

Wildfire Science in the USGS

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Changing nature of wildfire

Why has the number of acres burned increased over the last few years?

1. Many fires are caused by lightning, but nine out of ten U.S. wildfires are human-caused.
2. Past fire suppression policies which allowed for the accumulation of fuel in wildlands.
3. Increasingly dry, hot weather and longer 'fire seasons.'
4. Changing weather patterns across the U.S., with increased extremes.
5. Increased development in exurban areas.



MAJOR FIRES

since 2001, colored by units of nuclear power plant output

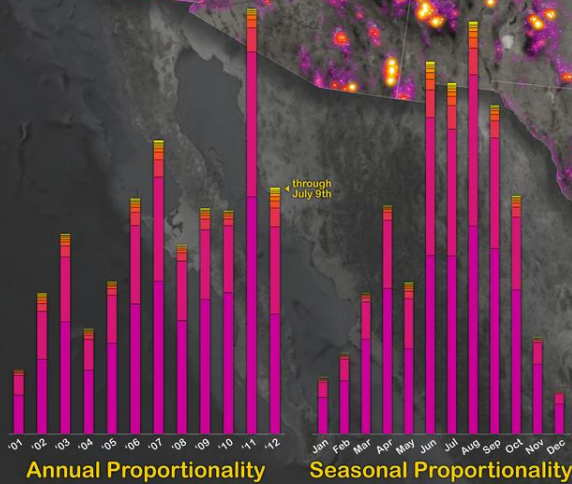
NASA Visible Earth | visibleearth.nasa.gov
 USDA Forest Service | activefiremaps.fs.fed.us
 MODIS | modis.gsfc.nasa.gov

Fires are detected by the MODIS satellite at the 1km centroid resolution and contain time, confidence, and wattage information. Only fires with a confidence greater than 50% and a wattage greater than 100 MW were retained. Data is current through July 9, 2012.

▲ US Nuclear Power Plants have a summer-time capacity of around 1,000 Megawatts...



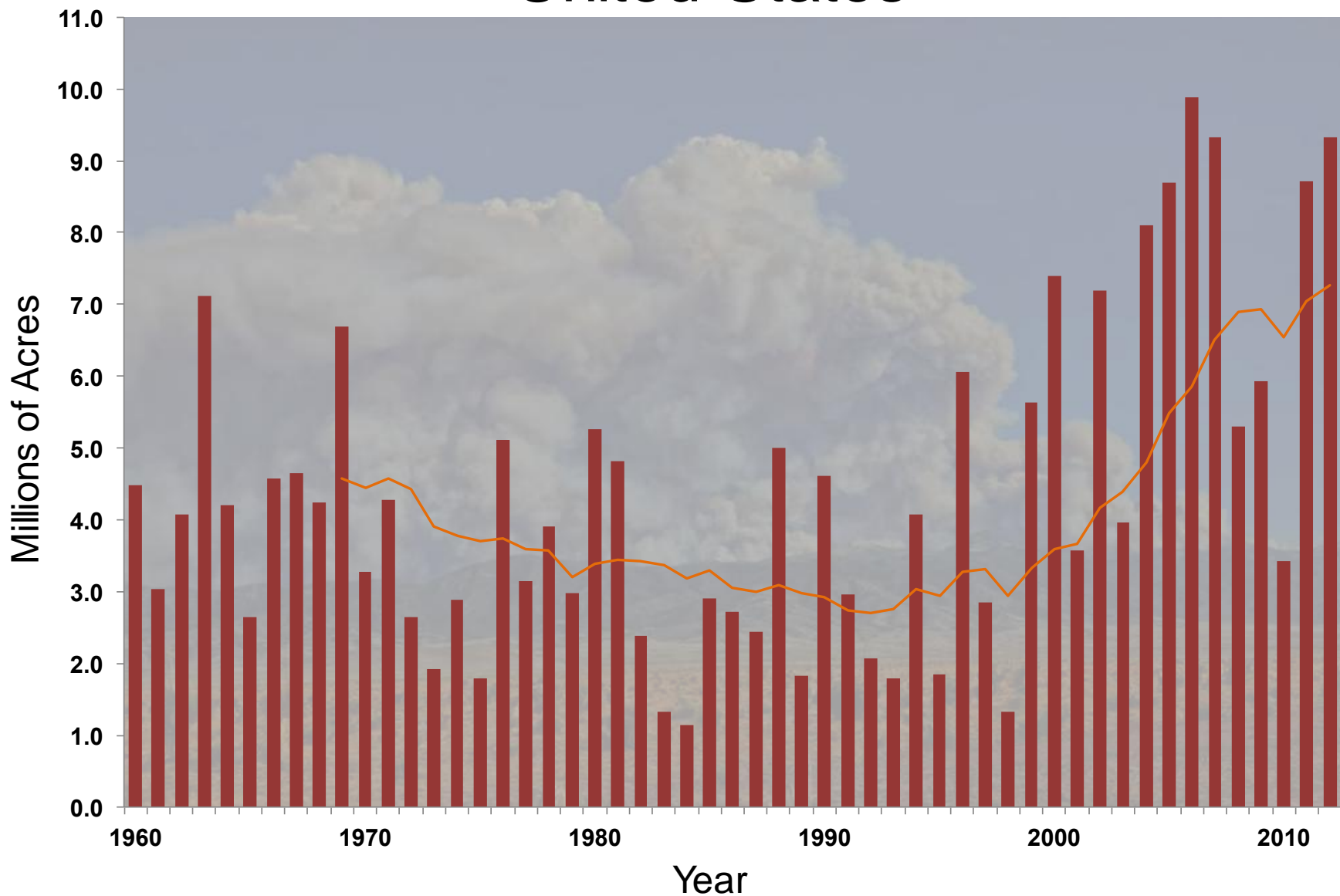
hottest momentary
square kilometer...
June 28, 2005



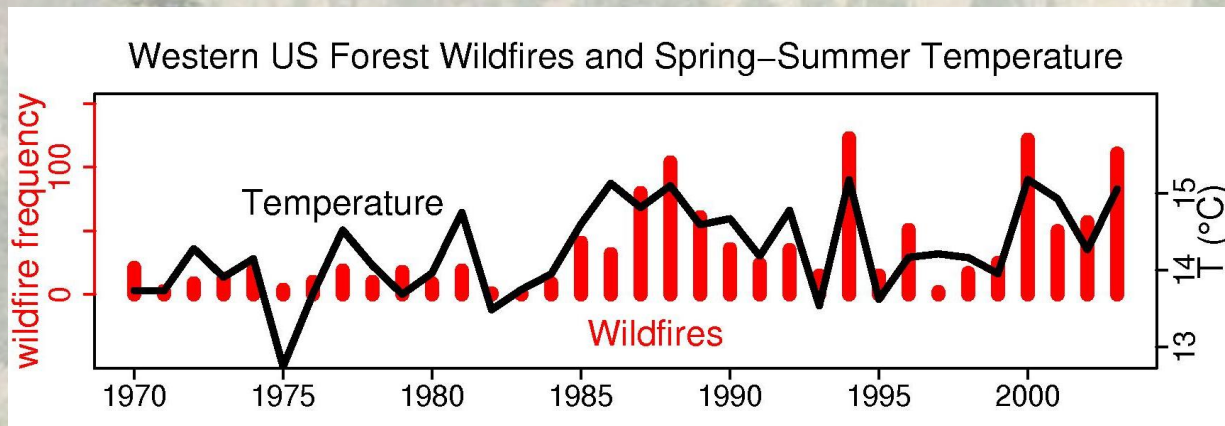
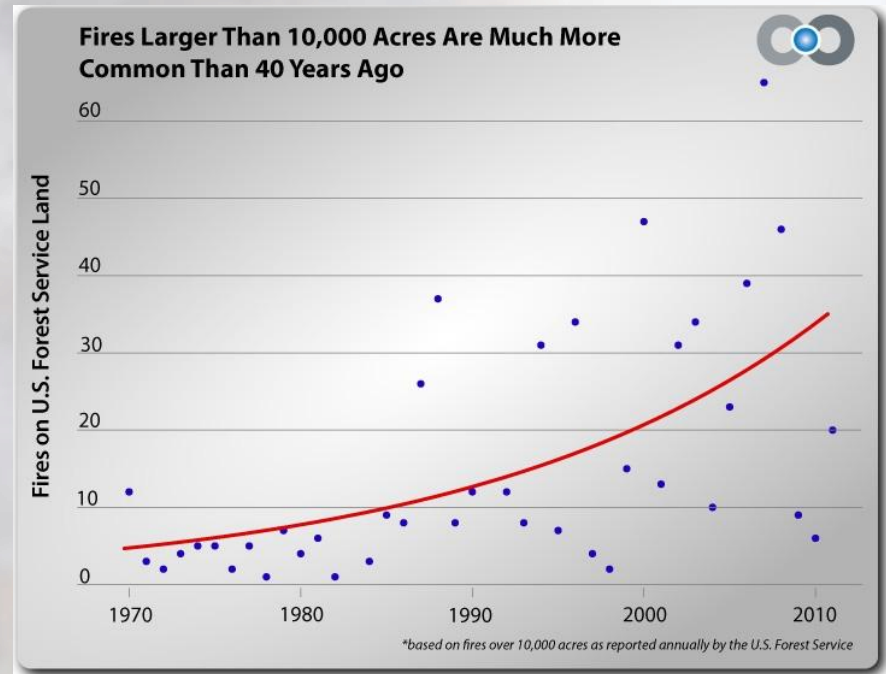
idvsolutions

