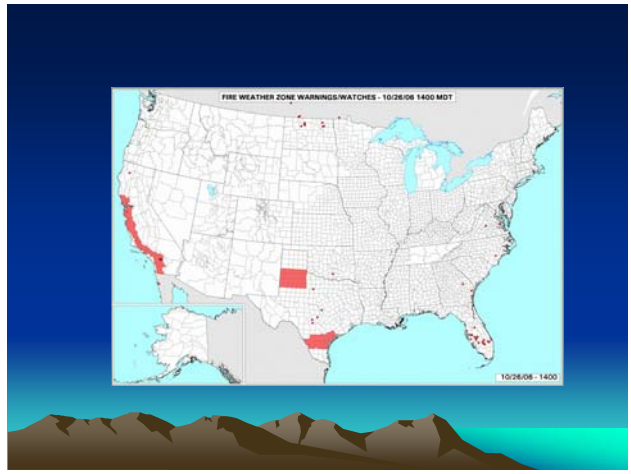
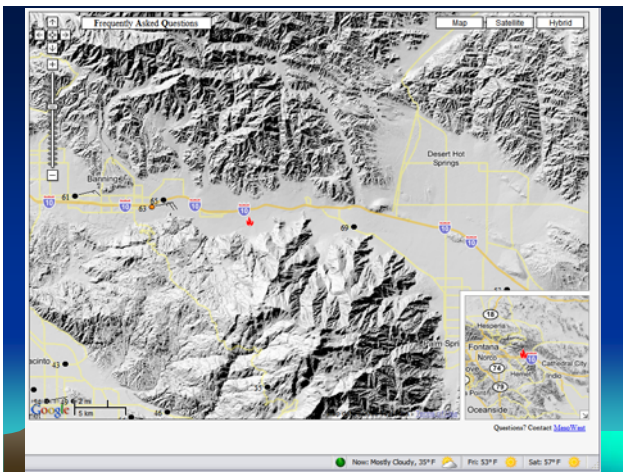
Biscuit 2002 www.biscuitfire.com

