Using climate information for Risk Mitigation and Objective Achievement in managed fire

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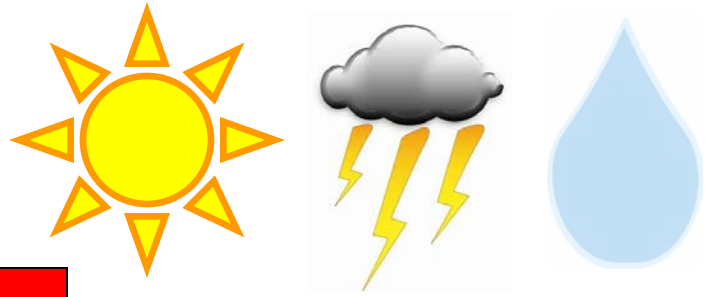
ECOSYSTEM CLIMATE FIRE APPLICATIONS

Overview

- What is managed fire?
- How can climate information be used to:
  1) Mitigate risks?
  2) Achieve management objectives?
- Tool demonstration:
  1) Interactive drought maps
  2) Managed fire seasonal forecast
  3) Historical prescription window analyst
  4) Wind roses

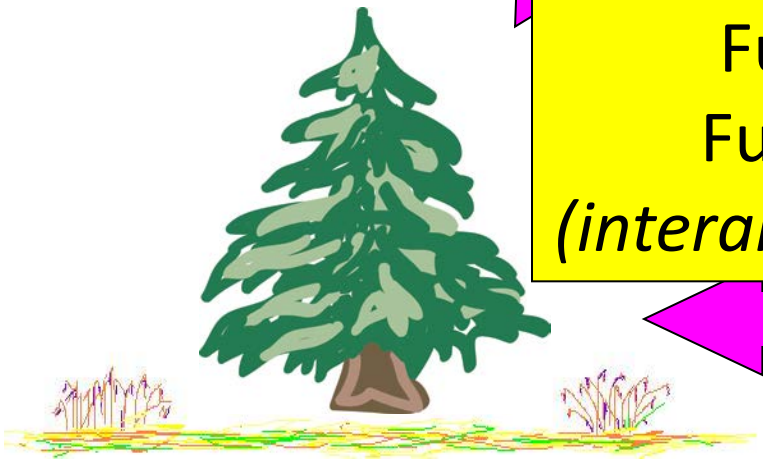
Climate



Insect outbreak
Invasive Species

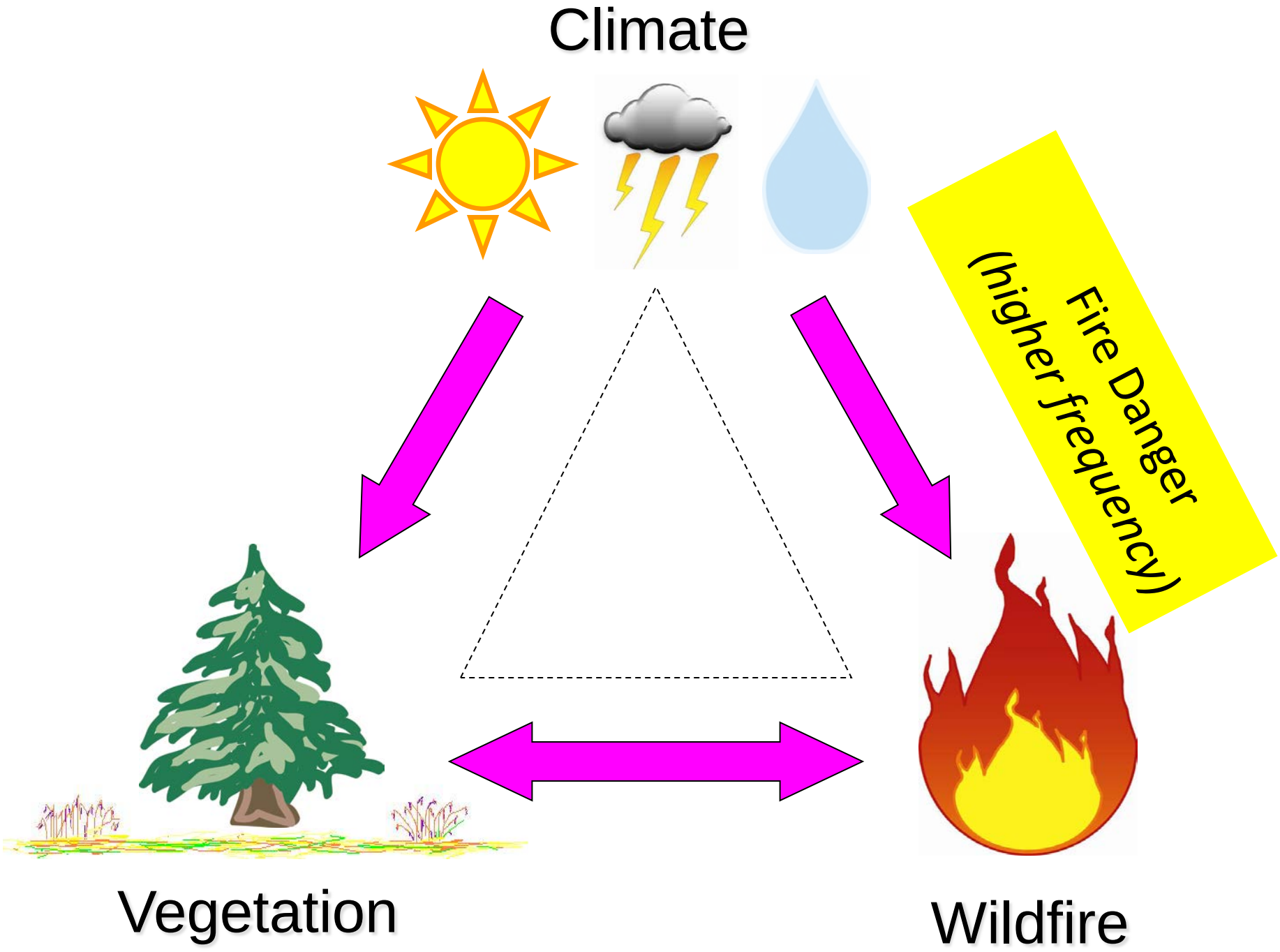
Vegetation distribution
(*bioclimatic envelopes*)

Fuel Loading
Fuel Moisture
(interannual variability)



Vegetation

Wildfire


Climate
Fire Danger
(higher frequency)
Vegetation
Wildfire

What is managed fire?

- Any fire that is managed to meet multiple objectives, not just 100% suppression
- Managed fires include:
  - Prescribed fires: planned ignition
  - Multiple Objective Fires: unplanned ignition
    - Wildfires that provide ecological/resource benefits
    - Wildfires that accomplish treatment objectives
    - Wildfires that are of minimal risk and are burning in areas designated to allow multiple-objective fire (MOF)

What is climate information?

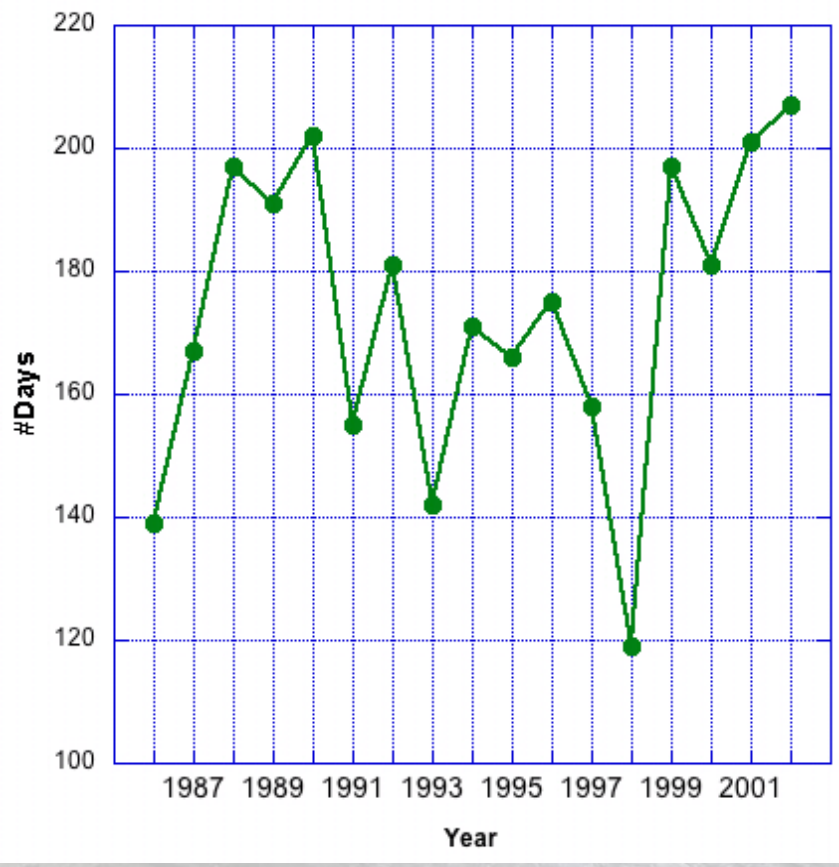
- Climate: what you expect (probability based on historic set of observations)
- Weather: what you observe
- Metrics that describe conditions climatically:
  - Normals (mean)
  - Anomalies
  - Deviations
  - Extremes
  - Records
  - -Teleconnections
  - -Seasonal
  - -Monthly
  - -Trends
  - -Change

Why use climate info for managed fire?