John Nelson | uxblog.idvsolutions.com
 IDV Solutions | www.idvsolutions.com

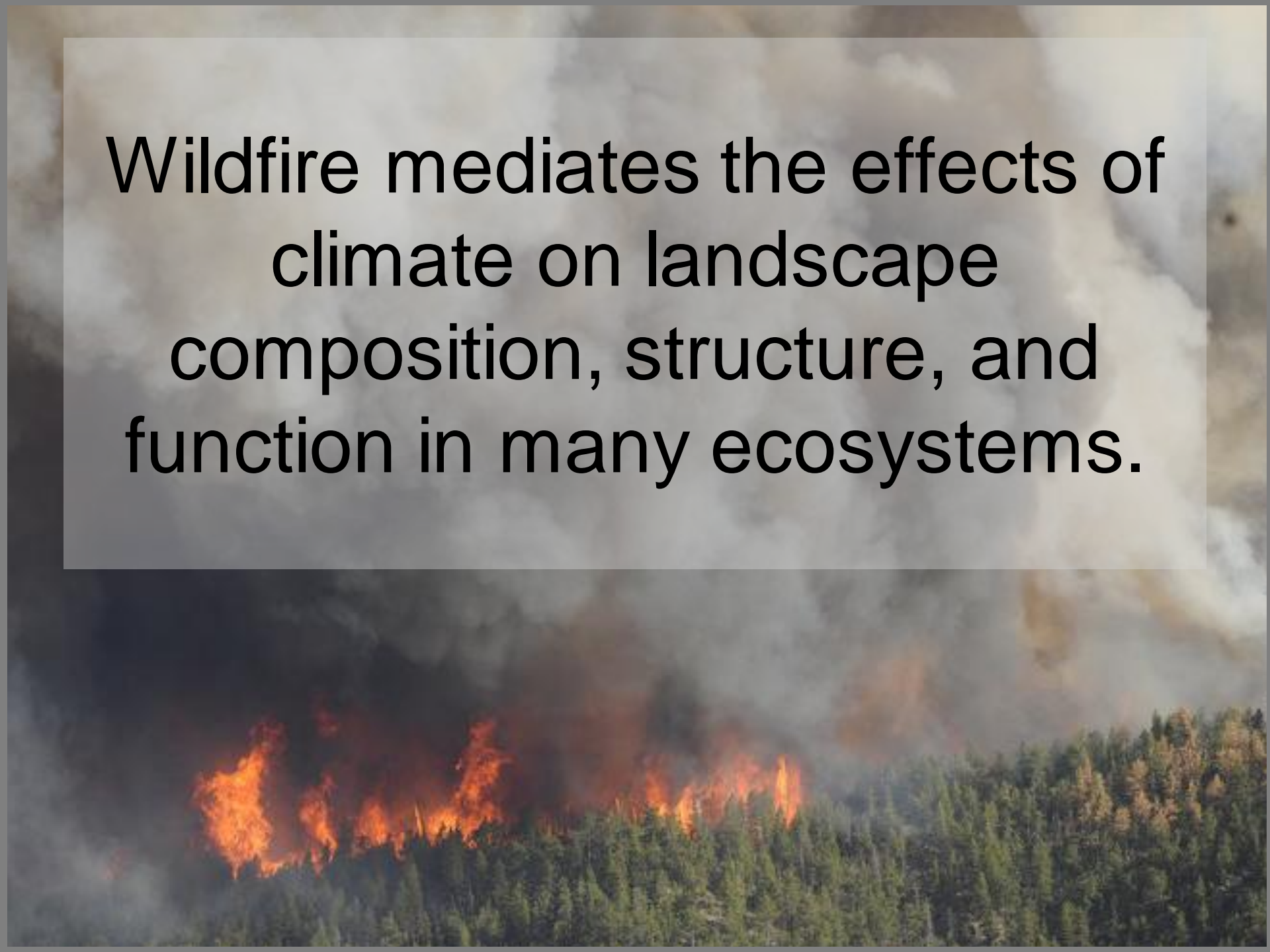
Area burned 1960-2012 in the United States



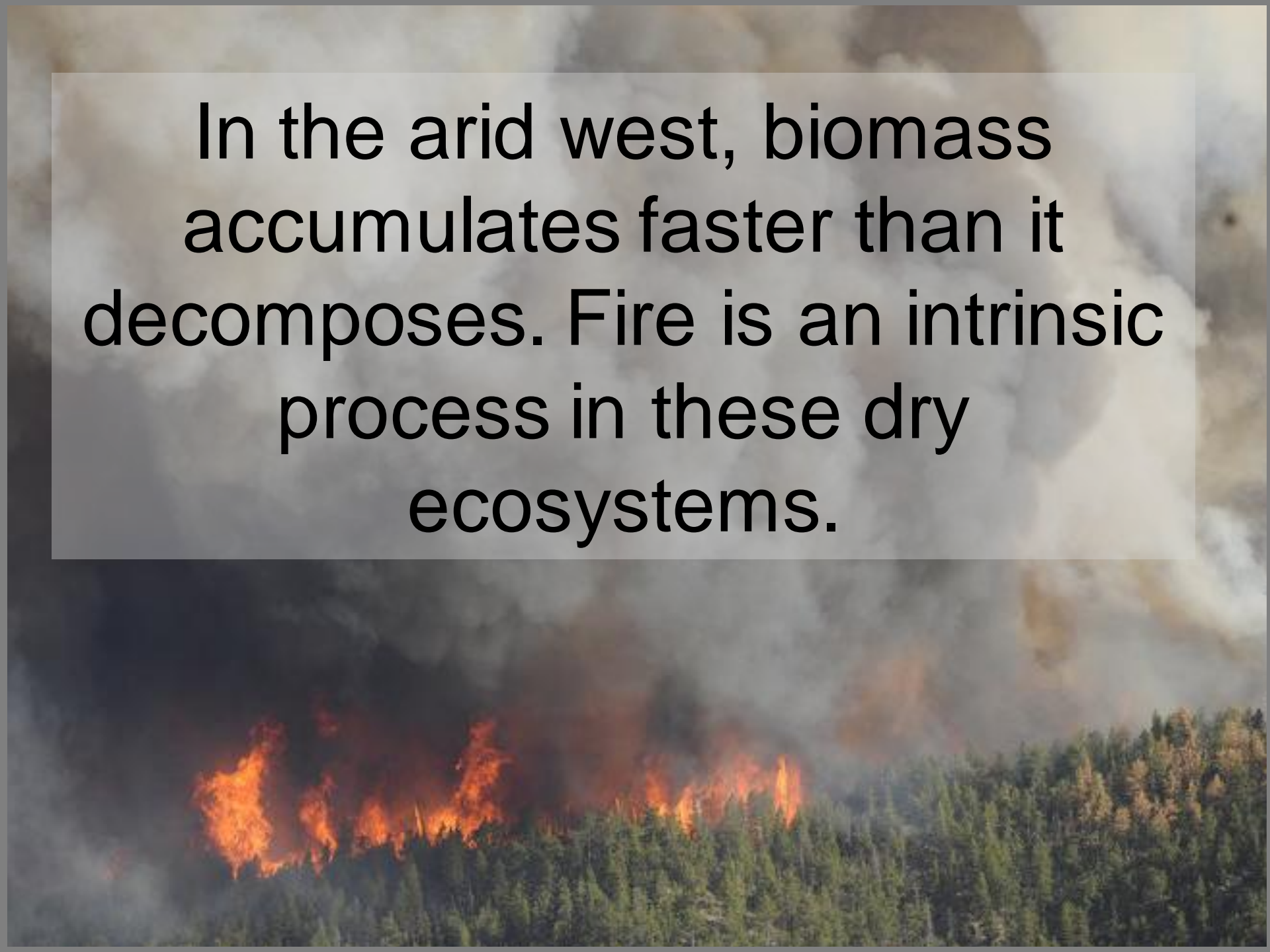
Generally, wildfires have become larger and more severe over the last 40 years
Linked to warmer weather, extended drought, and longer fire seasons.



Wildfire mediates the effects of climate on landscape composition, structure, and function in many ecosystems.

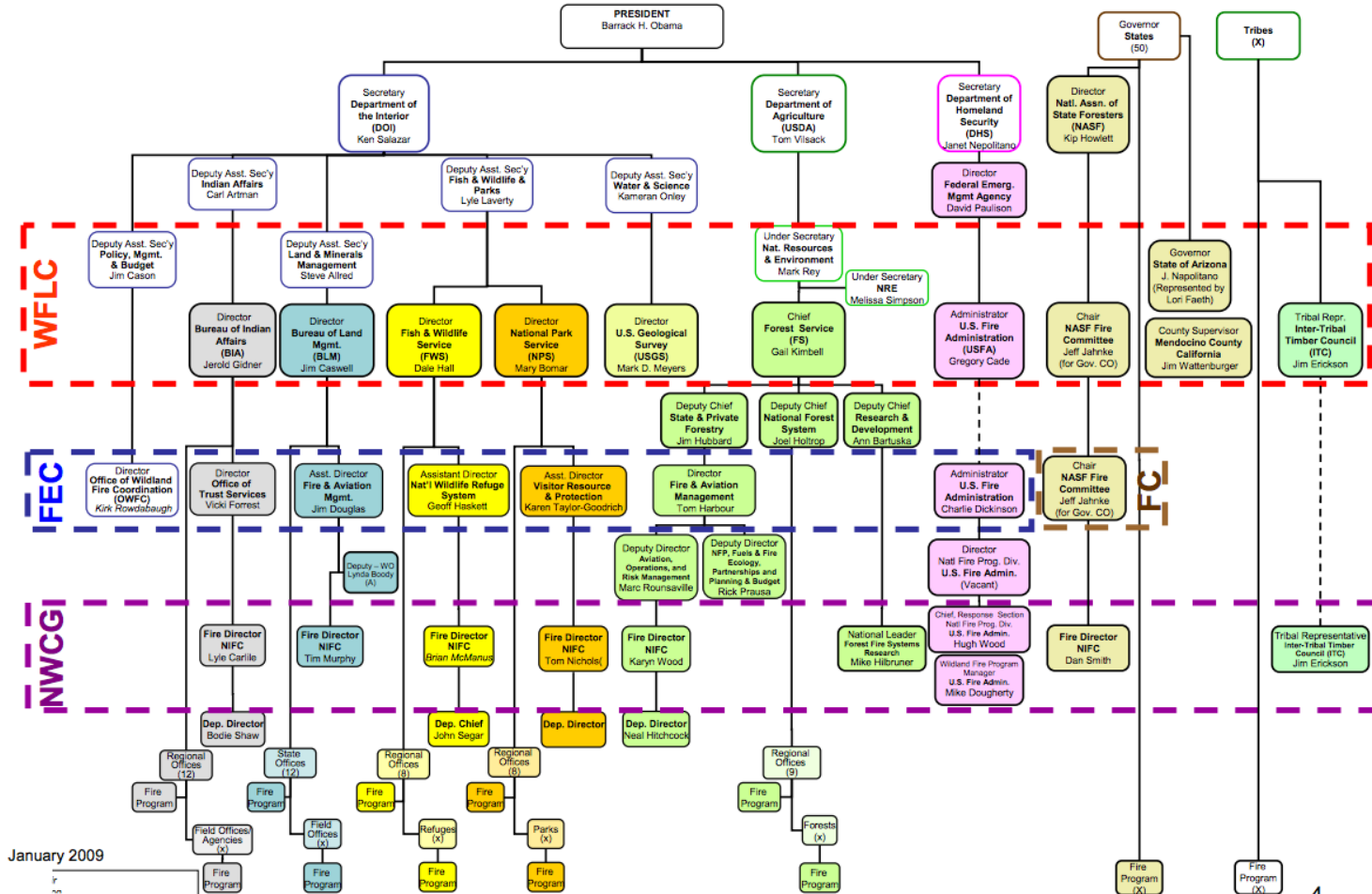


In the arid west, biomass accumulates faster than it decomposes. Fire is an intrinsic process in these dry ecosystems.



