



“Rogue Valley Climate: Trends & Projections”

A Primer

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*Presentation (as pdf) on web site: click ‘Projects’ – select ‘Presentation Project’
scroll down to listed presentation schedule*

For those who plan to nap through my presentation....



THE MESSAGES

- 1) Climate change consequences are here and now
- 2) Projections are mainly continuations of current trends

Historic Trends are based on DATA

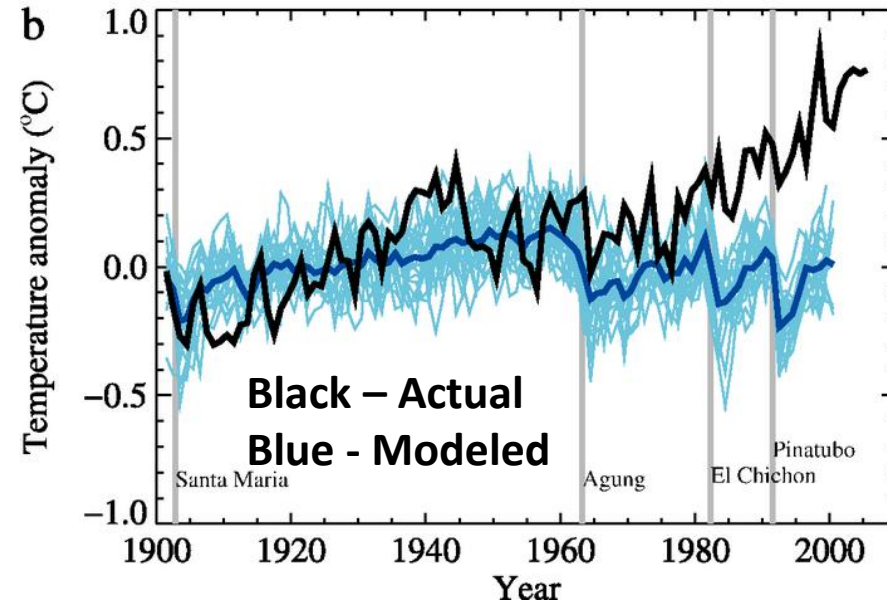
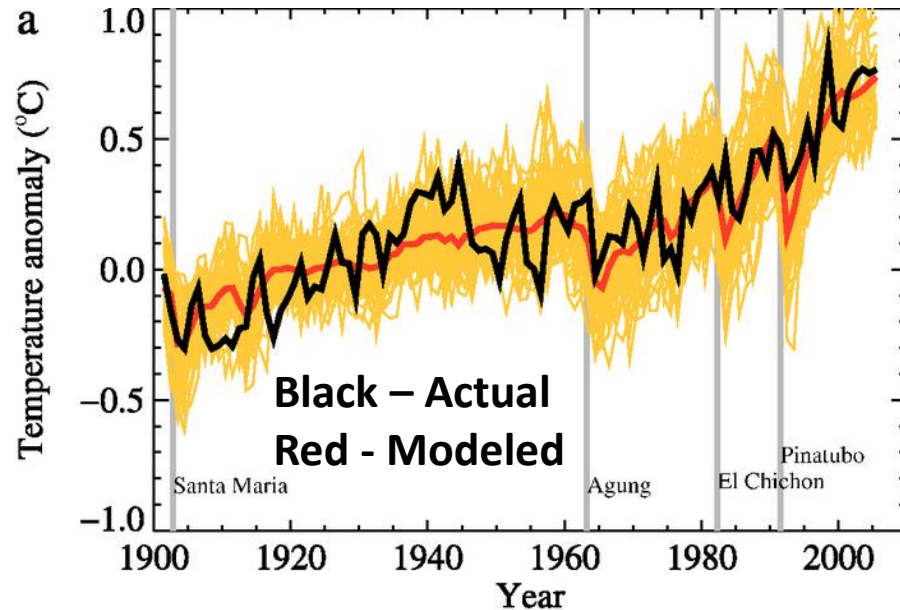
The Future is Based on Projections:

~ But Are Projections Meaningful?

Global models using 1901-1950 as baseline.

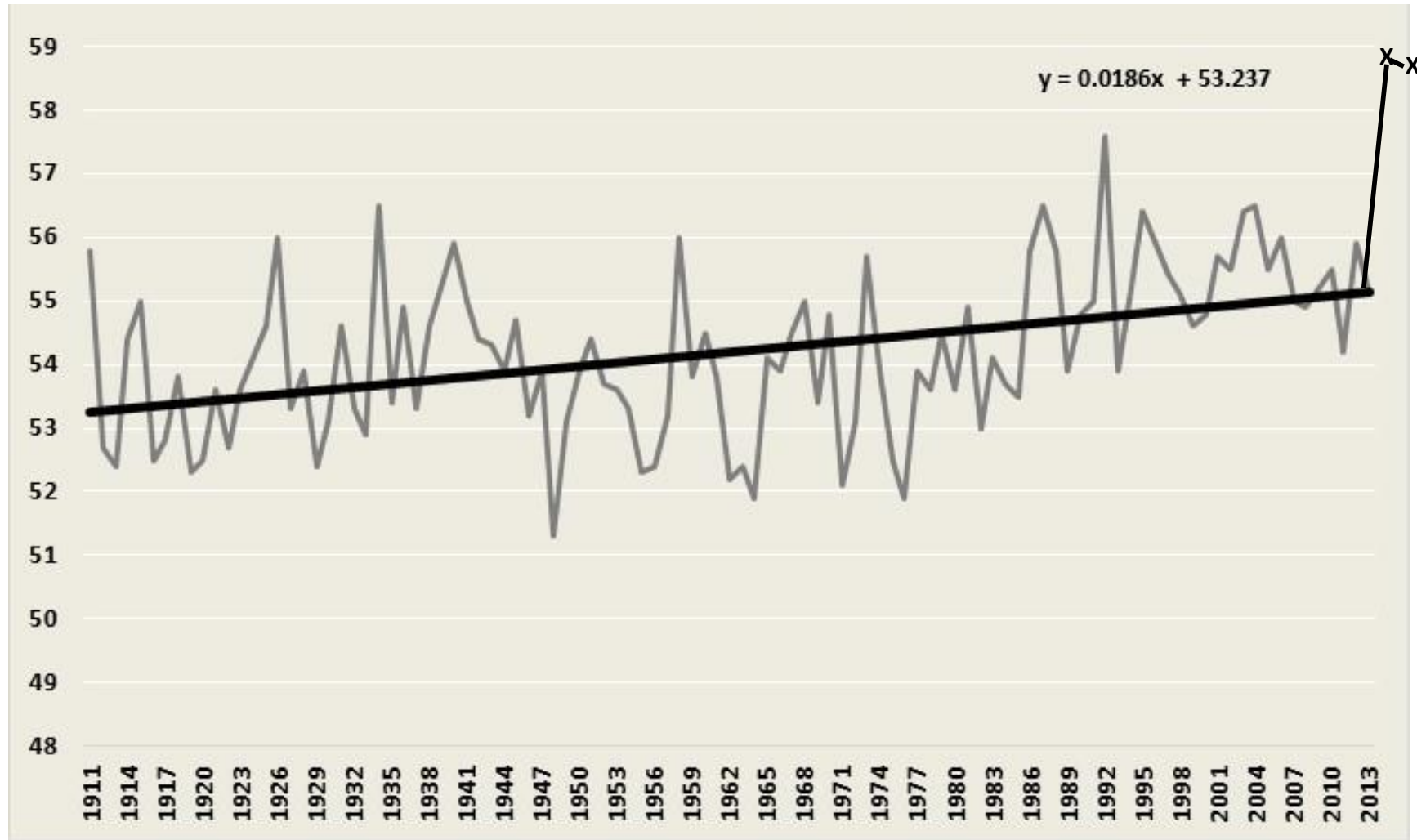
a) Simulations incorporating natural
and human-induced influences.

b) Simulations with natural influences only.



http://www.ipcc.ch/publications_and_data/ar4/wg1/en/figure-9-5.html

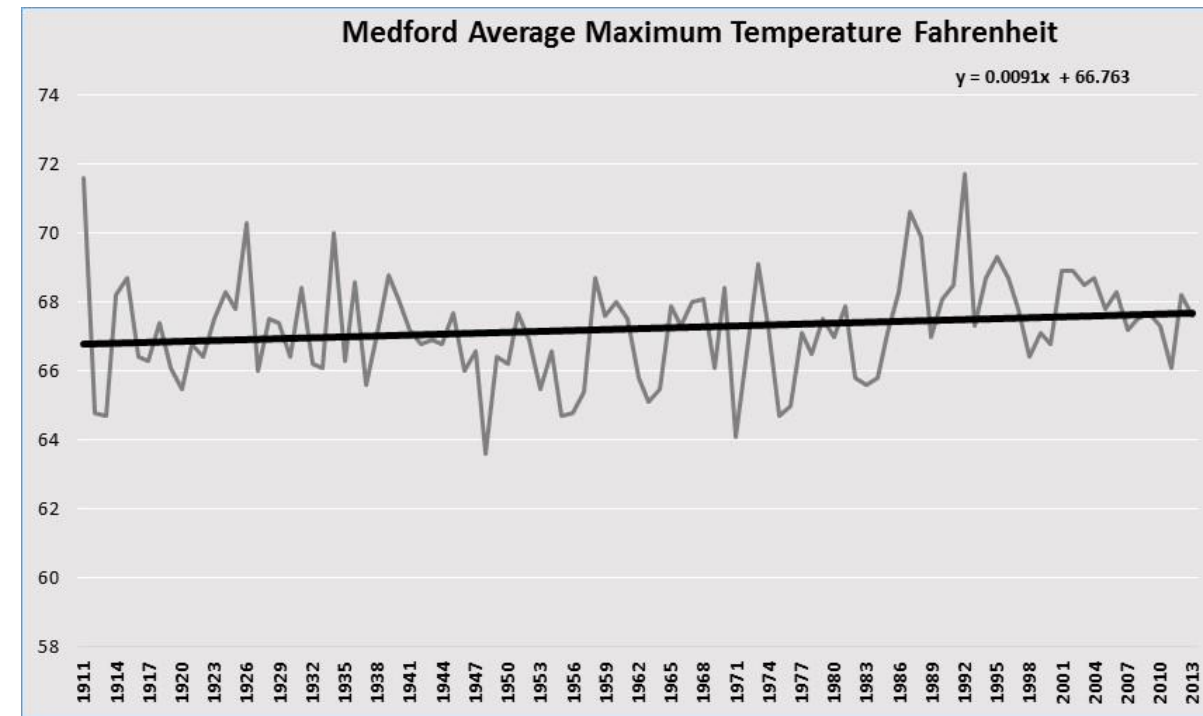
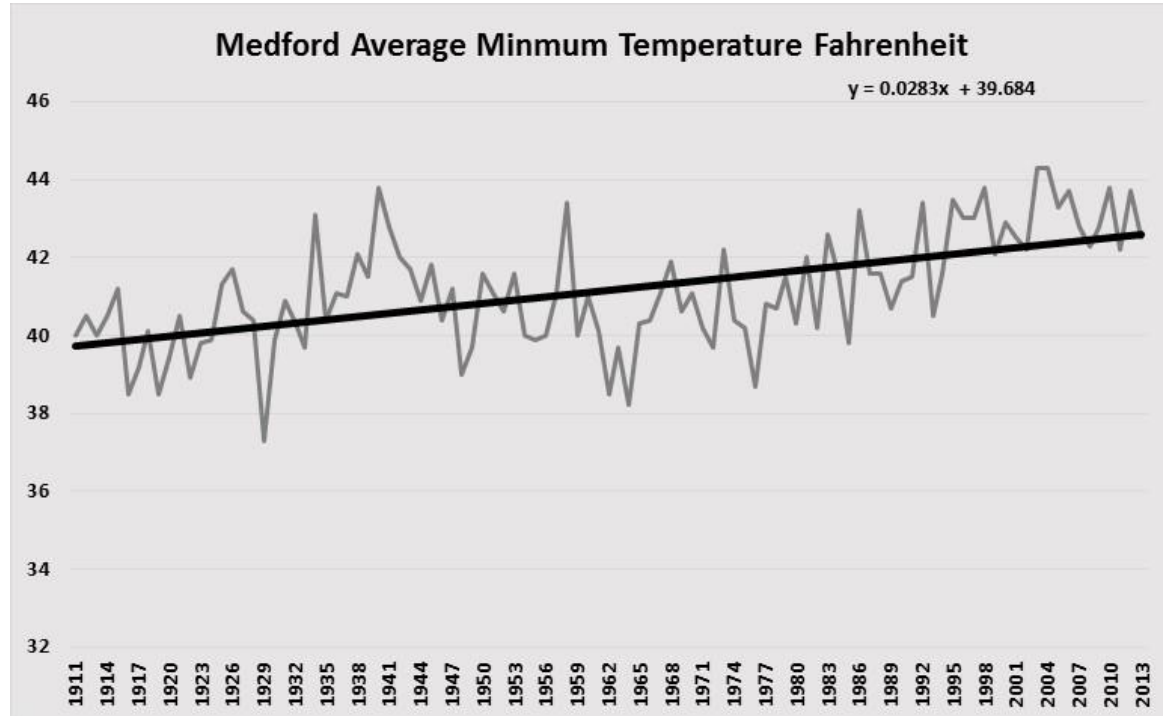
Medford Average Temperature History 1911 - 2014



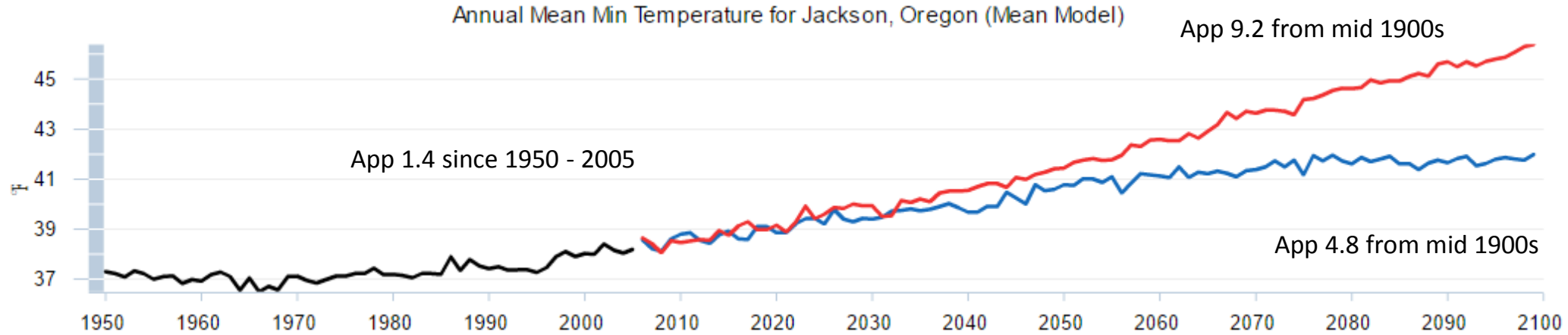
US National Weather Service, NOAA - Medford

http://www.ncdc.noaa.gov/cag/time-series/us/35/USW00024225/tavg/ytd/12/1895-2016?base_prd=true&firstbaseyear=1901&lastbaseyear=2016

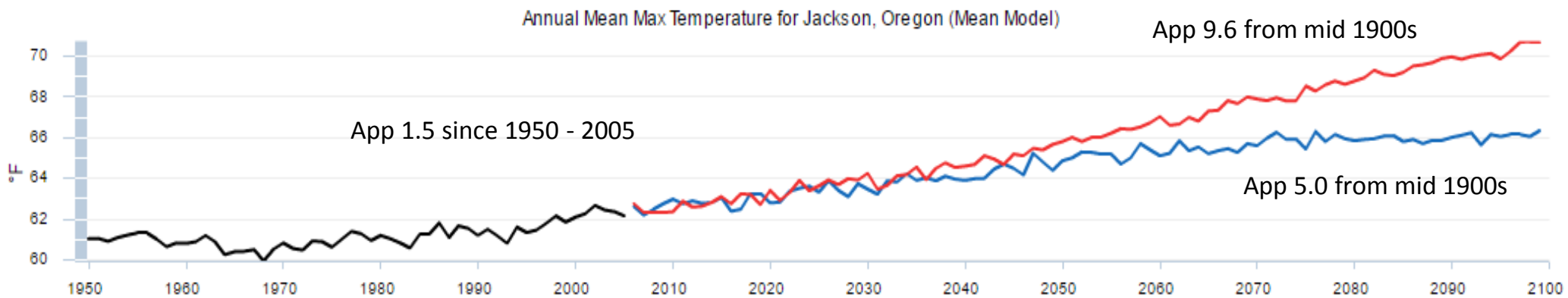
Medford Average Min and Max Temperature History 1911 – 2014