1) Achieving accomplishment targets
    1) Annual # of acres/ha
    2) Specific units (WUI, riparian, fuel break)
    3) Condition class restoration

Why use climate info for managed fire?

Achieving accomplishment targets



Burn window days varies interannually

<u>Example</u>

Currently: target 1,000 ac/year

Climatic approach: Target 5,000 ac over next 5 years

- Plan for resource-sharing
- Re-assess funding

Why use climate info for managed fire?

Achieving accomplishment targets

1) Riparian targets: drier conditions?
2) Live Herbaceous targets: drier conditions?
3) High risk/piles: wetter conditions?

Why use climate info for managed fire?

1) Achieving accomplishment targets
2) Achieving fire effects objectives
    1) Percent consumption downed and dead
    2) Percent mortality in live woody and herbaceous trees/shrubs/forbs
    3) Mosaics/wildlife habitat
    4) Invasive species eradication

Why use climate info for managed fire?

Achieving fire effects objectives

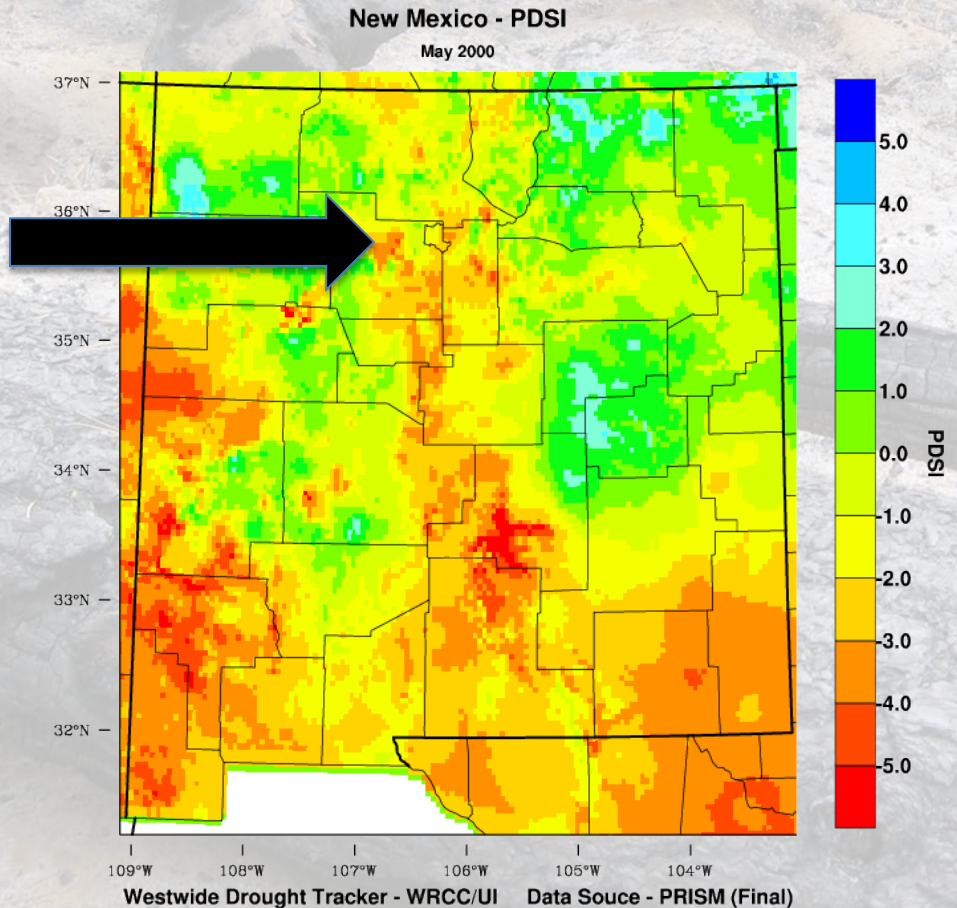
Example:
Drier than normal conditions = higher mortality in both younger and older trees

Why use climate info for managed fire?

1) Achieving accomplishment targets
2) Achieving fire effects objectives
3) Mitigate Risk
    1) Risk of Escaped Rx fire
    2) Risk of damage to property/infrastructure
    3) Risk of negative publicity/perception
    4) Risk of not meeting objectives

Why use climate info for managed fire?

Most fire investigation reports note unrecognized drought conditions at time of escape



Cerro Grande Fire
May 2000

Investigation report noted drought conditions were not adequately accounted for

Why use climate info for managed fire?

1) Achieving accomplishment targets
2) Achieving fire effects objectives
3) Mitigate Risk
4) Public information/communication
    1) Justification of actions - timing
    2) Justification of actions - intensity
    3) What are the expected outcomes/ fire behaviors?

FIRE INFORMATION

Why are we managing this fire for multiple resource objectives instead of suppressing it?

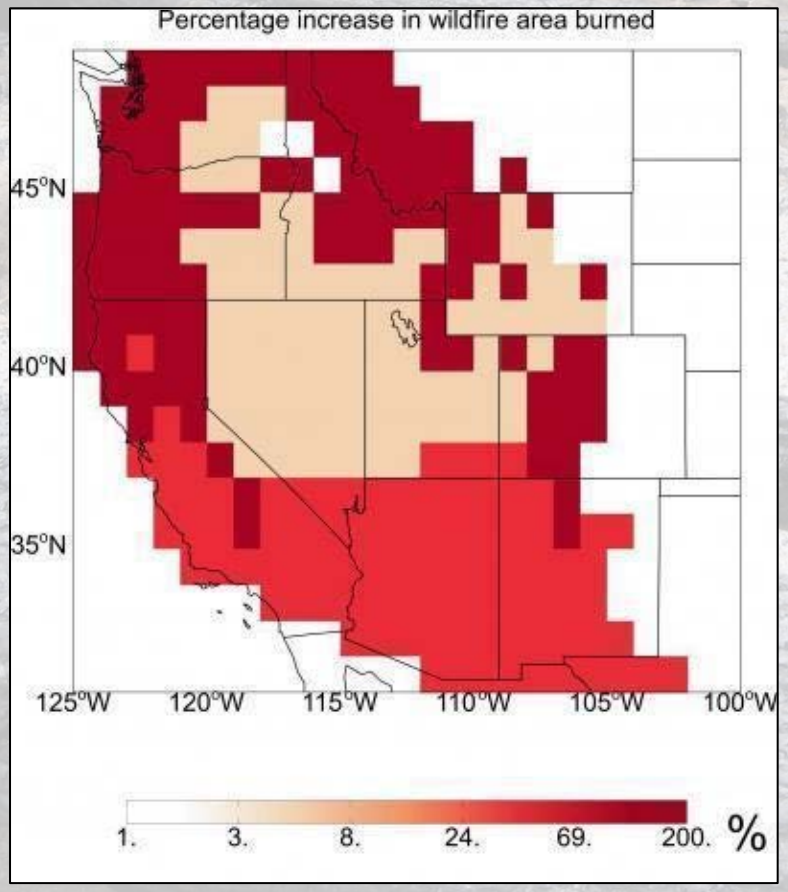
1) It's wetter than normal
2) Long-term forecast is for continued wetter than normal conditions
3) This reduces risk while promoting natural ecological processes in the forest
4) We're reducing the chances of a future catastrophic wildfire by reducing fuels

Why use climate info for managed fire?

