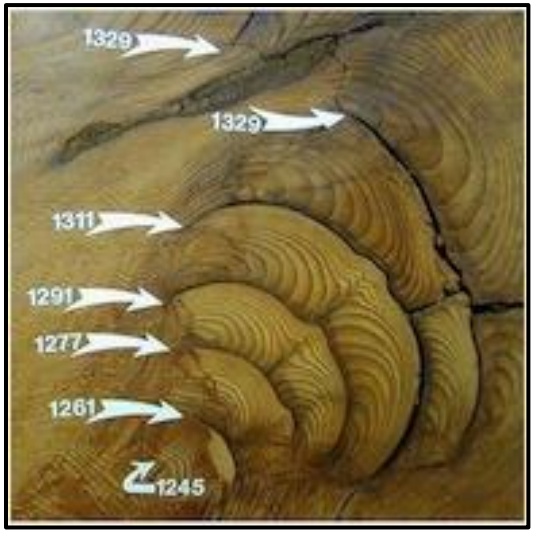
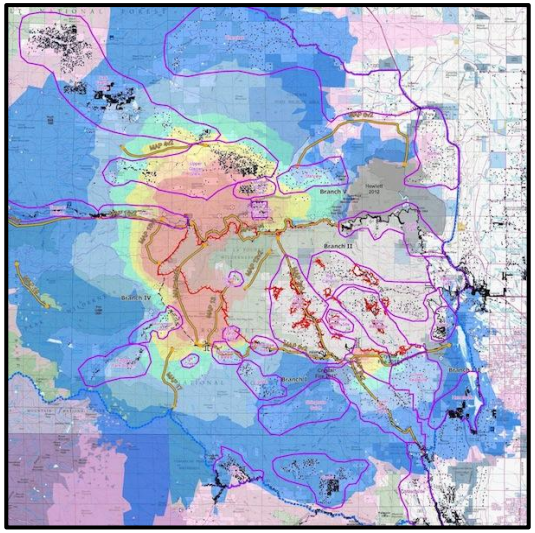




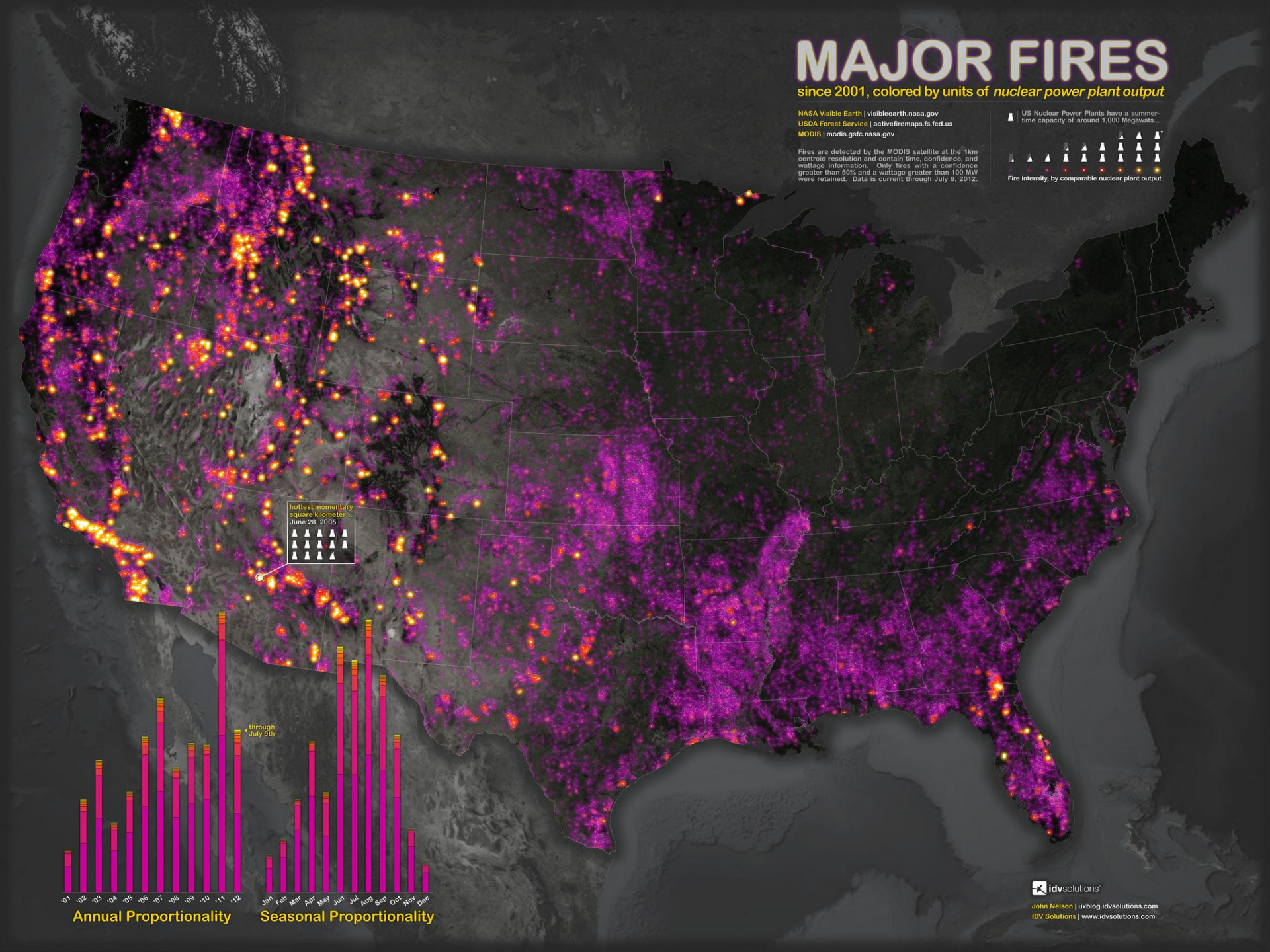

Wildfire Science in the USGS

Dr. Matt Rollins
USGS Fire Science Coordinator
USGS National Center
Reston, VA

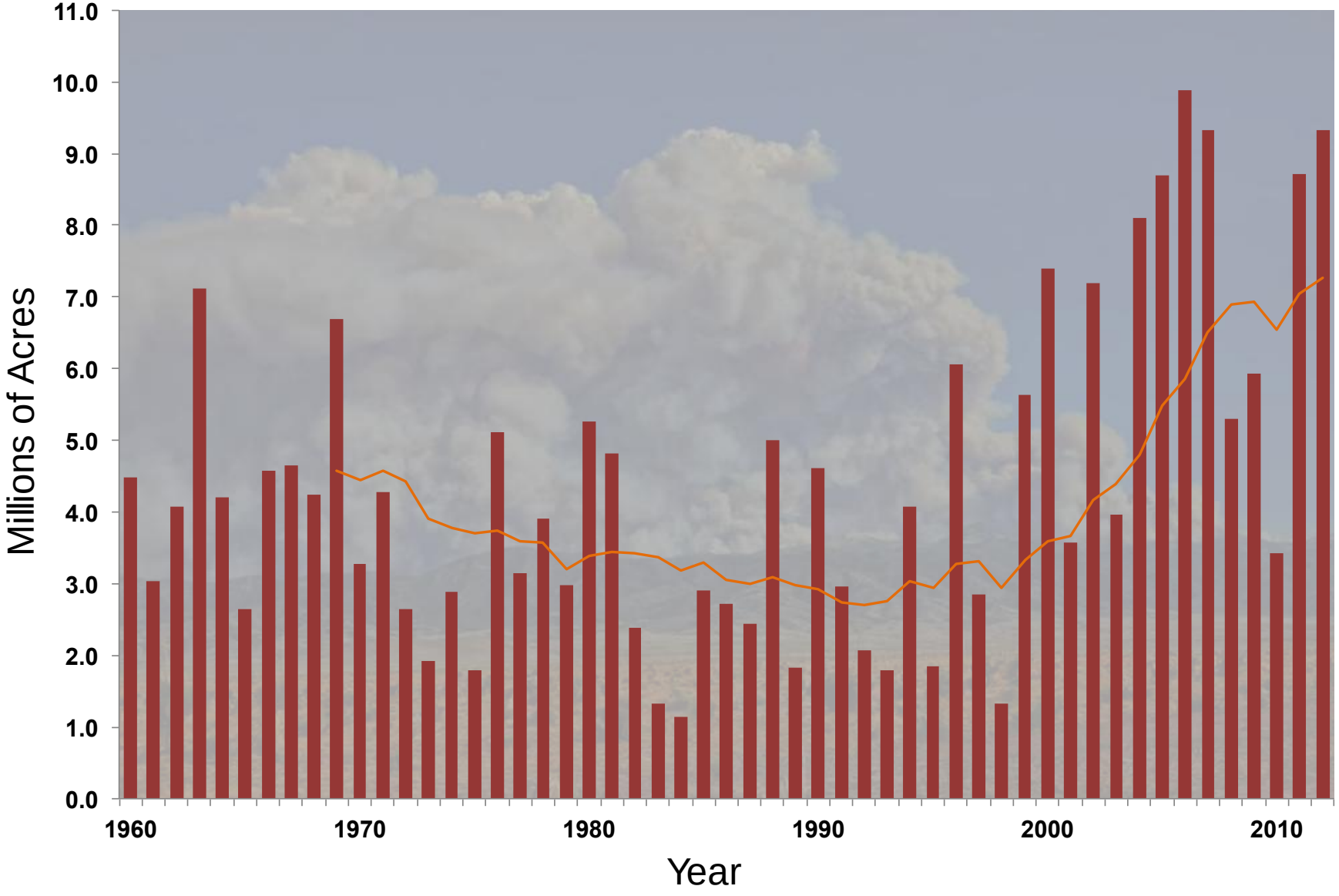
Changing nature of wildfire

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.

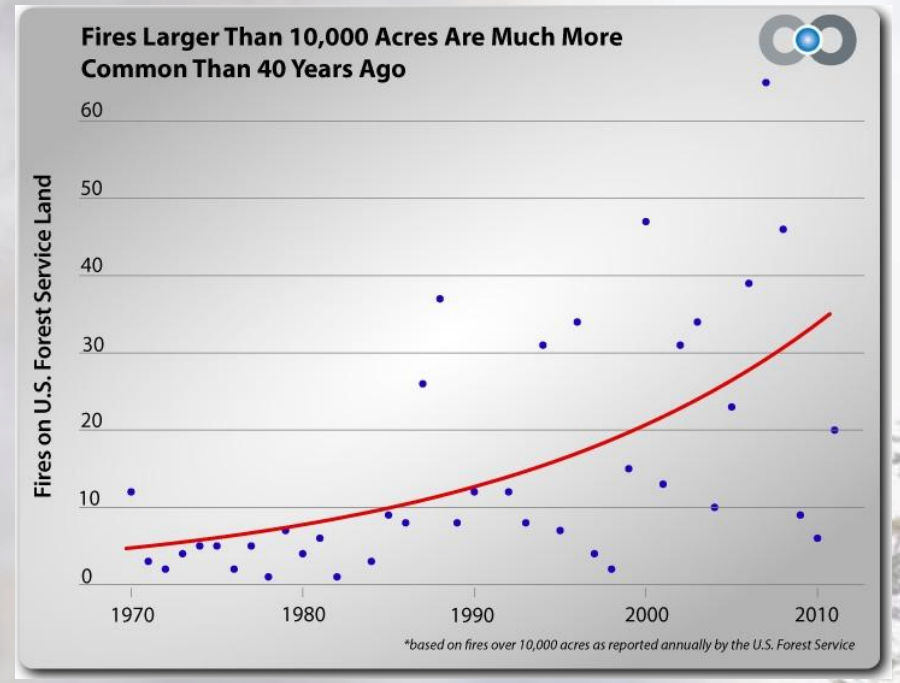

MAJOR FIRES
since 2001, colored by units of nuclear power plant output
NASA Visible Earth | visibleearth.nasa.gov
USDA Forest Service | activefiremaps.fs.fed.us
MODIS | modis.gsfc.nasa.gov
Fires are detected by the MODIS satellite at the 1km centroid resolution and contain time, confidence, and wattage 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 Megawats...
Fire intensity, by comparable nuclear plant output
hottest momentary square kilometer...
June 28, 2005
through July 9th
'01 '02 '03 '04 '05 '06 '07 '08 '09 '10 '11 '12
Annual Proportionality
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Seasonal Proportionality
idvsolutions
John Nelson | uxblog.idvsolutions.com
IDV Solutions | www.idvsolutions.com