Jackson County Summary - USGS *Based on IPCC 2013 & 28 models*



Average: RCP 8.5 = 9.4°F / RCP 4.5 = 4.9 °F

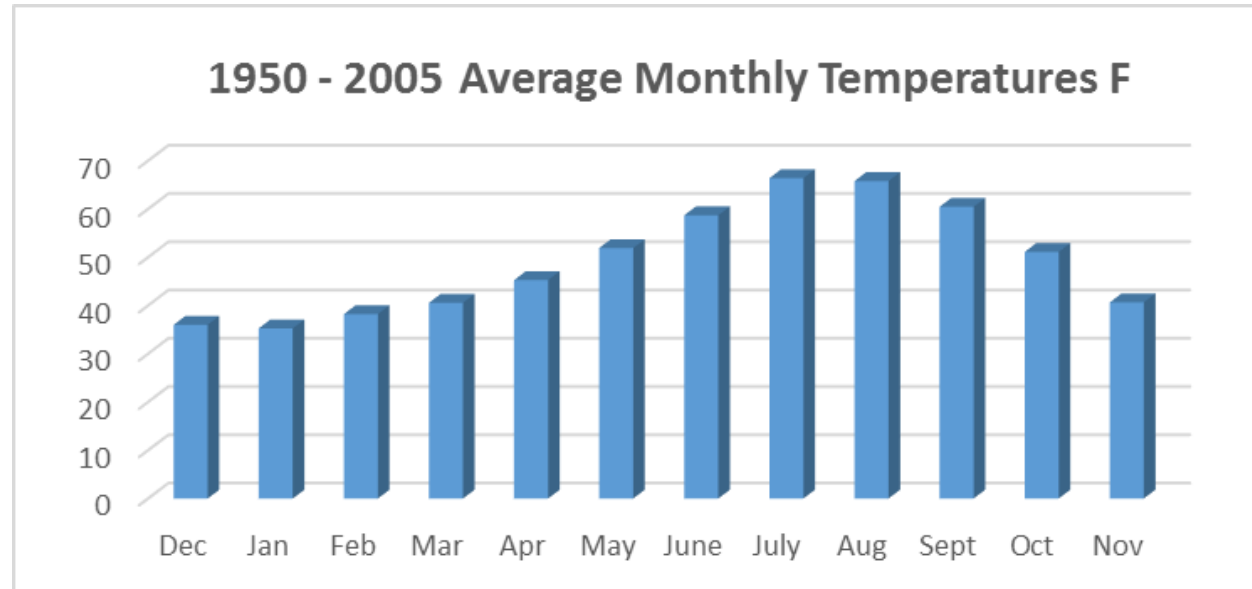


Historical RCP4.5 RCP8.5

Value Relative change

http://www.usgs.gov/climate_landuse/clu_rd/apps/nccv_viewer.asp

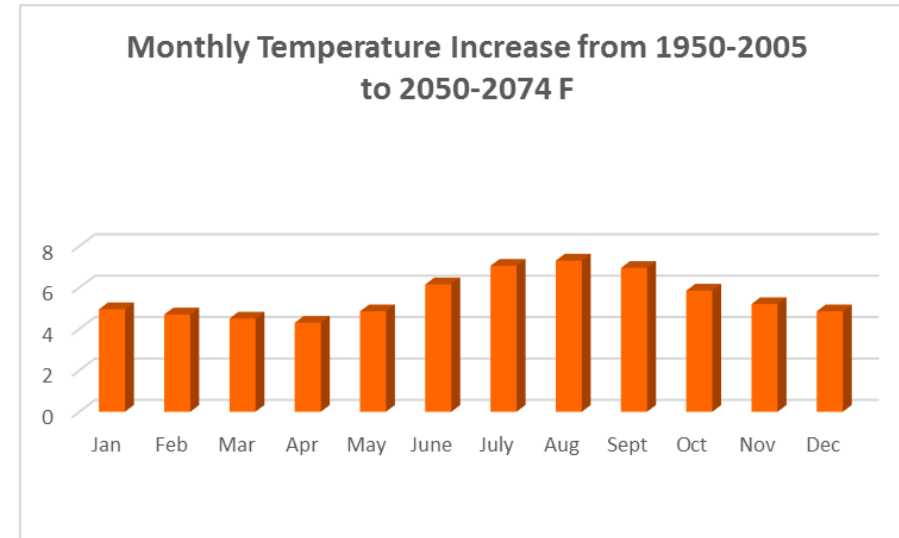
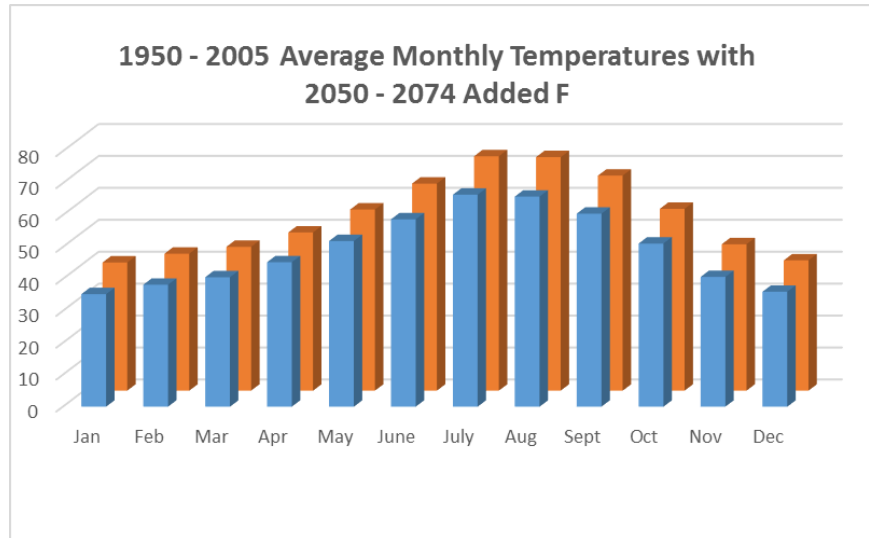
Jackson County Trends and Projections



http://www.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

Jackson County Trends and Projections

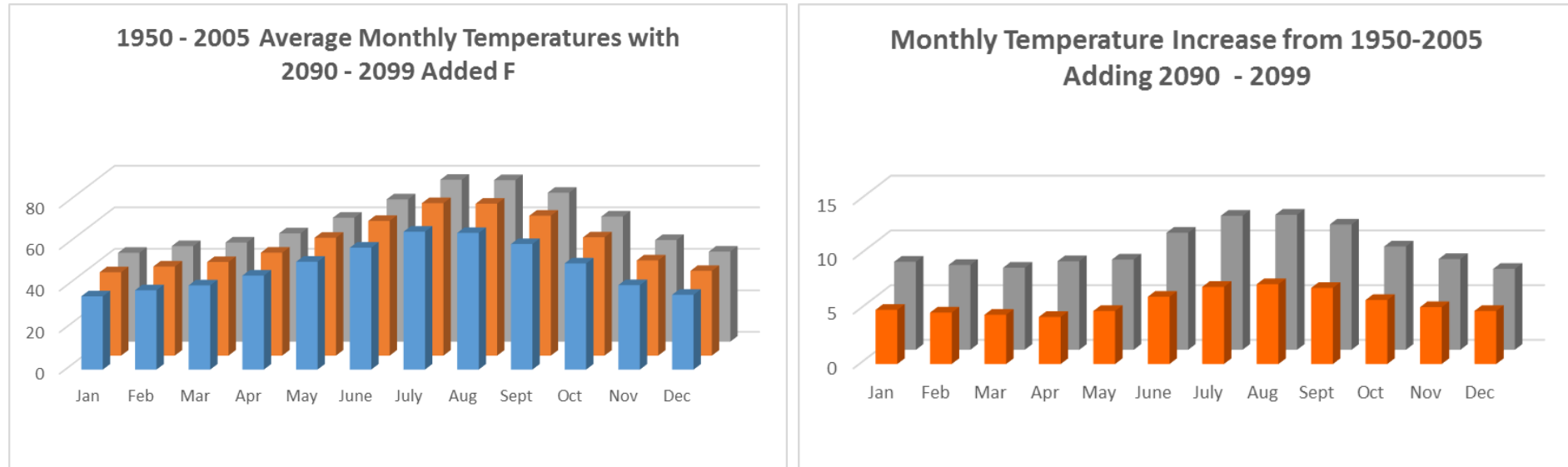
Average of 28 computer simulations



http://www.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

Jackson County Trends and Projections

Average of 28 computer simulations



http://www.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

Temperature Projections °F Through the 21st Century Compared to the Recent Past

IPCC RCP 8.5 'Business As Usual' Scenario

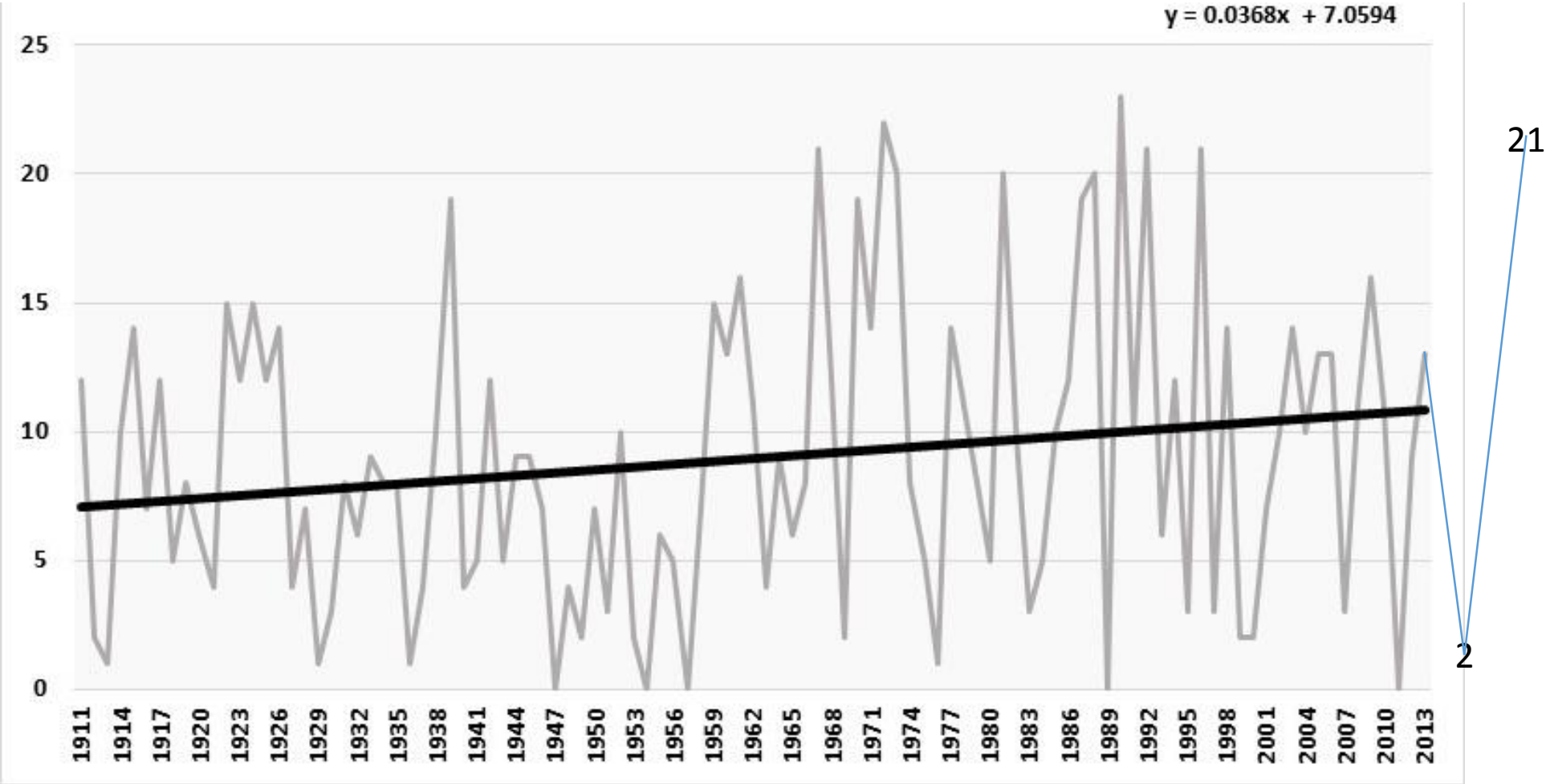
	1950 – 2005 Ave	2050 – 2074 Ave	Increase	2090 – 2099 Ave	Increase
Winter	36.48	41.28	4.83	44.05	7.73
Spring	45.90	50.45	4.55	53.19	7.95
Summer	63.63	70.47	6.83	74.75	11.77
Fall	50.73	56.72	6.00	60.29	9.73

July Mean Ave Max 94.95

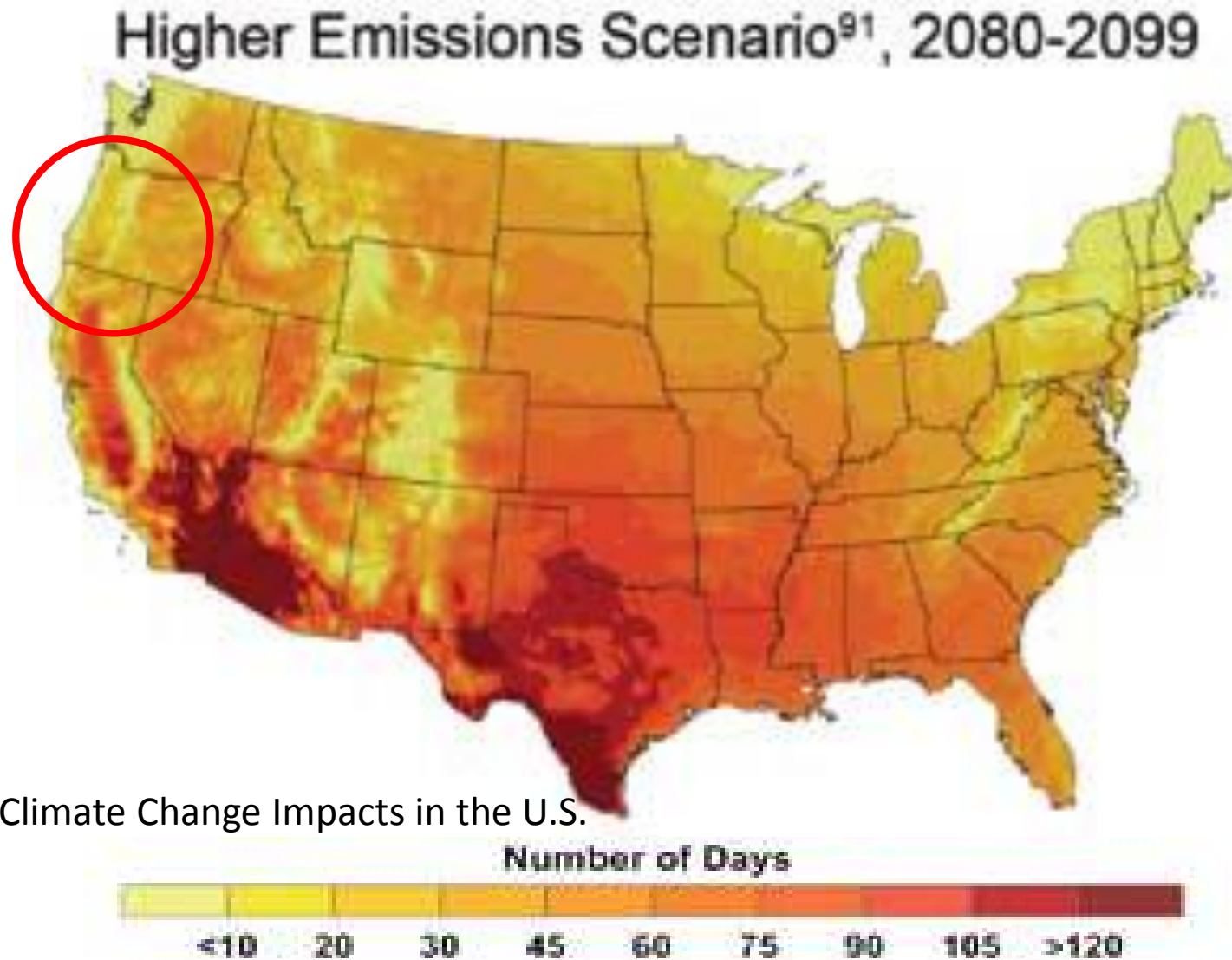
http://www.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

Medford 100 Degree Days History

EXTREMES
ARE ALSO
IMPORTANT



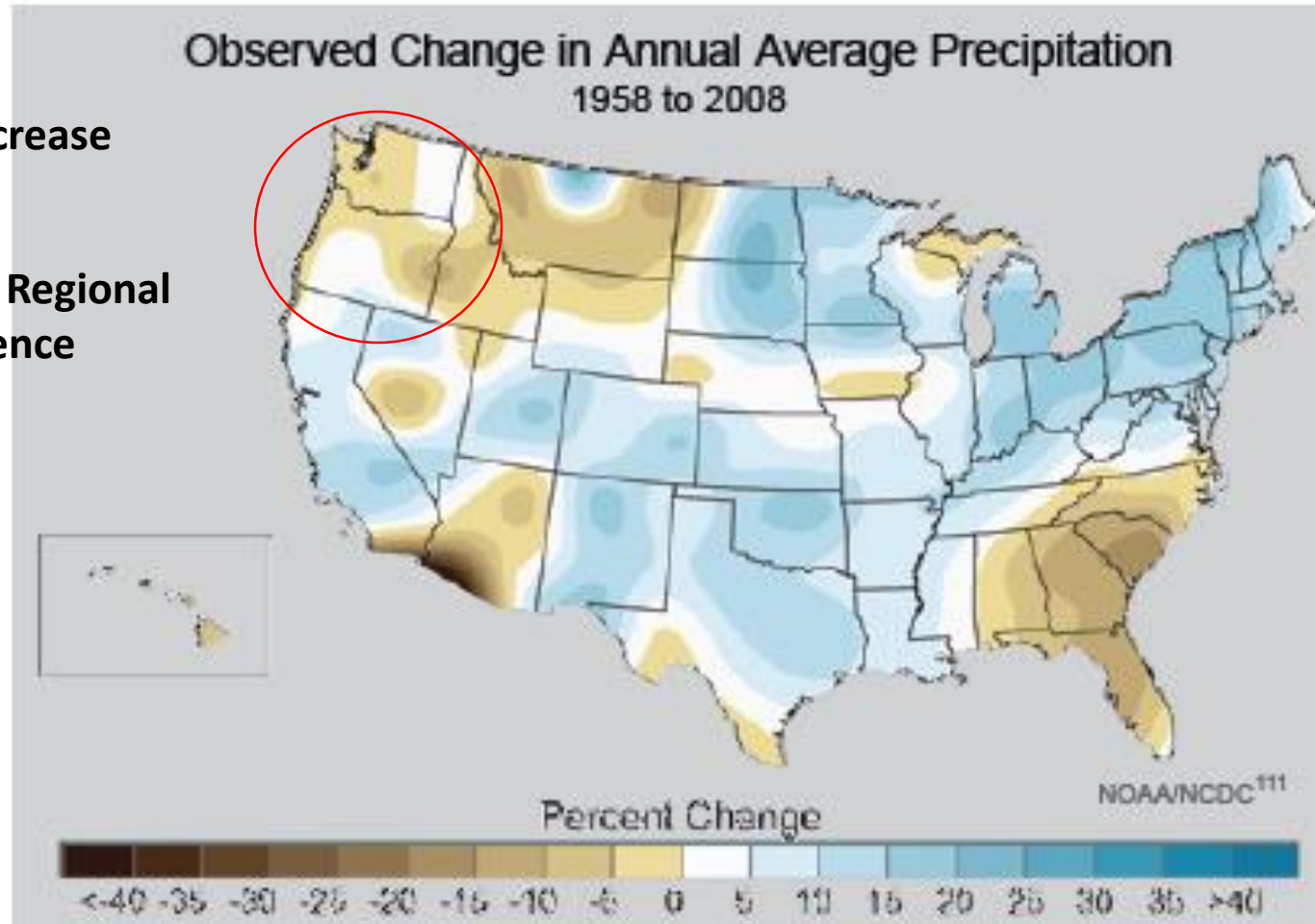
Heat Waves: Number of Days $> 100^{\circ}\text{F}$