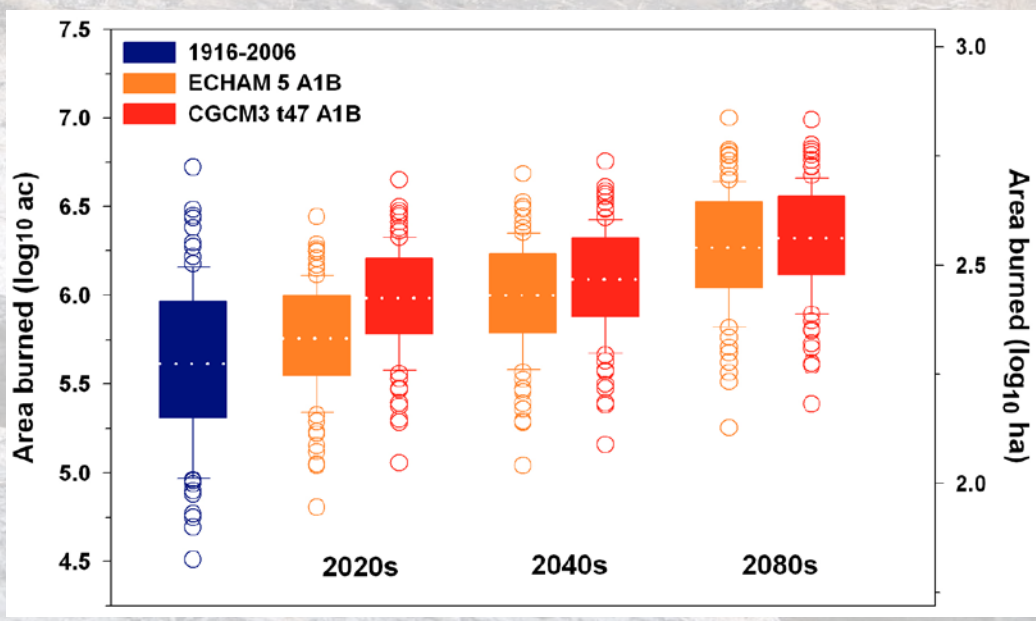
1) Achieving accomplishment targets
2) Achieving fire effects objectives
3) Mitigate Risk
4) Public information/communication
5) Planning for the future
    1) Actions now have impacts for multiple decades
    2) What will this landscape look like in 2050?

Why use climate info for managed fire?

What does the future look like?



Spracklen et al. 2009



Littell et al. 2010

Why use climate info for managed fire?

Planning for the future – Fuel break example

95th percentile flame length for historic period (1970-2000)

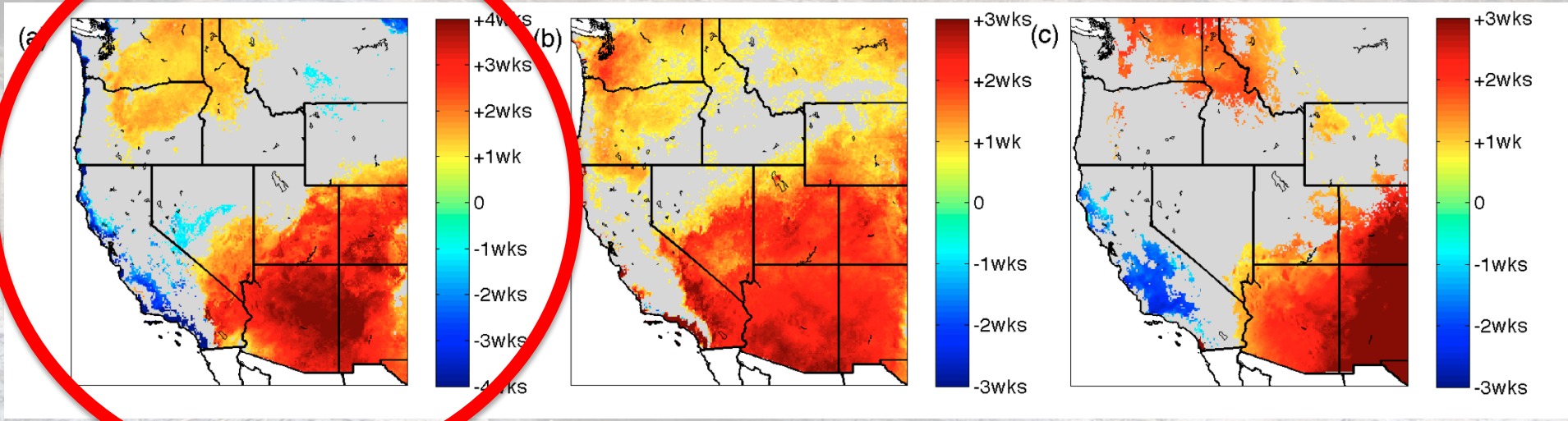
95th percentile flame length for mid-21st century (2030-2060)

Use climate model outputs to identify relevant changes and implications for fire operations and fuels management

-Increase fuel break width, intensity of treatment

Why use climate info for managed fire?

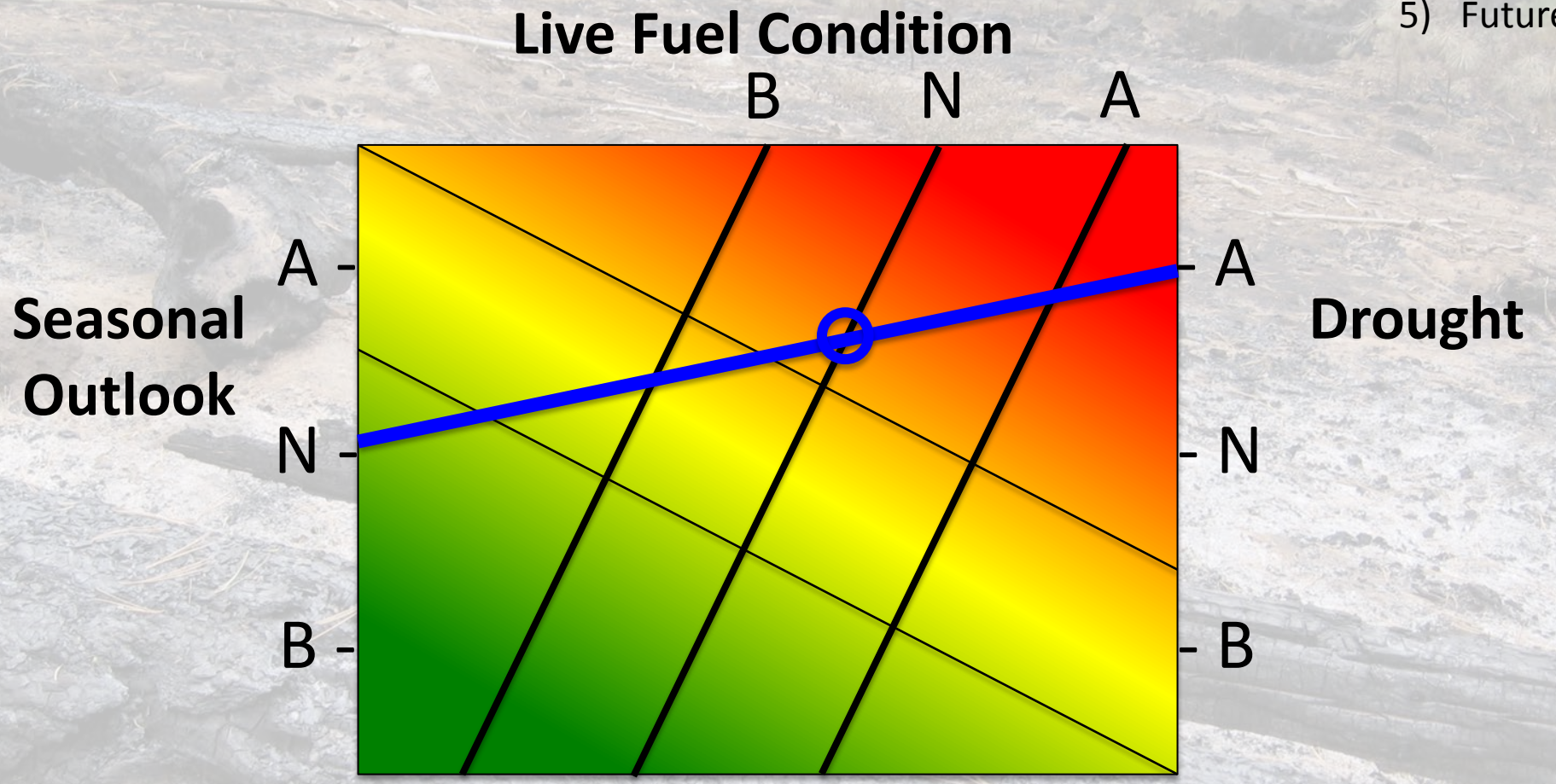
Address changing windows of opportunity



From Kolden et al. 2010: The projected change (averaged over 11 models) in a) fire season start date, b) the median (peak) date of fire season, and c) the frequency of high fire danger for the 21st century western US. Only significant values observed in over 2/3 of the models are shown in color, gray areas represent areas that have non-significant results.