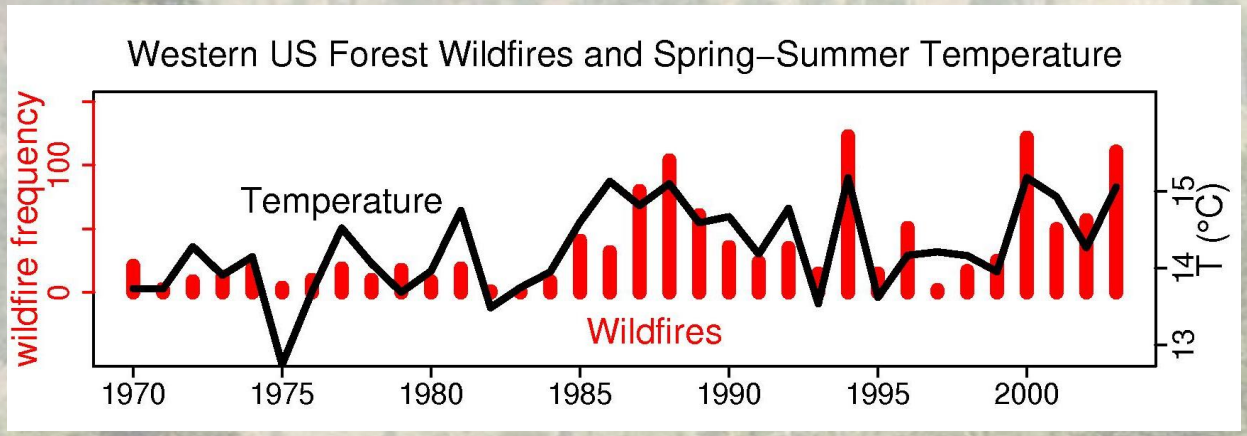
Area burned 1960-2012 in the United States

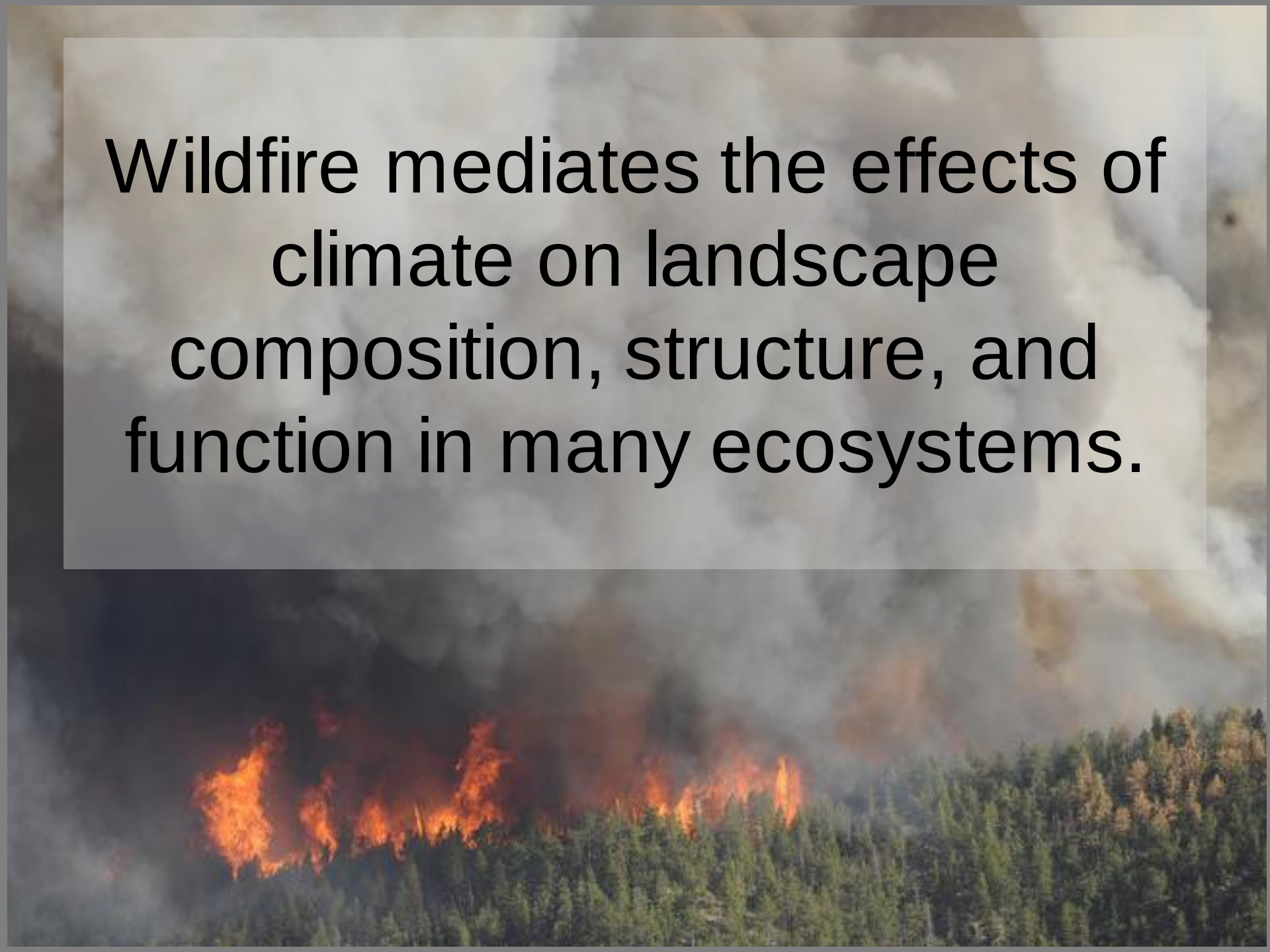


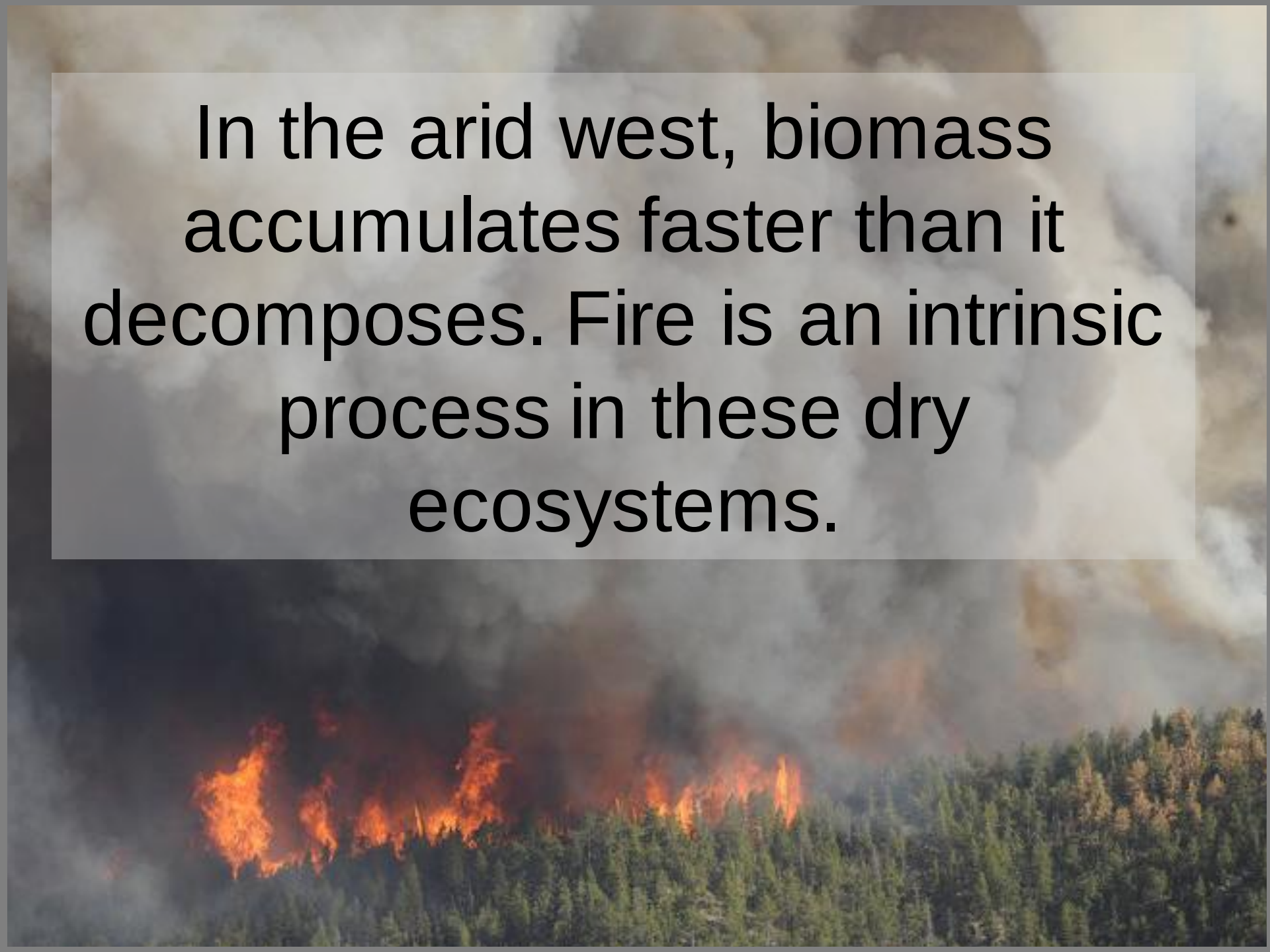
Generally, wildfires have become larger and more severe over the last 40 years

Linked to warmer weather, extended drought, and longer fire seasons.



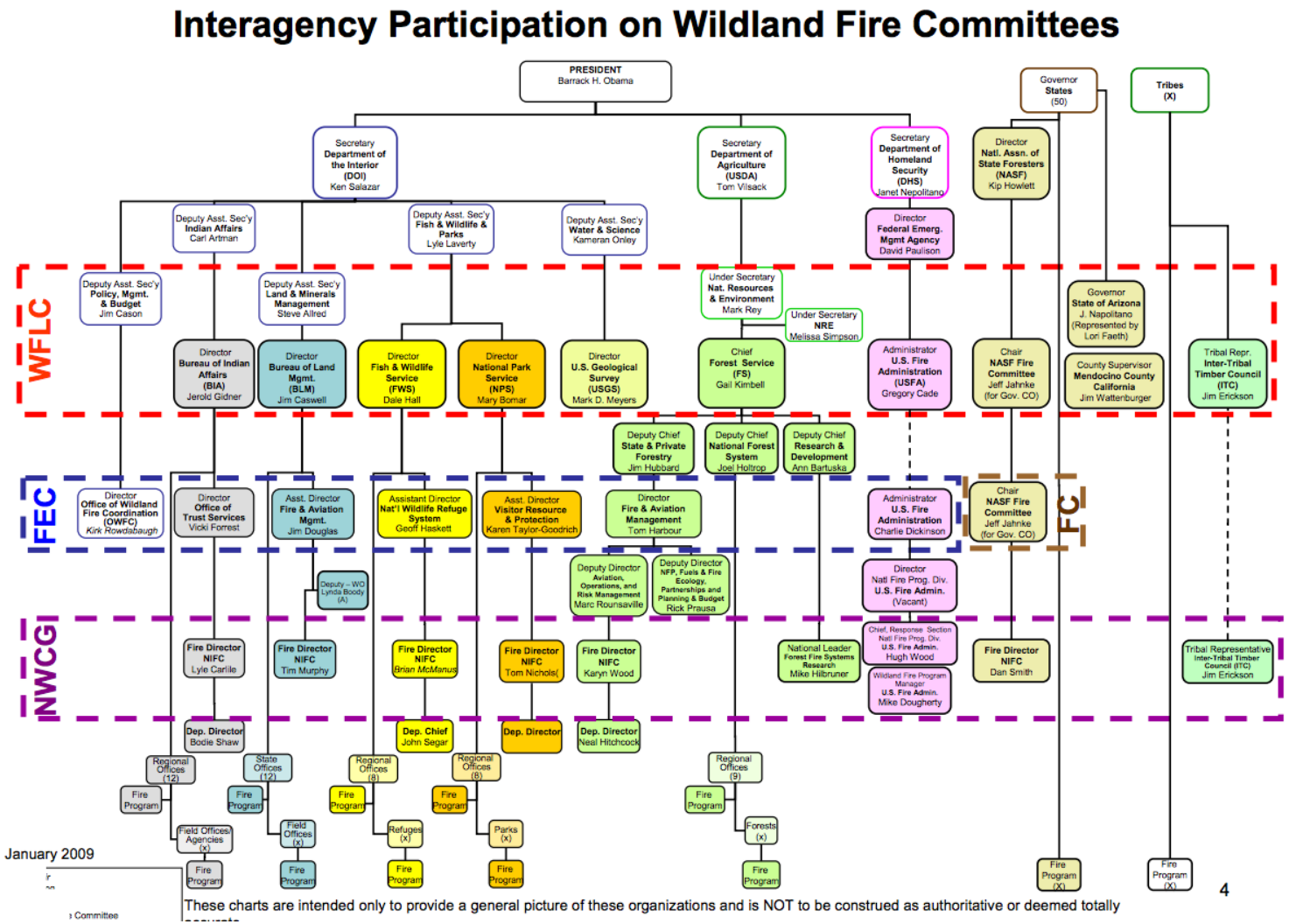



Wildfire mediates the effects of climate on landscape composition, structure, and function in many ecosystems.