Hayman 2002. Kenneth Wyatt

Fire Weather

Rodeo-Chediski 2002. www.floa.org/rodeo_chediski/fire_photos1.htm



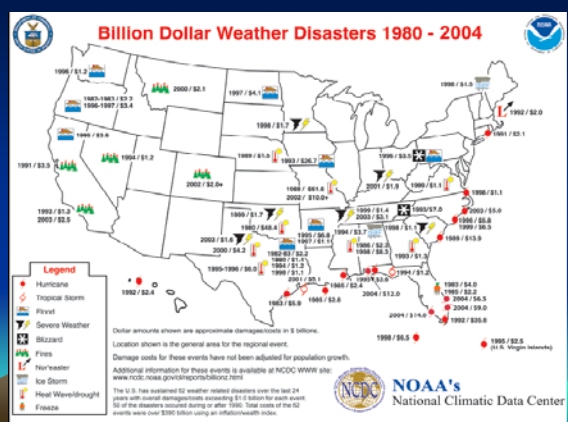


Bitterrrot NF photograph

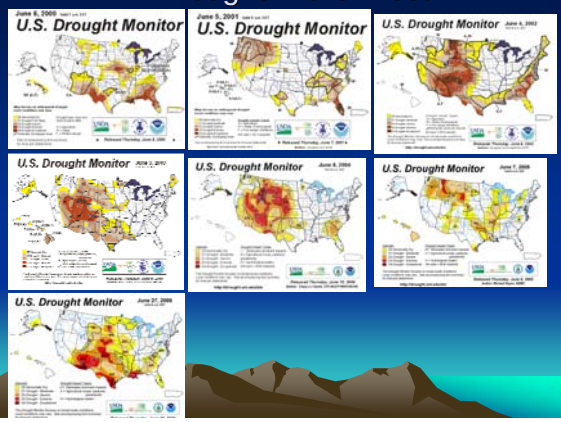
6 August 2000, Bitterroot NF, MT

© John McColgan

Societal Needs for Weather & Climate Information



Drought in the West

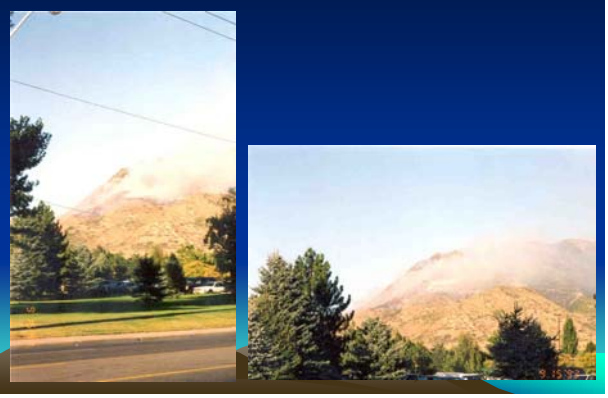


Fire Weather Internet Resources

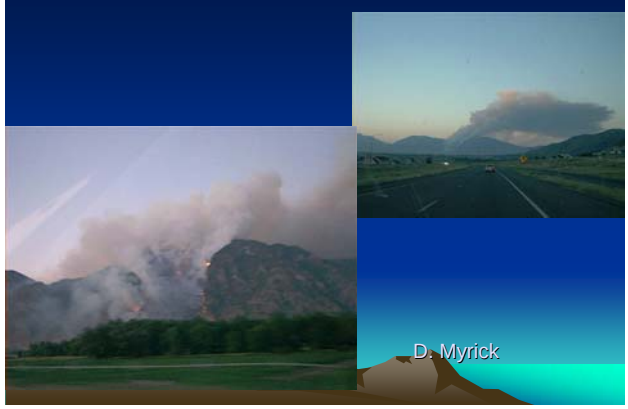
- National Fire plan: www.fireplan.gov
- National Interagency Fire Center (NIFC): www.nifc.gov
- GACCs: www.nifc.gov/fireinfo/geomap.html
- Fire Danger PocketCards: famweb.nwcg.gov/pocketcards
- GeoMAC: geomac.usgs.gov
- DRI: www.wrcc.dri.edu/fire/FW2.html
- Wildland Fire Assessment System: www.fs.fed.us/land/wfas/
- ROMAN: raws.wrh.noaa.gov/roman

Dimple Dell. Sandy. Summer 2001

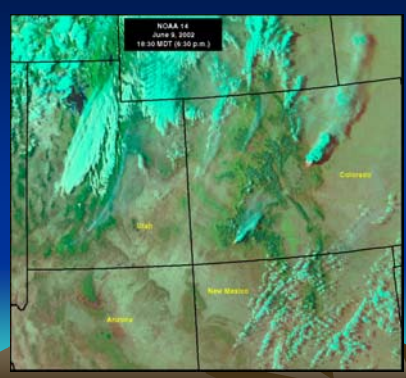
Red Butte. Salt Lake City



Springville. June 30, 2002



Hayman Fire 2002



Aftermath

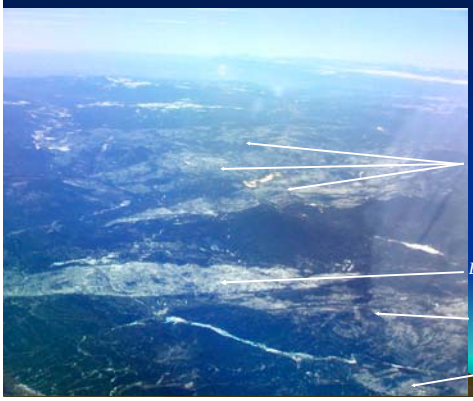
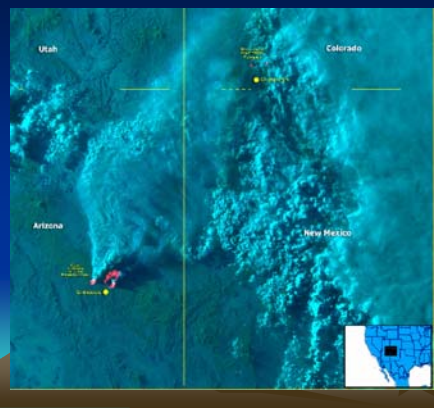