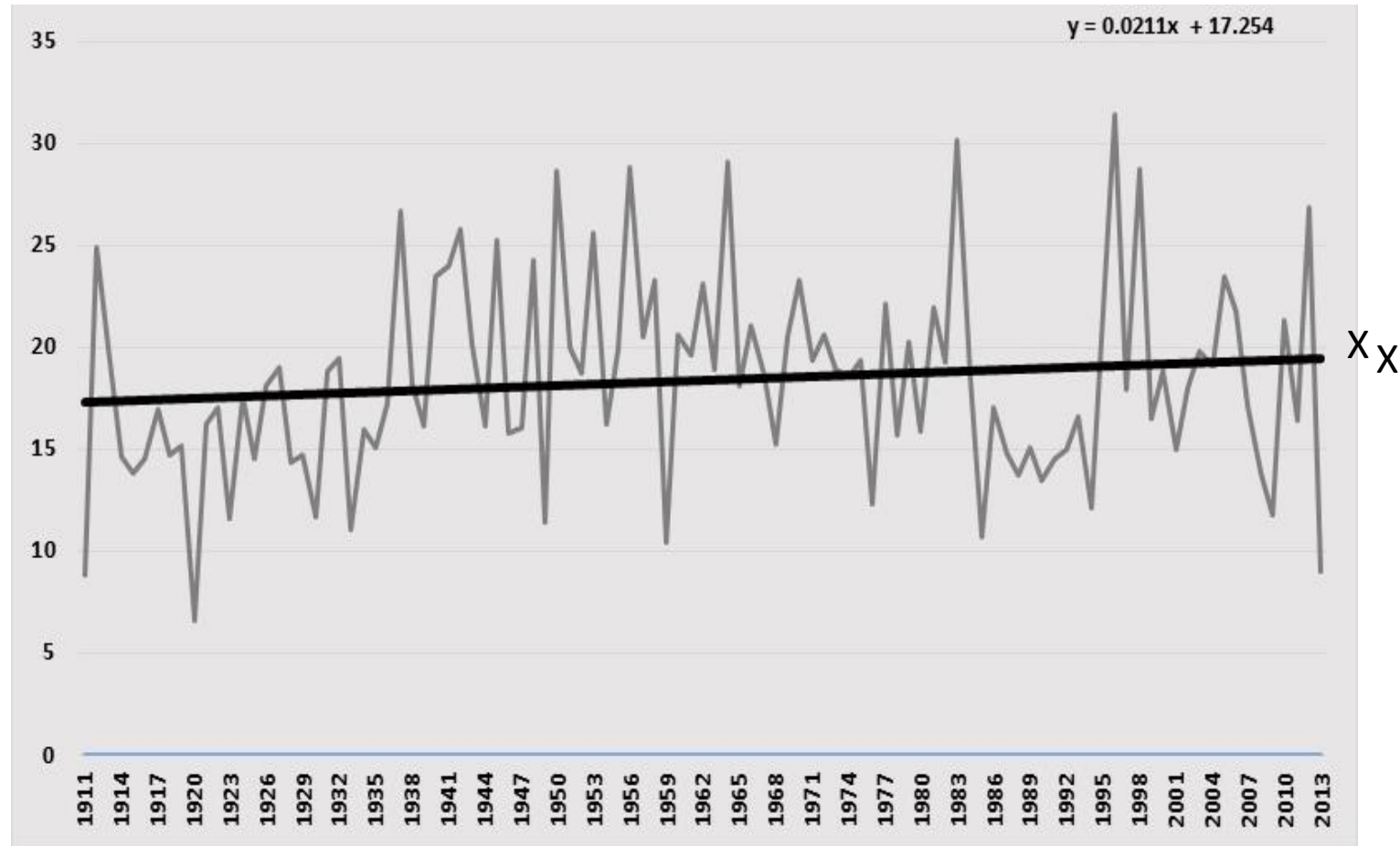
Historic Precipitation

National increase
of 5%

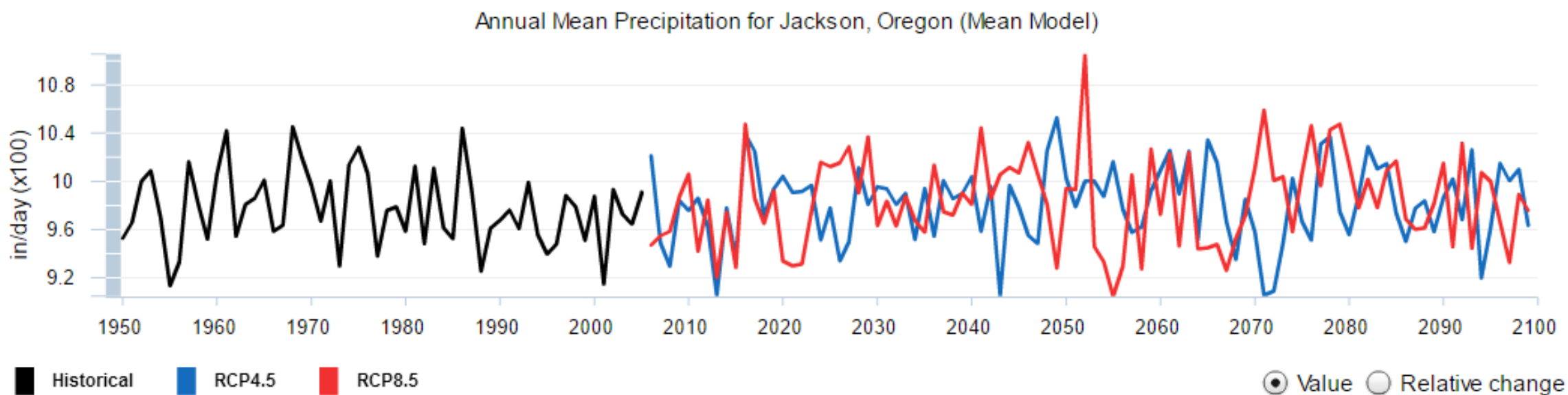
Substantial Regional
Difference



Medford Annual Precipitation - Inches Historic

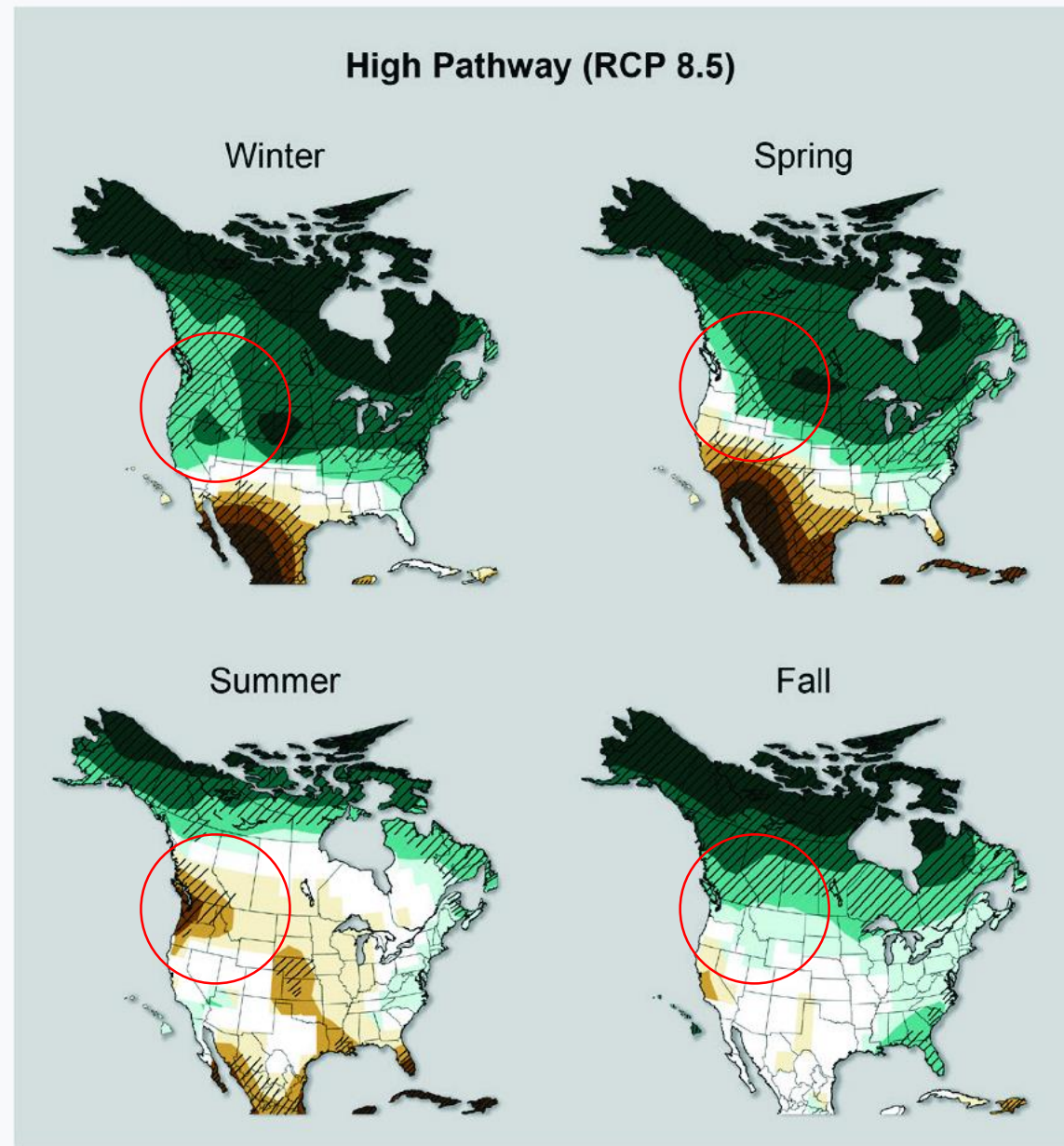
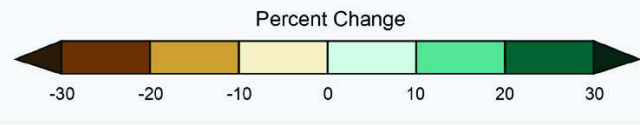


Jackson County Precipitation



Projected Precipitation Seasonal Pattern –

High
Emissions Scenarios
= 'Business As Usual'








U.S. Drought Monitor

West

February 9th 2016

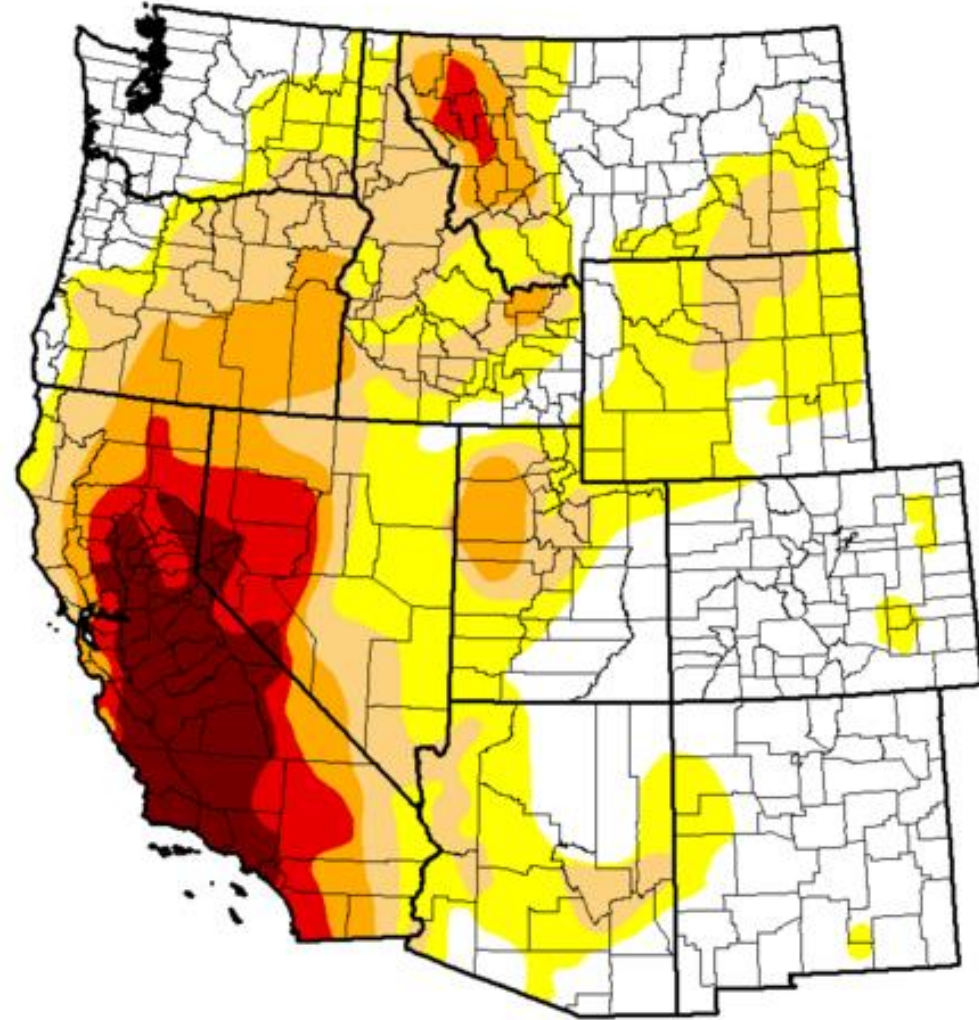
Intensity:

 D0 - Abnormally Dry
 D1 - Moderate Drought
 D2 - Severe Drought

 D3 - Extreme Drought
 D4 - Exceptional Drought

Estimated Population in Drought Areas: 42,841,580

Percent of area: 61.78%

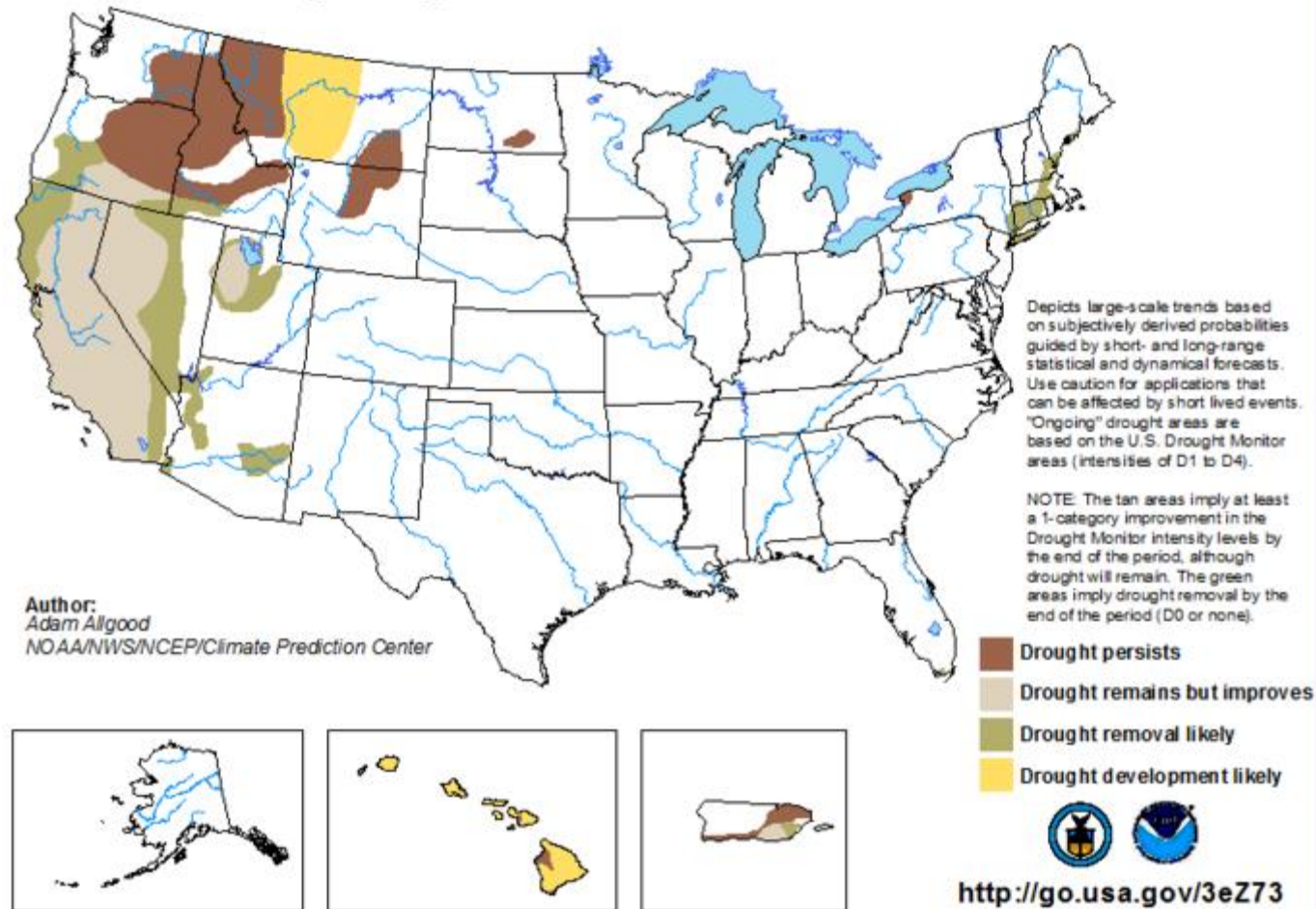


<http://droughtmonitor.unl.edu/Home/RegionalDroughtMonitor.aspx?west>

U.S. Seasonal Drought Outlook

U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid for January 21 - April 30, 2016
Released January 21, 2016