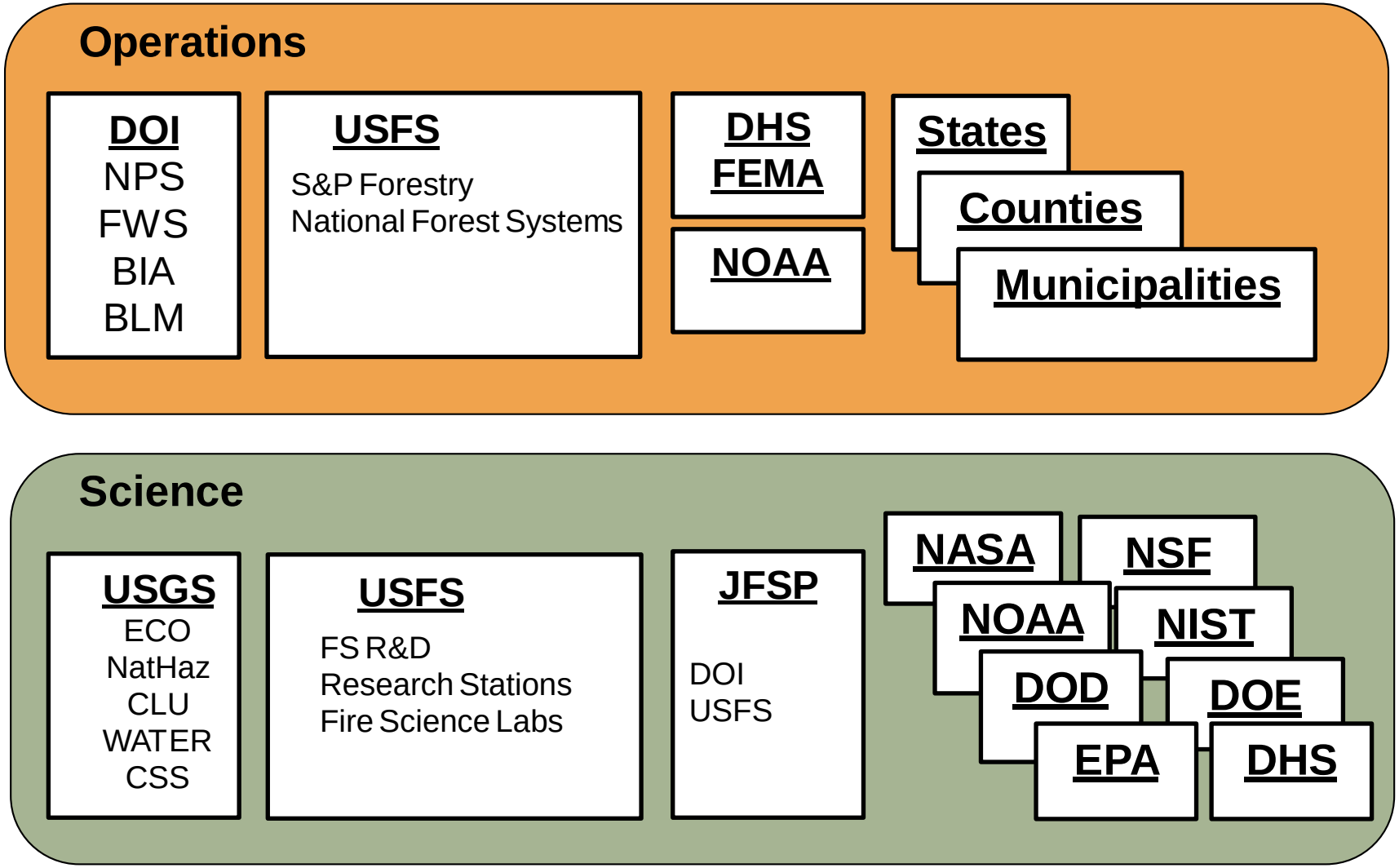


In the arid west, biomass accumulates faster than it decomposes. Fire is an intrinsic process in these dry ecosystems.

Wildfire organization

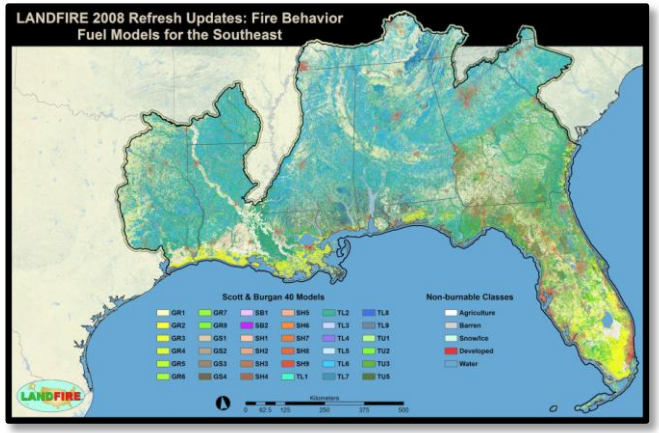


Wildfire Organizations



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

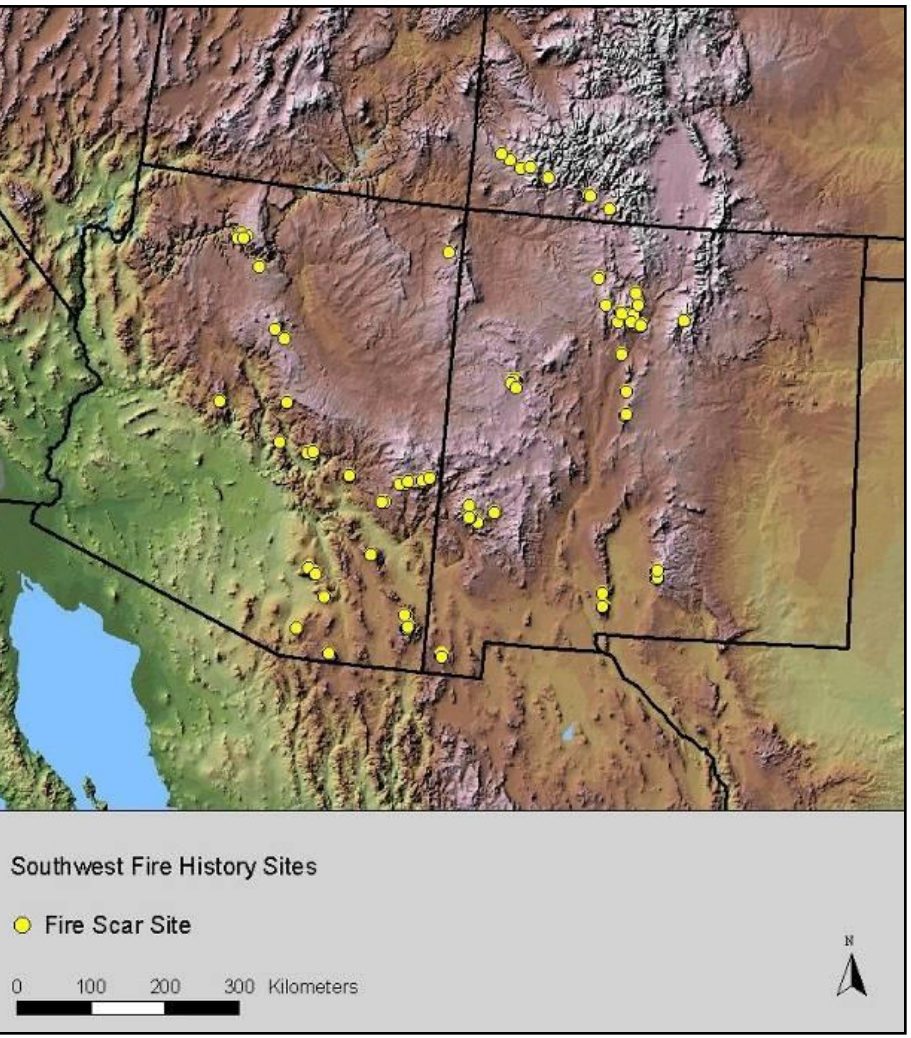
- Geospatial data for decision support
- High-resolution imagery
- Geospatial support for specific incidents and geographic areas
- Rapid deployment of science delivery.

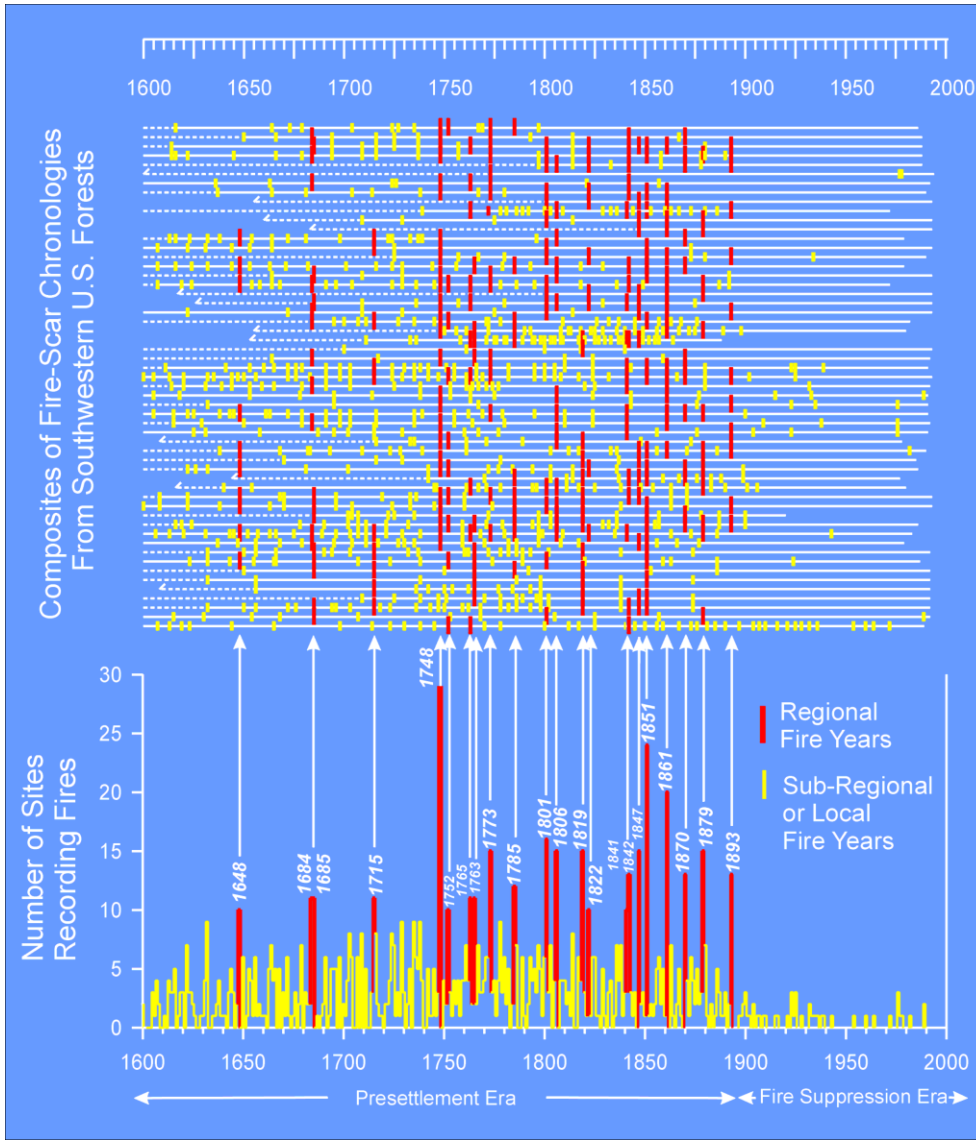
After Fires

- 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.

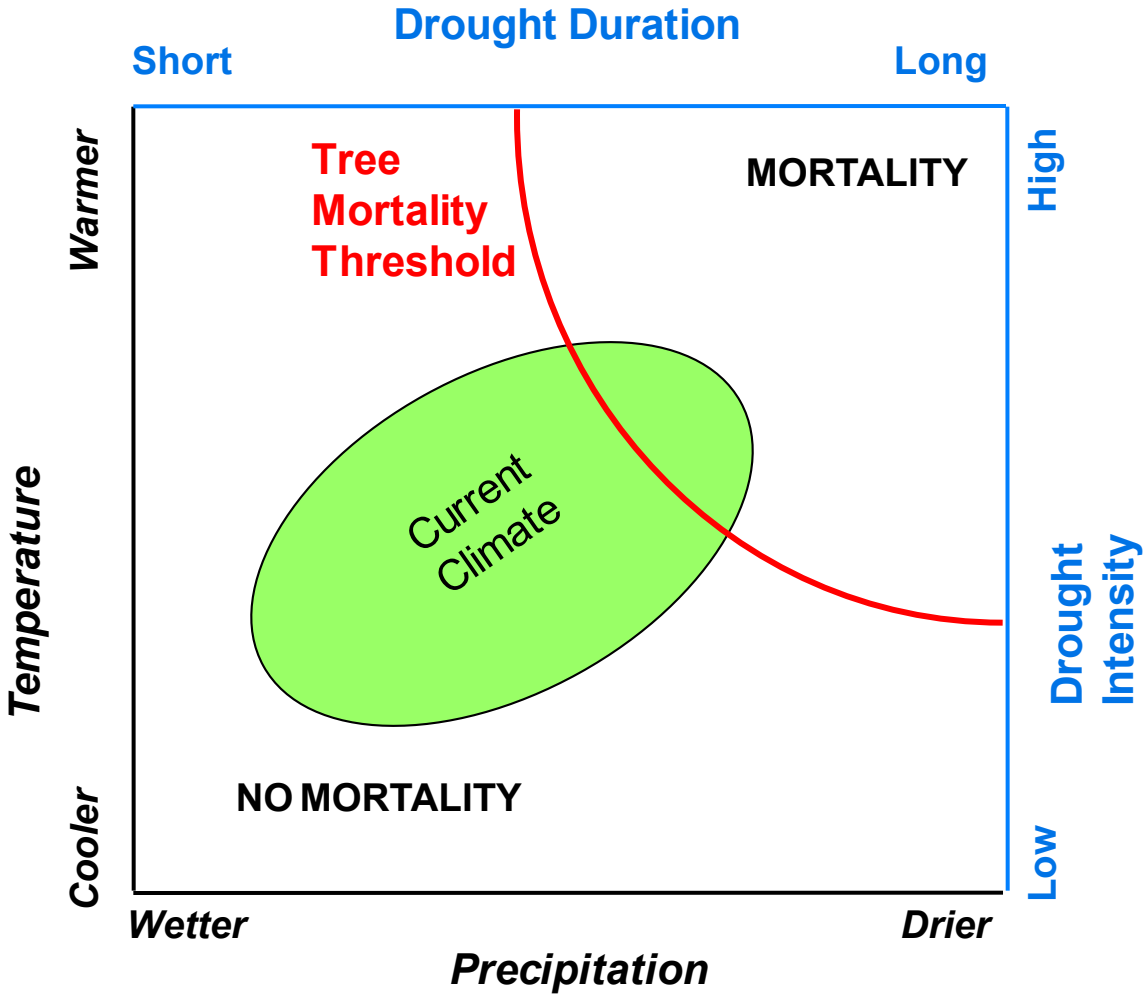




Swetnam, Allen & Betancourt. 1999.