1) Targets
2) Fire FX
3) Risk
4) Info
5) Future

Climate as a complexity factor



A = Above Normal

N = Normal

B = Below Normal

Types of Information – An Overview

1) Historic station data (e.g., RAWS)
2) Historic modeled data (e.g., PRISM)
3) Regional Climate Centers (e.g., WRCC)
4) Predictive Services
5) Seasonal Outlooks
6) Climate model outputs
7) Tools that blend data and make relevant for a purpose

Example demonstrations

1) A national seasonal forecast for managed fire
2) Information for Rx fire planning
    1) Historical Rx window analyst
    2) Historical wind rose analyst
    3) Greenness
3) Fine-scale information on drought conditions
4) Fine-scale information on greenness
5) ENSO relevancy assessment

Seasonal Forecasts

1) Asses Rx fire potential:
    1) Will you lose fall burning season?
    2) Will you have an opportunity to capitalize?
    3) Is your risk of escape increased?
2) Assess MOF potential:
    1) Increased opportunity for MOF at landscape scales?
    2) Short or long-duration season likely?
    3) Public outreach to inform/invest community

Seasonal Forecasts

1) MC1 http://cefa.dri.edu/mc1/mc1.php

1) Seasonal assessments – Predictive Services
http://www.predictiveservices.nifc.gov/outlooks/outlooks.htm

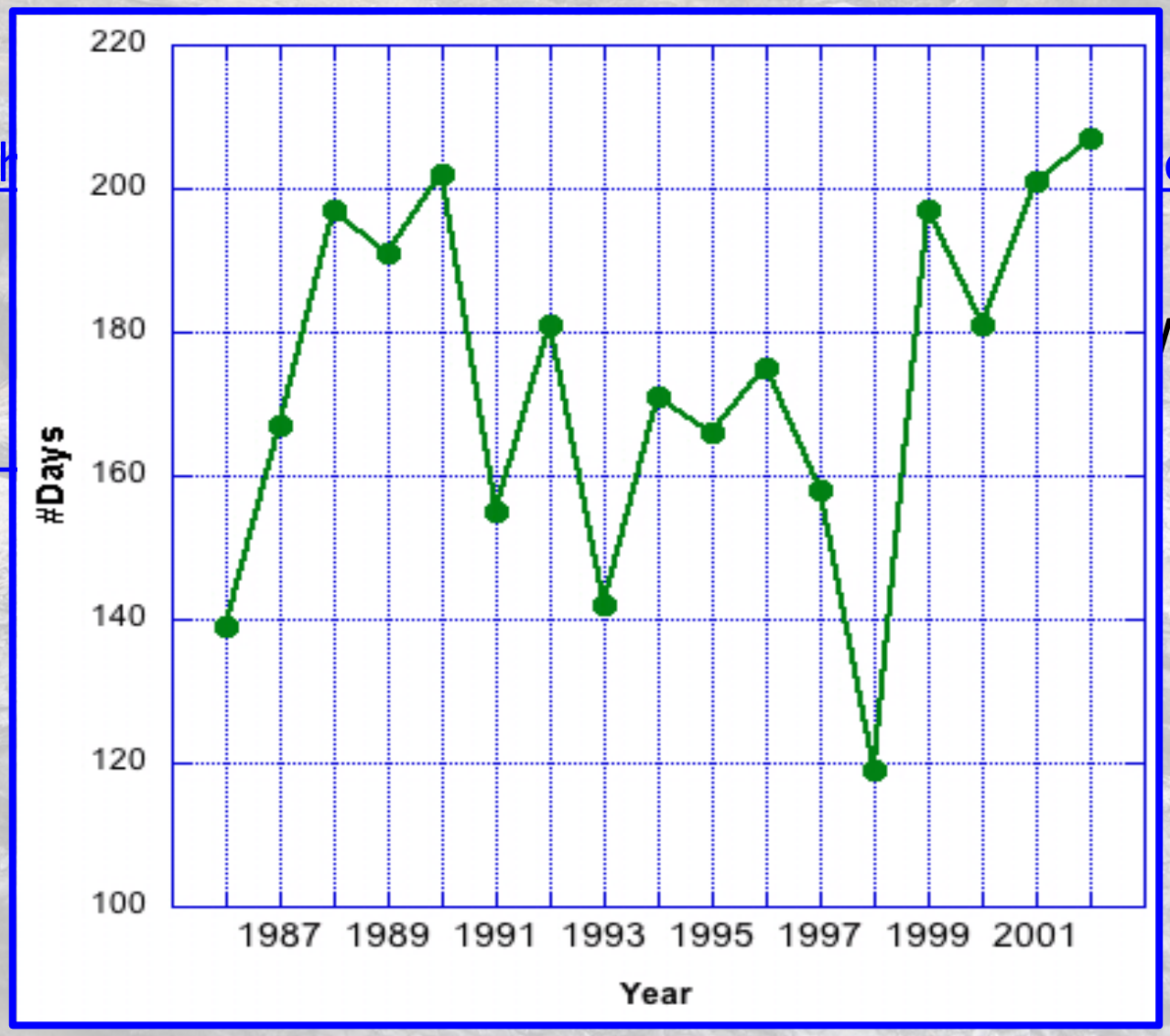
2) Seasonal Outlooks – NOAA CPC
http://www.cpc.ncep.noaa.gov/

4) ENSO –what does it mean?
http://www.wrcc.dri.edu/enso/ensorisk/index.html

Information for Rx fire planning

1)

2)



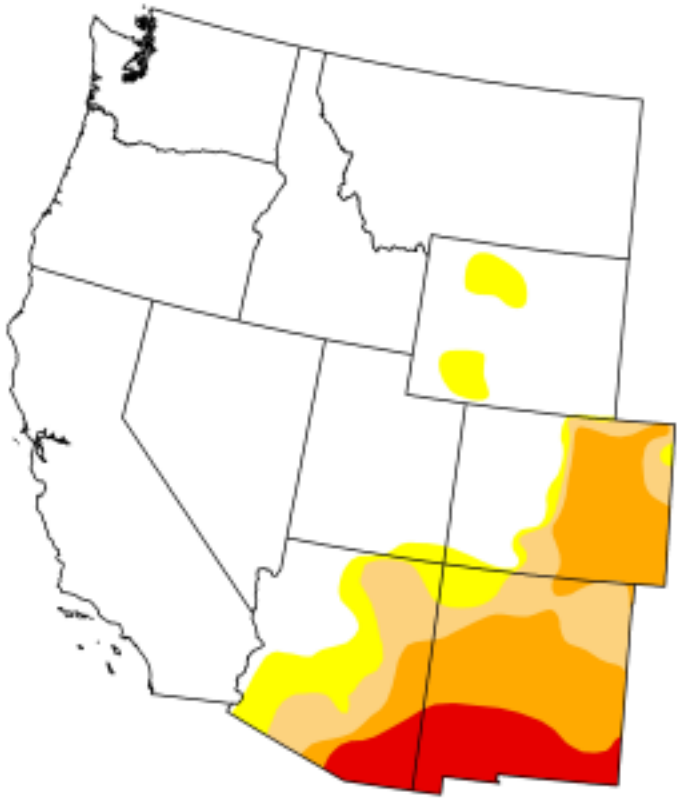
U.S. Drought Monitor

April 12, 2011
Valid 7 a.m. EST

West

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	75.98	24.02	19.17	13.34	4.15	0.00
Last Week (04/05/2011 map)	76.09	23.91	19.18	13.39	4.16	0.00
3 Months Ago (01/11/2011 map)	76.92	23.08	11.88	0.89	0.00	0.00
Start of Calendar Year (12/28/2010 map)	73.26	26.74	11.98	0.89	0.00	0.00
Start of Water Year (09/28/2010 map)	62.50	37.50	8.14	0.56	0.00	0.00
One Year Ago (04/06/2010 map)	43.54	56.46	20.63	4.89	0.00	0.00



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

Released Thursday, April 14, 2011
Anthony Artusa, NOAA/NWS/NCEP/CPC

Interactive Drought Tools

West Wide Drought Tracker (WWDT):

http://www.wrcc.dri.edu/monitor/WWDT/index.html

Feedback= http://wrcc.dri.edu/monitor/WWDT/aboutback.html

Climate Trackers for CA, NV, PNW

http://www.wrcc.dri.edu/PROJECTS.html (CA and NV)