Photo: E. Zipser
Jan. 7, 2003

Rodeo-Chediski fire 2002



Aftermath

http://www.guardian.co.uk/gall/0,8542,742962,00.html

http://www.floa.org/rodeo_chediski/fire_photos1.htm

http://www.calvarychapel.com/whitemountains/RodeoFire.html

MODIS image

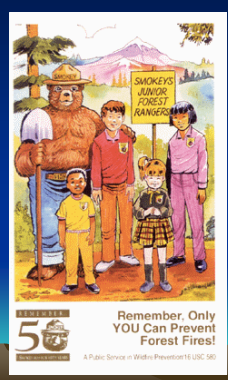
Smoke from southern California wildfires, 26 October 2003. Active fire perimeters are outlined in red in Ventura, San Bernardino, Los Angeles and San Diego counties, and in Baja California, Mexico.

Image courtesy of Tony Westerling and NASA/MODIS Rapid Response Team

Seattle Times, Thursday, December 12, 2002

- **Sweeping shift in forest policy: Bush plan would skip environmental reviews**
- WASHINGTON — In a sweeping forest-policy revision, the Bush administration announced plans yesterday to fundamentally alter how it manages federal lands by skipping extensive environmental reviews in the name of wildfire prevention.
- The proposal is part of a strategy to streamline environmental laws and help the land-management bureaucracy tick along more smoothly. It would allow the administration, in many cases, to skip traditional environmental analysis for projects that reduce wildfire risks or rehabilitate forests after wildfires occur.
- But environmentalists saw the changes as an attempt to remove the public's voice from decision-making while the administration tries to boost logging on federal lands. And some in Congress viewed the proposals as an attempt to sidestep lawmakers.
- The debate heated up last fall, after more than 7 million acres burned nationwide and President Bush announced his "Healthy Forests Initiative." The plan called for a range of changes, from limiting bureaucratic processes and appeals to expediting work that reduces wildfire dangers.

Smokey Bear



Smokey Bear - the only American hero to have his own zip code

Top Ten Fire Years: 1960-2004

Rank	Year	Total Acres Burned (x million)	Number of fires
1	2000	8.4	122,827
2	1988	7.4	154,573
3	1963	7.1	164,183
4	2002	6.9	88,458
5	2004	6.8	77,534
6	1996	6.7	115,025
7	1969	6.7	113,351
8	1999	5.7	93,702
9	1990	5.5	122,763
10	1980	5.3	234,892

www.nifc.gov

1910-2004: 913 firefighter fatalities, ~15-30/yr now

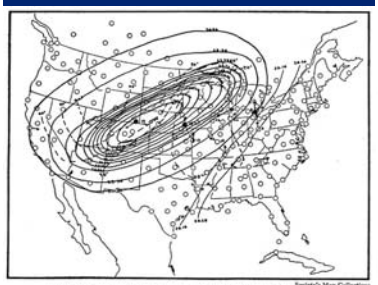
Selected Major Historical Fires

Date	Name	Location	Acres	Fatalities
Oct 1871	Peshtigo	WI, MI	3,780,000	1500 lives lost
Sept 1881	Michigan	MI	1,000,000	169 lives lost
Sept 1894	Hinckley	MN	?	418 lives lost
Sept 1902	Yacoult	WA OR	1,000,000+	38 lives lost
Aug 1910	Great Idaho	ID MT	3,000,000	85 lives lost
Sept 1947	Mann Gulch	MT	4,339	13 firefighters killed
1987	Siege of 87	CA	640,000	
1988	Yellowstone	MT ID	1,585,000	
Oct 1991	Oakland Hills	CA	1500	25 lives lost
July 1994	South Canyon	CO	1856	14 firefighters killed
May 2000	Cerro Grande	NM	47,650	
July-Oct 2000	Valley Complex	MT	292,000	
July-Oct 2000	Clear Creek	ID	217,000	
June 2002	Hayman	CO	137,000	
July 2002	Rodeo-Chideski	AZ	468,000	
July-Aug 2002	Biscuit	OR	500,000	
Oct. 2003	So Cal	CA	740,000	20