Wildfire organization

Interagency Participation on Wildland Fire Committees



January 2009

3 Committee

These charts are intended only to provide a general picture of these organizations and is NOT to be construed as authoritative or deemed totally

Wildfire Organizations

Operations

DOI

NPS
FWS
BIA
BLM

USFS

S&P Forestry
National Forest Systems

DHS FEMA

NOAA

States

Counties

Municipalities

Science

USGS

ECO
NatHaz
CLU
WATER
CSS

USFS

FS R&D
Research Stations
Fire Science Labs

JFSP

DOI
USFS

NASA

NSF

NOAA

NIST

DOD

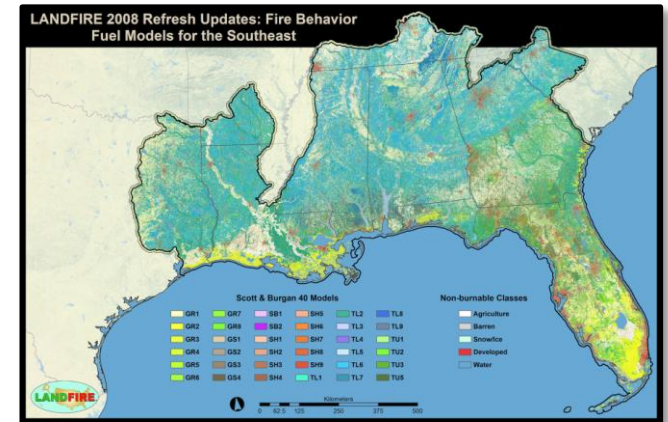
DOE

EPA

DHS

USGS Fire Science Portfolio

- Science branch of DOI.
- Research conducted across the range of fire science.
- Fire science activities in each Mission Area.
- \$10m annually, split between appropriated and reimbursable.
- Appx. 70 scientists who self-identify as 'fire scientists.'



Wildland Fuel Mapping



Wildfire Risk

USGS Fire Science

USGS conducts science across its Mission Areas that support fire management decisions before, during, and after wildfires

ECOSYSTEMS Mission Area

- Fire and invasive vegetation
- Wildlife and fish habitat effects
- Effects of fuel treatments on landscapes
- Montane/Alpine fire regimes and climate change

CLIMATE AND LAND-USE CHANGE & CORE SCIENCE SYSTEMS Mission Areas

- National surface and canopy fuels maps
- Remote sensing based fire histories
- Wildland fire and climate change
- Geospatial support for wildfire incidents and planning

NATURAL HAZARDS & WATER SCIENCE Mission Areas

- Risk to public safety and communities
- Land slide and debris flow monitoring and forecasting
- Water quality and supply monitoring and forecasting
- Toxicity of fire suppression chemicals

A rough map of the USGS Fire Science Portfolio



USGS Fire Science Community of practice

- Group of USGS scientists who self-identify as fire scientists
- Regular conference calls, to re-start soon!
- Rotating presentations of issues, both internal and external.
- Advocacy from a Fire Science Council comprised of relevant USGS leadership.

USGS Fire Science

USGS conducts science to support land management decisions within each Mission Area

Before Fires

- Foundational science
- Historical ecology
- Climate connections
- Wildland fire, carbon cycles, and climate change
- Risk scenarios
- Management frameworks
- Geospatial data for planning

During Fires

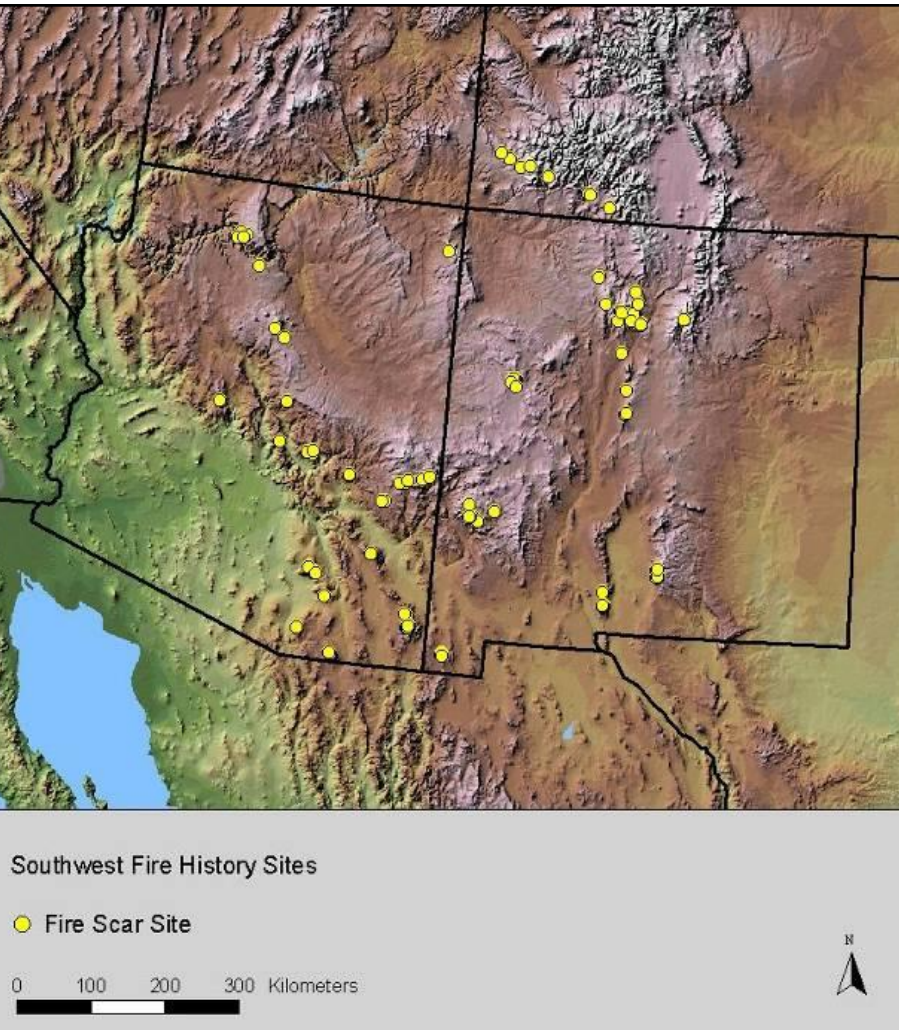
- Geospatial data for decision support
- High-resolution imagery
- Geospatial support for specific incidents and geographic areas
- Rapid deployment of science delivery.

After Fires

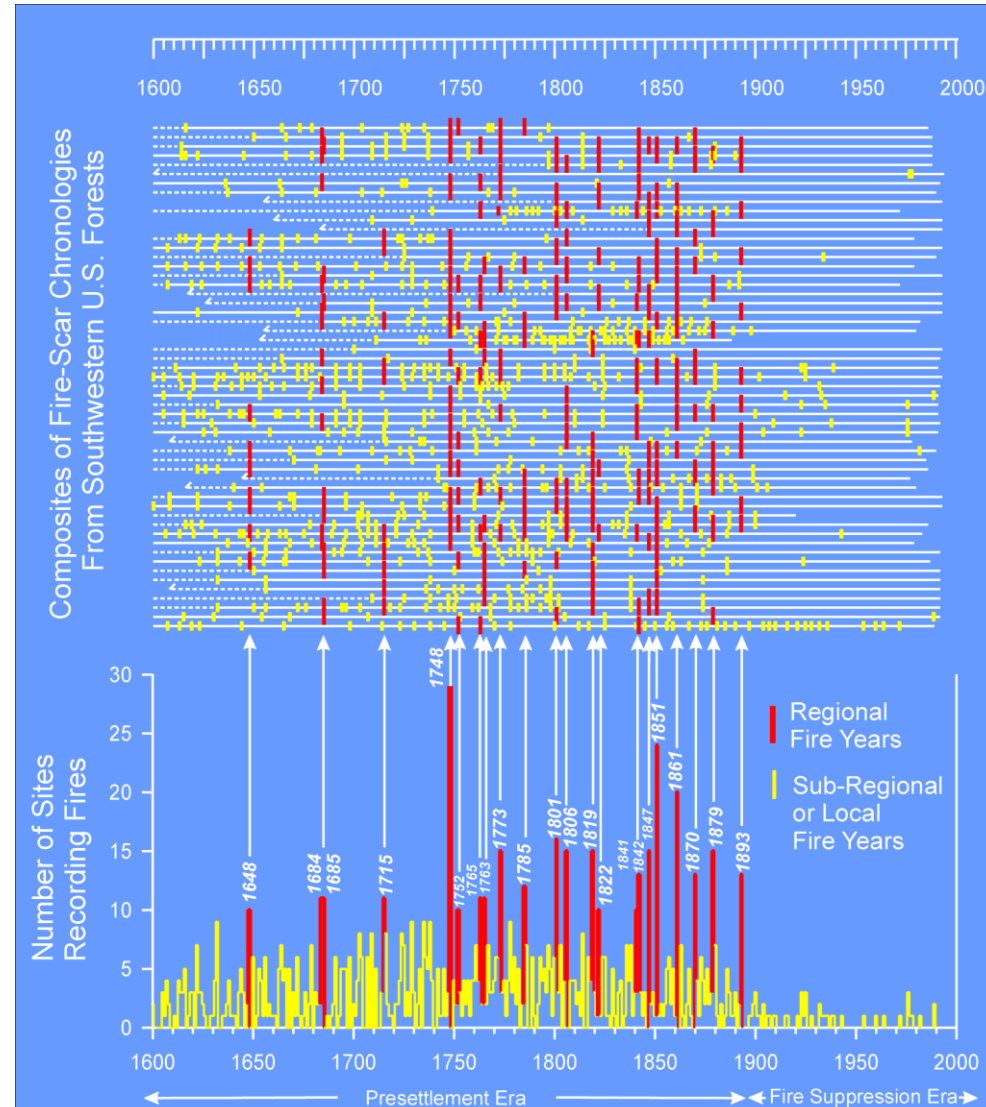
- Stabilization and restoration frameworks and activities.
- Maintaining currency of national databases.
- Water quality and supply monitoring and forecasting.
- Soil erosion & Invasive species mitigation.
- Water quality assessment.
- Toxicity of fire suppression chemicals.