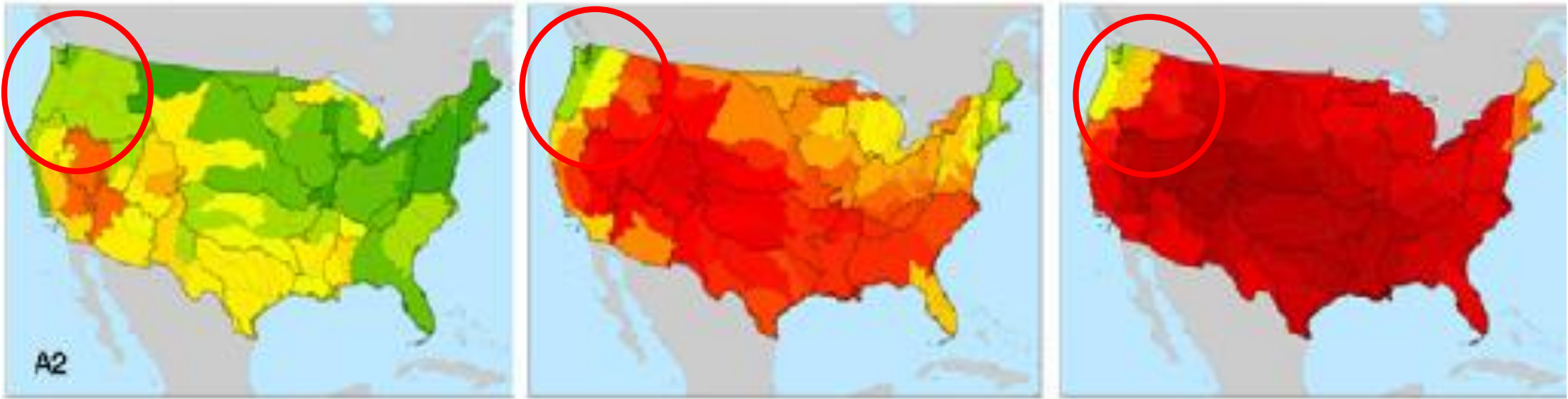


Palmer Drought Severity Index with Projections

2006-2035

2036-2065

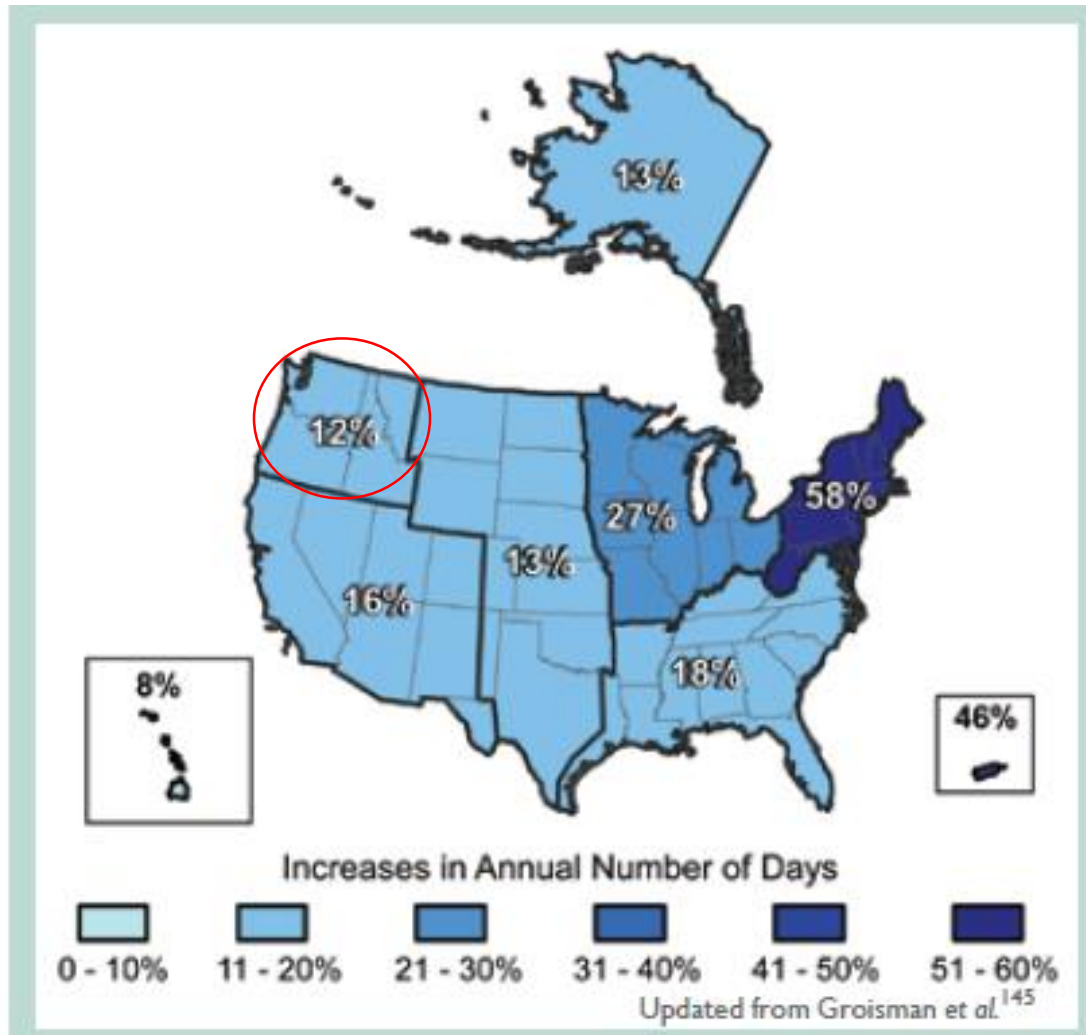
2066-2095



– Business
as
usual

Green: Decreasing Drought → 7 months fewer per 30 years

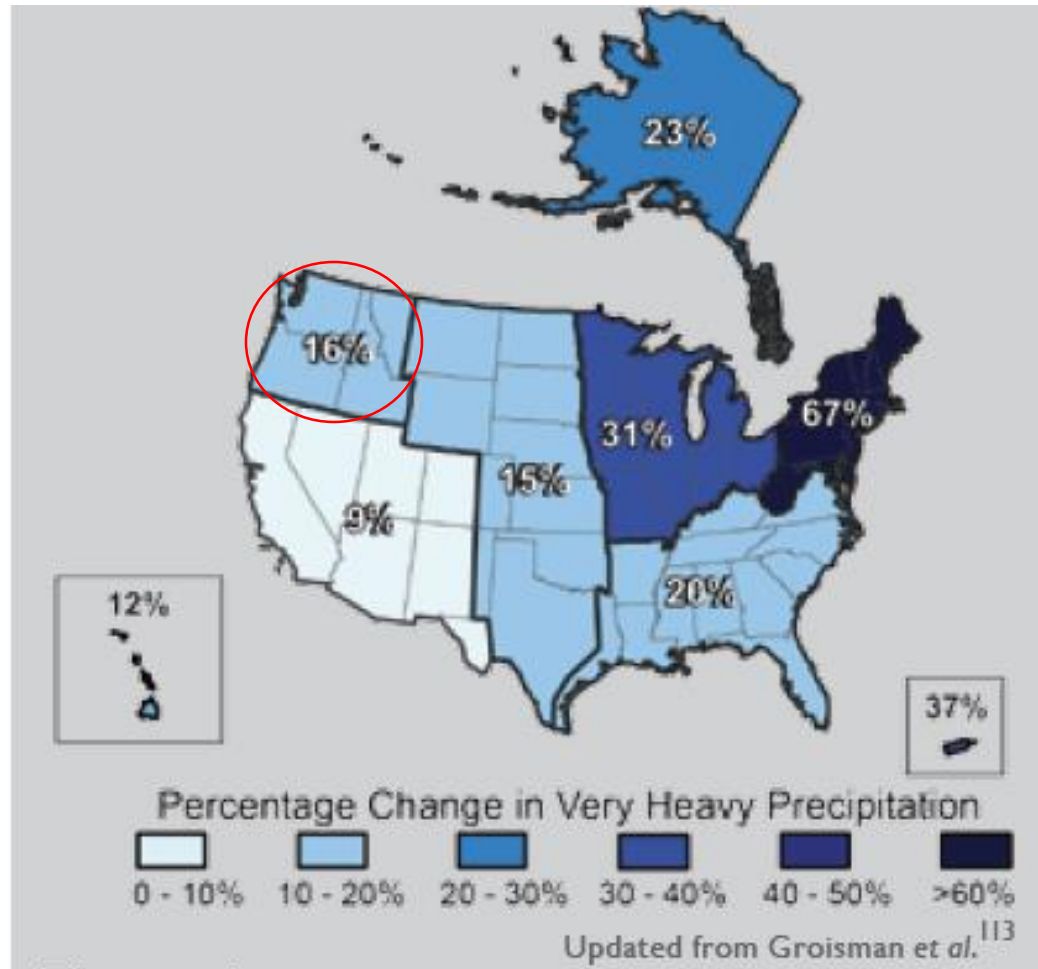
Yellow- Red: Increasing Drought → over 60 months more per 30 yrs



1958 – 2007
Historic Heavy
Downpours
(Heaviest 1%
of all events):
% Increase in
Freq. Heavy
Events

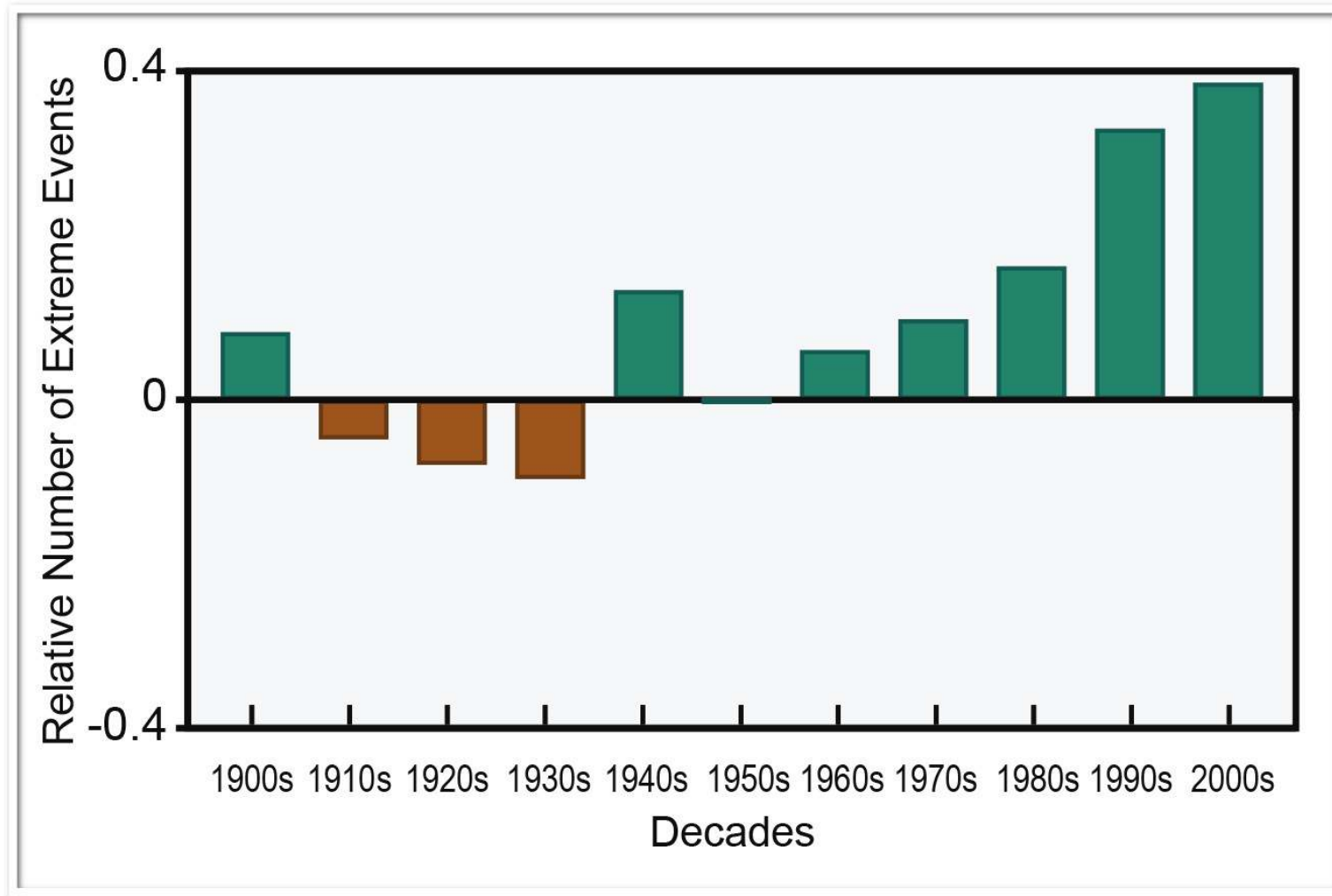
More events featuring heavy downpours

1958 – 2007
Historic Increase
in Amount of
pptn falling in
Heavy
Downpours
Pattern –
Heaviest 1% as
**Amount in Heavy
Events**