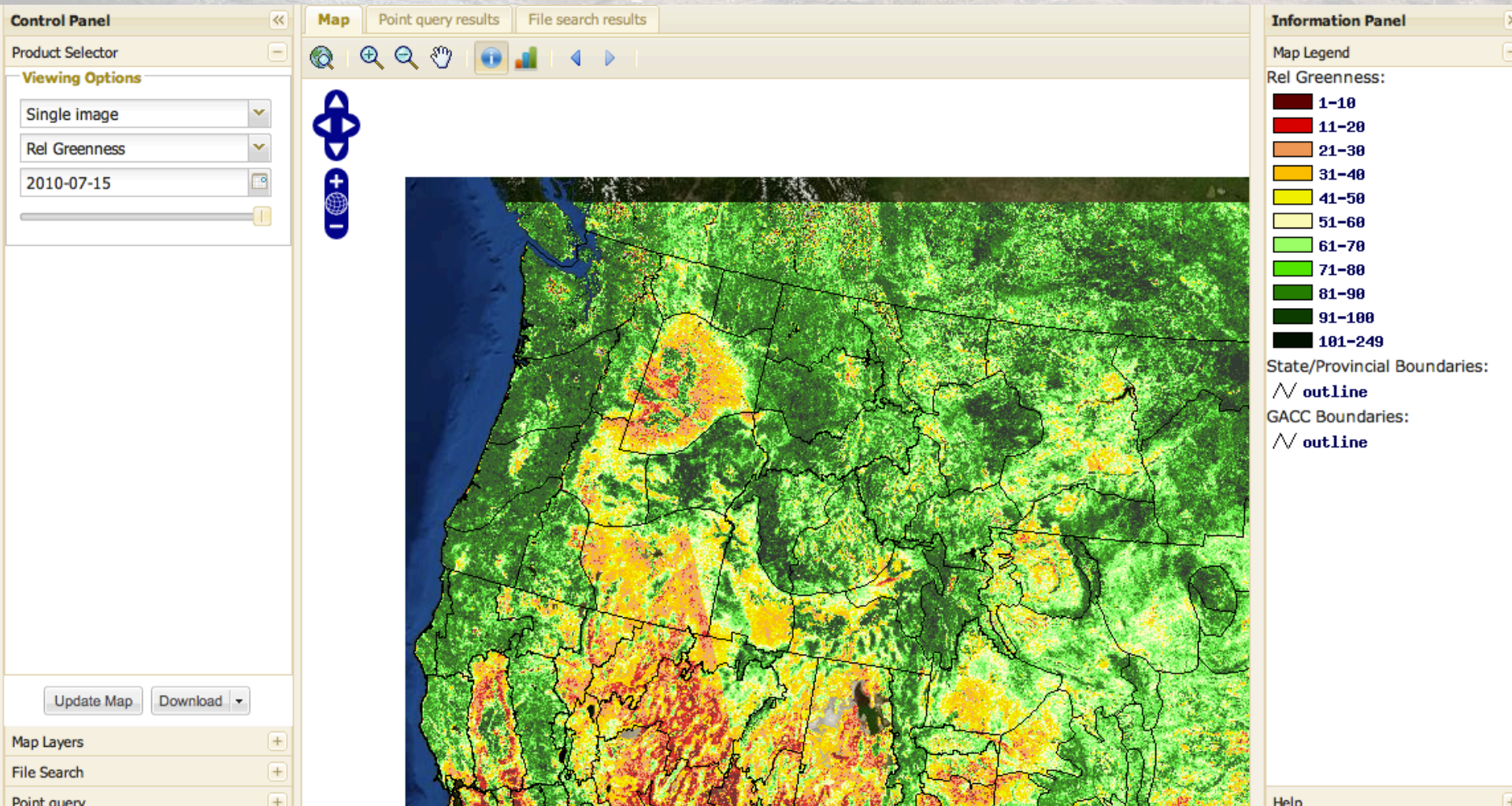
http://www.wrcc.dri.edu/research/jtwrcc/idaho-mon/

Westmap (maps and time series):

http://www.cefa.dri.edu/Westmap/Westmap_home.php

Interactive Drought/Greenness Tools

WFAS: Now with Google Maps (maps.wfas.net)

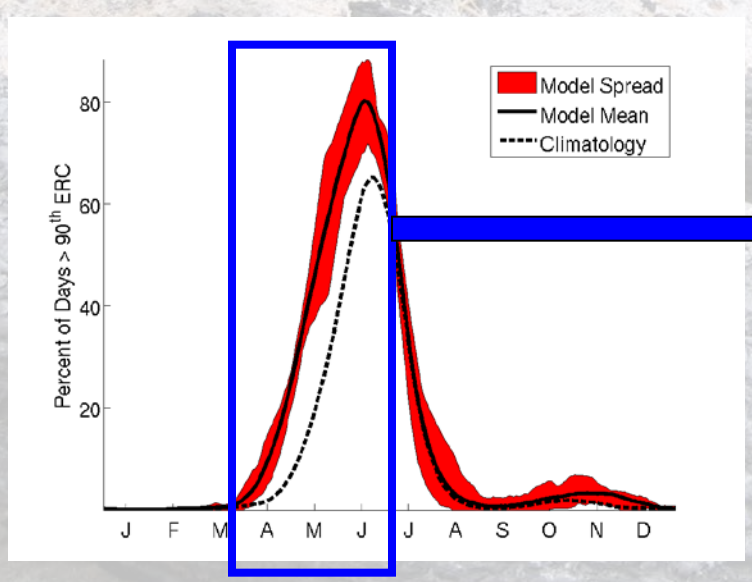


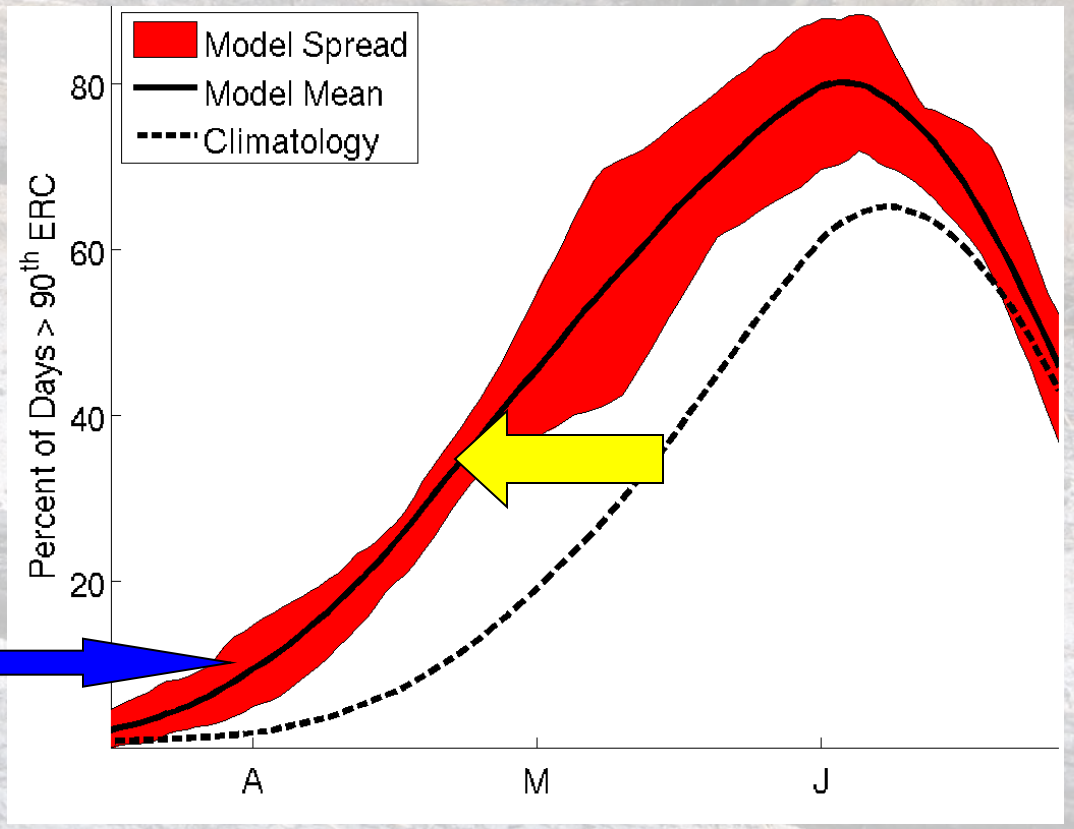
Future climate data

- Numerous projects producing downscaled future climate data
  - .fw9 files for 40 SoCal RAWS for 2030-2060
- How effective will fuel treatments be in future?
- How will prescribed fire opportunities change?
- How will MOF opportunities change?

Future climate information

Length of fire season: use 90th percentile ERC as a proxy for start/end of fire season to look at shifts in season length and timing





*Earlier onset of fire season, more intense (higher fire danger at peak)

Abatzoglou and Kolden, forthcoming

Summary

- Climate information comes in many shapes and forms
- Can be used in a variety of ways for decision-support in managed fire
- Practitioners: keep asking for more RELEVANT climate-fire tools!!

Questions?