Before wildfires

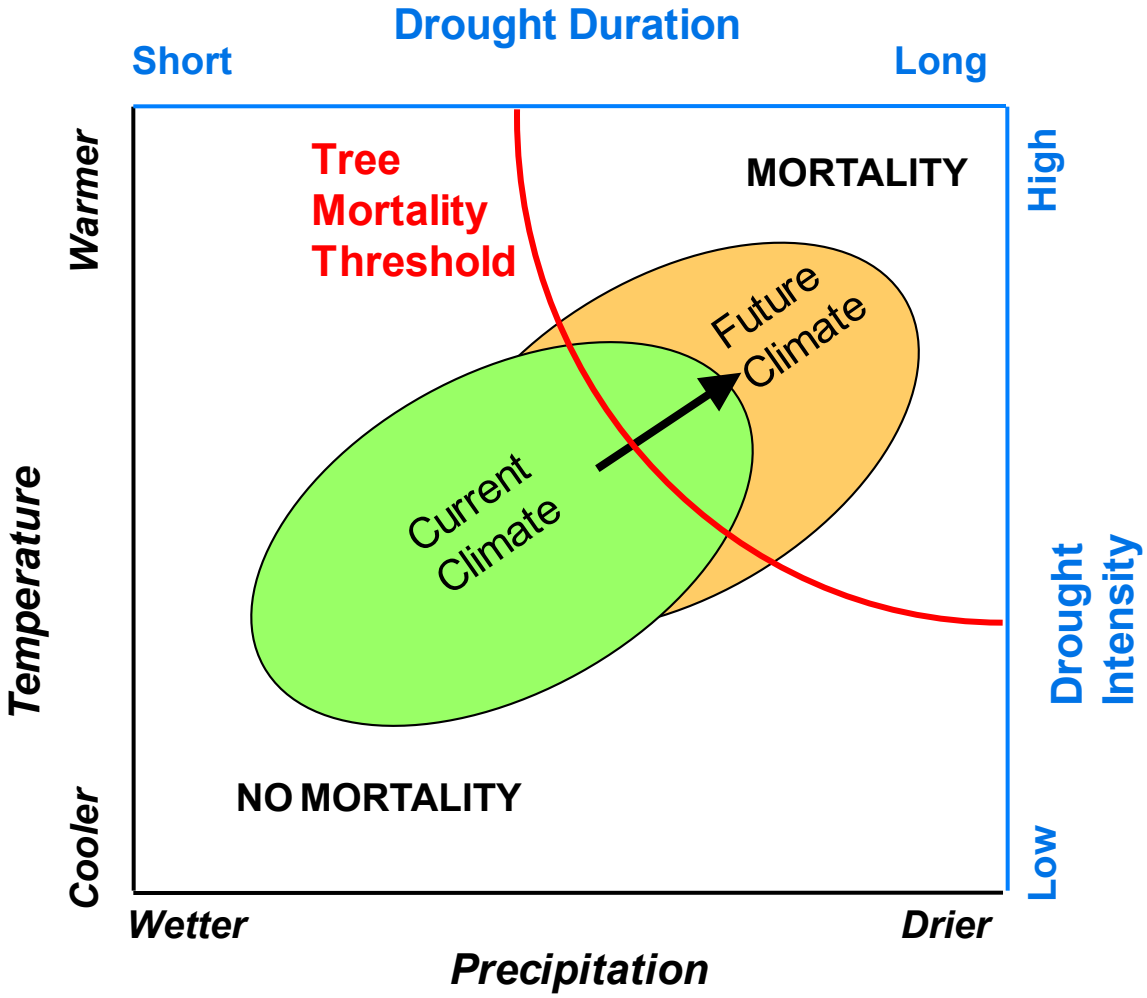
Coupled climate dynamics, disturbance interactions, and vegetation community dynamics



Allen et al – 2010

Before wildfires

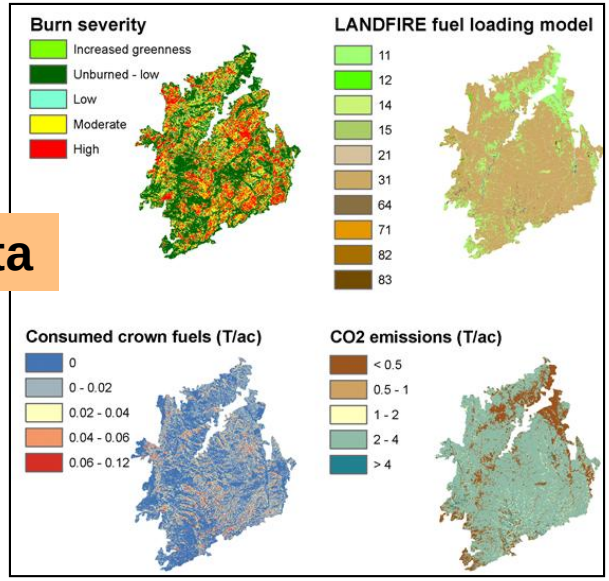
Coupled climate dynamics, disturbance interactions, and vegetation community dynamics



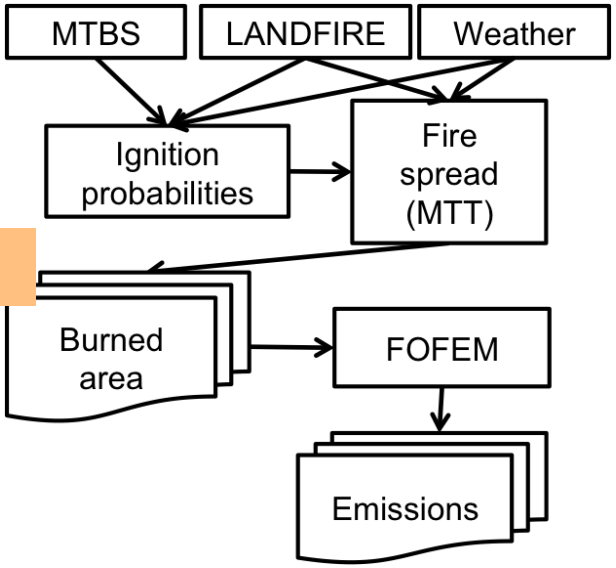
Before wildfires

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

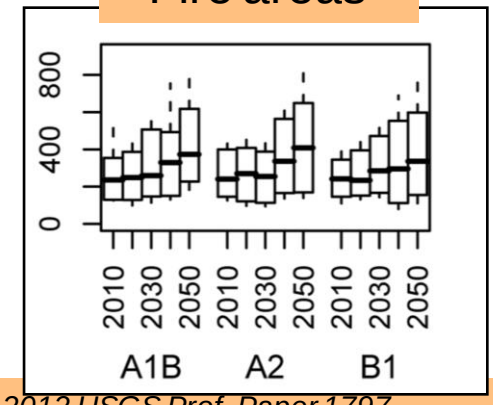
Data



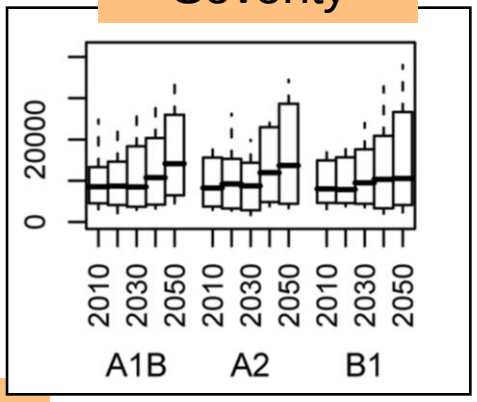
Model



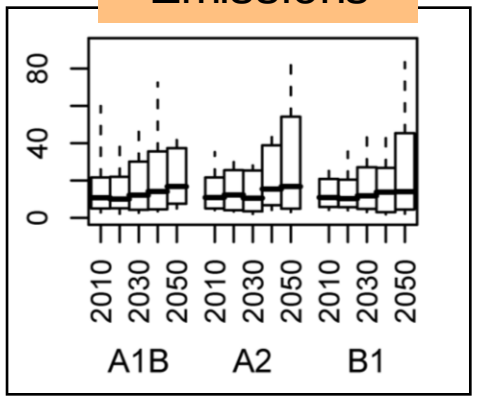
Fire areas



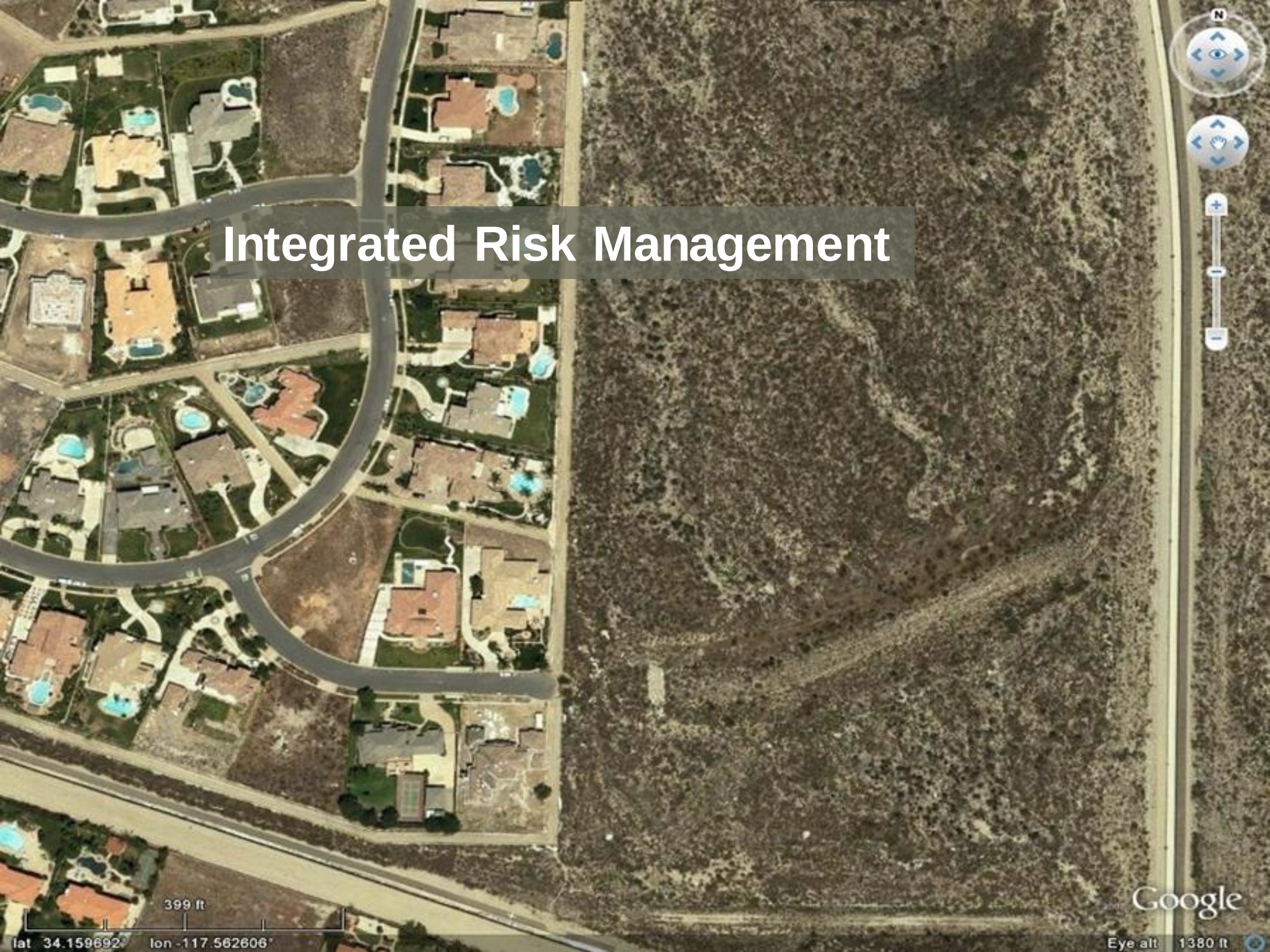
Severity



Emissions



Todd Hawbaker 2012 USGS Prof. Paper 1797


Integrated Risk Management
399 ft
lat 34.159692°
lon -117.562606°
Eye alt 1380 ft
Google