Before Wildfires

Shows same pattern at regional scale of fire cessation at most sites, suggesting the importance of land use in suppression.

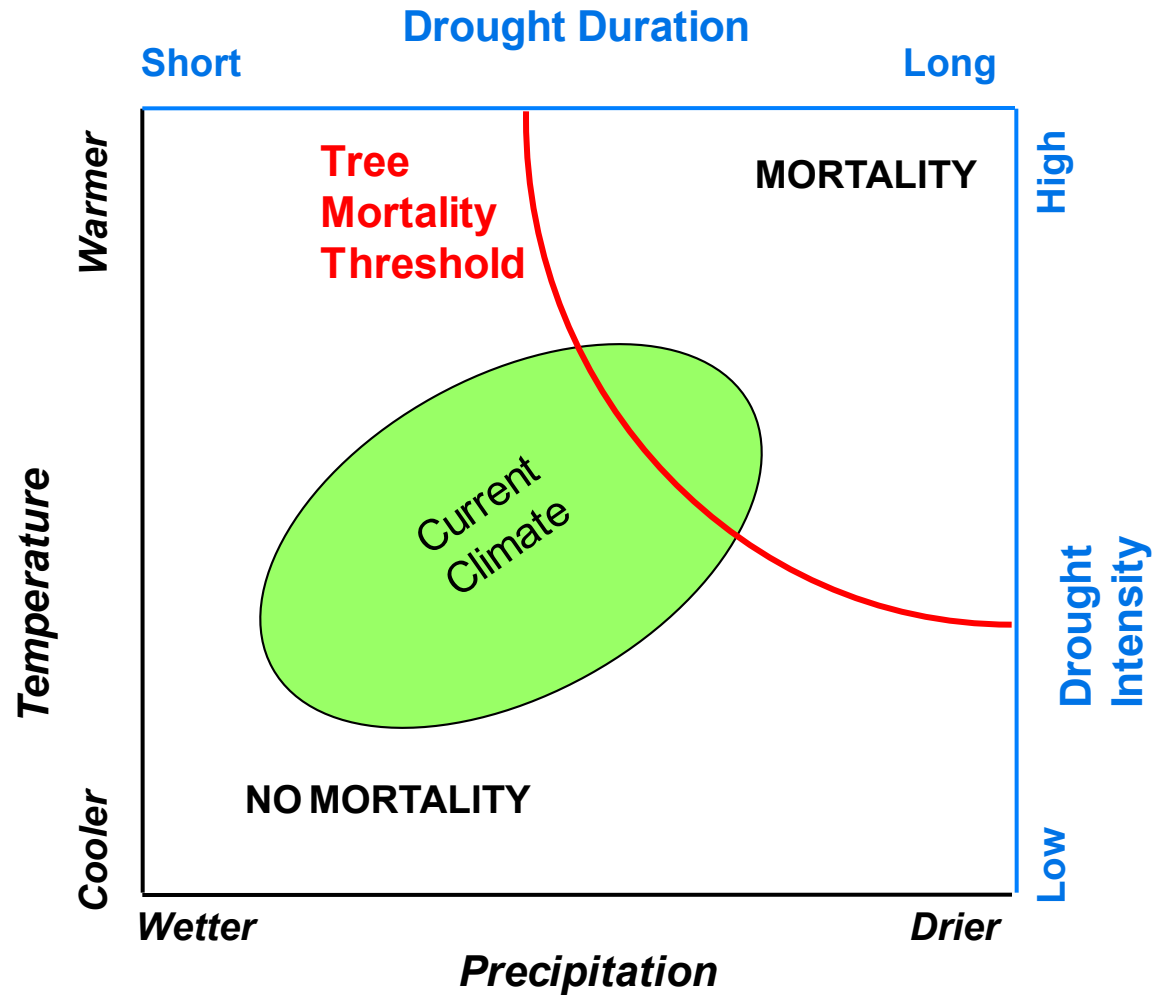


Swetnam, Allen & Betancourt. 1999.



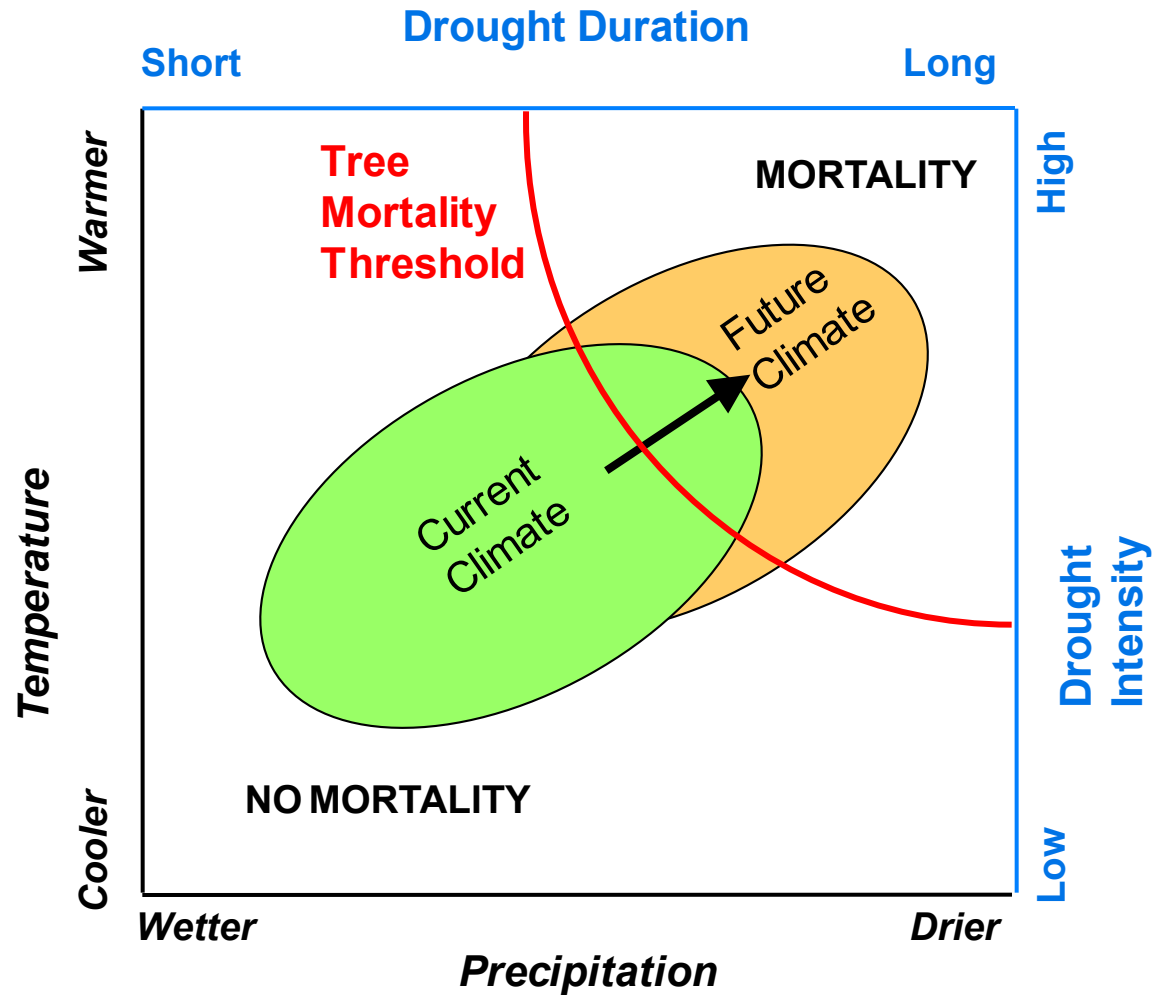
Before wildfires

Coupled climate dynamics, disturbance interactions, and vegetation community dynamics



Before wildfires

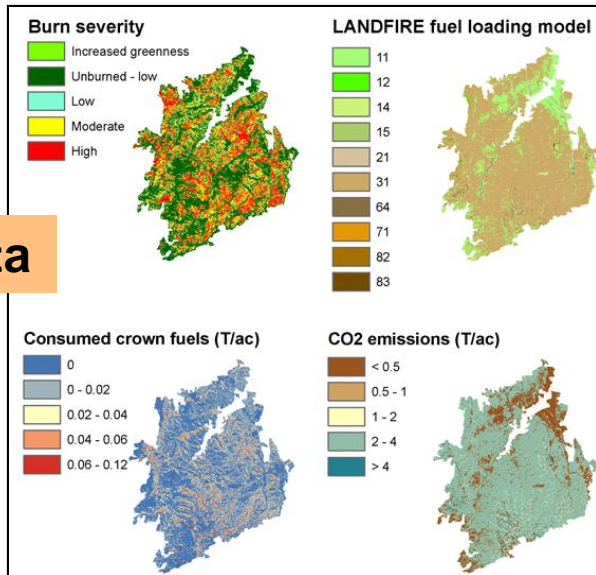
Coupled climate dynamics, disturbance interactions, and vegetation community dynamics



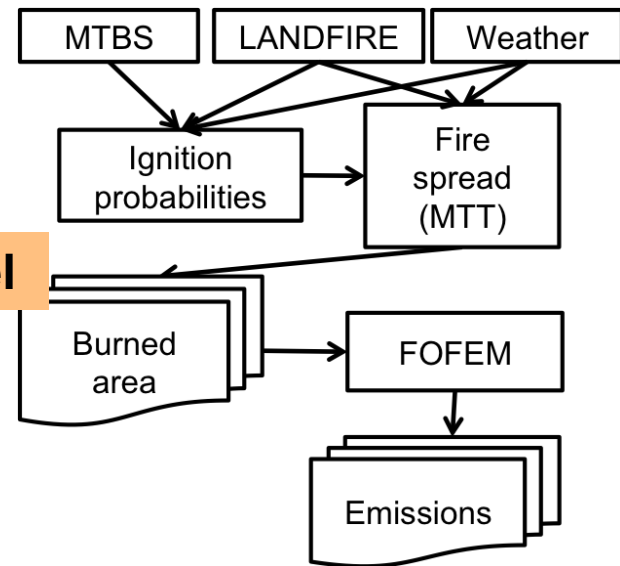
Before wildfires

National-level effects of wildfire and fire management strategies on carbon storage and greenhouse gas emissions

