the record books. Eighty percent contained, the fire was the third largest in California since records began in 1932.

The brightest, most intense parts of the fire glow white. Pale gray smoke streams away, generally to the north. Thin clouds obscured the view on some days, particularly August 31, September 1, and September 3. On August 20, the Moon was full, so the landscape was reflecting a large amount of moonlight. The background grew progressively darker as the September 5 new moon approached.

The perimeter of the fire changed along different fronts from day to day, depending on winds and firefighting efforts. On August 24, firefighters focused on containing the western edge of the fire to prevent it from burning into Tuolumne City and the populated Highway 108 corridor. They also fought the eastern edge of the fire to protect Yosemite National Park. These efforts are evident in the images: Between August 23 and 24, the eastern edge held steady, the western edge receded, and the fire grew in the southeast. On the morning of August 25, 2013, fire managers reported that the blaze was growing in the north and east. With the fire burning aggressively and moving east into Yosemite, August 26 and 27 proved challenging days for firefighters. But over the next few days, they began to gain control after a series of burnout operations along the fire's northern and eastern edges. On August 29, the evacuation advisory for Tuolumne City was lifted. The southeastern flank continued to burn intensely in the first week of September, but officials expect the blaze will be 100 percent contained by September 20.


Rim Fire Progression
through September 2, 2013
Fire Extent
August 19
August 26
September 2

Beaver Creek Fire Eastern Great Basin IMT 1

August 13-23, 2013

All pictures were taken by Faith Ann Heinsch or other federal government employees. Fire operations pictures were taken from the Beaver Creek Fire Flickr site (http://www.flickr.com/photos/100460143@N08/9544445495/) or IMT Facebook site.

Beaver Creek Fire Video

http://vimeo.com/72619750

http://vimeo.com/72705351

Air Retardant Drop
Water Drop Near Golden Eagle
Water Drop, Picture by Lori Iverson, Public Information Officer
Helicopter Dip Site

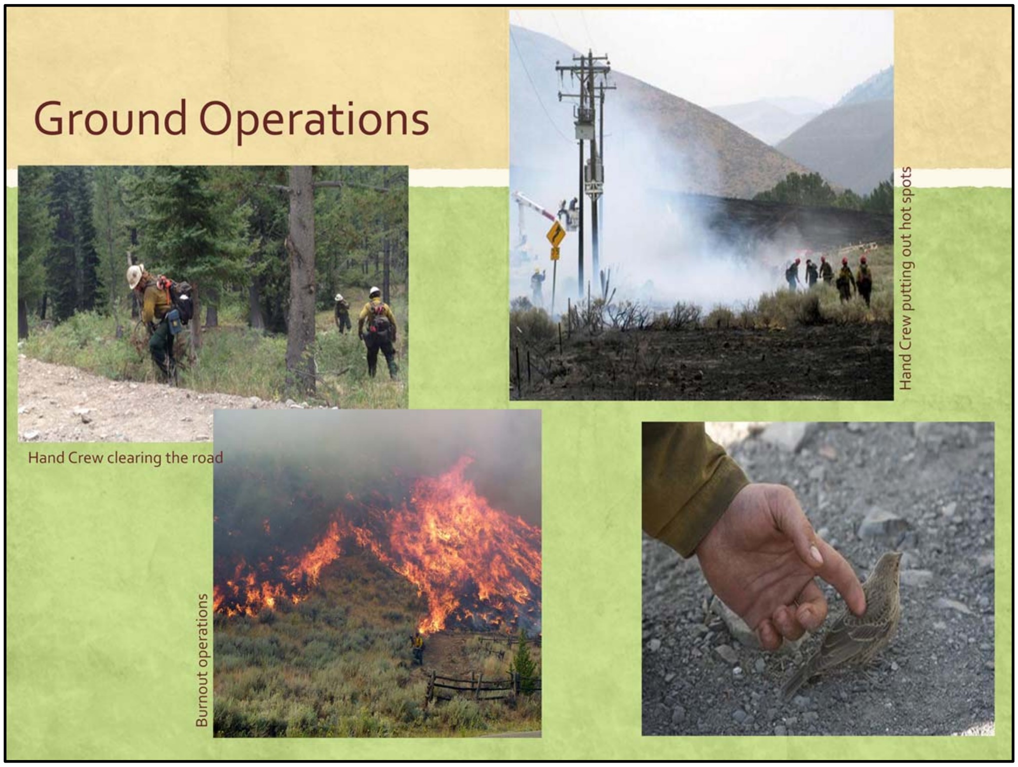
Structure Support

Mowing the lawn near the historic ranger station

Structure protection - sprinklers and hose on a house

Structure protection - Wrapping a bridge

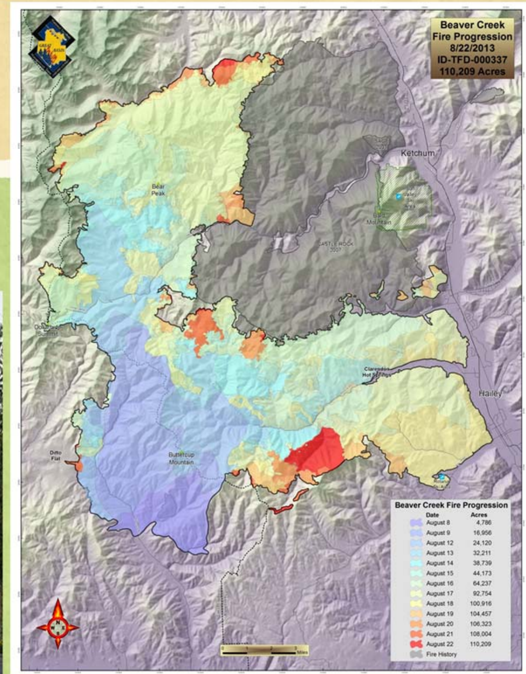
Structure protection - Wrapping a bridge
Mowing the lawn near the historic ranger station
Structure protection - sprinklers and hose on a house



Hand Crew clearing the road
Hand Crew putting out hot spots
Burnout operations
Bird near fire…

Beaver Creek Progression Map

Public Information Trapline, near Albertsons, Hailey, Idaho



Beaver Creek Daily Progression Map using airplane infrared data

Public Information Trapline, near Albertsons, Hailey, Idaho
Beaver Creek Daily Progression Map using airplane infrared data

Lolo Creek Fire Northern Rockies

August 18-September 11, 2013

All pictures were taken from Inciweb (http://inciweb.org/incident/3683/)

Active Crown Fire on U.S. Highway 12

http://inciweb.org/incident/photograph/3683/4/

Crown Fire, northeast side of fire

http://inciweb.org/incident/photograph/3683/3/

Camp Creek Drainage, post-fire

http://inciweb.org/incident/photograph/3683/33/

Backing Fire near Fort Fizzle

http://inciweb.org/incident/photograph/3683/55/

Wild turkeys temporarily displaced by fire:
http://inciweb.org/incident/photograph/3683/41/
Wild turkeys return: http://inciweb.org/incident/photograph/3683/42/
Moose in crown fire burn along Lolo Creek:
http://inciweb.org/incident/photograph/3683/43/

Questions?