Integrated Risk Assessment

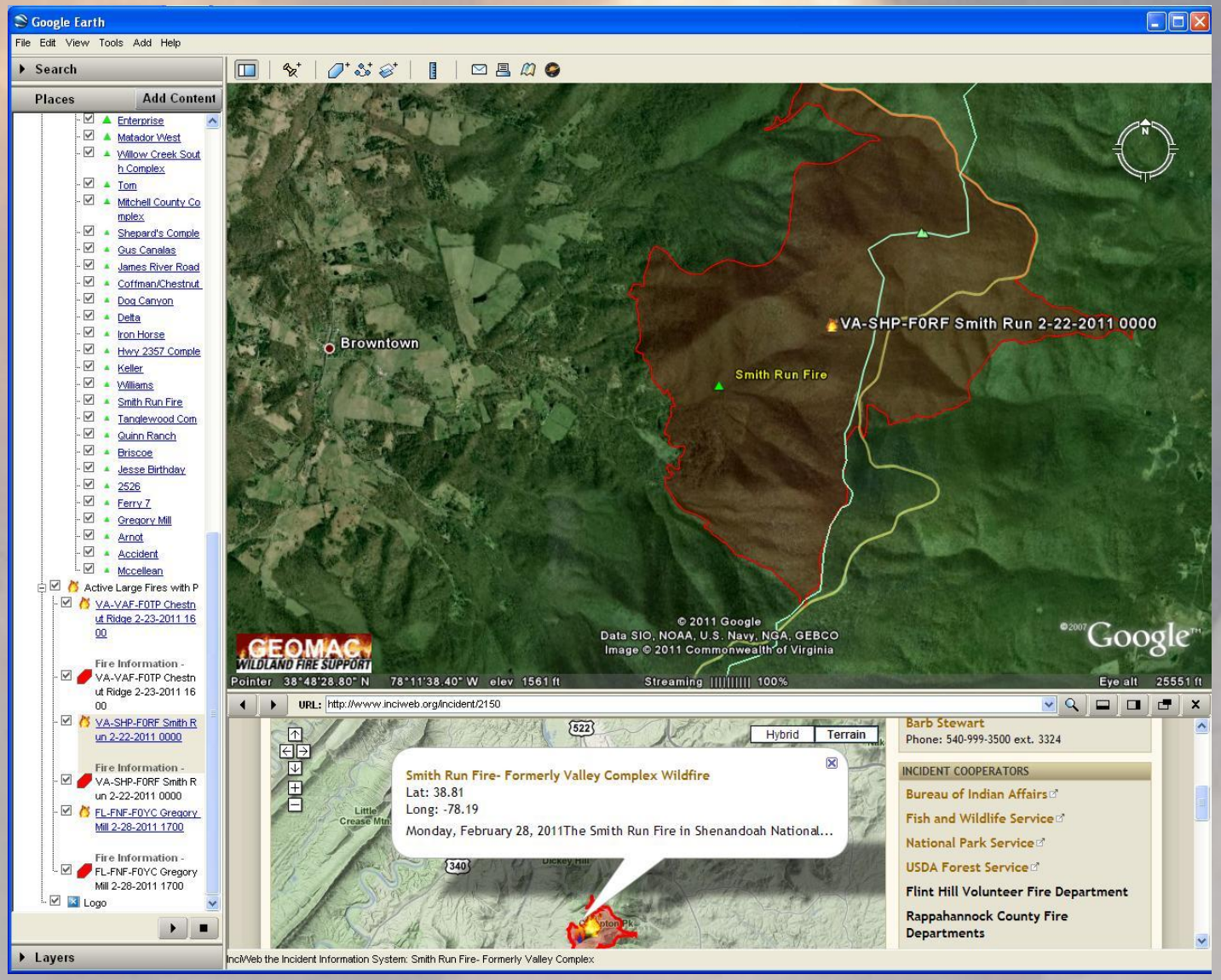
- Characteristics of damaging wildfires.
- Prevention and preparedness
- Valuation of property, resources, and ecosystem services.
- Probability of wildfires.
- ‘Good’ vs. ‘Bad fire.
- Scenario approach, similar to Earthquakes and Tsunamis.