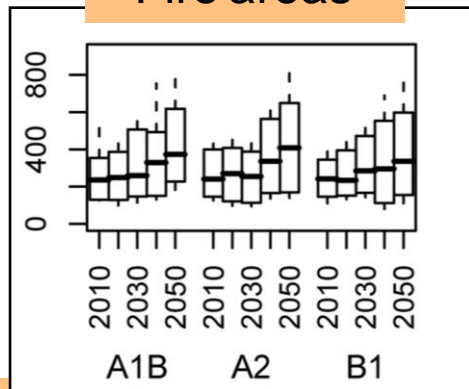
Data



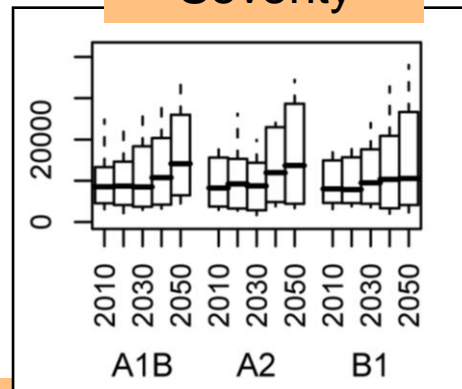
Model



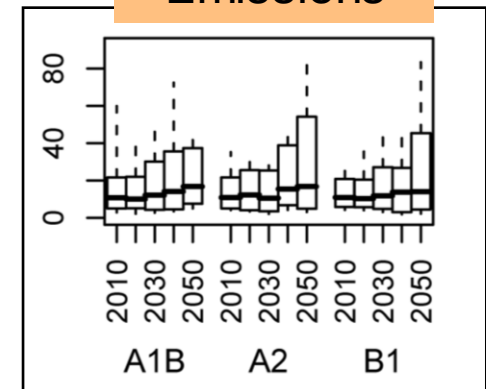
Fire areas



Severity



Emissions



Integrated Risk Management



Google

Eye alt 1380 ft

399 ft

lat 34.159692 lon -117.562606

Integrated Risk Assessment

- Characteristics of damaging wildfires.
- Prevention and preparedness
- Valuation of property, resources, and ecosystem services.
- Probability of wildfires.
- 'Good' vs. 'Bad' fire.
- Scenario approach, similar to Earthquakes and Tsunamis.



Bastrop, TX 2011



Waldo Canyon 2012

Wildland Fire Support

The screenshot displays the Google Earth interface with a satellite view of a mountainous region. A large, irregularly shaped area is outlined in red and labeled "Smith Run Fire". To the left of the fire area, the town of "Browtown" is marked. The left sidebar shows a list of places, including "Enterprise", "Matador West", "Willow Creek South Complex", "Tom", "Mitchell County Complex", "Shepard's Complex", "Ous Canelas", "James River Road", "Coffman/Chestnut", "Dog Canyon", "Delta", "Iron Horse", "Hwy 2357 Complex", "Keller", "Williams", "Smith Run Fire", "Tanglewood Com", "Quinn Ranch", "Briscoe", "Jesse Birthday", "2526", "Ferry 7", "Gregory Mill", "Arnot", "Accident", "McClellan", and "Active Large Fires with P". Below this list, there are several fire information entries, including "VA-VAF-FOTP Chestnut Ridge 2-23-2011 16 00", "VA-SHP-FORF Smith Run 2-22-2011 0000", and "FL-FNF-FDYC Gregory Mill 2-28-2011 1700". The bottom of the screen features a detailed incident information window for the "Smith Run Fire- Formerly Valley Complex Wildfire". This window includes a map of the fire area, a list of incident cooperators (Bureau of Indian Affairs, Fish and Wildlife Service, National Park Service, USDA Forest Service, Flint Hill Volunteer Fire Department, and Rappahannock County Fire Departments), and contact information for Barb Stewart (Phone: 540-999-3500 ext. 3324). The window also displays the URL: <http://www.inciweb.org/incident/2150>.

Google Earth interface showing a map of the Smith Run Fire area. The map displays the fire perimeter (outlined in red) and surrounding terrain. Key locations marked include Browtown and the fire itself, labeled "Smith Run Fire". The interface includes a search bar, a list of places on the left, and a detailed incident information window at the bottom. The incident information window provides details about the "Smith Run Fire- Formerly Valley Complex Wildfire", including its location (Lat: 38.81, Long: -78.19), date (Monday, February 28, 2011), and a list of incident cooperators (Bureau of Indian Affairs, Fish and Wildlife Service, National Park Service, USDA Forest Service, Flint Hill Volunteer Fire Department, Rappahannock County Fire Departments). The window also displays the URL: <http://www.inciweb.org/incident/2150>.

Wildland Fire Support



GeoMAC RSS Feed in IGEMS

Hazards Data Distribution System











USGS Home
Contact USGS
Search USGS





Hazards Data Distribution System (HDDS)





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




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Download: 





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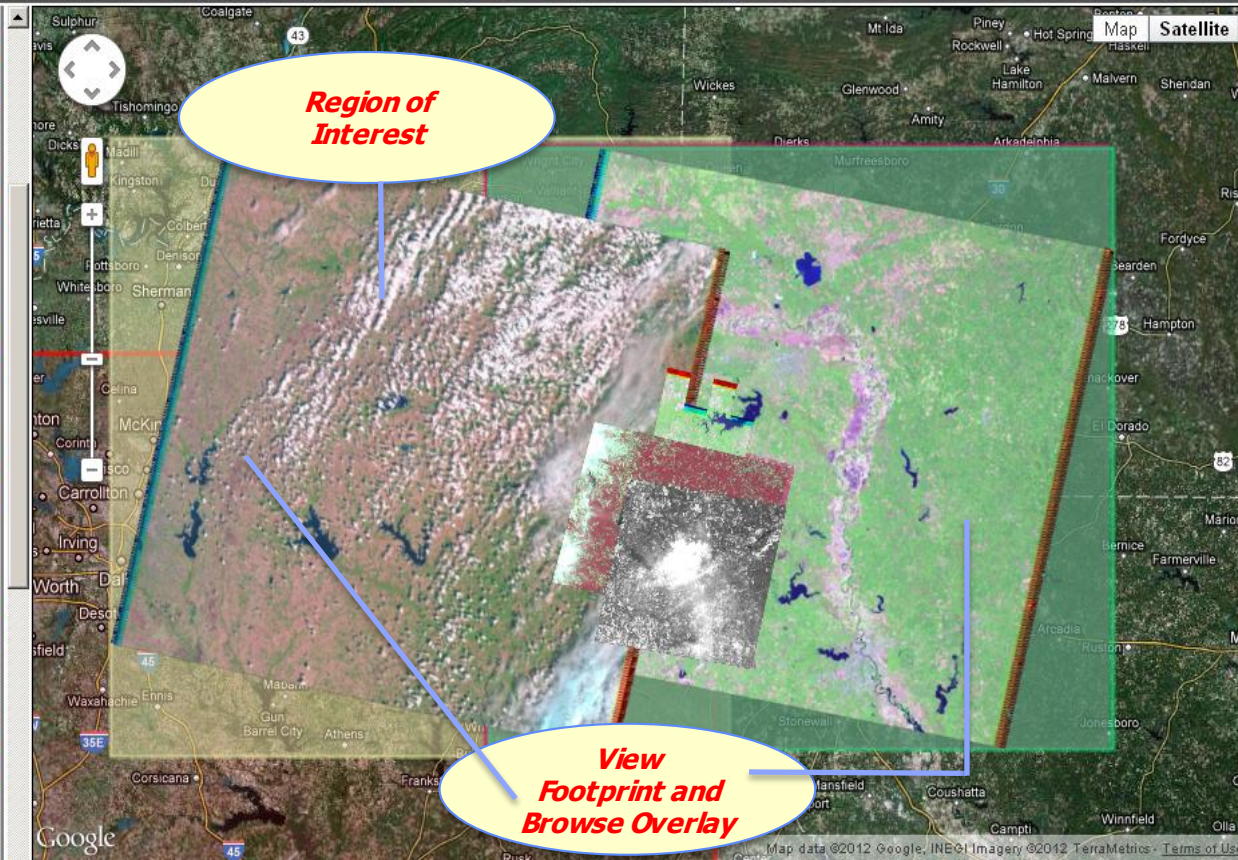

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Acquisition Date: 2011-09-09
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Agency: DOD
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Footprint: 
Browse: 



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LANDFIRE in One Page

Objectives

- A national assessment of vegetation, fuel and ecosystem conditions
- Consistent, comprehensive, repeatable

24 primary data products

- 30m nominal resolution nationwide
- Vegetation (potential and existing vegetation, structure, and succession classes) – ES / NVCS
- Fuel (surface and canopy)
- Fire regime condition class (reference conditions, departure from reference conditions)