www.nifc.gov

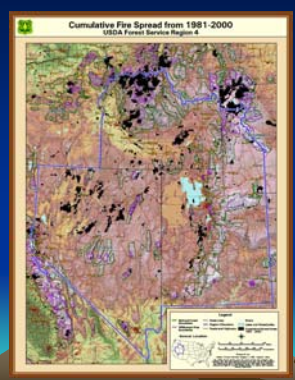
Peshtigo, Wisconsin Fire

- **Oct. 8–14 1871**
  - over 1,500 lives lost and 3.8 million acres burned



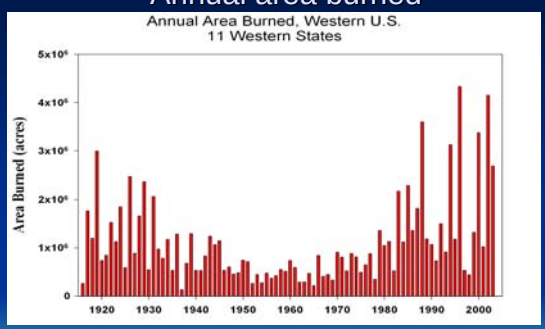
This U.S. Weather Bureau map, prepared from reports made by U.S. Army Signal Service observers at 5:35 P.M. Central Standard time, October 8, 1871, shows the course of the cyclonic storm that prevailed on the day of the Chicago and Peshtigo fires.

Fires: 1981-2000



http://www.fs.fed.us/r4/rsgis_fire/

Annual area burned



From National Integrated Fire Management Integrated Database (NIFMID), USFS, Seattle. Courtesy of Jeremy Littell, Univ. Washington Climate Impacts Group

A Perspective on Area Burned

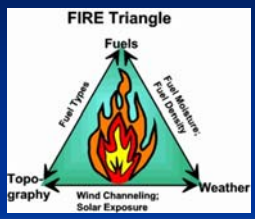
The explanation that typically goes with the cumulative fire area burned graphic is that fires were extensive until the middle of the 20th century
- when post-world war II fire fighting technologies became better
- more money was being spent on fire fighting
- agency mandate was typically to put out all fires if possible.

Subsequent increase in the latter quarter of the century is typically attributed to fuel accumulations brought about by this more or less effective fire suppression

Is that correct?
- 95% of the area is burned by about 5% of the fires
- Large fires are not handled well because they are expensive, occur during extreme weather and climate conditions, and dangerous for fire fighters.
- Large fraction of the variability in fire area burned may be explainable by climate alone between 1980 and 2000.
- Many forests have seen fuel accumulations, but the rate of fuel accumulation is directly proportional to the departure in fire regime. Places that used to burn very frequently (such as ponderosa pine forests in the southwestern U.S.) have more fuel accumulation than Douglas-fir forests in Yellowstone, which are so cold and dry that fuel accumulation was typically slow and fire return intervals something like 35-50 years.

Jeremy Littell
Univ. Washington

The fire environment



sere.org

1. Fuels

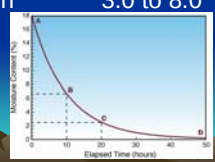
- Fuel characteristics:
  - size
  - shape
  - compactness
  - horizontal continuity
  - vertical arrangement
  - fuel loading
  - chemical content
- The amount of wildland fuel available for burning depends on fuel moisture, which depends directly on past and present atmospheric humidity and precipitation.
- Different fuels respond to changes in humidity and precipitation at different rates.

Fuel moisture content

- The most important variable in determining fire ignition, rate of combustion, and energy output from fire.
- fmc = 100 * (field weight-oven dry weight)/ODW
- dead fuels, 1.5-30% moisture content
- live fuels, 35-200% moisture content
- Live FMC varies seasonally with phenology.
- Dead FMC varies daily with moisture.
- Fire Danger Rating uses Dead FMC as a key component.

Dead fuels

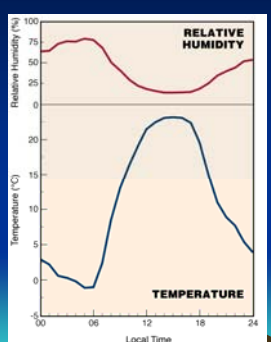
- Four size classes with characteristic reaction times (time lags) to changes in atmospheric moisture
- 1-h 0 to 0.25" (0-6mm)
- 10-h 0.25 to 1.0" (6 to 25mm)
- 100-h 1.0 to 3.0" (25 to 76mm)
- 1000-h 3.0 to 8.0" (76 to 203mm)