Bastrop, TX 2011

Waldo Canyon 2012

USGS
science for a changing world

Wildland Fire Support



USGS science for a changing world

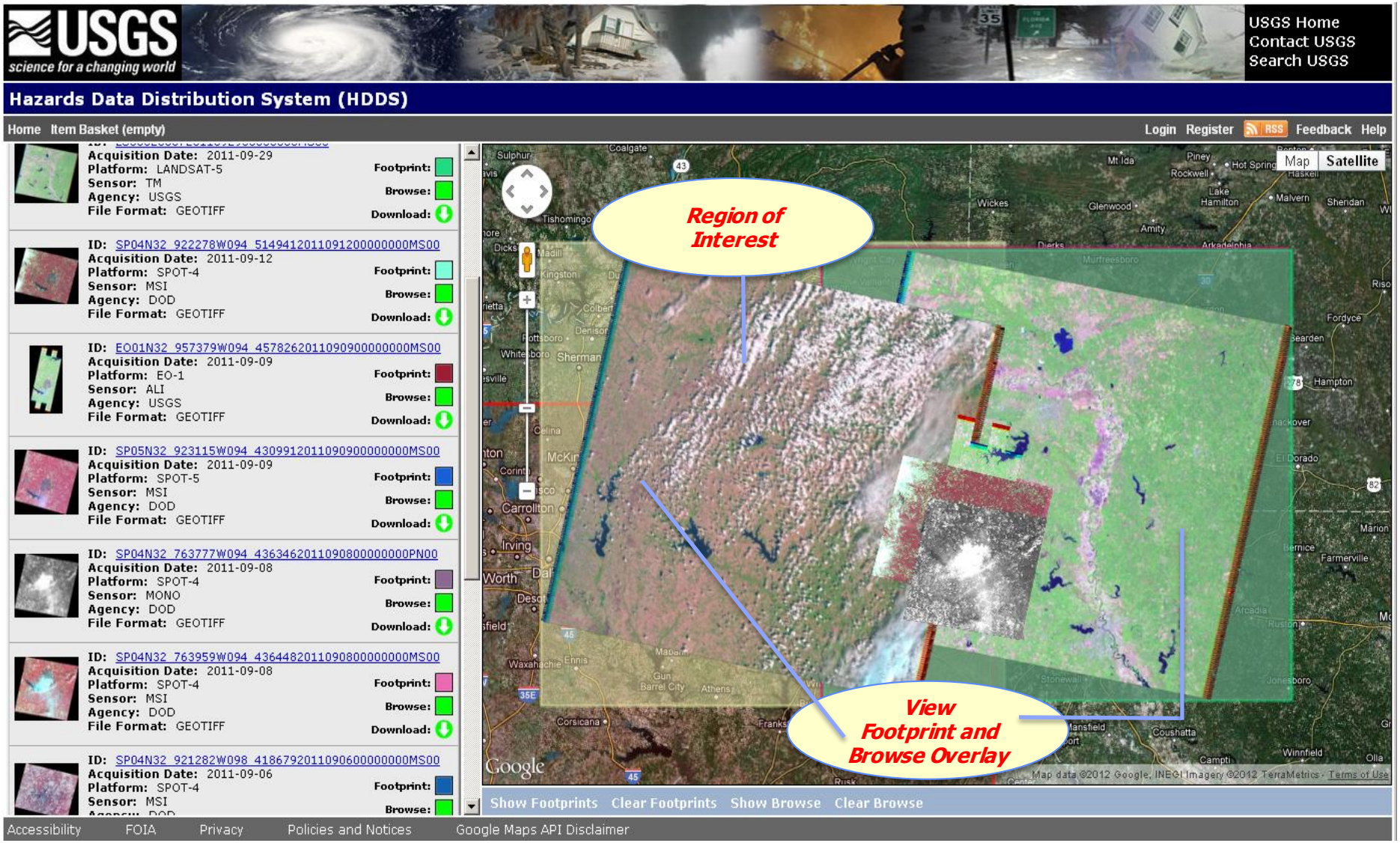
GeoMAC KML's used by InciWeb

Wildland Fire Support

GeoMAC RSS Feed in IGEMS

USGS science for a changing world

Hazards Data Distribution System



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

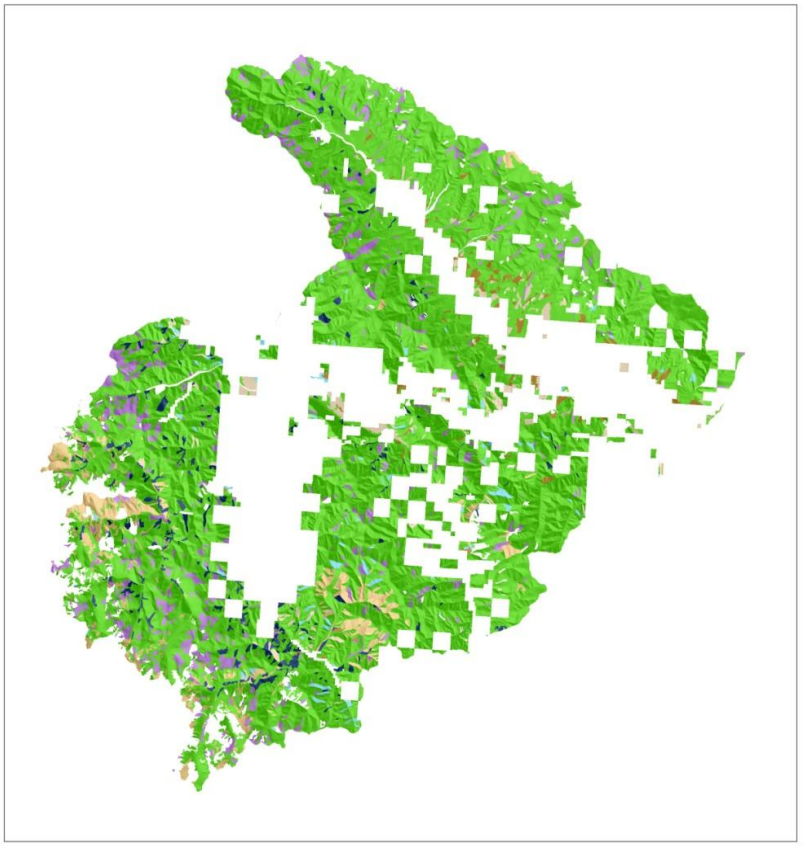
USGS

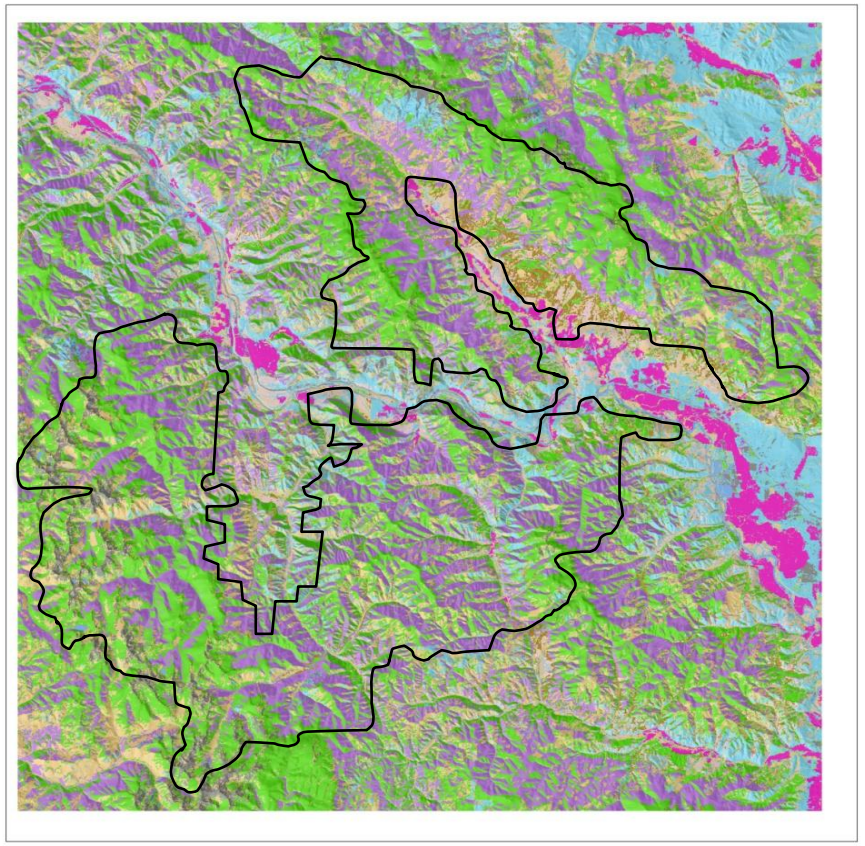
The Nature Conservancy

http://www.landfire.gov

Geospatial Data and Wildland Fire

Lolo National Forest, 9-Mile Ranger District

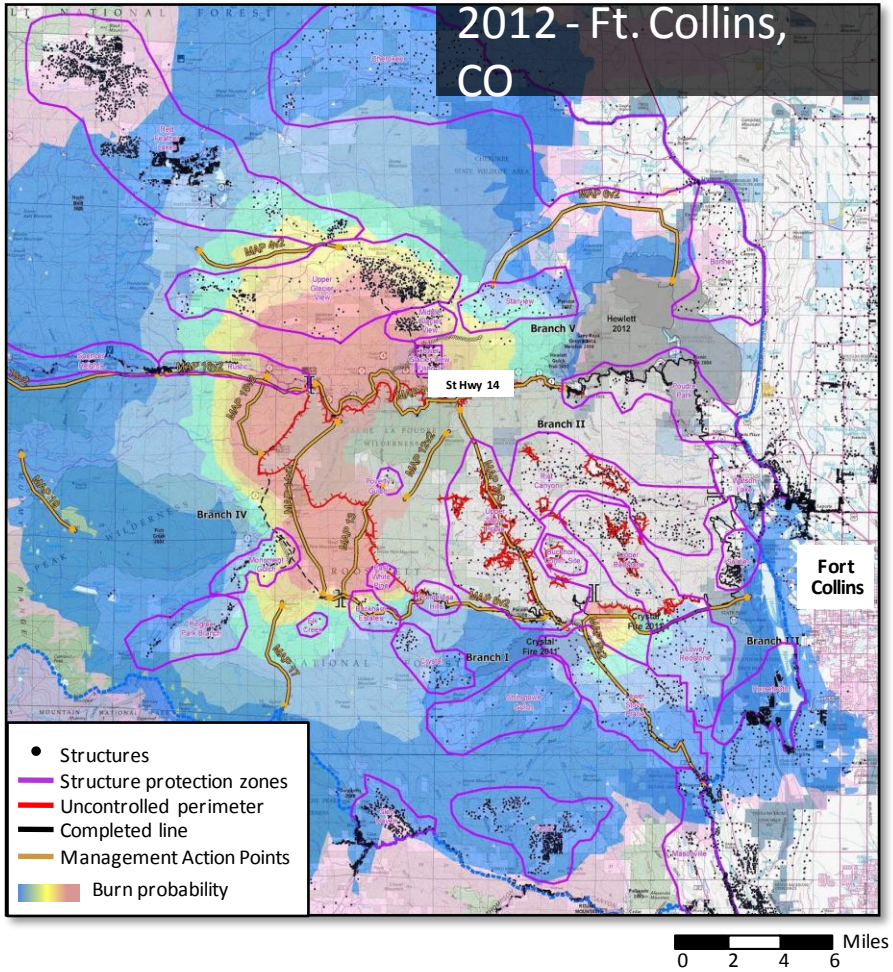




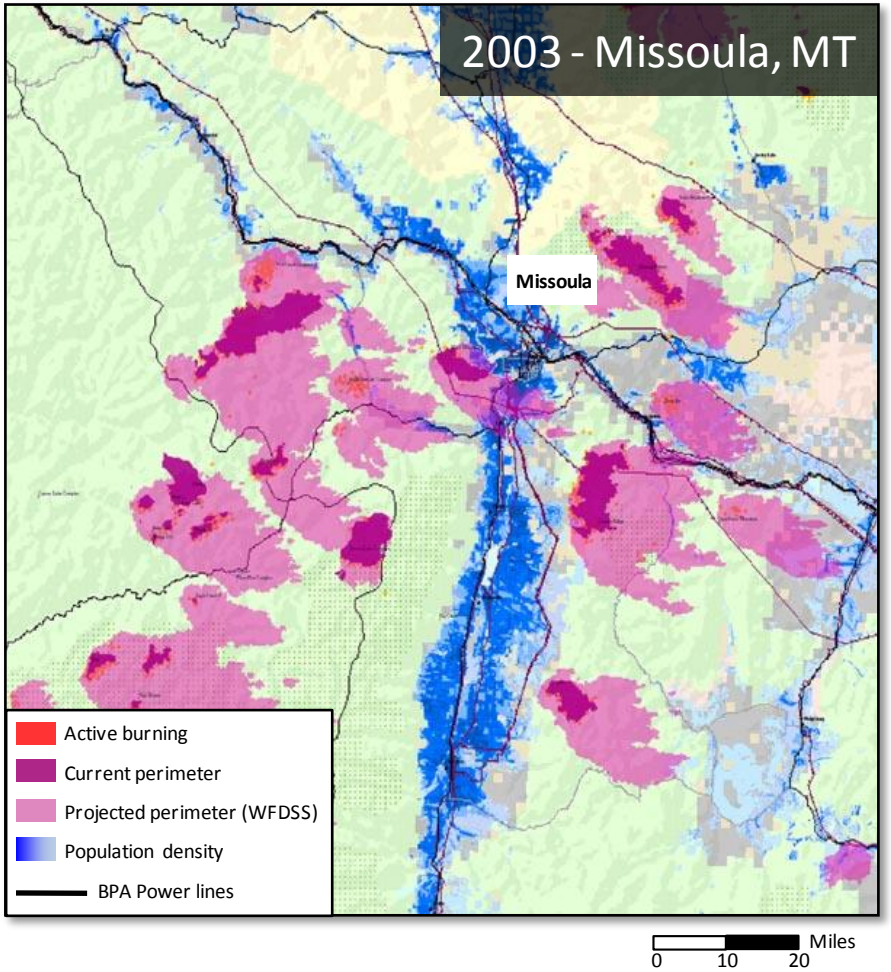
USGS

Wildland Fire Decision Support

Local Level



Regional Level



Monitoring Trends in Burn Severity

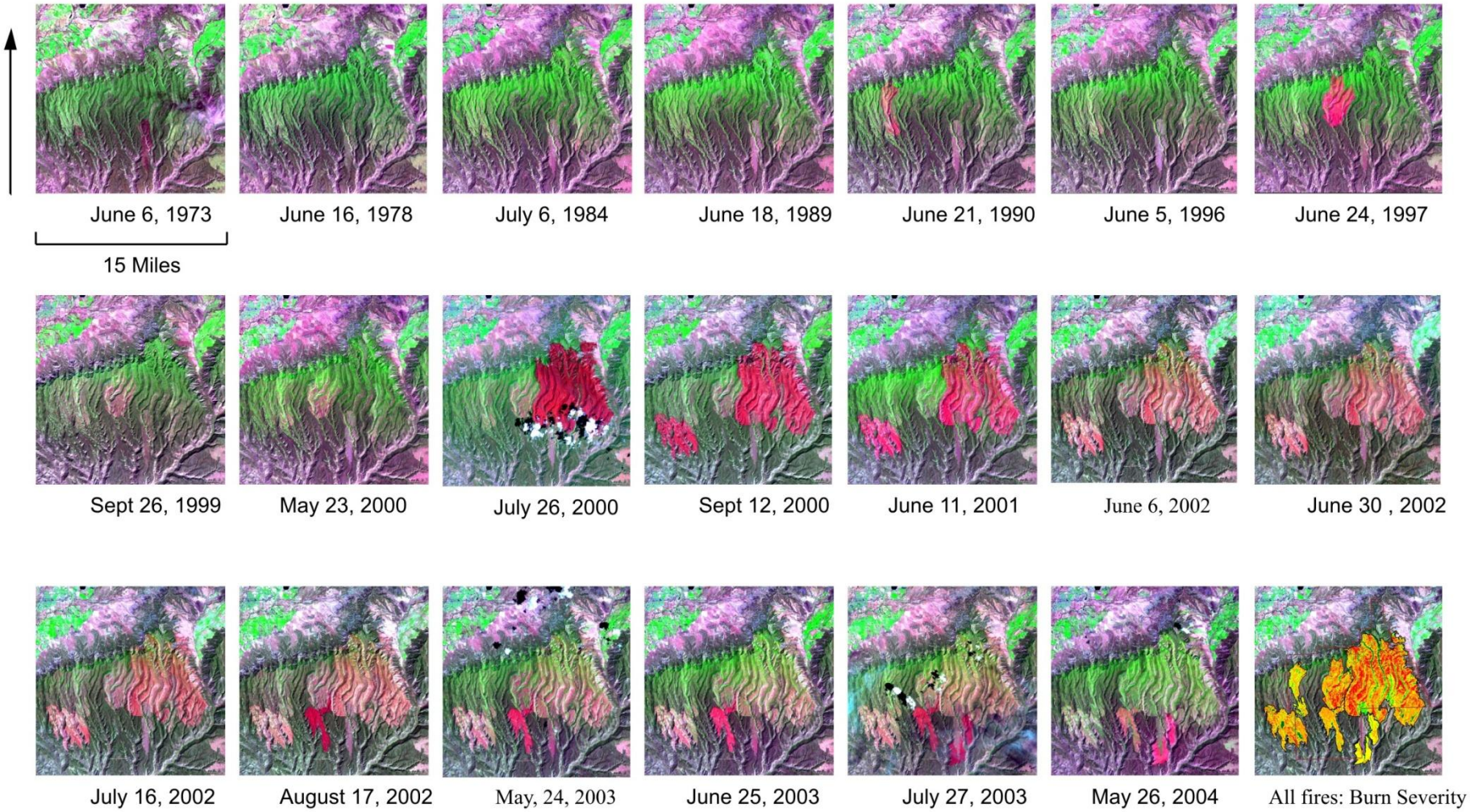
- **Duration: FY2006 - FY2011.**
- **Fires over 1,000 acres in West, 500 in East.**
- **Severity mapped using time series of Landsat imagery and Differenced Normalized Burn Ratio.**
- **Evaluate 'historical fires': 1984 – 2003**
- **Annual evaluations (current fires) 2004 – 2010**
- **MTBS has mapped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