Intended applications

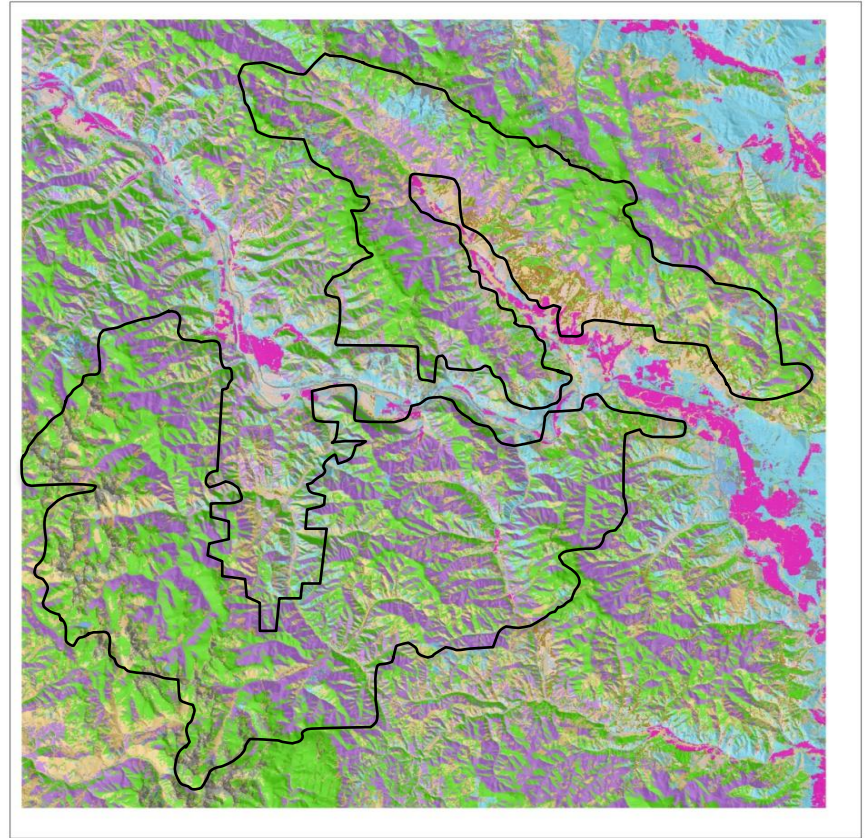
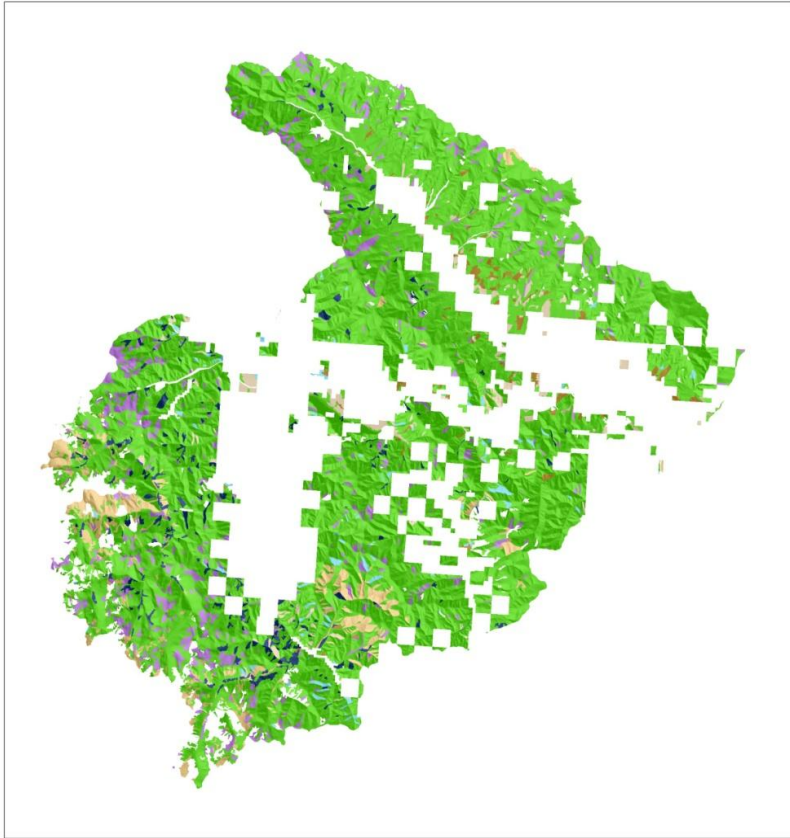
- Fire hazard assessment
- Fuel management
- National strategic planning
- Incident support
- Other land management applications



<http://www.landfire.gov>

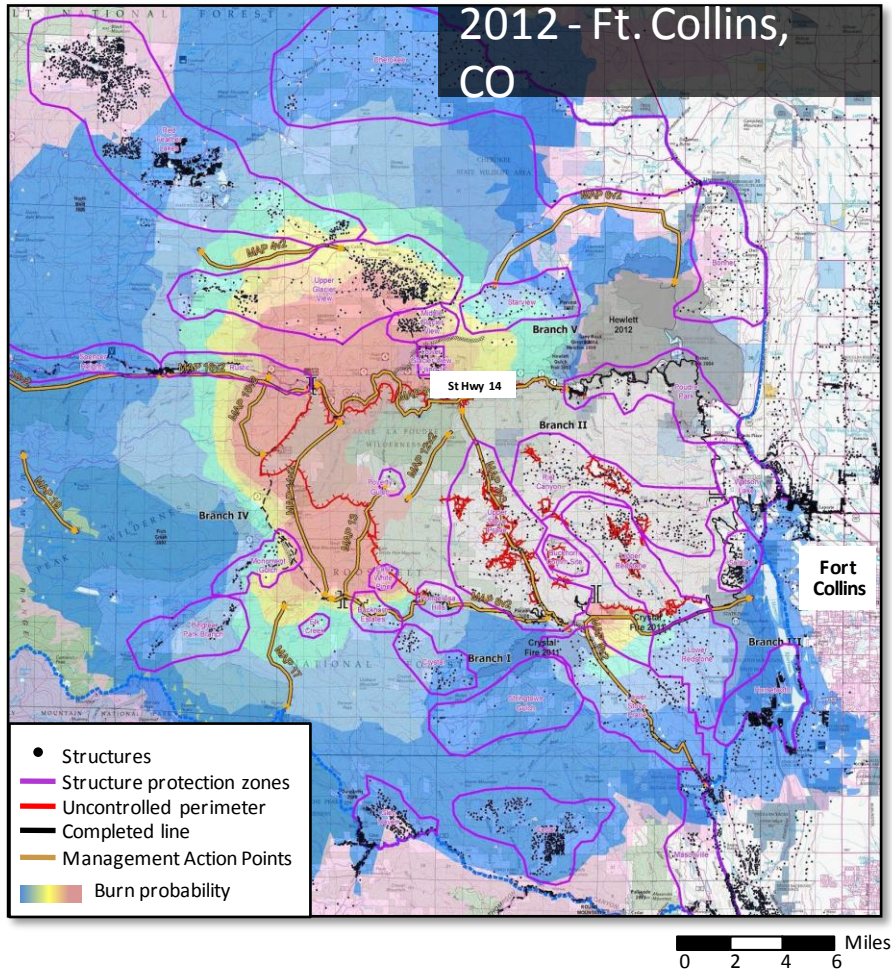
Geospatial Data and Wildland Fire

Lolo National Forest, 9-Mile Ranger District

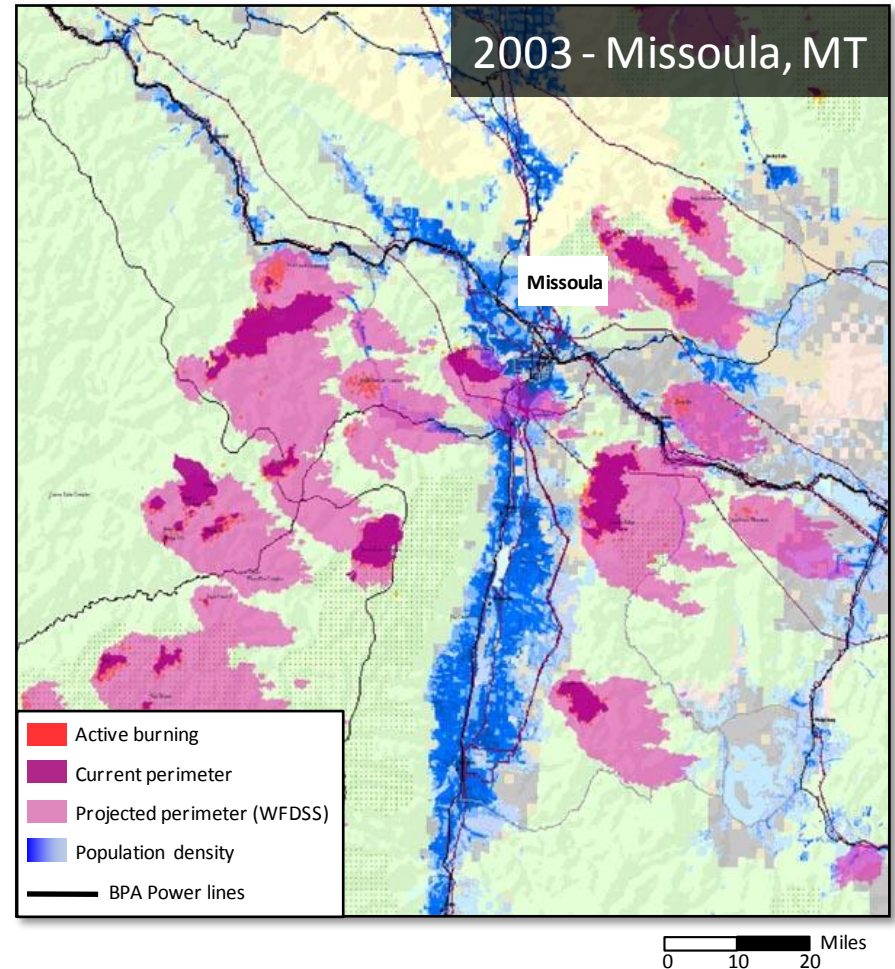


Wildland Fire Decision Support

Local Level



Regional Level



Monitoring Trends in Burn Severity

- Duration: FY2006 - FY2011.
- Fires over 1,000 acres in West, 500 in East.
- Severity mapped using time series of Landsat imagery and Differenced Normalized Burn Ratio.
- Evaluate 'historical fires':
1984 – 2003
- Annual evaluations (current fires) 2004 – 2010
- MTBS has mapped well over 10,000 fires