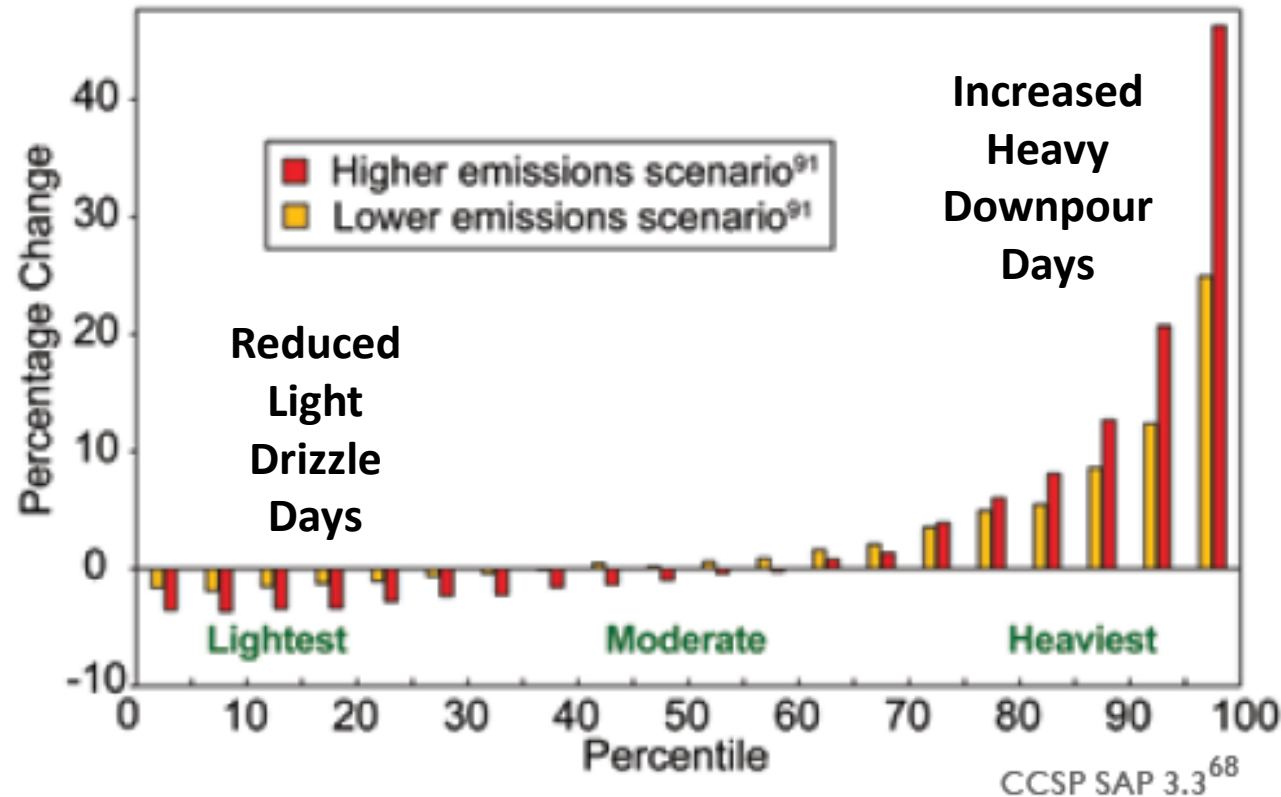


More precipitation in the heavier downpours

Observed U.S. Trends in Heavy Precipitation



Projected Patterns in Light, Moderate & Heavy Precipitation Events by 2090s



Highway 42 Landslides



Logged May 2013 - 2015

Oregon Department of Transportation
2015

Related Climatic Factors: Local Trends & Projections

Less Snow Accumulation



Transition from Snow to Rain



Earlier Snow Melt



Flashier Floods in Spring & Winter



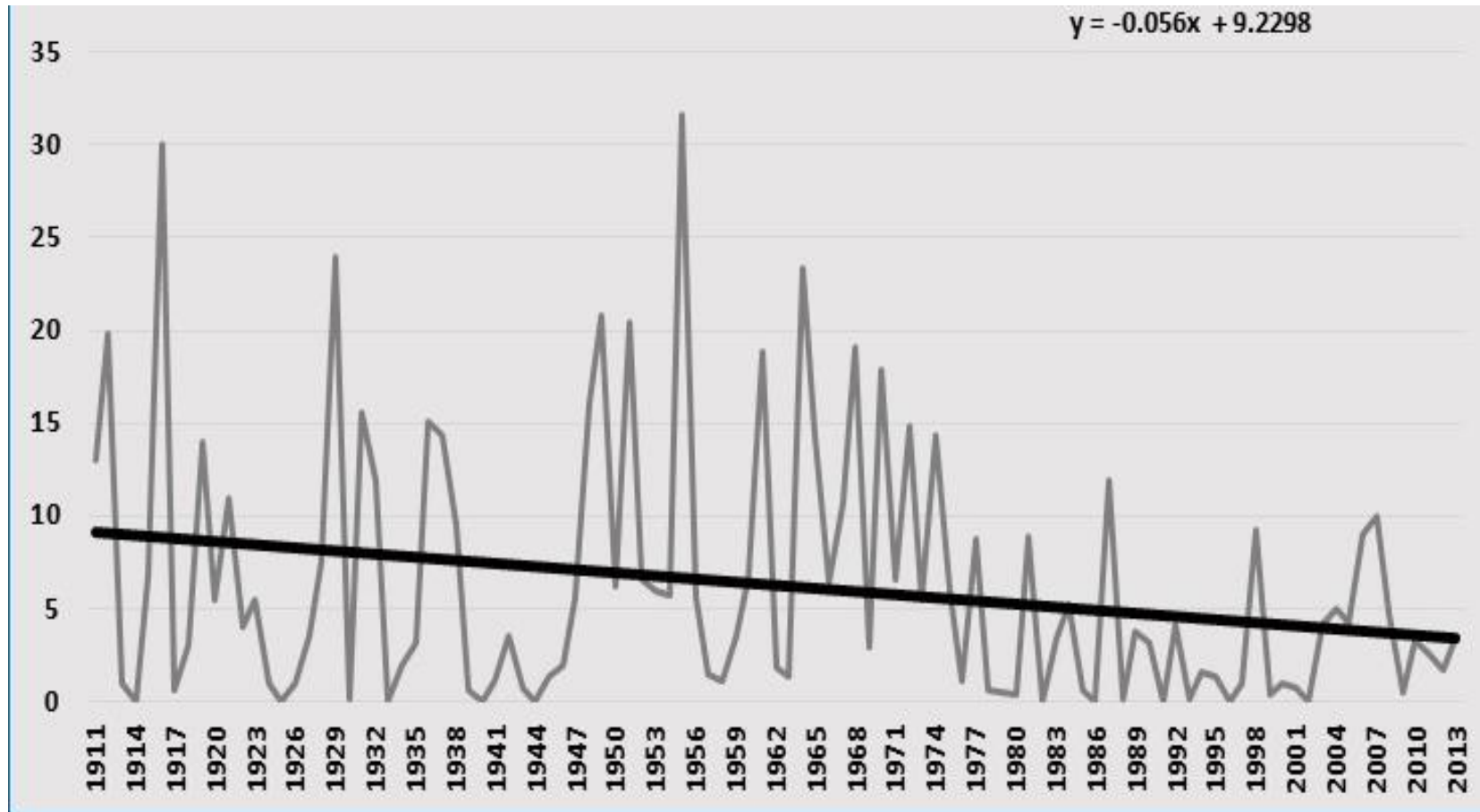
Dry Streams in Summer



Increased Risk of Wildfires

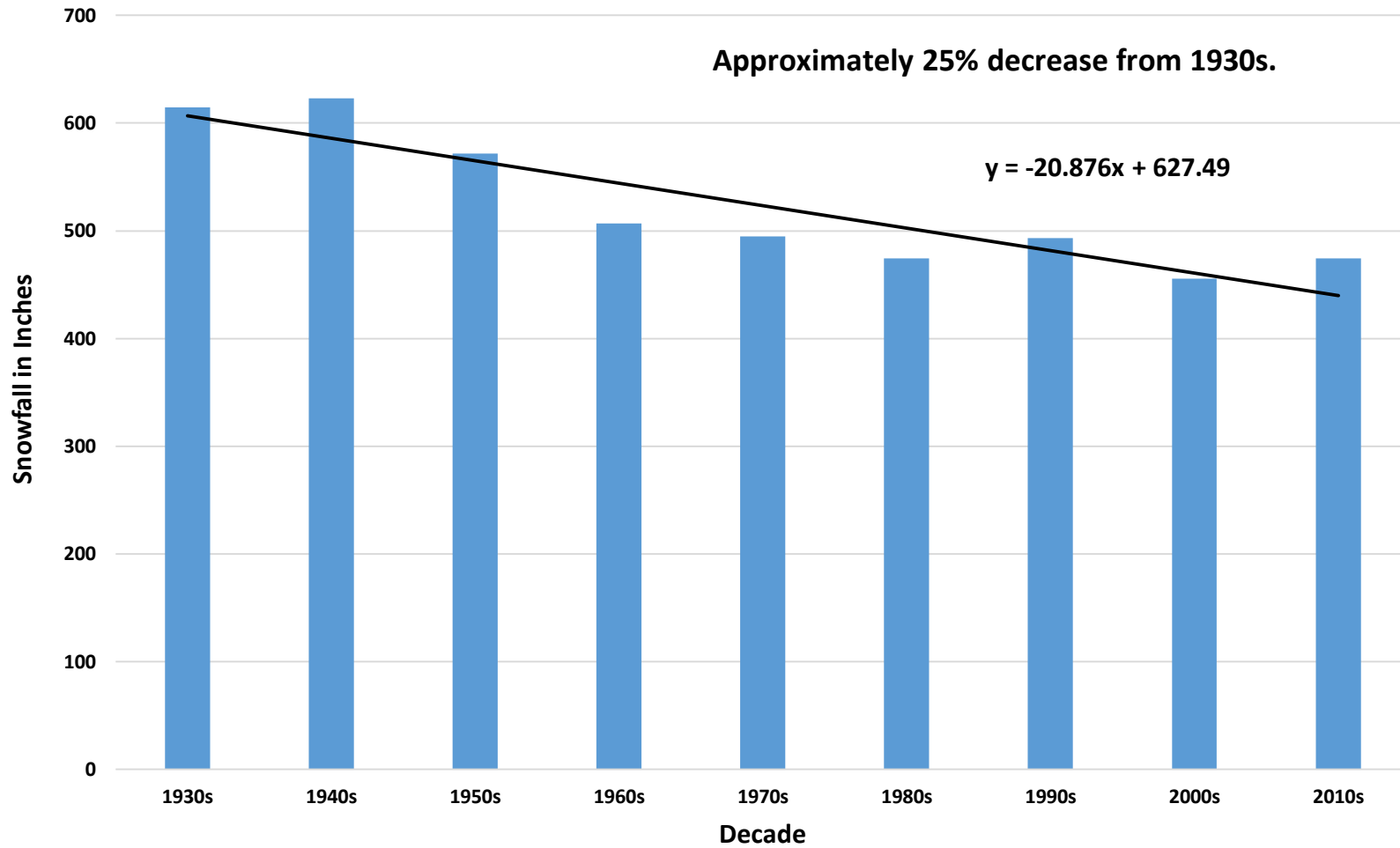


Medford Annual Snowfall - Inches Historic



US National Weather Service, NOAA - Medford

Mid-Elevation Snowfall Crater Lake 7,000 – 8,000 ft

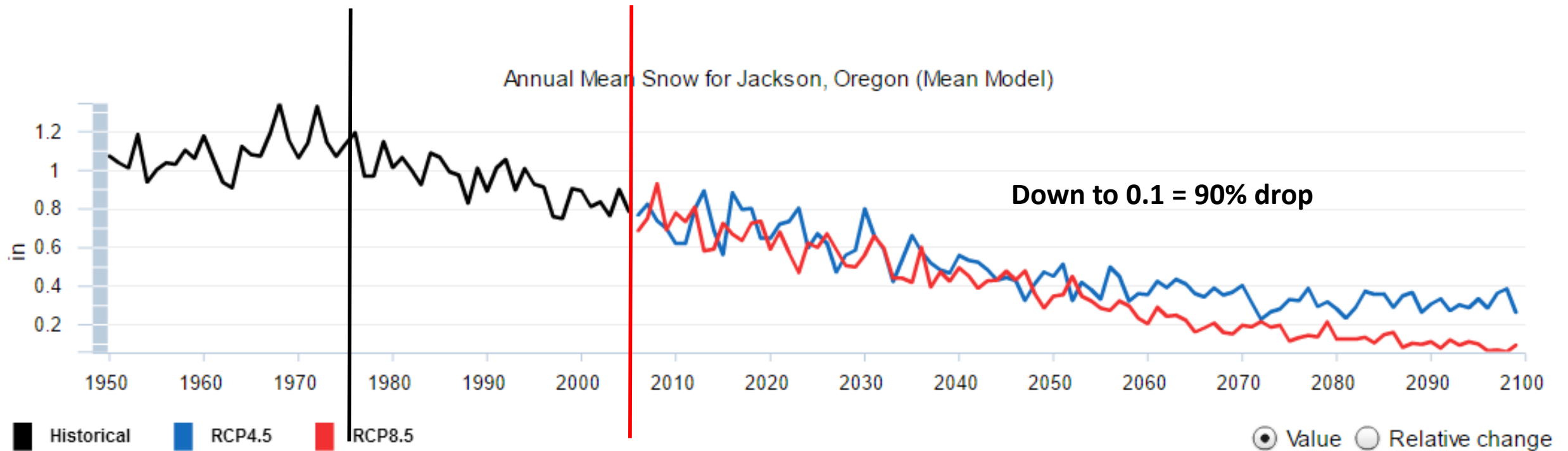


N. California 1950 - 2000

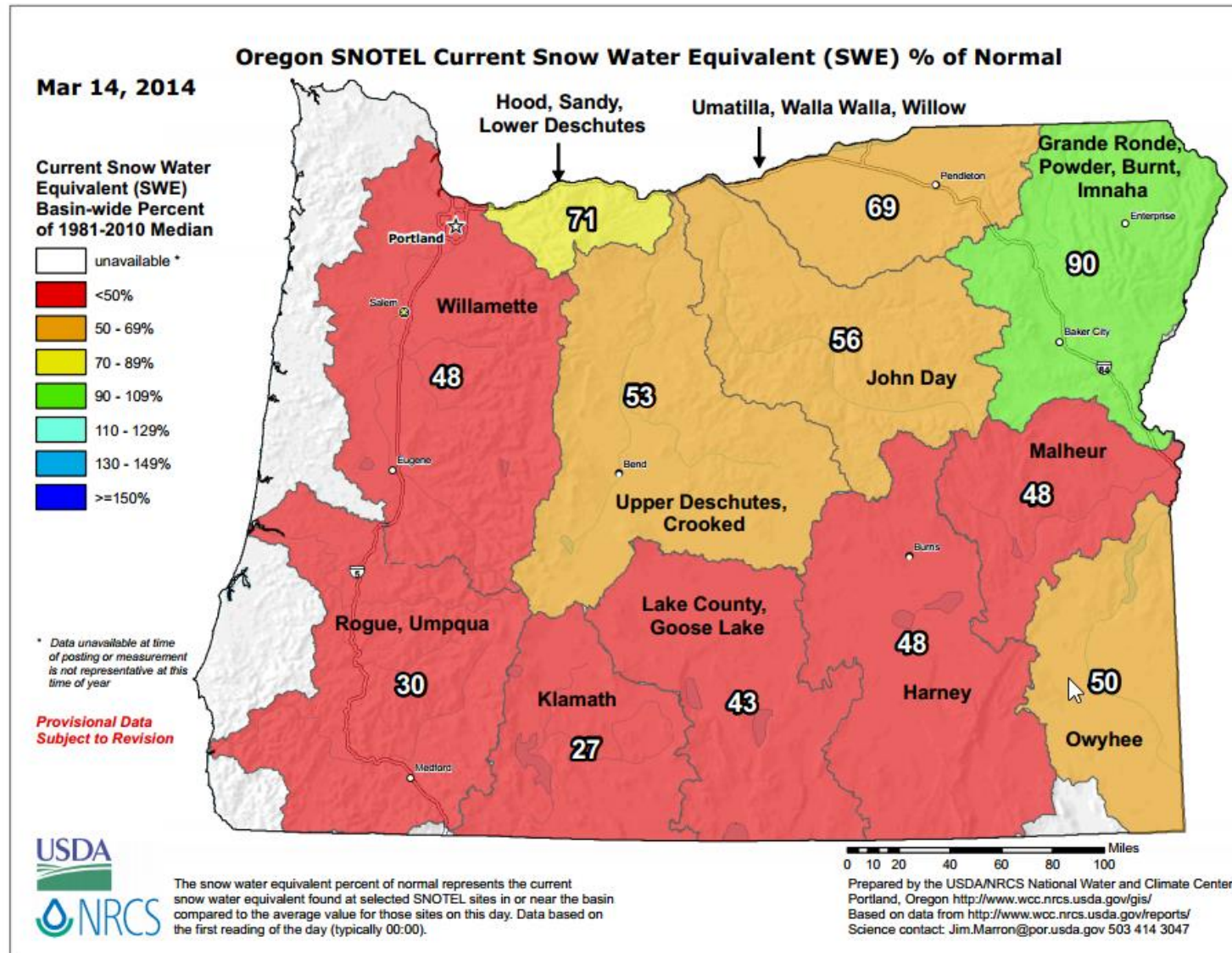
Below 7500' 13% decline
Above 7500' 12% increase



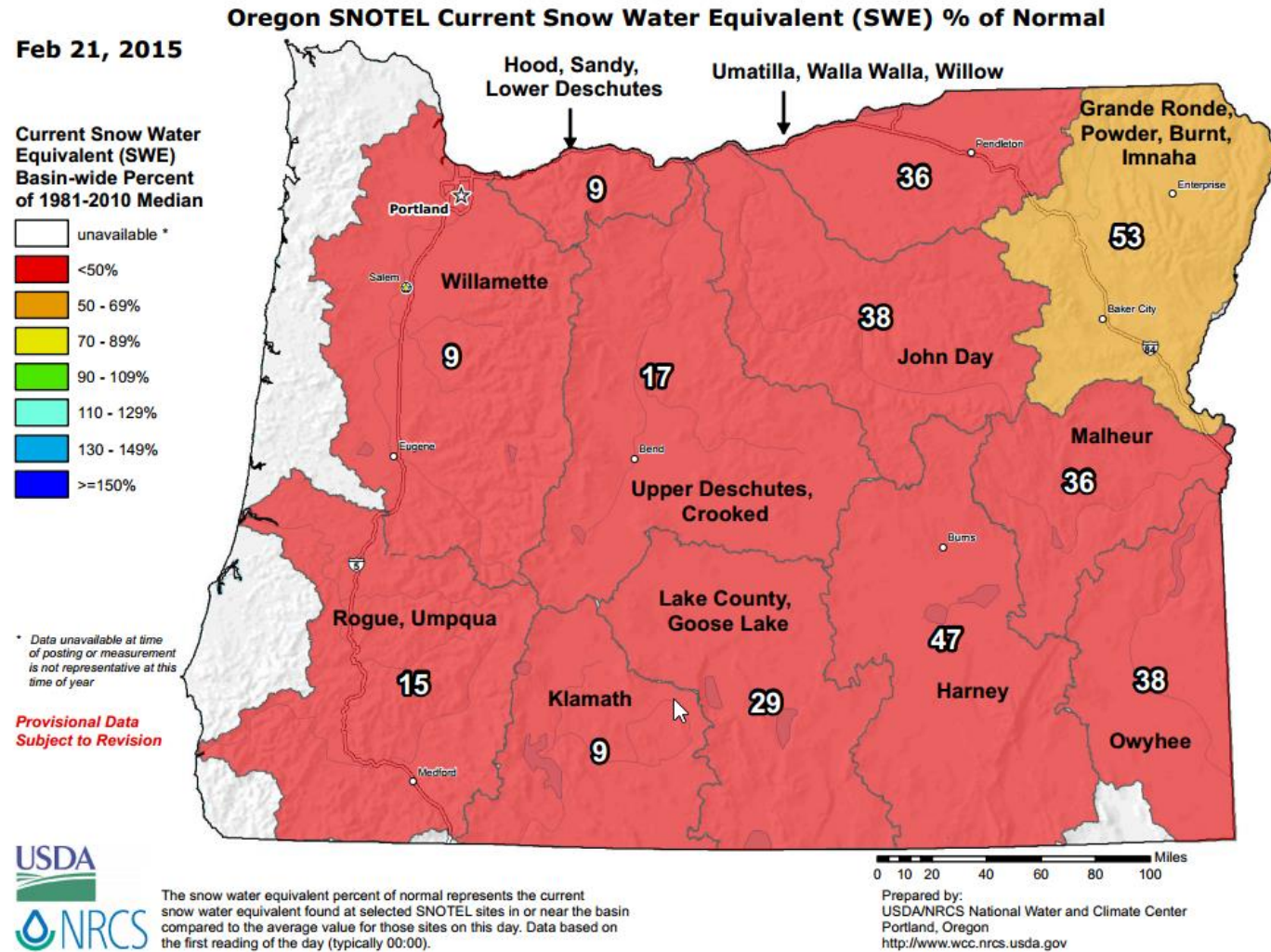
Jackson County Snowfall Trend and Projection