Roberts Fire
Glacier National Park
August 2003

http://mtbs.gov

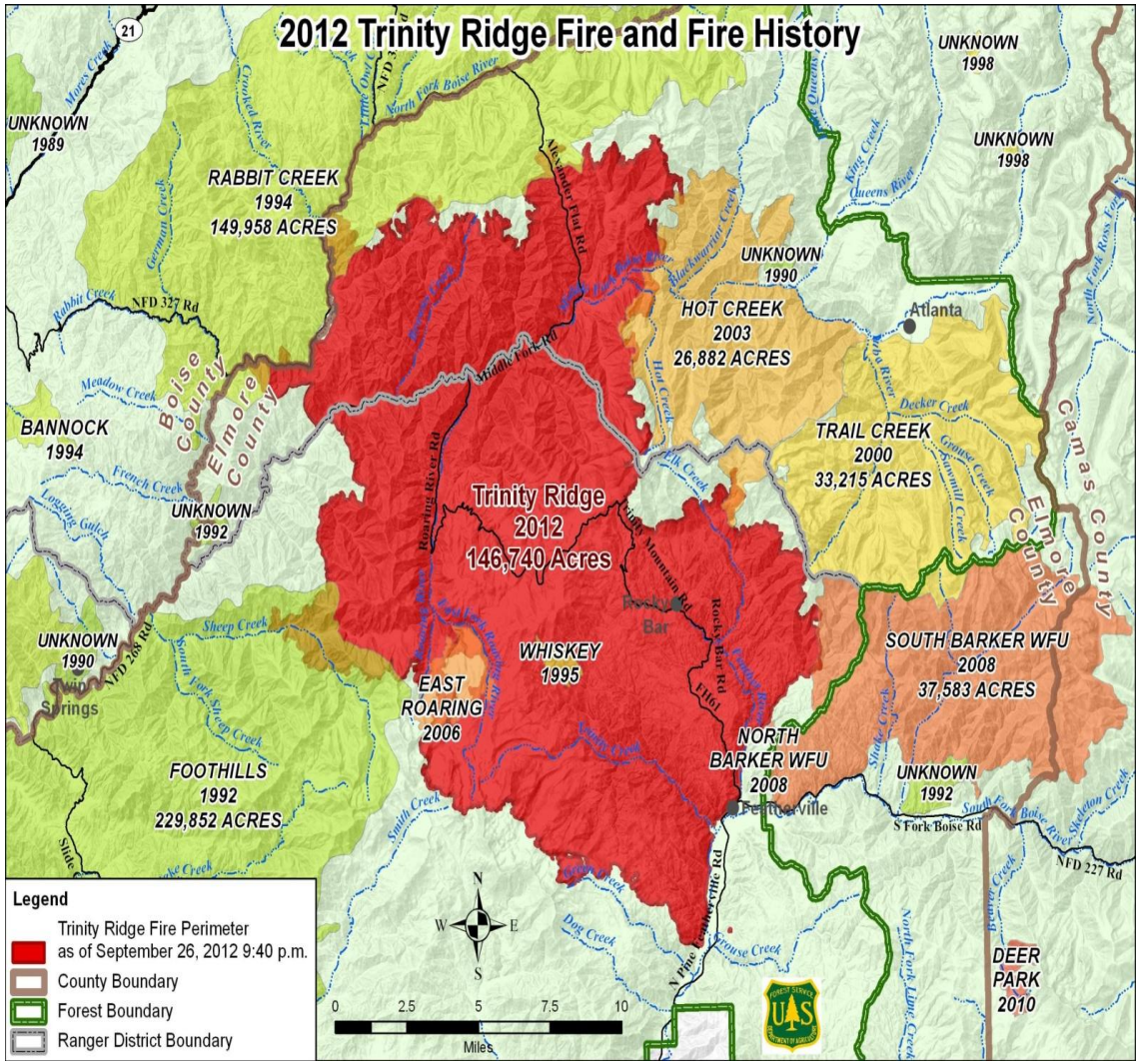
USGS

Monitoring Trends in Burn Severity



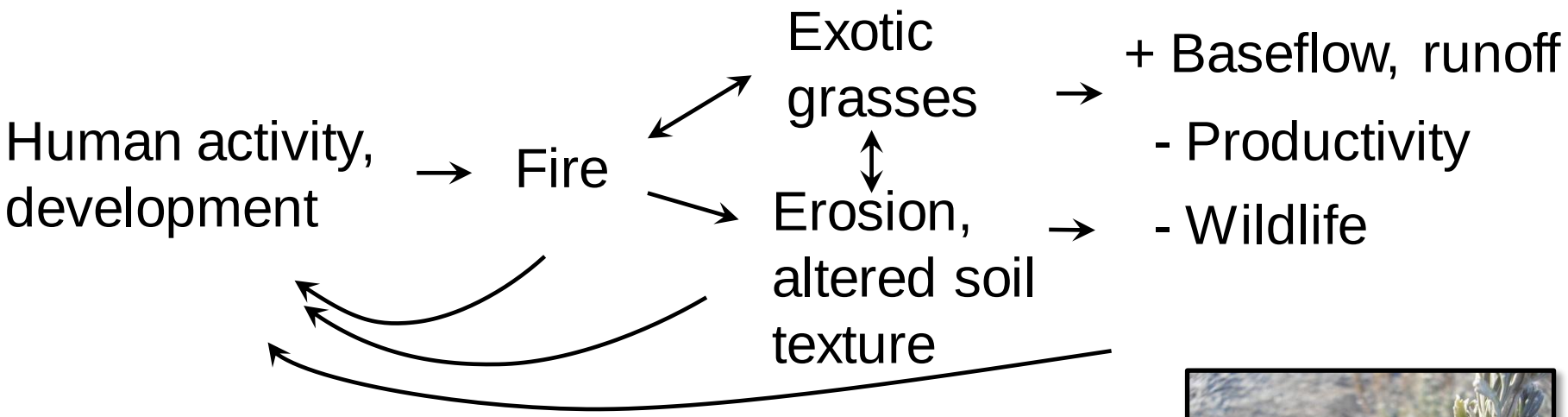
Trinity Ridge Fire (2012)

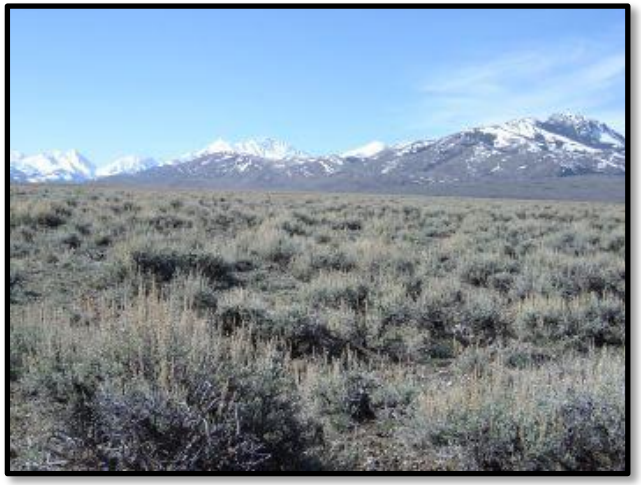
Recent fire history



After wildfires

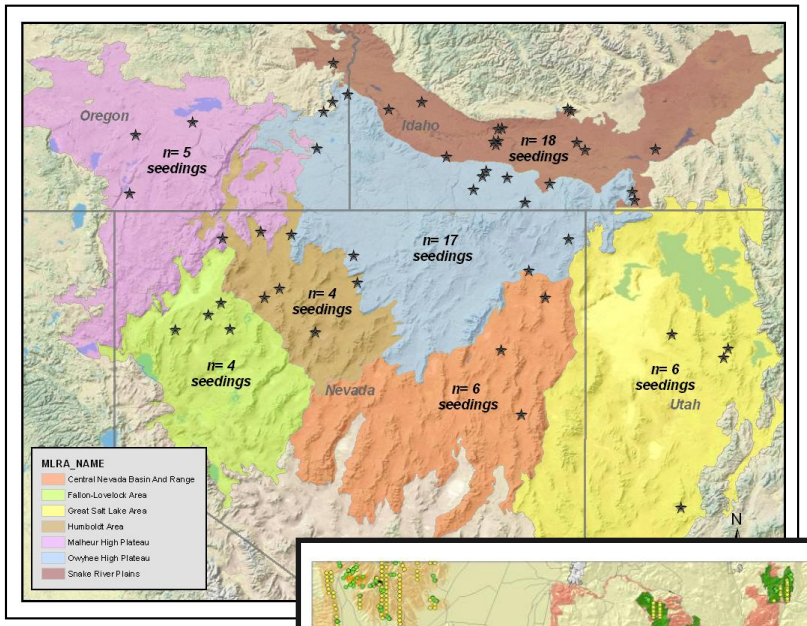
Climate effects on sagebrush ecosystems

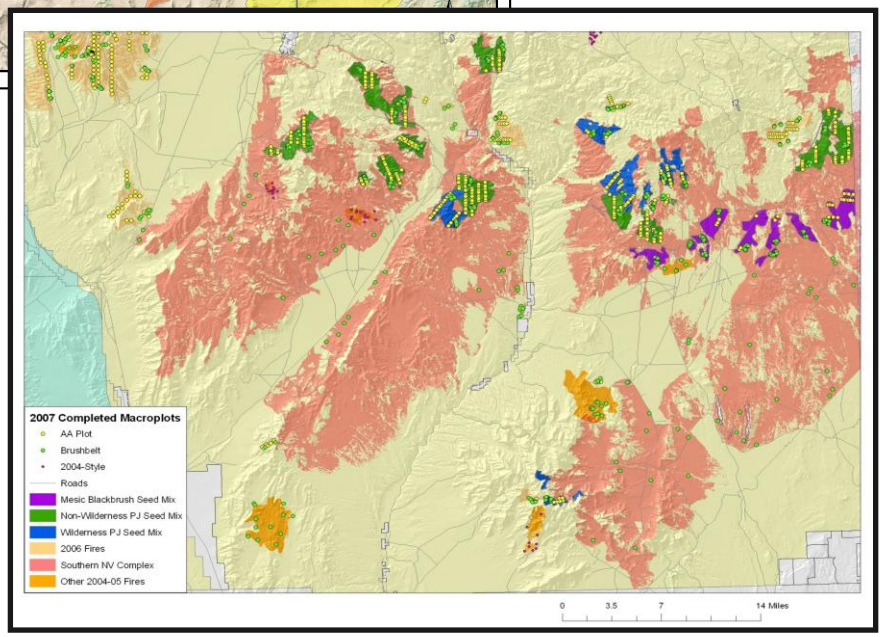




After wildfires

Vegetation rehabilitation chronosequence





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

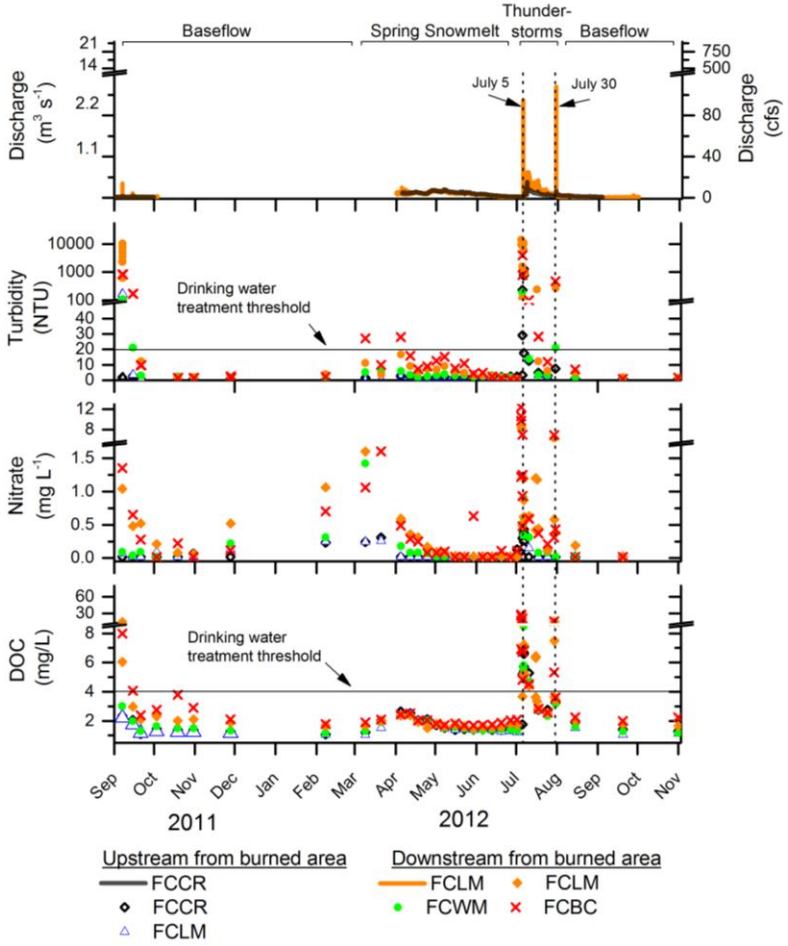
Water Quality and Supply

Monitoring

Early warning networks

Post fire water sampling

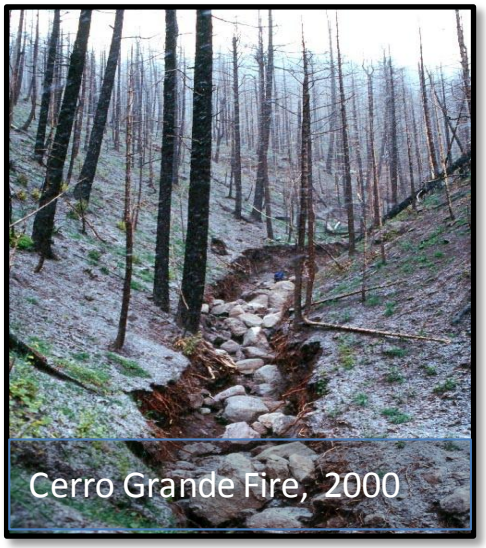
Assessment



USGS
science for a changing world

After wildfires

The effects of fire on hydrology and geomorphology


Cerro Grande Fire, 2000


Las Conchas, 2011 – USGS OFR 2011-1308


Shultz Fire -2010


Buffalo Creek Fire, 1997


High Park Fire, 2012 – USGS OFR 2012–1148

Post-fire debris flows

Applied Research

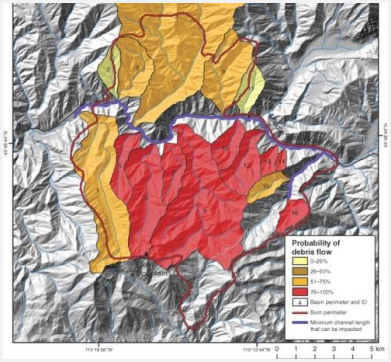
<u>Product</u>: Emergency assessments of post-wildfire debris-flow hazards

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.

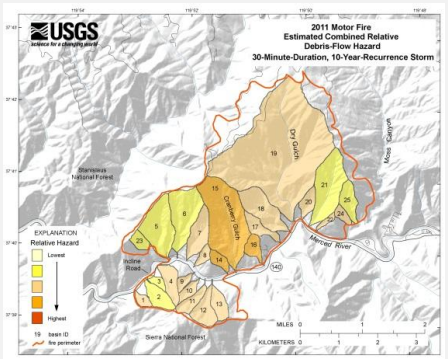
Probability Model

Where?



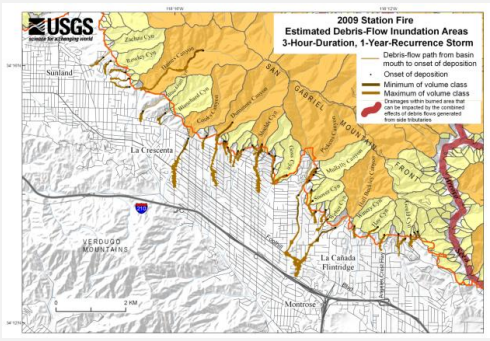
Magnitude Model

How Big?



Inundation Model

How Far?