Time-lag concept, 10-h fuels

Whiteman (2000)

Diurnal changes in relative humidity

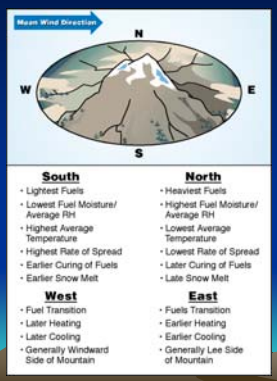


Whiteman (2000)

2. Topography

- The most constant in time of the three factors, but may vary over space.
- Elevation, aspect, slope steepness, landform characteristics.
- Linked to spatial variations in climate (determines fuel type and loading) and temporal and spatial variations in weather.

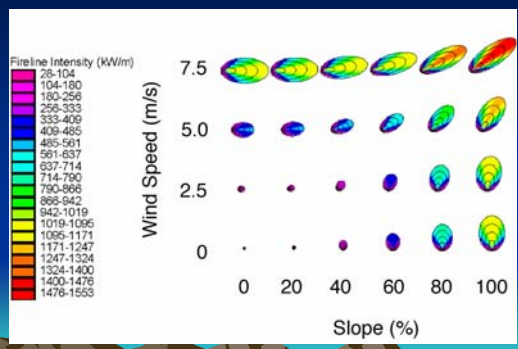
Northern Hemisphere microclimate factors



Mid-latitude slope

Whiteman (2000)

Combined effect - Terrain slope and wind speed



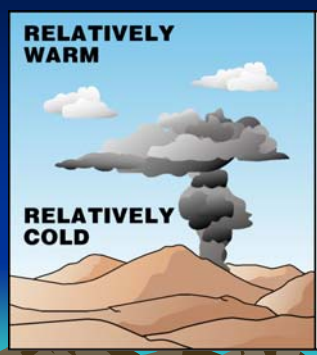
Wind is across slope, left to right

Finney (1998)

3. Weather

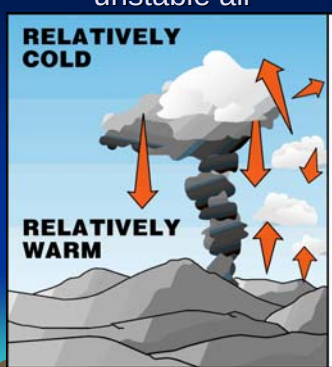
- Is the most variable over time and is the most difficult for the resource manager to predict.
- Directly affects fire behavior and significantly affects smoke production and dispersion.
- Lightning, strong winds, precipitation and humidity

Indicators of stable air



- Cloud in layers, no vertical motion
- Stratus type clouds
- Smoke column drifts apart after limited rise
- Poor visibility in lower levels due to accumulation of haze and smoke
- Fog layers
- Steady winds

Indicators of unstable air



- Clouds grow vertically and smoke rises to great heights
- Cumulus type clouds
- Upward and downward currents
- Gusty winds
- Good visibility
- Dust devils, firewhirls

Summit fire (OR), plume-dominated. Lightning and downbursts developed in convective column

Horseshoe Fire (NM), wind driven, grew to 3500 ha, SW winds gusting to over 50 mph

Fire terminology

- **Crown fire** - a severe fire where flames travel from tree to tree at the level of the tree's crowns or tops.
- **Fire line** - a zone along a fire's edge where there is little or no fuel available to the fire
- **Backfire** - a fire started to stop an advancing fire by creating a burned area in its pattern
- **Firebrand** - flaming or glowing fuel particles that can be carried naturally by wind, convection currents or gravity into unburned fuels
- **Spotting** - outbreak of secondary fires as firebrands or other burning materials are carried ahead of the main fire by winds
- **wildfire** - an unwanted fire that requires measures of control.
- **firing pattern** - the specific pattern and timing of ignition of a prescribed fire to affect the direction or rate of fire spread and fire intensity.

Spot fire, backfire, crown fire

Spot fire > .5 mi from main fire. Ponderosa Pine.

Backfiring, Aug 1994, north of McCall, ID

Spruce and subalpine fir *crowning*. Blackwell Fire, Aug 1994.