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Special thanks to Tim Brown (DRI), John Abatzoglou (U. Idaho), and Kelly Martin (YOSE)

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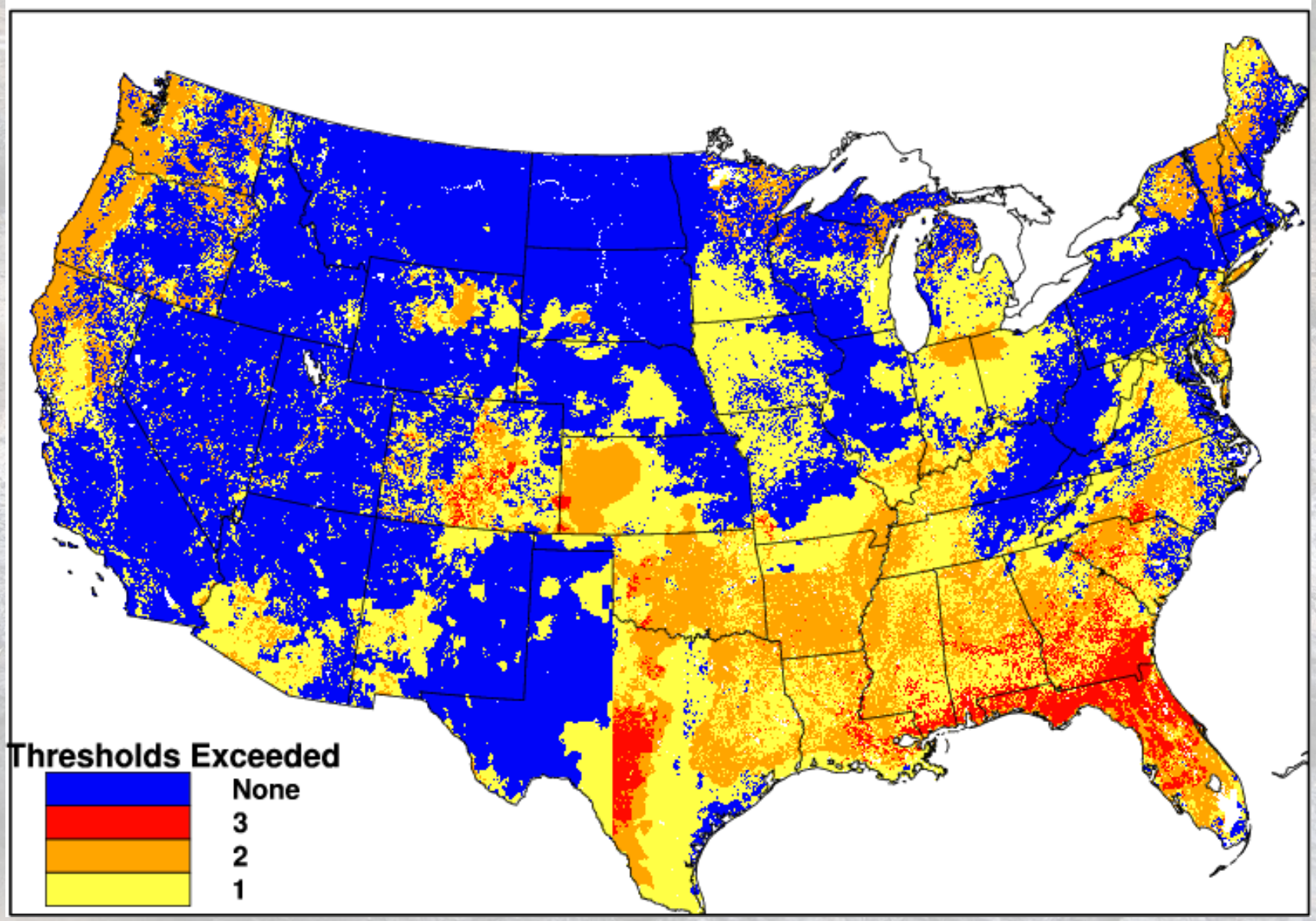
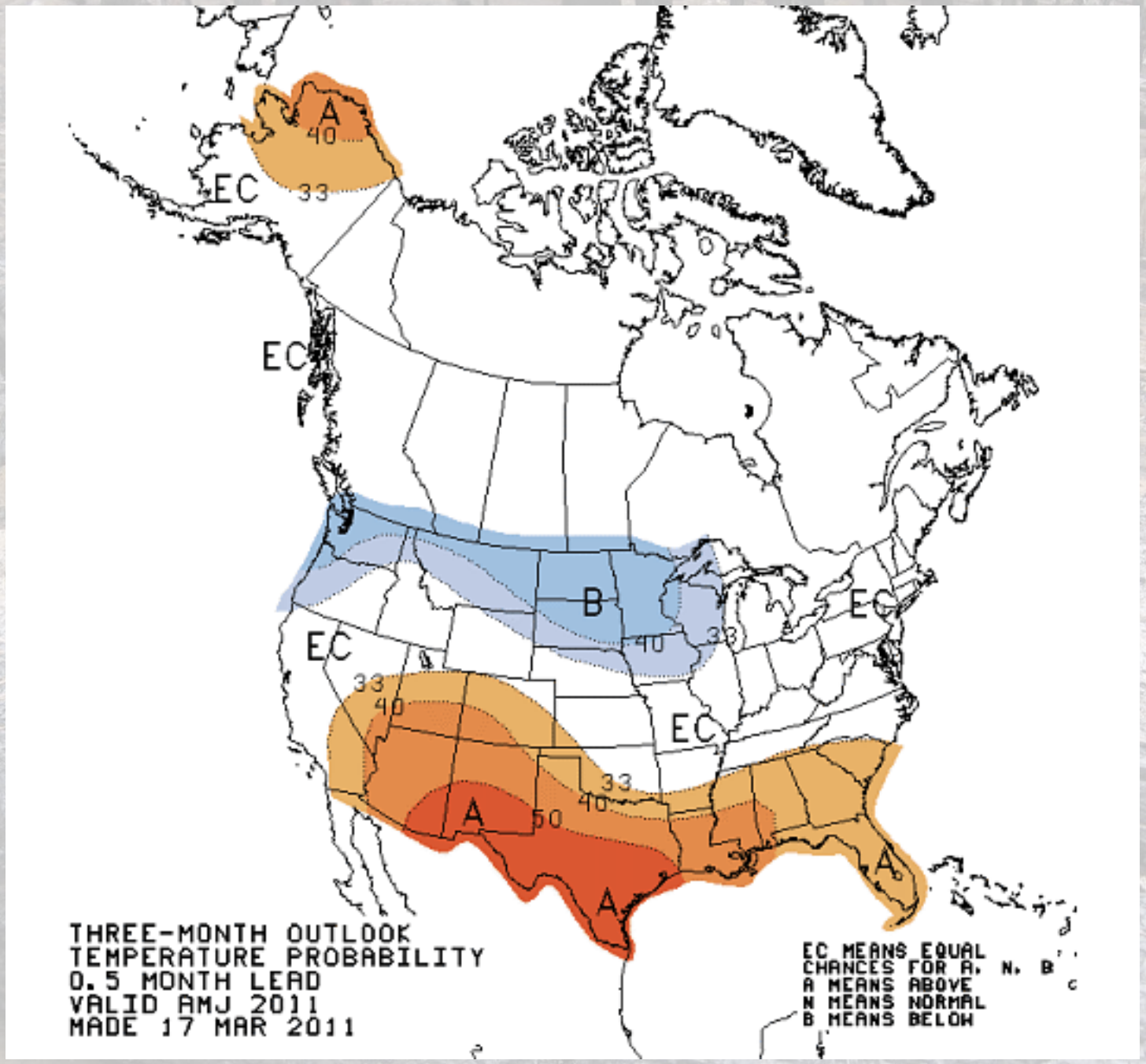
ECOSYSTEM CLIMATE FIRE APPLICATIONS