Roberts Fire
Glacier National Park
August 2003

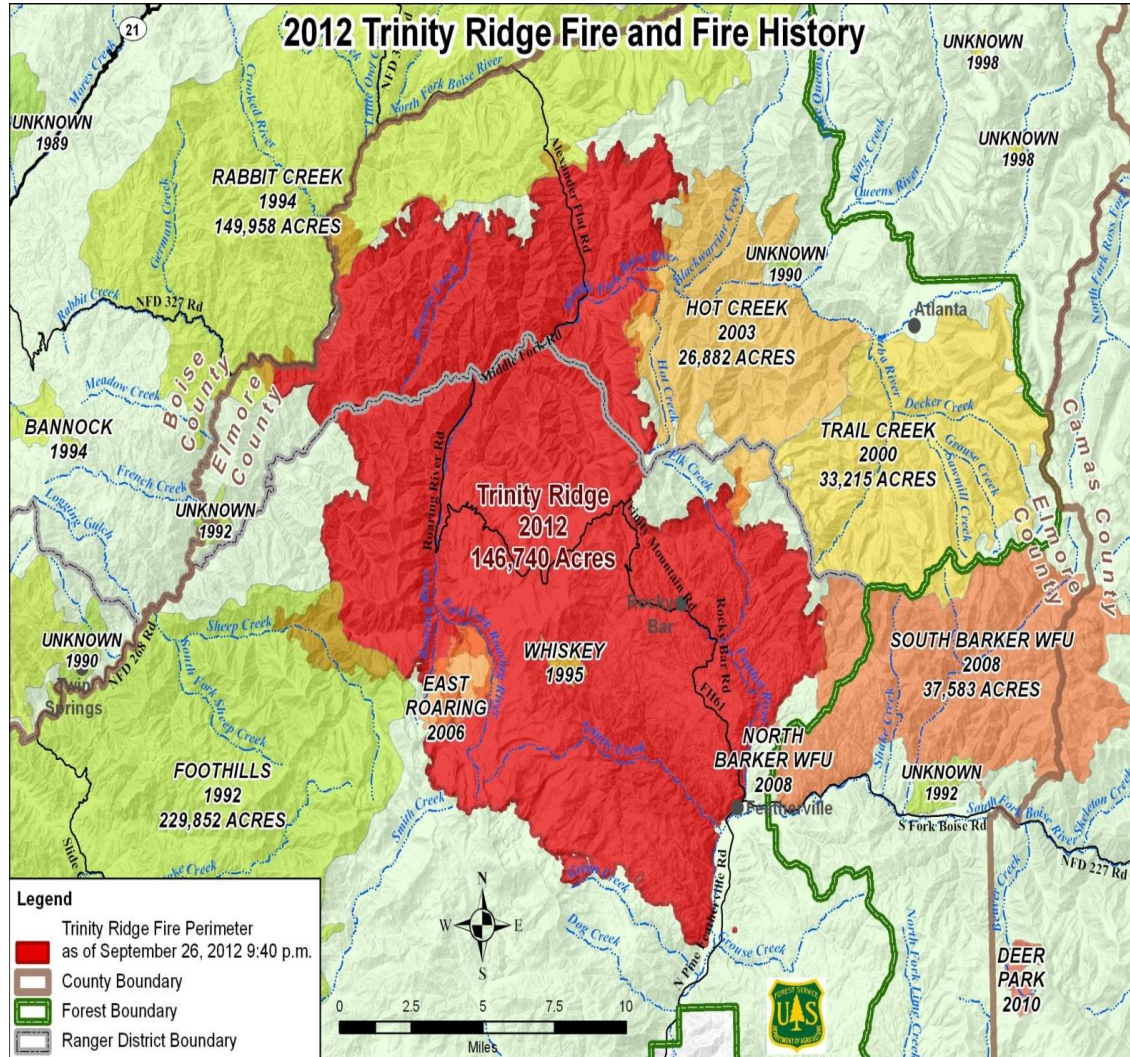
<http://mtbs.gov>

Monitoring Trends in Burn Severity



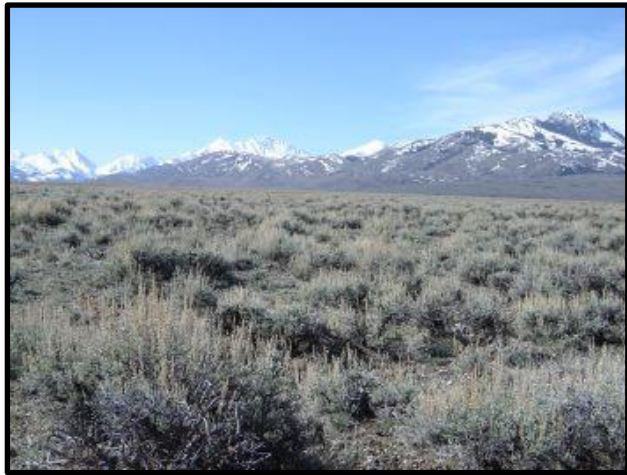
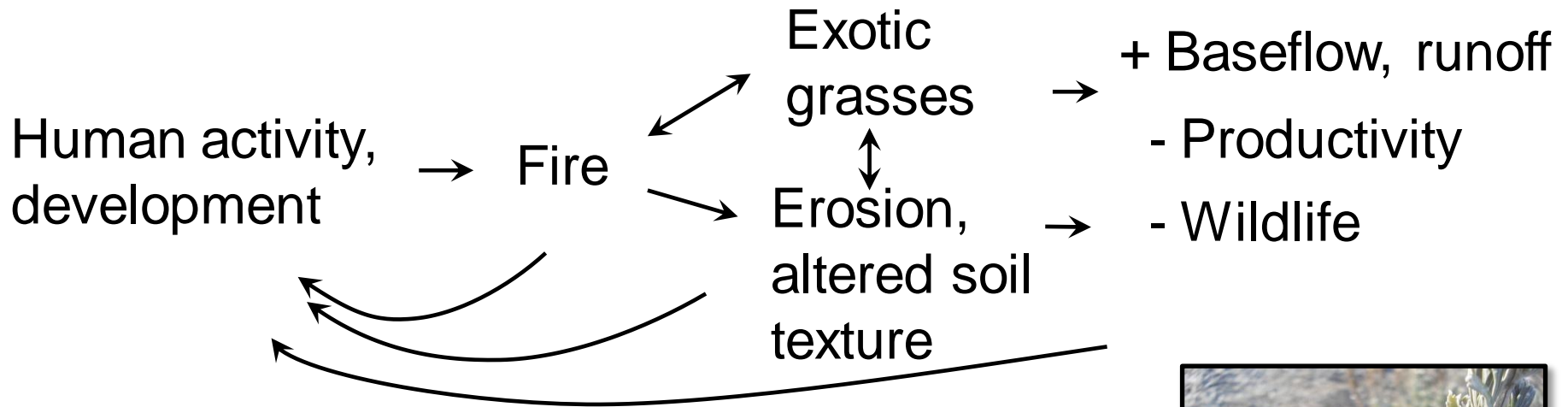
Trinity Ridge Fire (2012)

Recent fire history



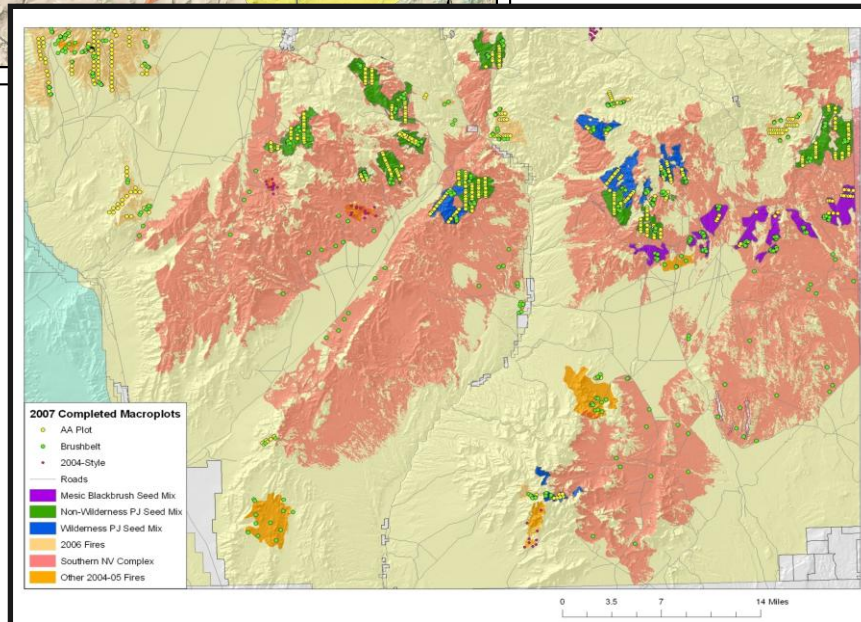
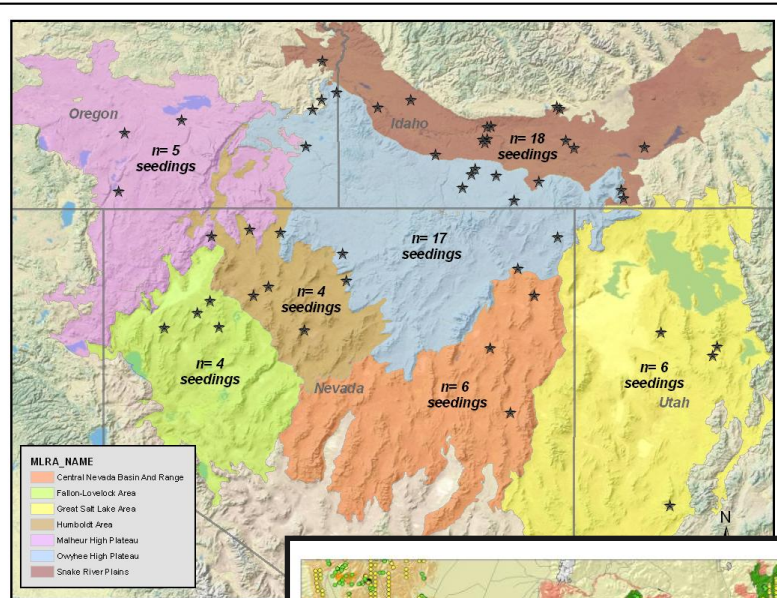
After wildfires

Climate effects on sagebrush ecosystems



After wildfires

Vegetation rehabilitation chronosequence



- Burned
 - Seeded/Unseeded
- Unburned
 - Unseeded
- Matched Ecol. Sites
- 3 reps / project
- Across 7 MLRAs
- Over 60 projects