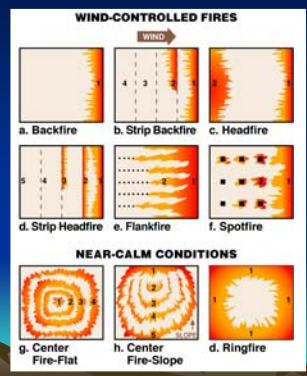
A. Farnsworth photos

Prescribed Fires

♦ Prescribed fire - a management-ignited or natural wildland fire that burns under specified conditions where the fire is confined to a predetermined area and produces the fire behavior and fire characteristics required to attain planned resource management objectives

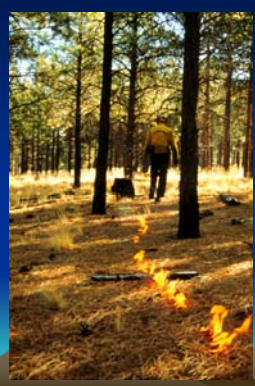
♦ Examples of management objectives
- to reduce the danger of large catastrophic fires
- to prepare land for planting
- to control spread of disease or insect infestations
- to benefit plant species that are dependent on fire
- to influence plant succession
- to alter soil nutrients

Firing patterns



Backfiring in light grass at Kingman, AZ, June 1994

Prescribed fire, drip torch



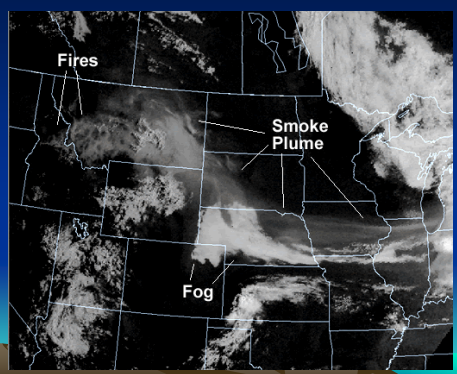
Prescribed burning, AZ, Nov 1995. Was burned also in 1989 and 1992. Quantity and duration of smoke was greatly reduced on 2nd and 3rd burns.

Prescribed fires in western OR

Smoke management

- A major problem
- Road accidents
- Drainage into cities
- Temperature inversions and smoldering fires
- Can determine place and time and firing pattern
- Hot fires, mid-day (unstable), moderate winds, best diffusion

Satellite photo of smoke transport



Smoke Management - a major problem

- Road accidents
- Drainage into cities
- Temperature inversions and smoldering fires
- Can choose place, time and firing pattern
- Best diffusion is with hot fires, at mid-day in moderate winds when atmospheric stability is unstable or neutral

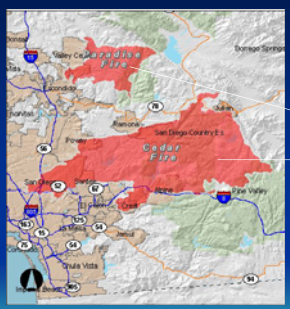
Smoke creates hazardous flying conditions near fire camp

Cedar Fire Pyrobubble 28-29 October 2003

Mike Fromm, NRL
Rene Servranckx, CMC
Dan Lindsey, CO St.
Larry Di Girolamo, U. IL

Photos from http://www.wildlandfire.com/pics/cedar_socal/cedar.htm

Cedar Fire Hot Bubble



Hot spots just before pyrobubble appears.
Big hot spot is Cedar Fire.

GOES-10 Ch 2-4 29 Oct 03 02:15 UTC

The Cedar Fire Pyrobubble Sequence GOES imagery

11 micron (Channel 4)
http://rammb.cira.colostate.edu/projects/pyrocu/29oct03/irloop.asp

3.9 micron – 11 micron (channel 2 – channel 4)
http://rammb.cira.colostate.edu/projects/pyrocu/29oct03/diffloop.asp

Comments from M. Fromm:

The pyrobubble was a singular event in the life of the So. CA fires in 2003.

Note how the smoke blows strictly offshore before the ~02 UT blob "launch." Then after launch, the low smoke veers from west to north to northeast to east.

Note also a "trail" of material blowing off at different eastward directions behind the blob. This trail no doubt reveals the wind profile at that time.

Thanks to Dan Lindsey, CIRA, for these loops.