MEAN ALL Threshold Exceedance

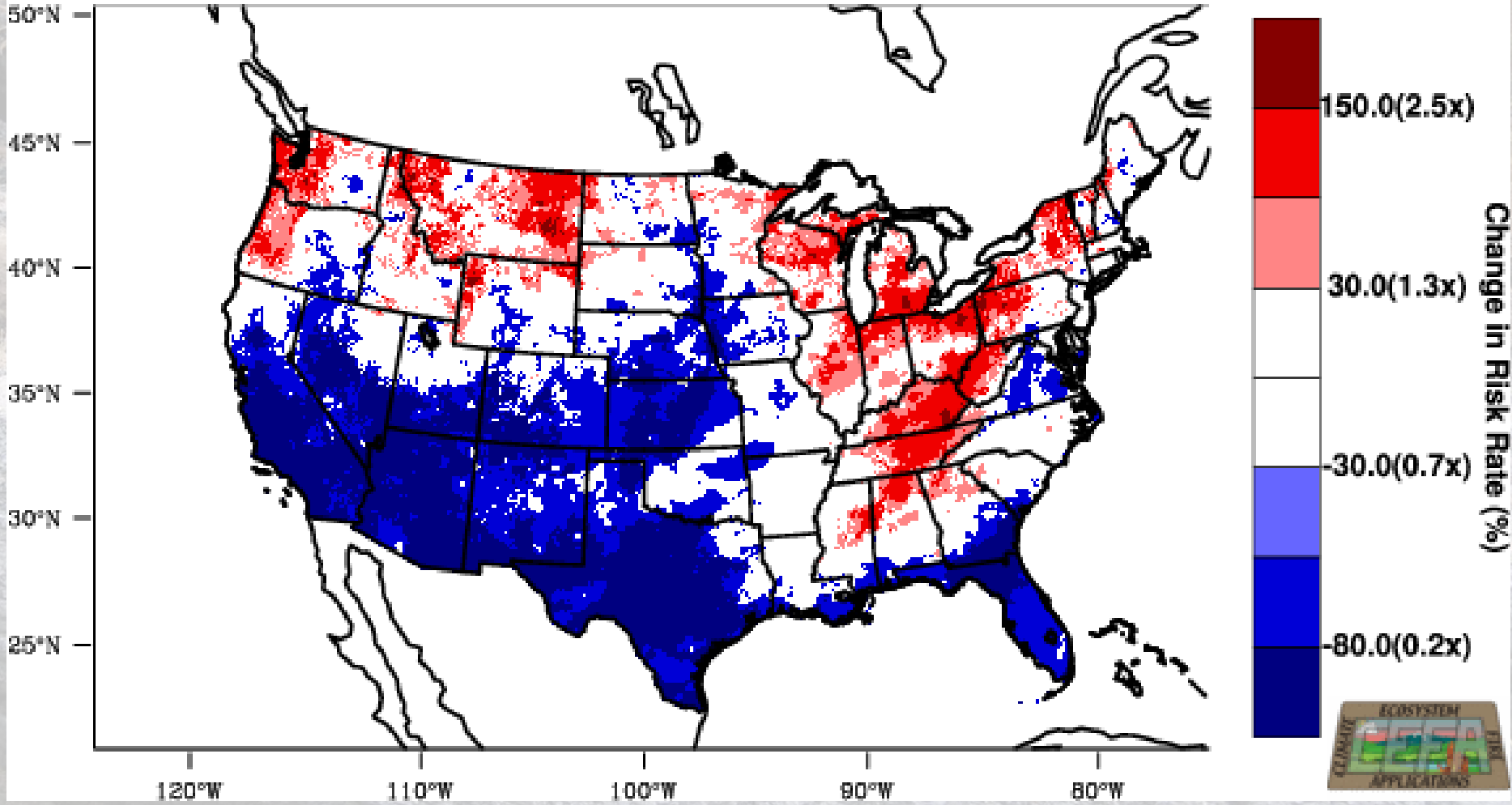
Forecast Month: Jun 2011 **Based on Jun 2011 forecast**




A
40
33
EC
EC
B
40
33
EC
EC
33
40
EC
33
40
A
50
A
A
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.5 MONTH LEAD
VALID AMJ 2011
MADE 17 MAR 2011
EC MEANS EQUAL
CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW

JFM Dry Extremes During El Nino

Change in Risk Rate for Continental United States



Enter ID & Select Station

Search by NWS / WIMS ID

0406 Search

Results: 11

- 040632 Arbuckle Basin California
- 040690 Lundylk California
- 040609 Manzanita Lake California
- **040636 Oak Bottom California**
- 040635 Oak Mountain California
- 040631 Rattle Brush California
- 040611 Redding Airport California
- 040618 Sims California
- 040630 Soldier Mountain California
- 040614 Sugarloaf (SHF) California
- 040615 Whitmore California

Enter Prescription Range

Temperature

62 to 85 °F

Relative Humidity

15 to 41 %

Wind Speed

3 to 10 mph

Enter Burn Period Window

October 01

to

March 31

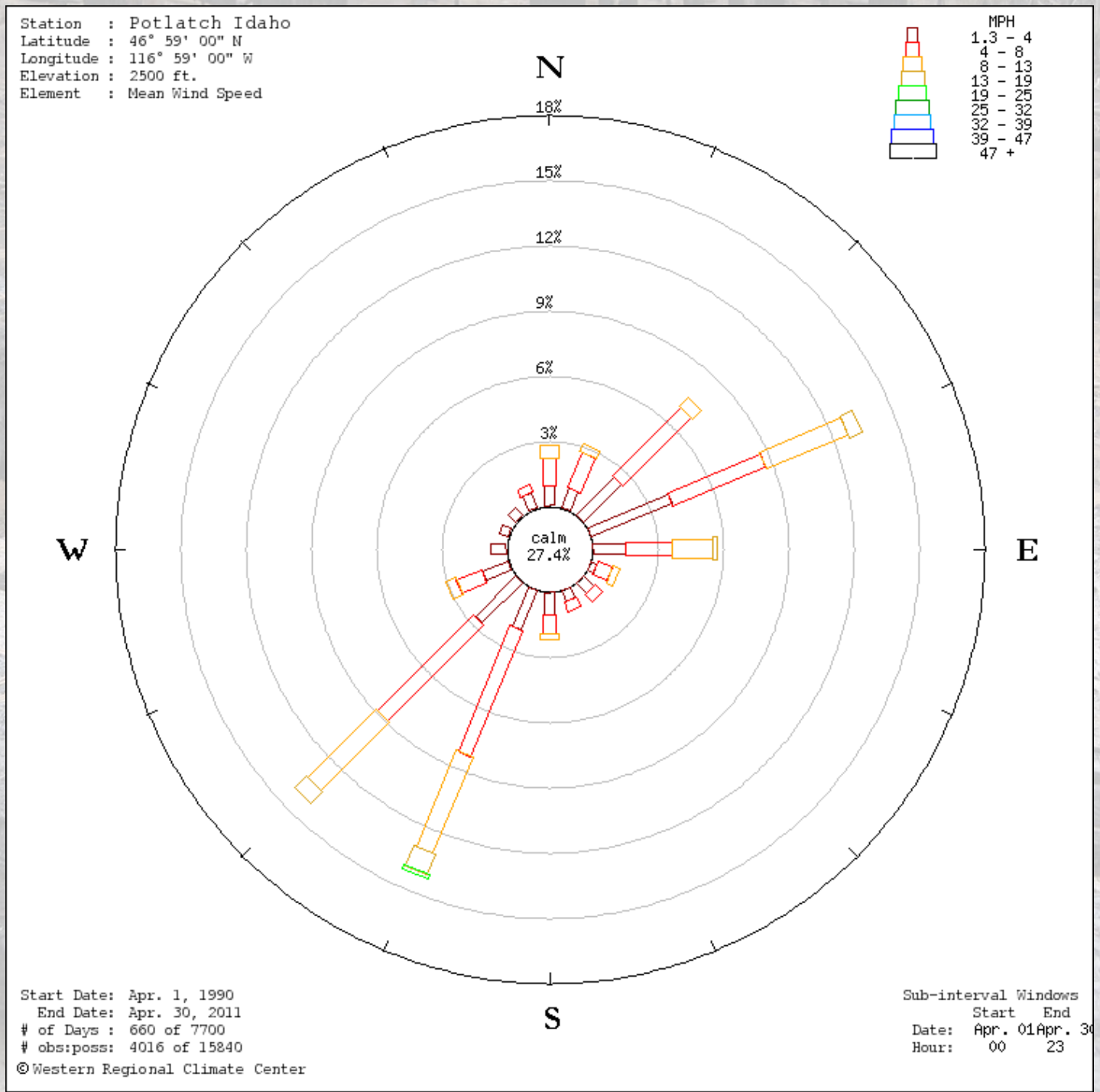
Get Report →

Oak Bottom California

Temperature:	62°F to 85°F	**Start Date:**	Aug. 1, 2001	**Latitude:**	40° 39' 02" N
Relative Humidity:	15% to 41%	**End Date:**	Jun. 30, 2010	**Longitude:**	122° 36' 20" W
Wind Speed:	3 mph to 10 mph	**Burn Window:**	Oct. 1 to Mar. 31	**Elevation:**	1326 ft.