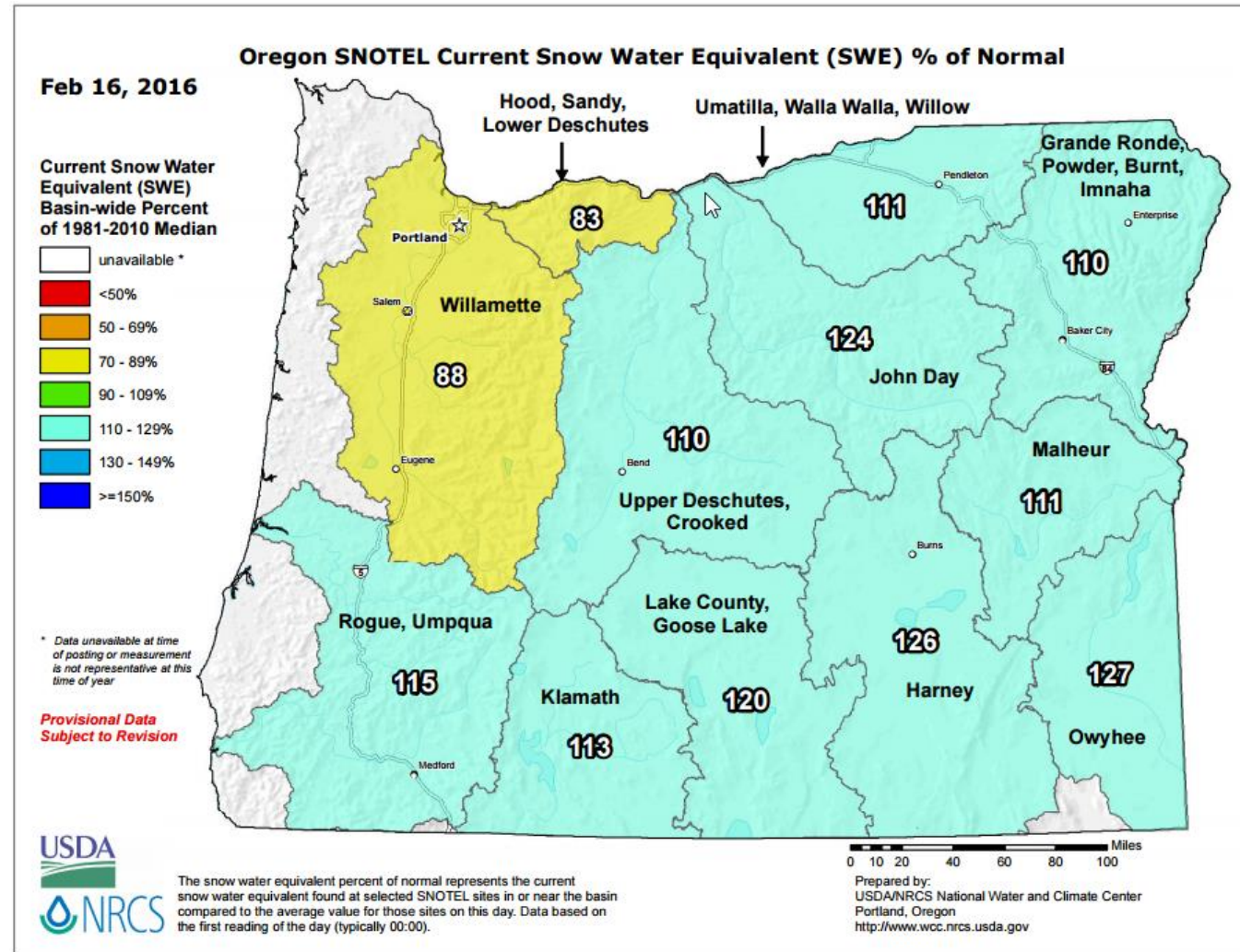
March 14th 2014 Snowpack



Feb 21st 2014

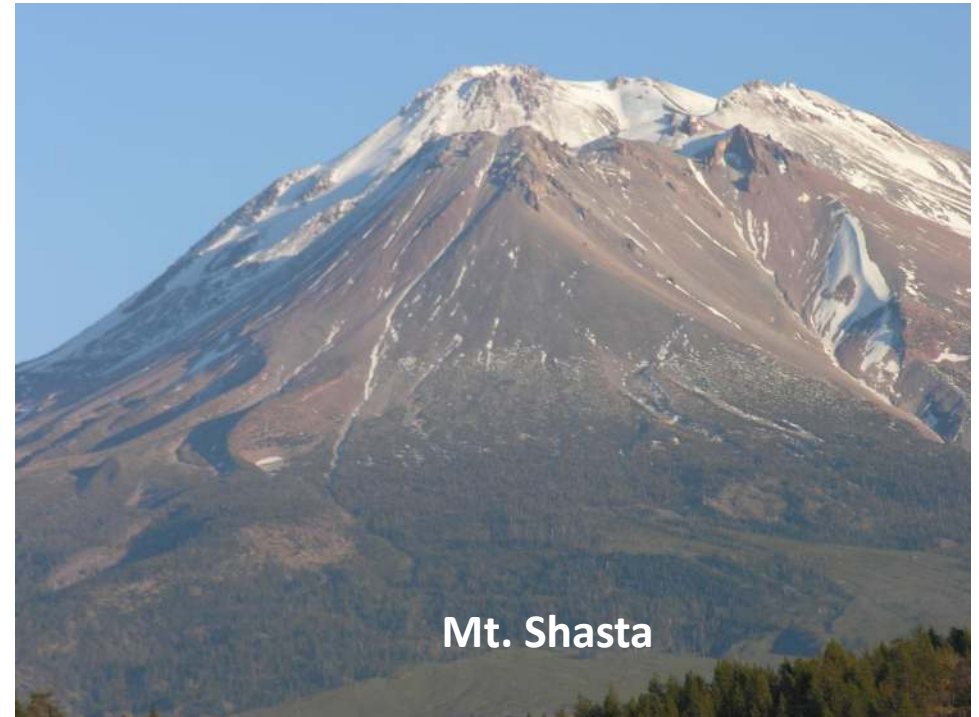


Feb 16th, 2016



Snowpack Projections

- By late century may be a 90% drop in high elevation snowpack →
 - Only approximately 10% historic accumulation.
- Lack of snowpack has more than recreational consequences.

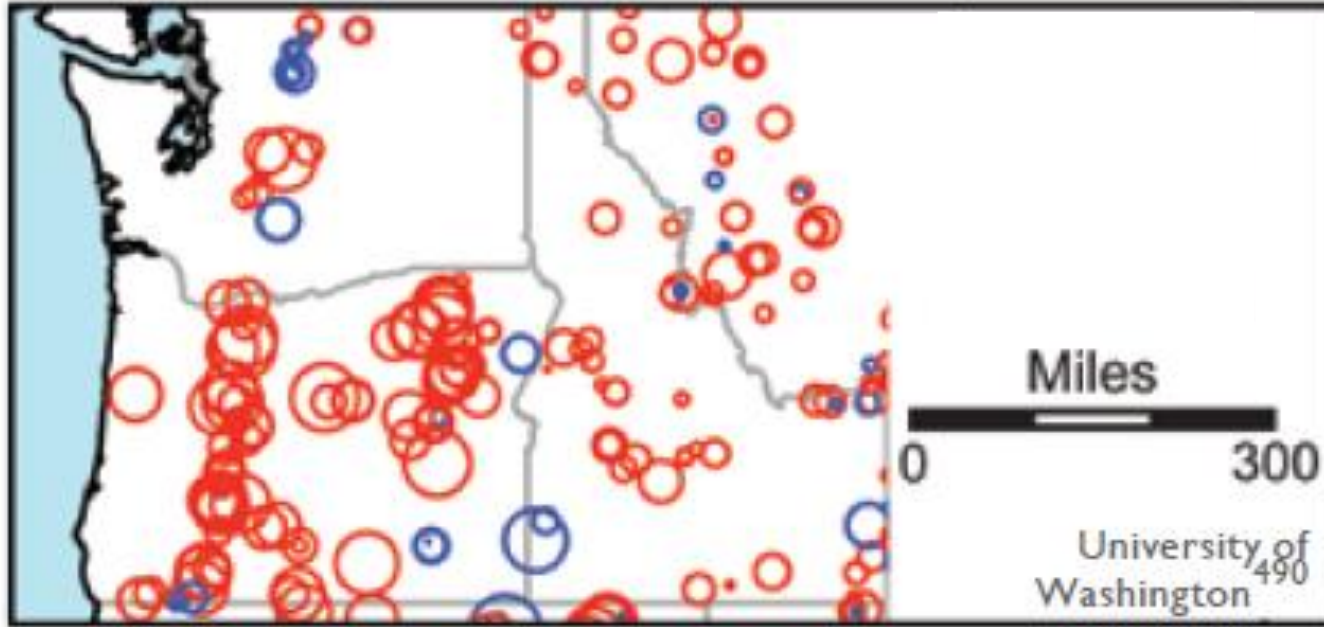


It serves as late summer and fall irrigation source

Snow vs Rainfall Trend

- Current trend is towards precipitation falling as rain at lower elevations rather than snow at higher elevations
- Expected to continue

Trends in April 1 Snow Water Equivalent 1950 to 2002



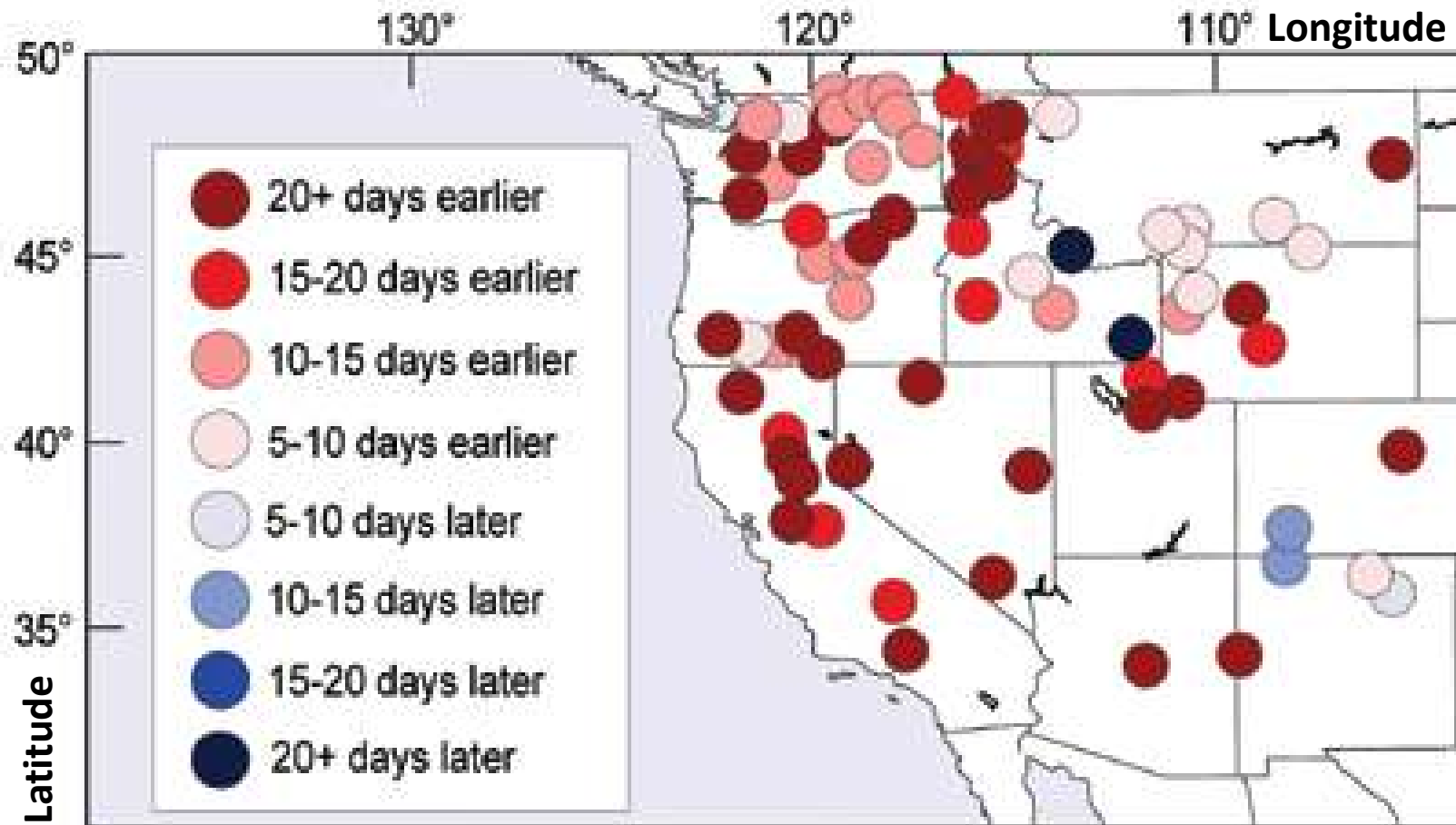
Red = decreasing snow water
Blue = increasing snow water

**Declining snowpack leads to
reduced water supply in our 'natural' reservoirs.**

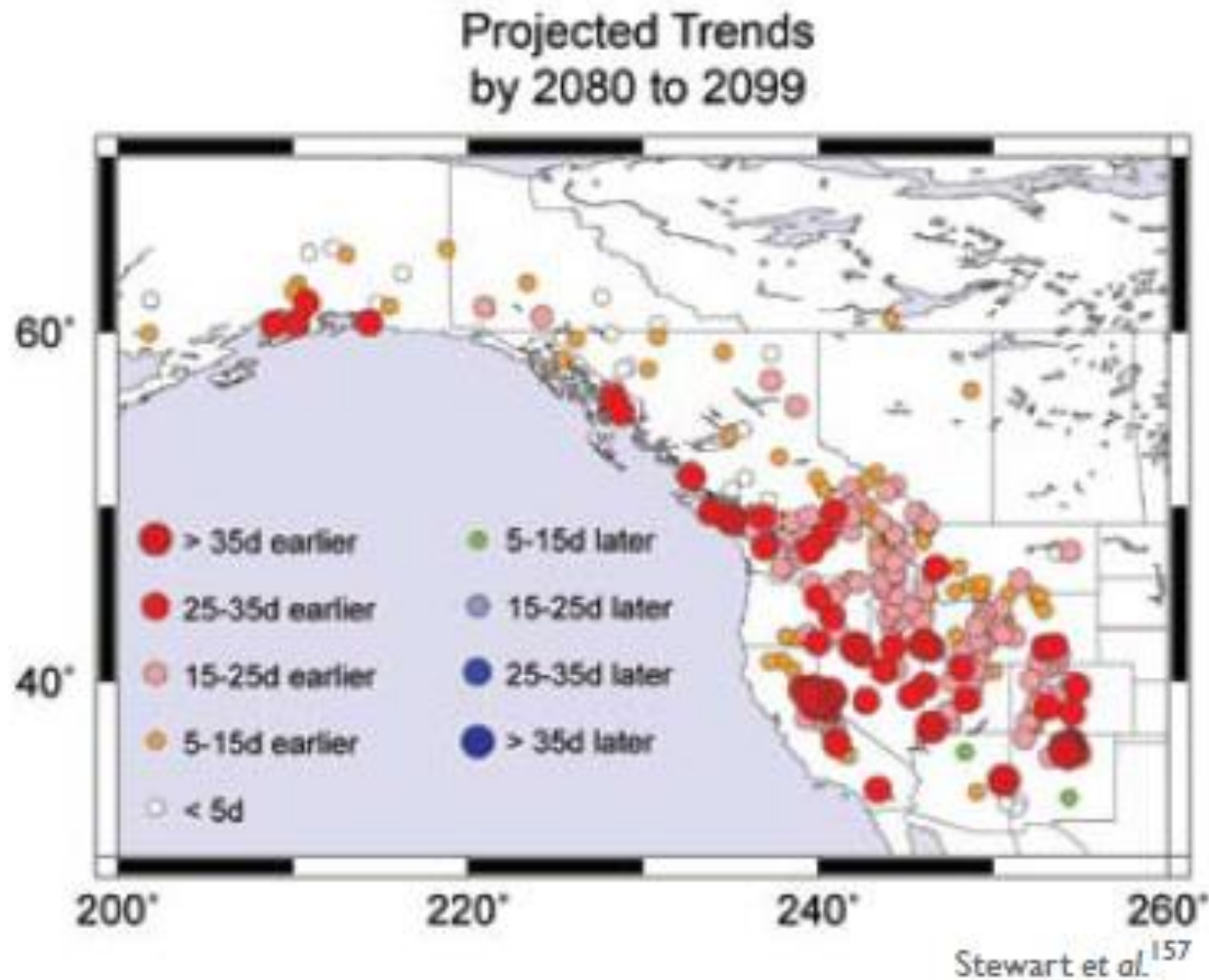
Global Climate Change Impacts in the U.S.

<http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf>

Spring Snowmelt Advance - Critical in West

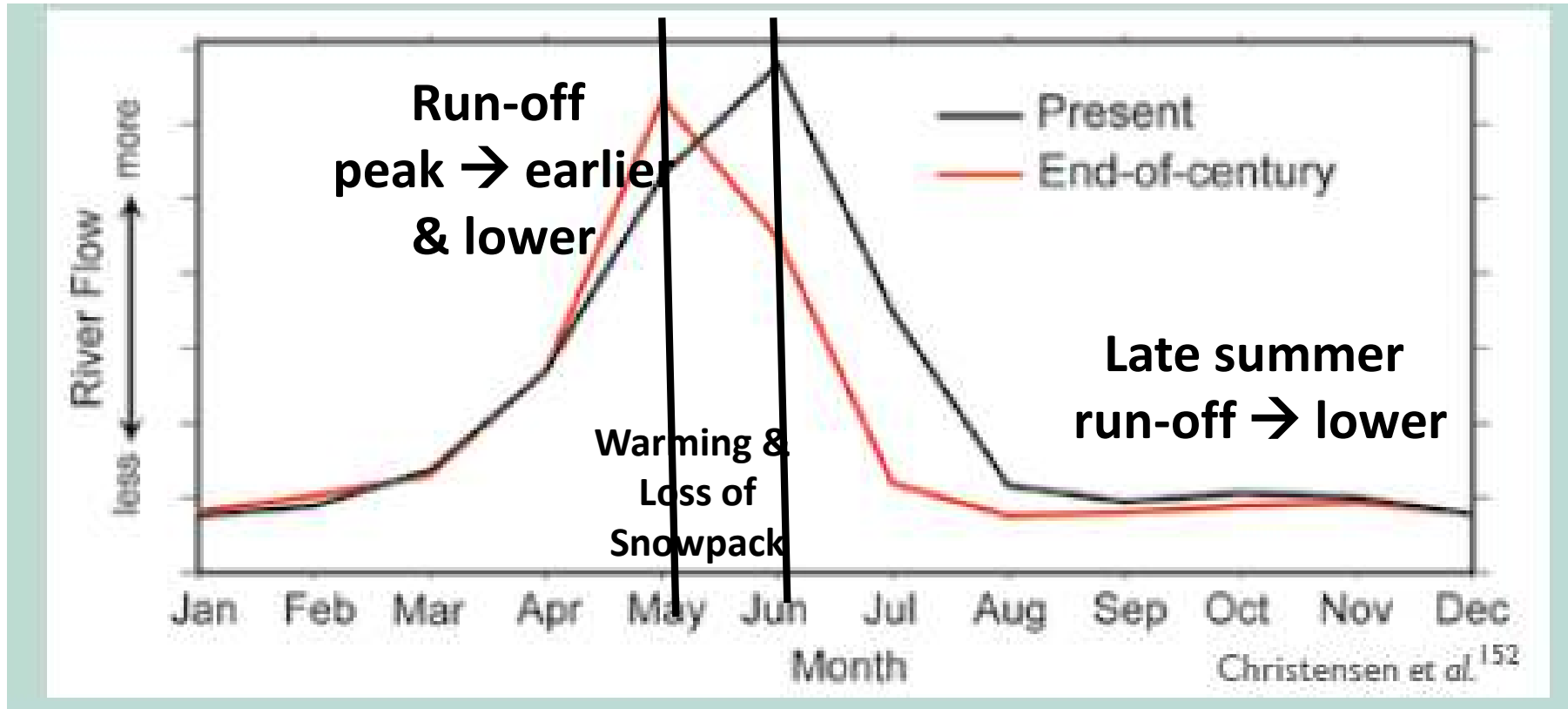


Impact on streams – both peak timing and flow rate



Projected
Stream Flow
Timing in
Western
States

Projected PNW Run-off Timing



Global Climate Change Impacts in the U.S.

<https://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf>

Western Wildfires & Climate Change

0.5°C or < 1°F (March - August) is the difference between a high fire year and a low fire year.