Water Quality and Supply

Monitoring

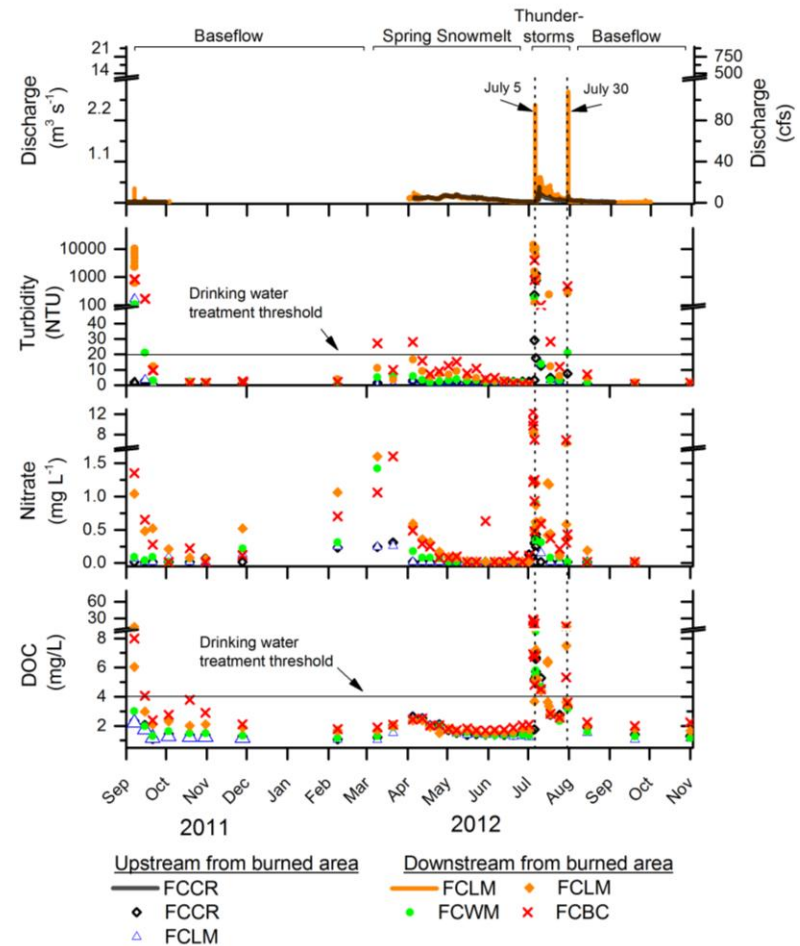


Early warning networks



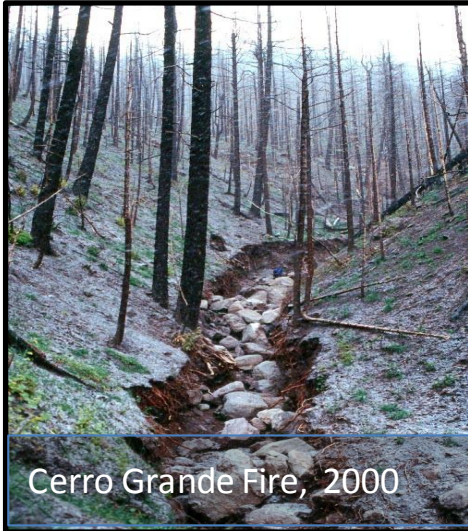
Post fire water sampling

Assessment



After wildfires

The effects of fire on hydrology and geomorphology



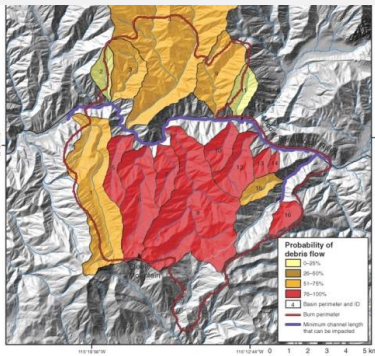
Product: Emergency assessments of post-wildfire debris-flow hazards

A suite of tools have been developed for making rapid post-fire hazards assessments.

Maps identify which drainage basins are most vulnerable to post-fire debris flows.

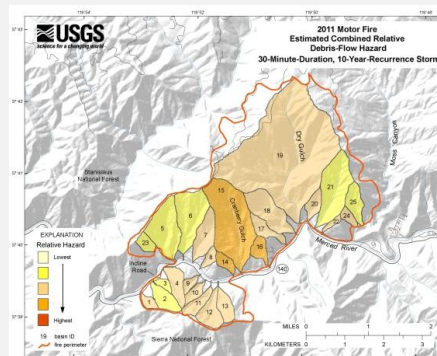
Probability Model

Where?



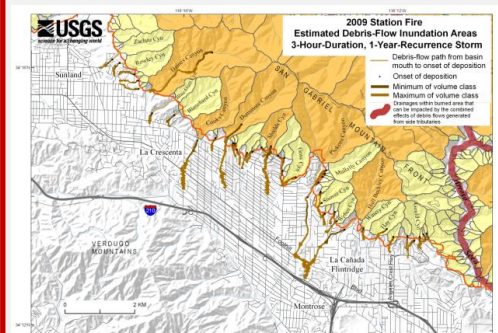
Magnitude Model

How Big?



Inundation Model

How Far?

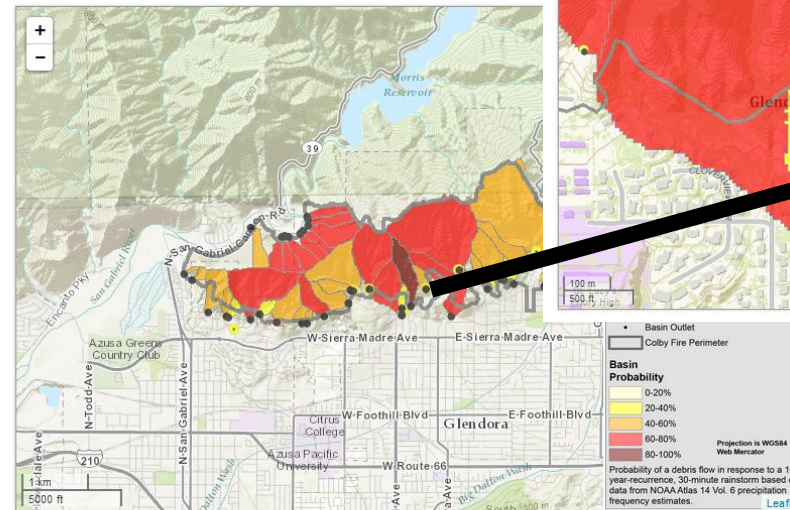


Landslide Occurrences-Current & Archives
Did You See It?
News-Interesting Stuff
CAP Alerts
Early Warning System
Post-fire Debris-flow Hazards
Scientific Background
Disclaimer

2014 Colby Fire - Los Angeles County, California

Date of origin: January 16, 2014
Location: 34.159, -117.873
Total Area Burned: 8 km²

Preliminary Hazard Assessment



The interactive map above displays estimates of the probability of debris flow (in %), potential volume of debris flow (in m³), and combined relative debris flow hazard. These predictions are made at the scale of the drainage basin, and at the scale of the individual stream segment. Estimates of probability, volume, and combined hazard are based upon a design storm with 10-year recurrence interval (i.e., a 1 in 10 chance of a storm of that magnitude occurring in any given year). Predictions may be viewed interactively by clicking on the button at the top right corner of the map displayed above. Visit the [Scientific Background](#) page for more information on how the predictions are calculated. For more information about what to do in case you live in an area where debris flows are possible, please visit this [page](#), or contact the [Glendora Police Department](#) or [Los Angeles County Sheriff](#).

Downloads

Below are the shapefiles and geodatabase information that was used in the creation of the maps on this page.

- [Geodatabase \(.gdb\)](#)
- [Shapefile \(.shp\)](#)
- [README \(.docx\)](#)

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Page URL: http://ehpd-landslides.cr.usgs.gov/current/postfire_debrisflow/2014/20140116colby/

Page Contact Information: [EHP Web Team](#)

Page Last Modified: February 12, 2014 17:53:49 UTC

[DOI](#) and [USGS](#) link policies apply.

Link to page
[here](#)

Interactive map →

Drainage above
Rainbow Drive
is most
susceptible

GIS files for download →

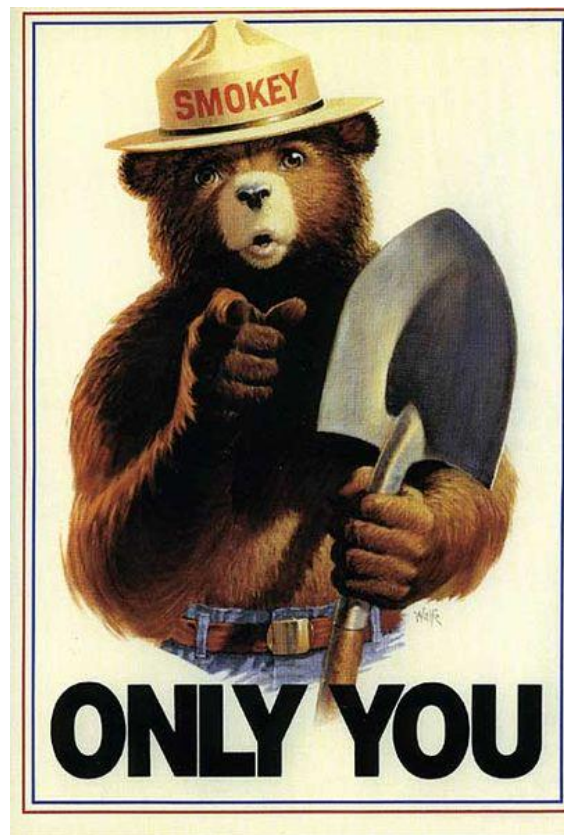


Gila Wilderness, Whitewater-Baldy Fire, late July 201



I THINK I'M GOING NUTS, DOC!
I KEEP HEARING STRANGE VOICES...
SAYING IT'S MY FAULT... THAT
ONLY FOREST FIRES CAN
PREVENT FOREST FIRES...

SMOKEY



... can postpone wildfires

“We can keep pouring money on large fires if we want, But we have to think in terms of the future. It may feel safer to put the fire out now, but that just means someone else will inherit the risk down the road.”

-Anonymous

2012 Trinity Ridge Fire and Fire History

Trinity Ridge 2012
146,740 Acres

Rabbit Creek 1994
149,958 ACRES

Hot Creek 2003
26,882 ACRES

Trail Creek 2000
33,215 ACRES

South Barker WFO 2008
37,583 ACRES

East Roaring 2006

North Barker WFO 2008

Foothills 1992
229,852 ACRES

Bannock 1994

Deer Park 2010

Legend


- Trinity Ridge Fire Perimeter as of September 26, 2012 9:40 p.m.
- County Boundary
- Forest Boundary
- Ranger District Boundary


Scale: 0 2.5 5 7.5 10 Miles


North Arrow

US Forest Service

Trinity Ridge Fire Perimeter
as of September 26, 2012 9:40 p.m.

 County Boundary

 Forest Boundary

 Ranger District Boundary

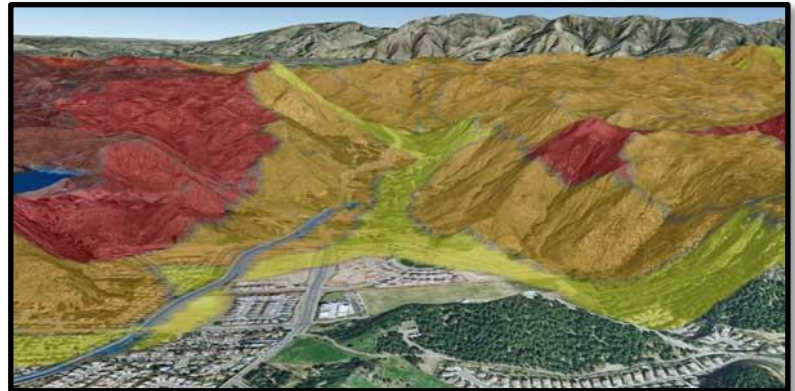
How do we successfully handle risk in the context of current wildland fire policy?

Tactical risk aversion

‘Smart money’ is on acquiring resources and practicing aggressive suppression.

Strategic risk management

Incentives for success rather than purely sanction for failure.



Questions?

mrollins@usgs.gov

202.288.4535



Zone 16 Potential Vegetation Type

Actual