Link to page
here

Interactive map →

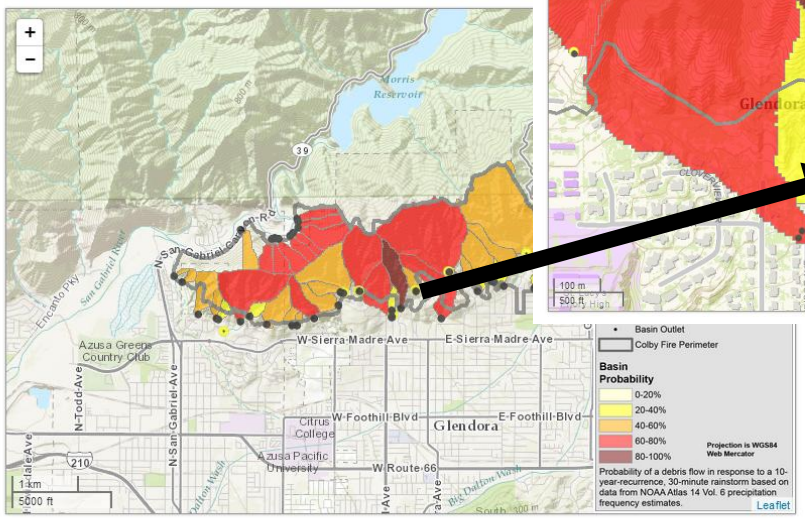
GIS files for download →

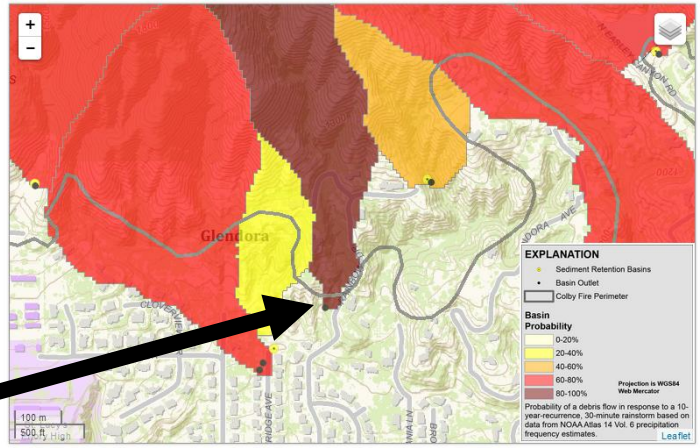
Landslide Occurrences-Current & Archives
Did You See It?
News-Interesting Stuff
CAP Alerts
Early Warning System
Post-fire Debris-flow Hazards
Scientific Background
Disclaimer

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





Drainage above Rainbow Drive is most susceptible

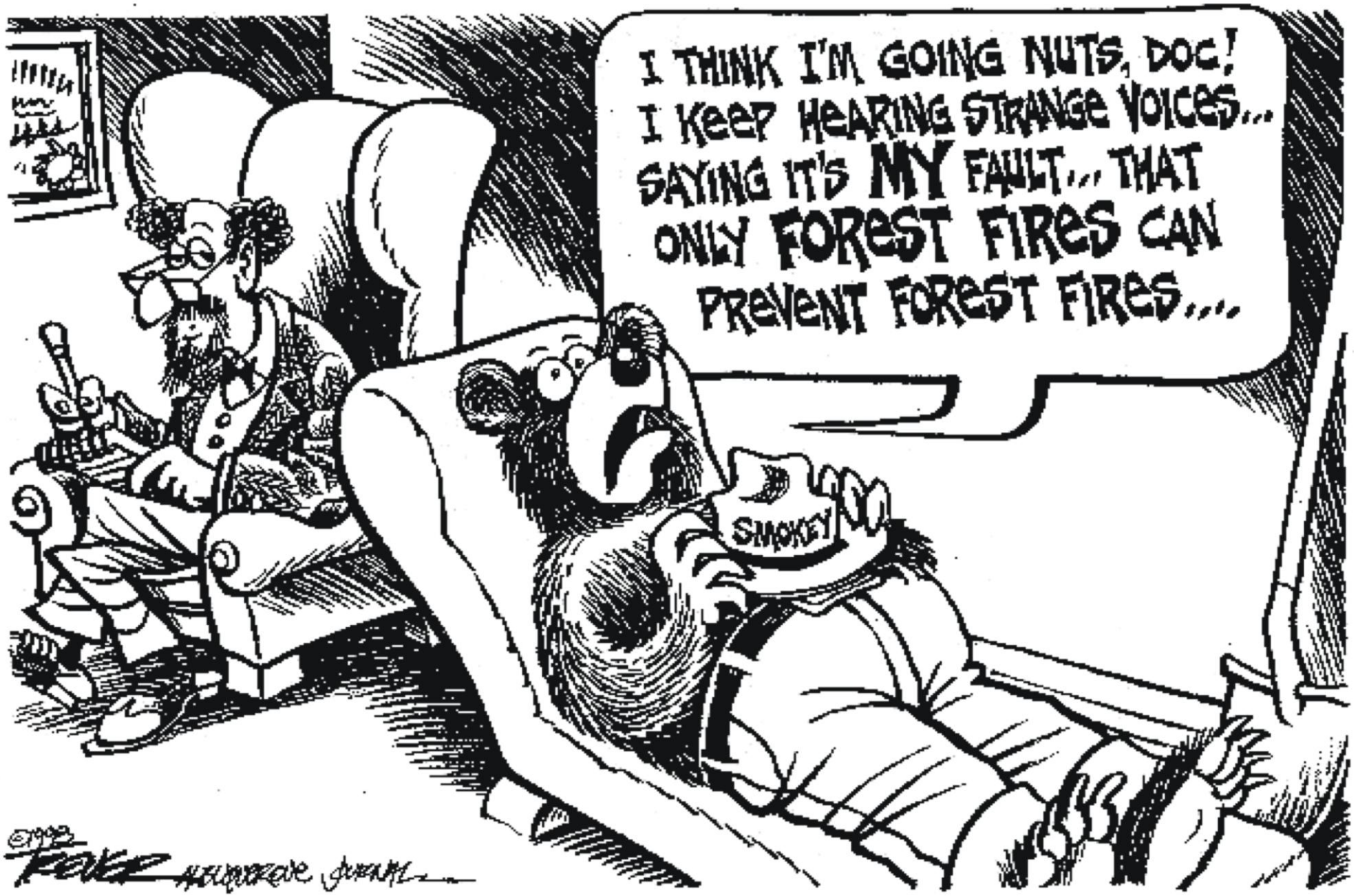
The interactive map above displays estimates of the probability of debris flow (in %), potential volume of debris flow (in m^3), and combined relative debris flow hazard. These predictions are made at the scale of the drainage basin, and at the scale of the individual stream segment. Estimates of probability, 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.

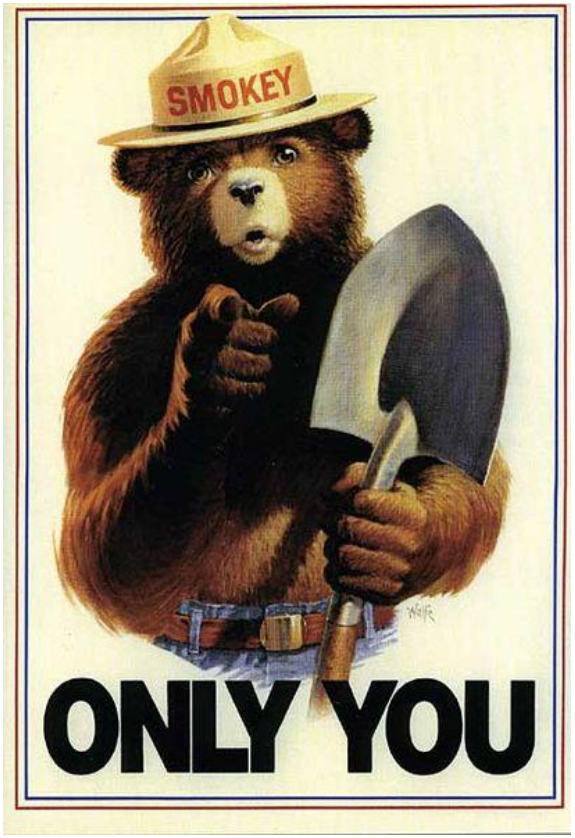
Downloads

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)

Gila Wilderness, Whitewater-Baldy Fire, late July 201

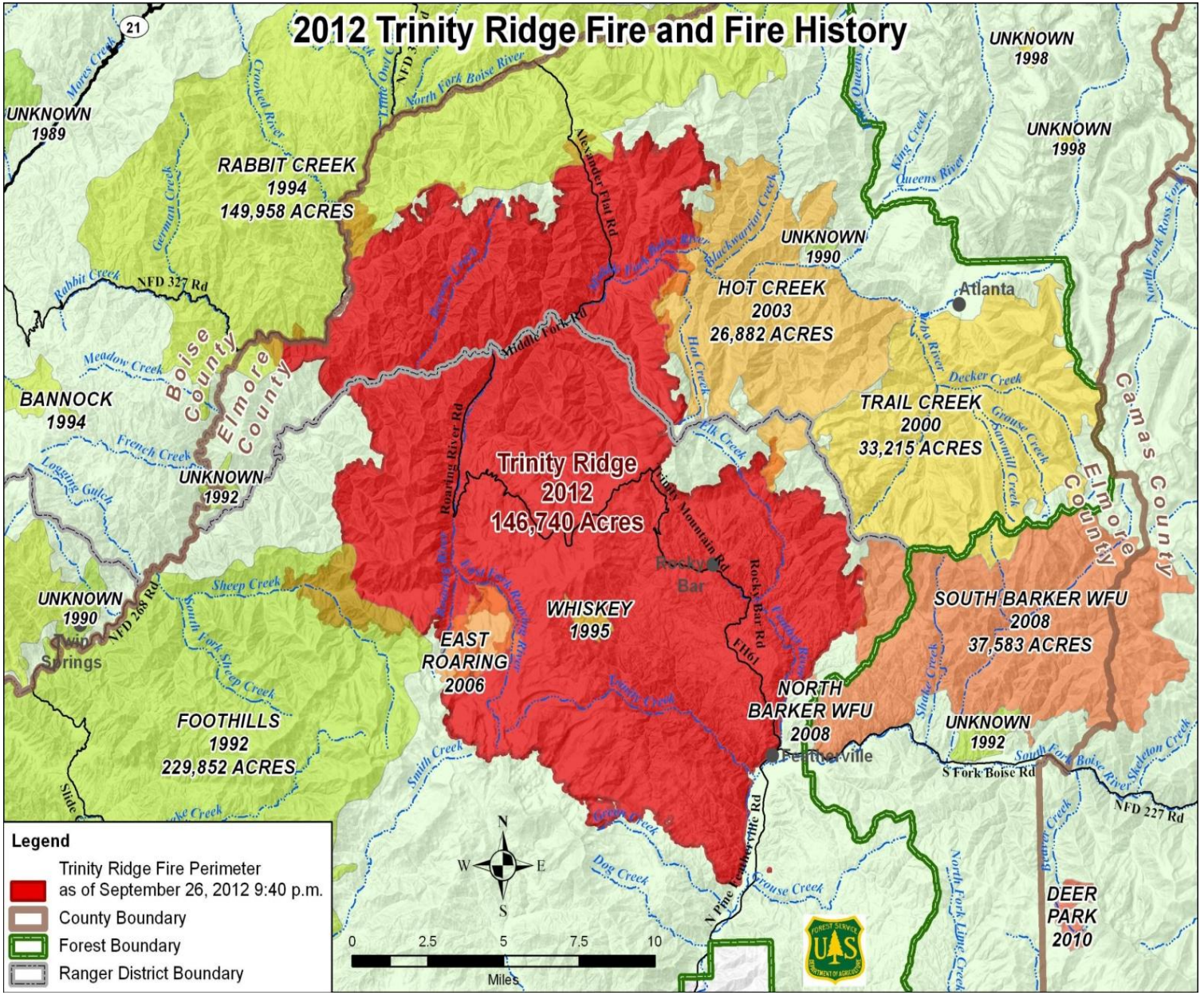

I THINK I'M GOING NUTS, DOC! I KEEP HEARING STRANGE VOICES... SAYING IT'S MY FAULT... THAT ONLY FOREST FIRES CAN PREVENT FOREST FIRES....
SMOKEY



… can <u>postpone</u> 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
UNKNOWN 1989
RABBIT CREEK 1994 149,958 ACRES
UNKNOWN 1998
UNKNOWN 1998
UNKNOWN 1990
HOT CREEK 2003 26,882 ACRES
Atlanta
TRAIL CREEK 2000 33,215 ACRES
BANNOCK 1994
UNKNOWN 1992
Trinity Ridge 2012 146,740 Acres
WHISKEY 1995
EAST ROARING 2006
SOUTH BARKER WFU 2008 37,583 ACRES
NORTH BARKER WFU 2008
UNKNOWN 1990
UNKNOWN 1992
FOOTHILLS 1992 229,852 ACRES
Featherville
DEER PARK 2010
Boise County
Elmore County
Camas County
Legend
Trinity Ridge Fire Perimeter as of September 26, 2012 9:40 p.m.
County Boundary
Forest Boundary
Ranger District Boundary
0 2.5 5 7.5 10
Miles

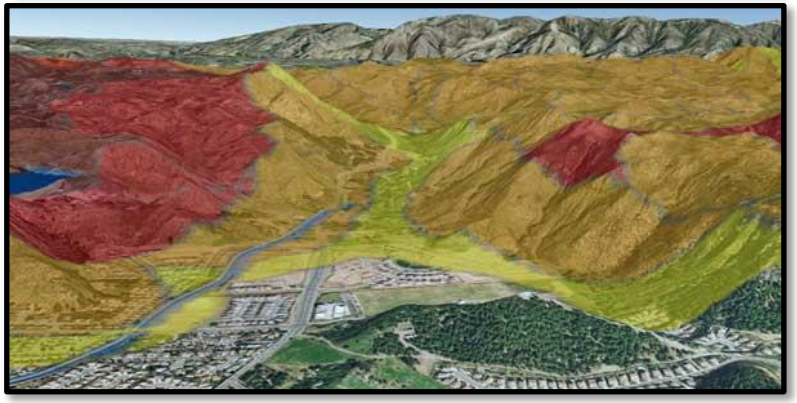
How do we successfully handle risk in the context of current wildland fire policy?

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?

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