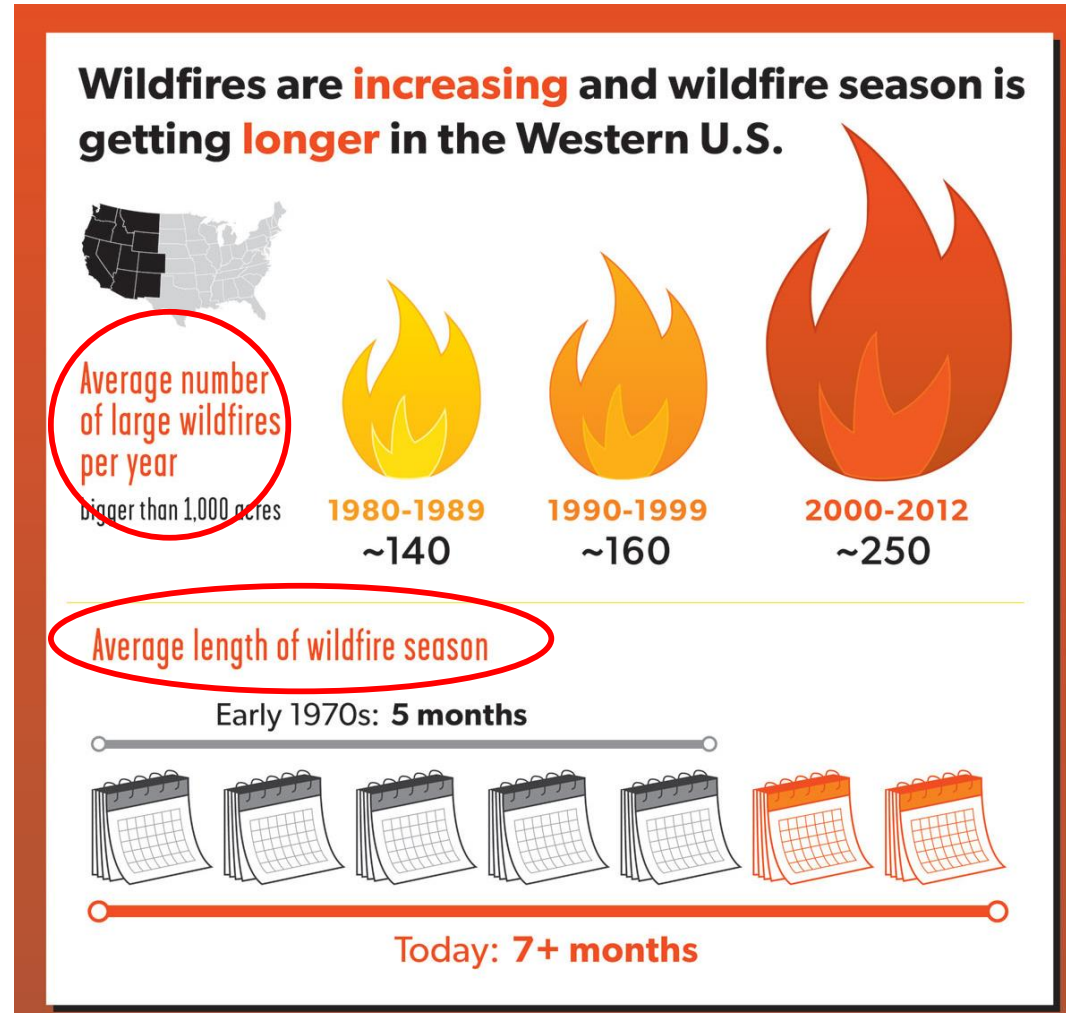
(<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3156206/pdf/pnas.201110199.pdf>)



Forest studies tell us wildfire frequency is high when annual average temperature is high and snowmelt arrives early.

Exactly the historic trends and projections discussed

Western Wildfires & Climate Change



Western Wildfires & Climate Change



General Local Projections

Less Snow Accumulation



Transition from Snow to Rain



Earlier Snow Melt



Flashier Floods in Spring & Winter



Dry Streams in Summer

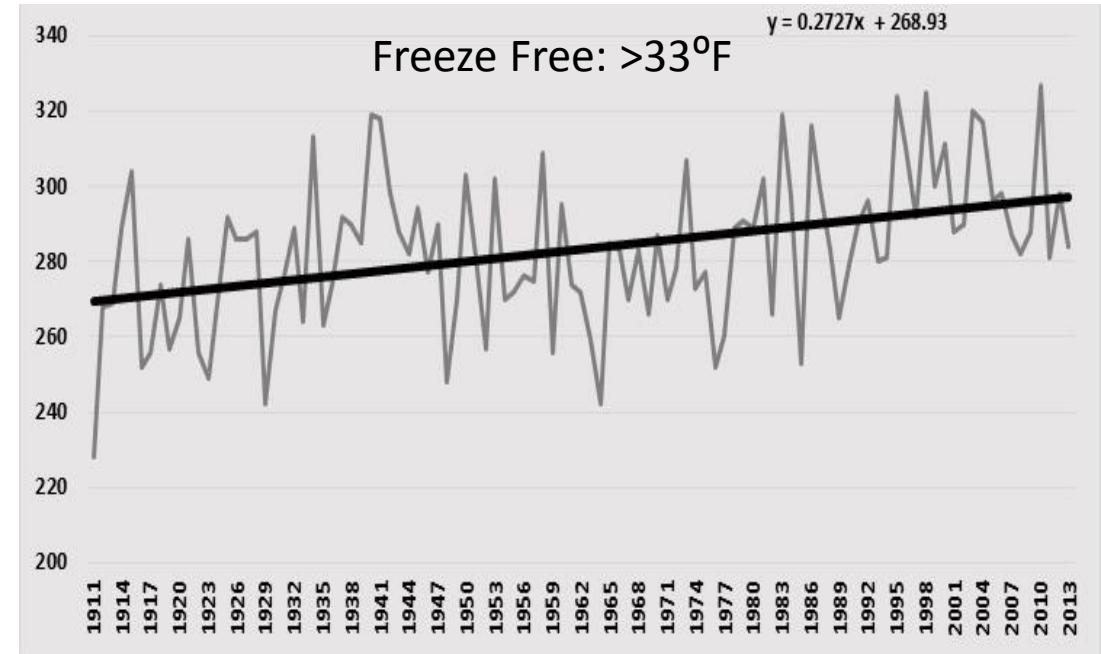
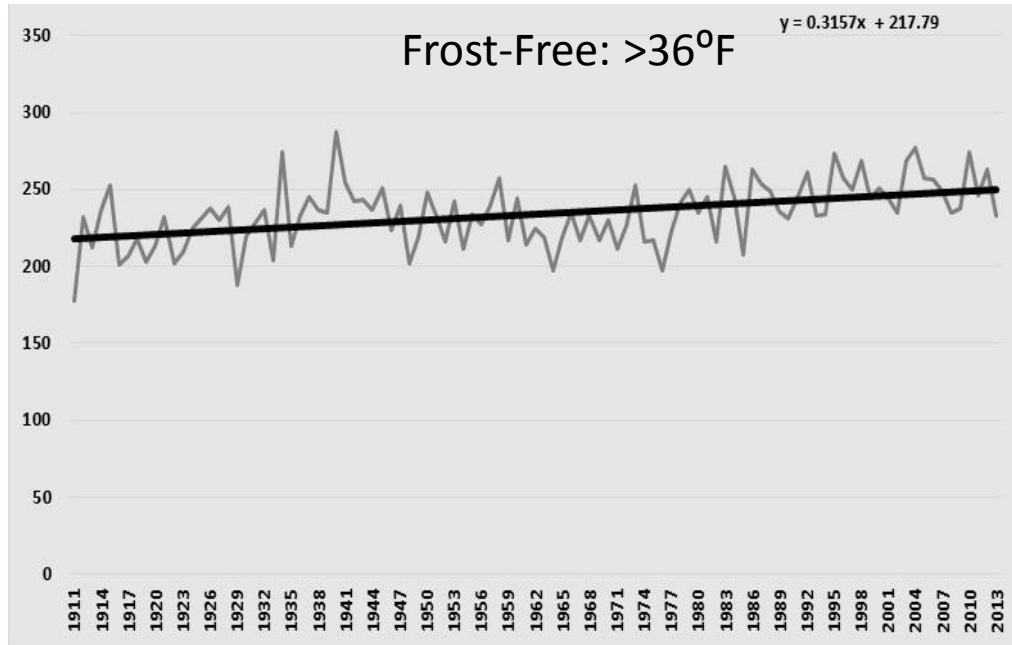


Increased Risk of Wildfires

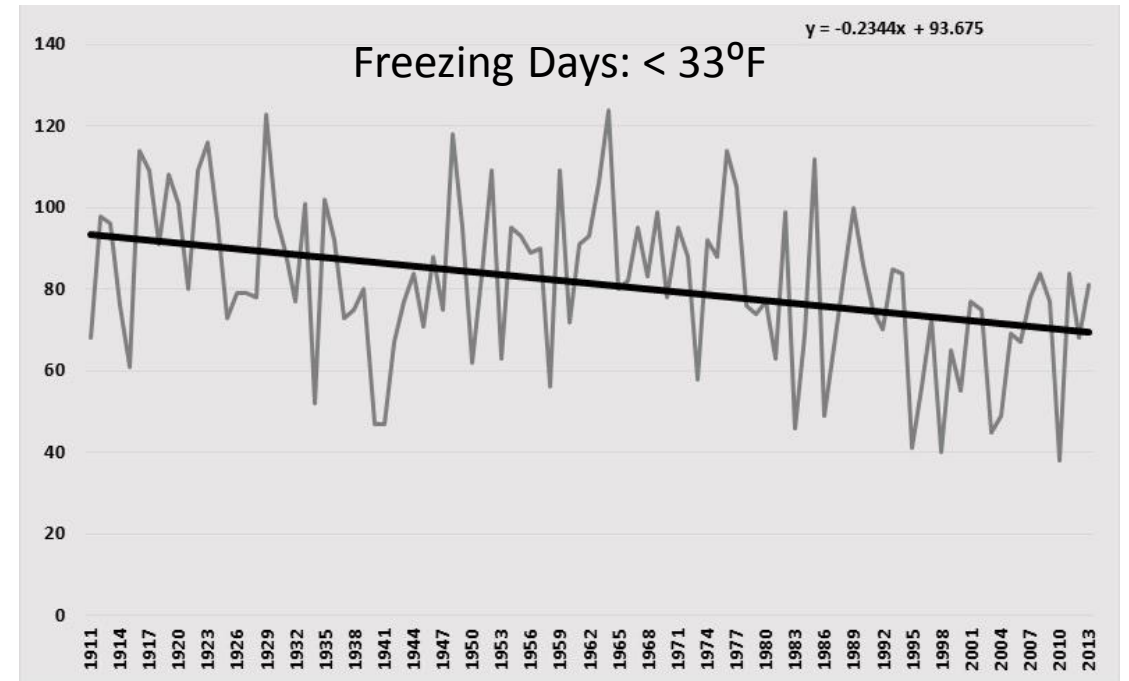
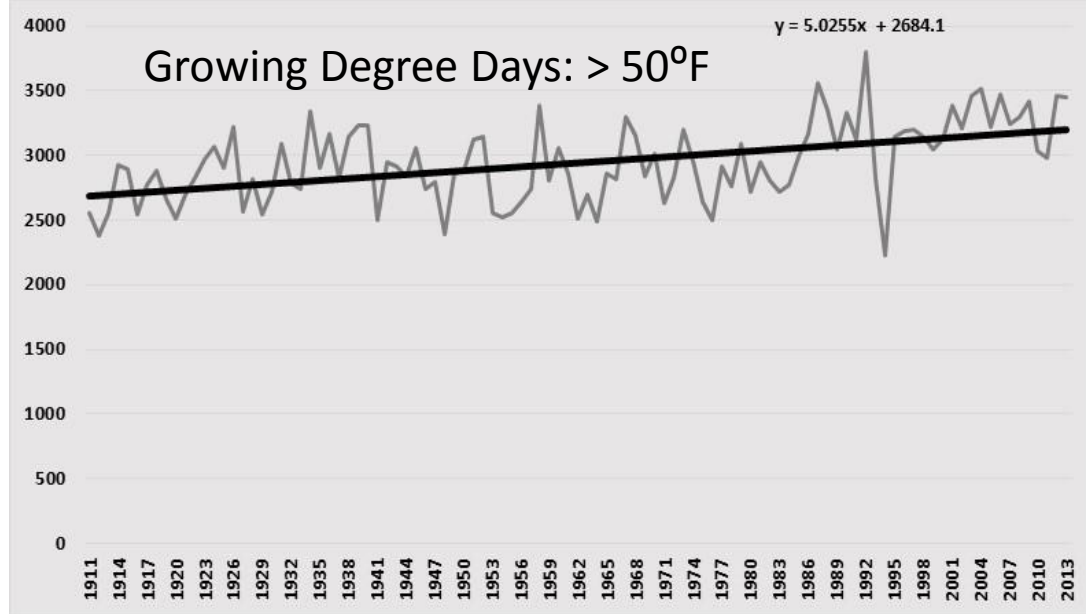


What's happening locally in terms of growing season?

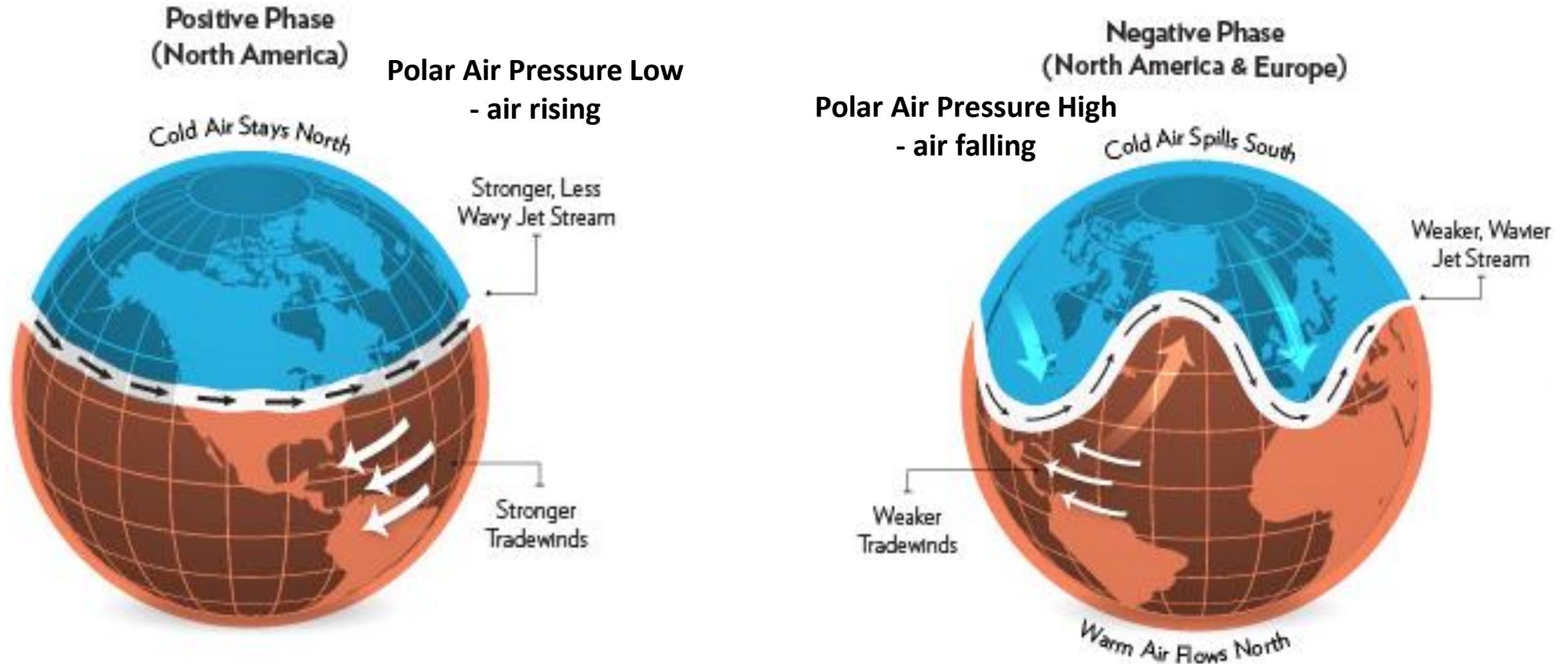
Medford Frost-Free and Freeze Free Days Historic



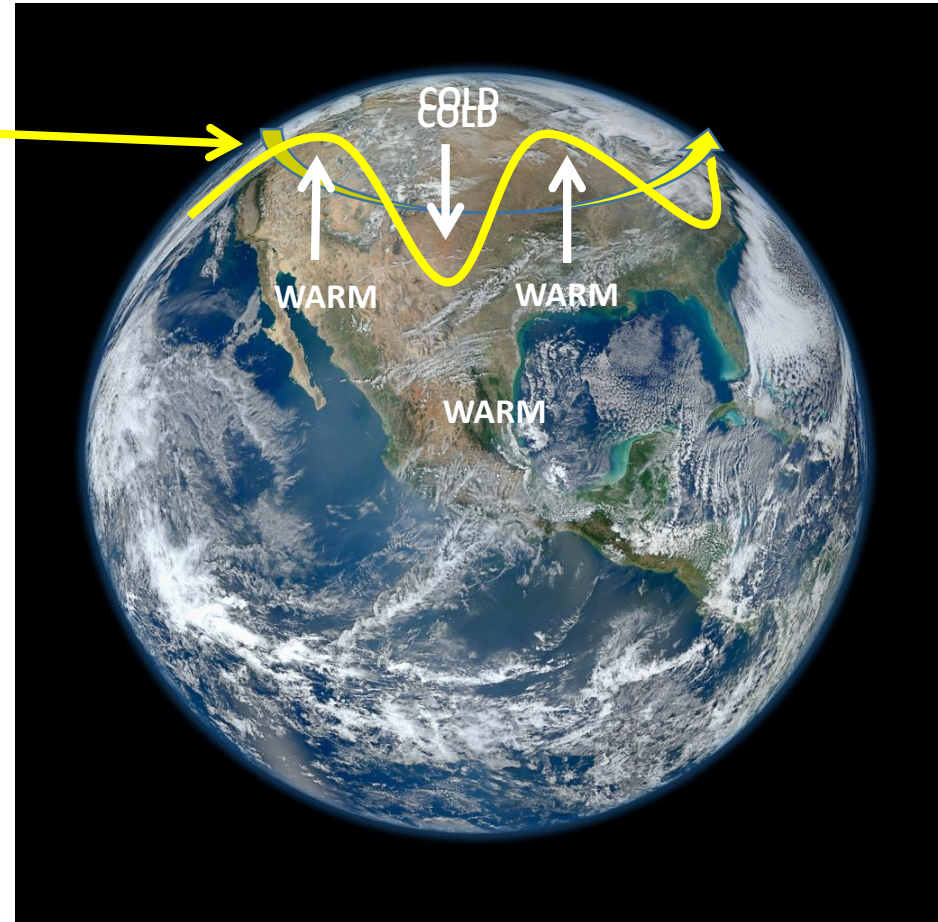
Medford Growing Degree and Freezing Days Historic



Jet Stream and the Arctic Oscillation



Climate Change (Chaos) and the Jet Stream



THE MESSAGES



- 1) Climate change consequences are here and now
- 2) Projections are mainly continuations of current trends
- 3) Unless we choose to address the problem
- 4) Denying the evidence just delays action
- 5) It's about Inter-generational Justice; do we care about the future, or not?