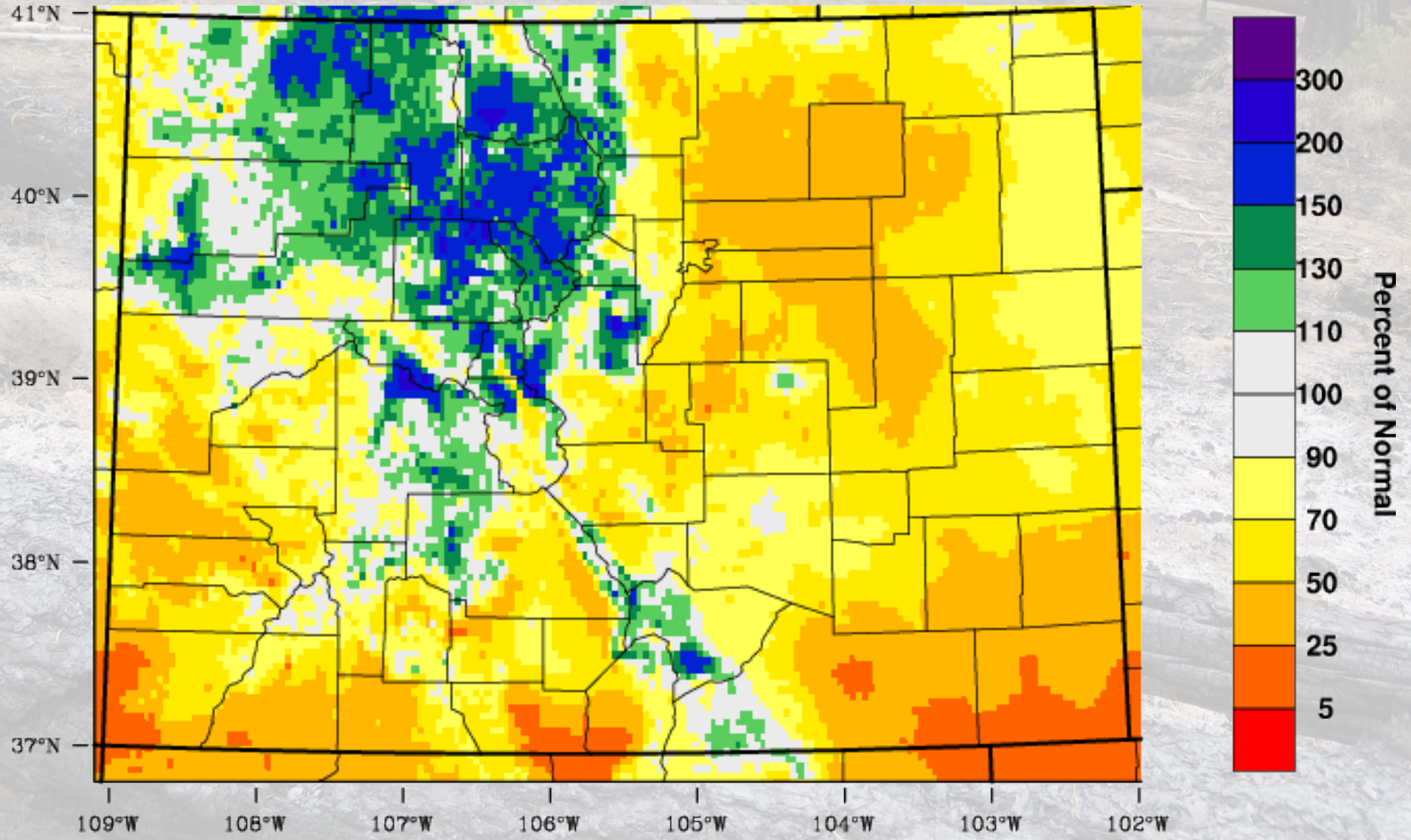
Percent Occurrence	0	0	0	0	0	0	0	0	3	10	14	20	23	23	20	17	13	9	7	3	2	1	0	0
Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Count 2845 total of 38998 possible	8	7	4	4	3	2	2	10	60	167	234	330	388	385	326	283	217	148	114	63	39	25	16	10

Report Generated: Apr. 19, 2011


Station : Potlatch Idaho
Latitude : 46° 59' 00" N
Longitude : 116° 59' 00" W
Elevation : 2500 ft.
Element : Mean Wind Speed
MPH
1.3 - 4
4 - 8
8 - 13
13 - 19
19 - 25
25 - 32
32 - 39
39 - 47
47 +
N
W
E
S
18%
15%
12%
9%
6%
3%
calm
27.4%
Start Date: Apr. 1, 1990
End Date: Apr. 30, 2011
# of Days : 660 of 7700
obs:poss: 4016 of 15840
Sub-interval Windows
Start End
Date: Apr. 01 Apr. 30
Hour: 00 23
©Western Regional Climate Center

Colorado - Precipitation

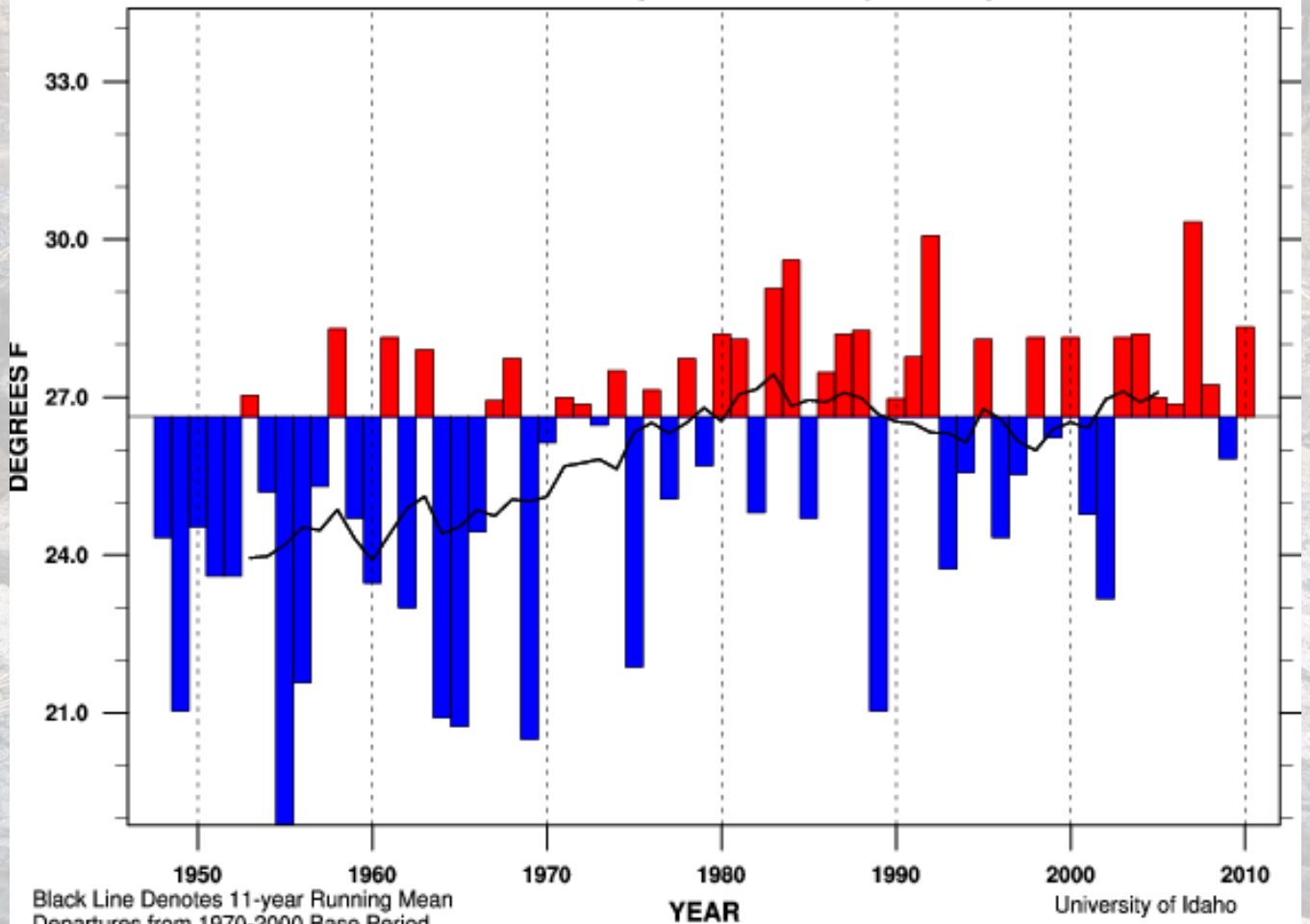
February-March 2011 Percent of 1971-2000 Normals



Westwide Drought Tracker - WRCC/UI Data Souce - PRISM (Prelim)

Missoula, MT

Miniumum Temperature
3 month period ending in May



Black Line Denotes 11-year Running Mean
Departures from 1970-2000 Base Period
Vertical Gray Bar Denotes Incomplete Data

University of Idaho

Linear Trend 1948-2010	+ 6.20 ± 3.26 °F/100yr
Warmest Year	30.3 °F (+3.7 °F) in 2007
Coldest Year	18.9 °F (-7.7 °F) in 1955
2010	28.3 °F (+1.7 °F)

Base Period Statistics
1970-2000

MEAN	26.6 °F
STDEV	2.07 °F
RANK	59 of 63

Westmap Time series