Any Thoughts or Feelings So Far?



ANY COMMENTS OR
QUESTIONS ?????

Biological Consequences



**What incited my concern
about climate change?**

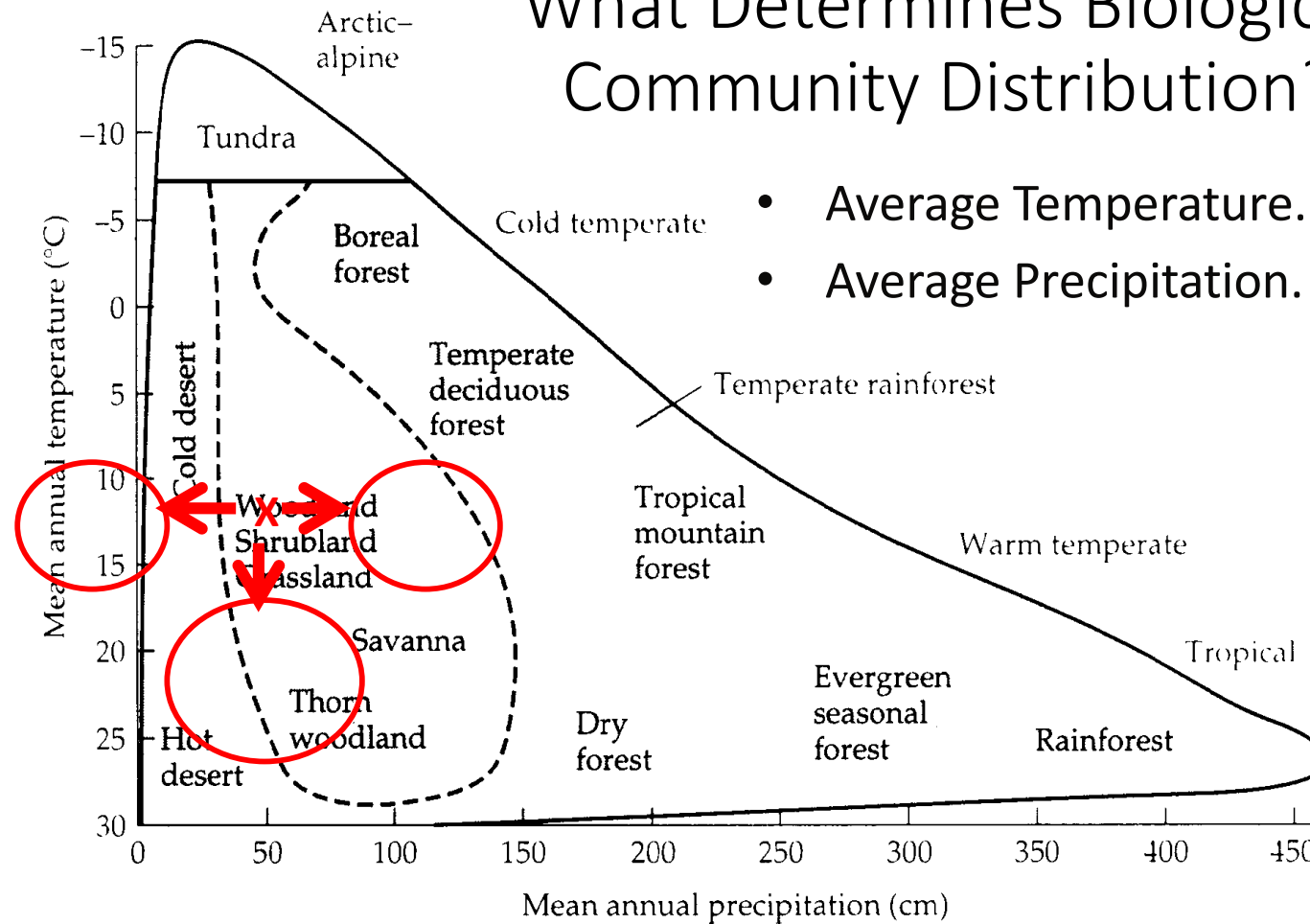


30 years teaching biology at Southeast
Missouri State University:
Mainly ecology, science methods.



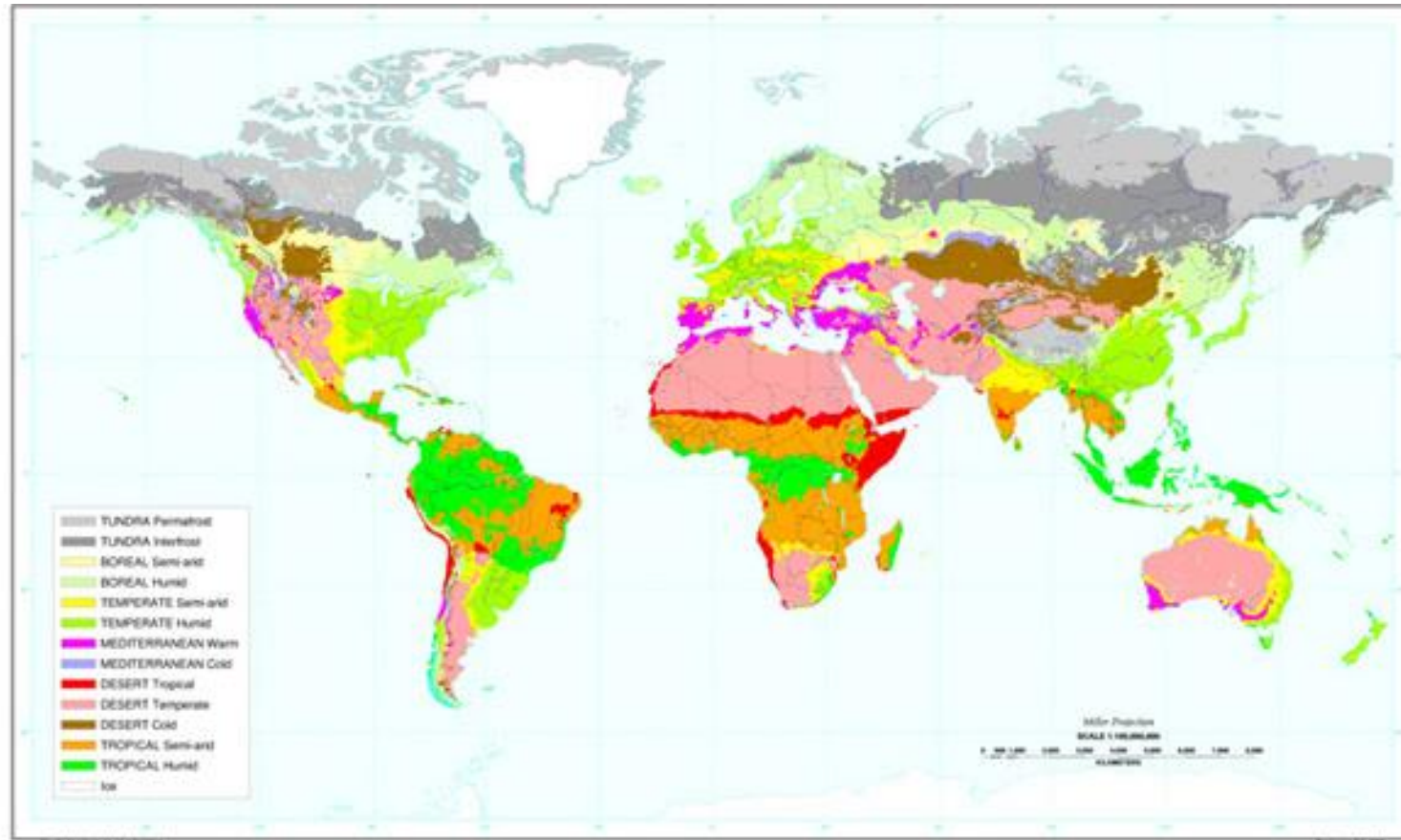
What Determines Biological Community Distribution?

- Average Temperature.
- Average Precipitation.



So What (again)?

MAJOR BIOLOGICAL COMMUNITIES OF THE WORLD



**Not only do these represent where
our flora and fauna live...but**

**These control the agricultural
and forestry potential of our land**

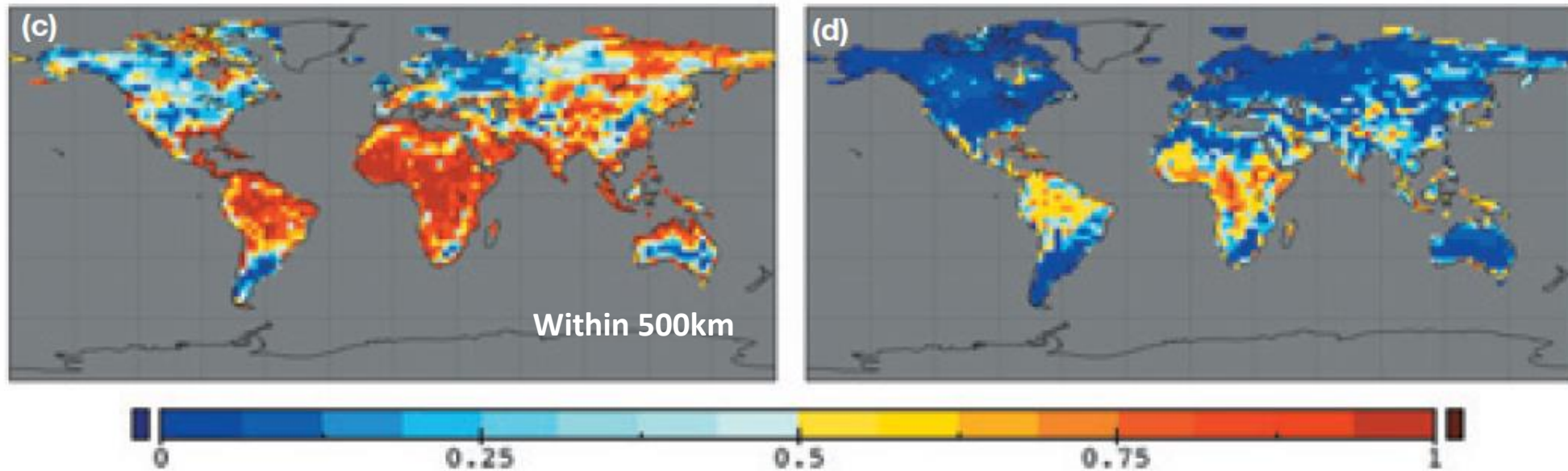
POTENTIAL FUTURE OF CURRENT NATURAL COMMUNITIES

Business as usual CO₂ → 850 ppm

Some redress: CO₂ → 550 ppm

Blue Probability = 1; Red Probability = 0

500-km limit

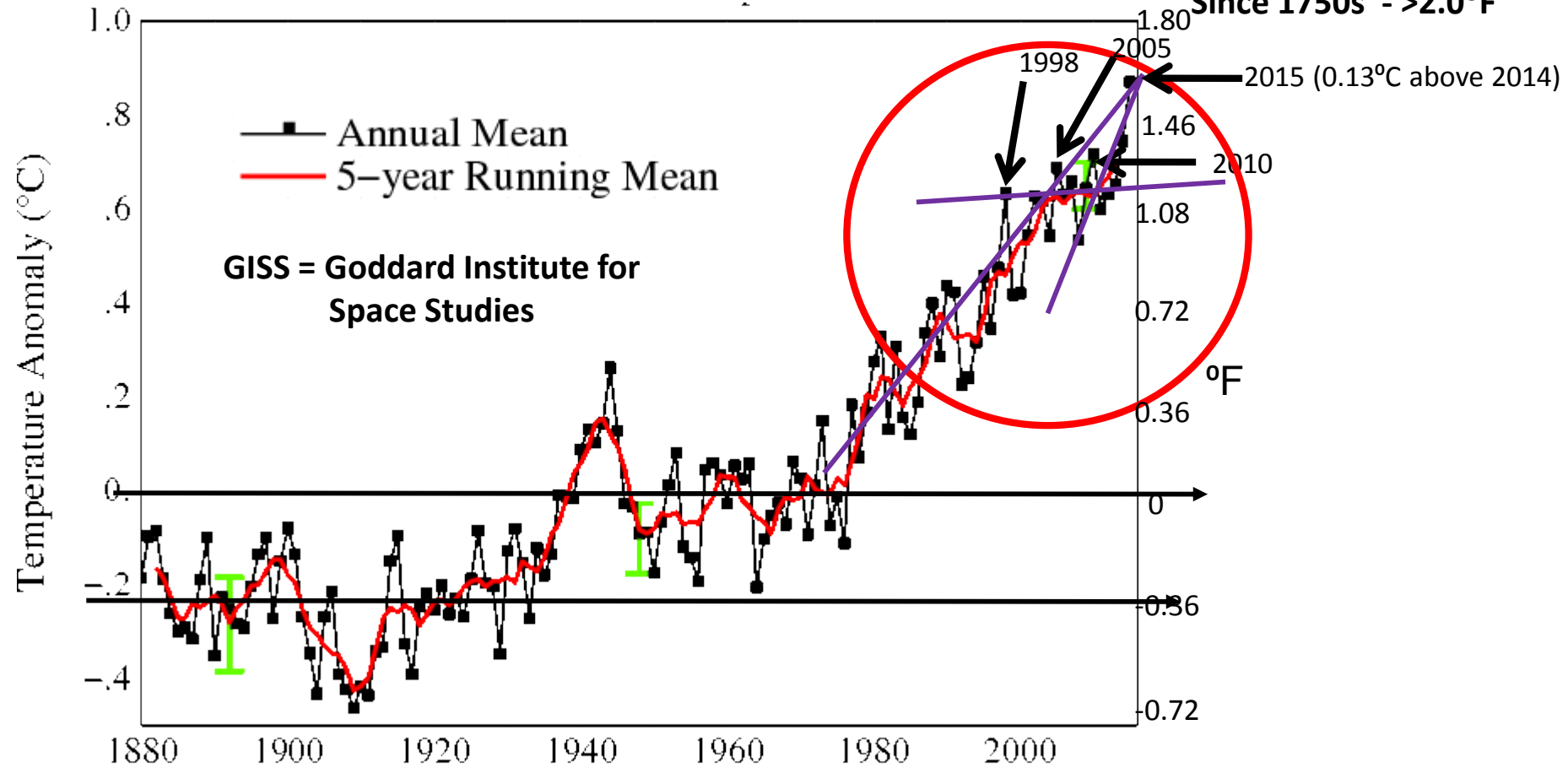


Williams & Jackson 2007: <http://www.frontiersinecology.org/paleoecology/williams.pdf>

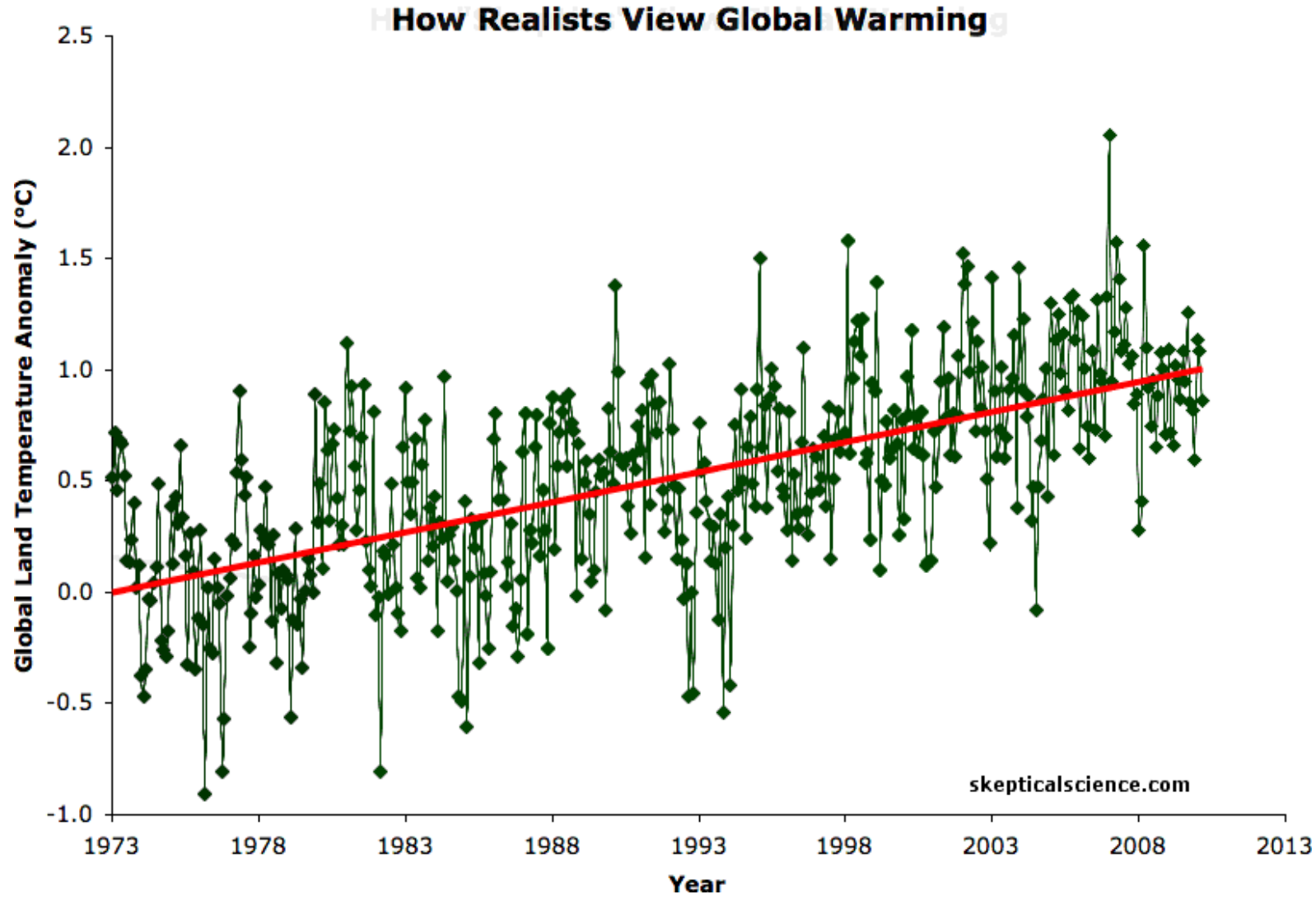
Global Temperatures 1880 – 2015

cf 1951-1980

Since 1970s - 1.3°F
Since 1880s - app. 2.0°F
Since 1750s - >2.0°F

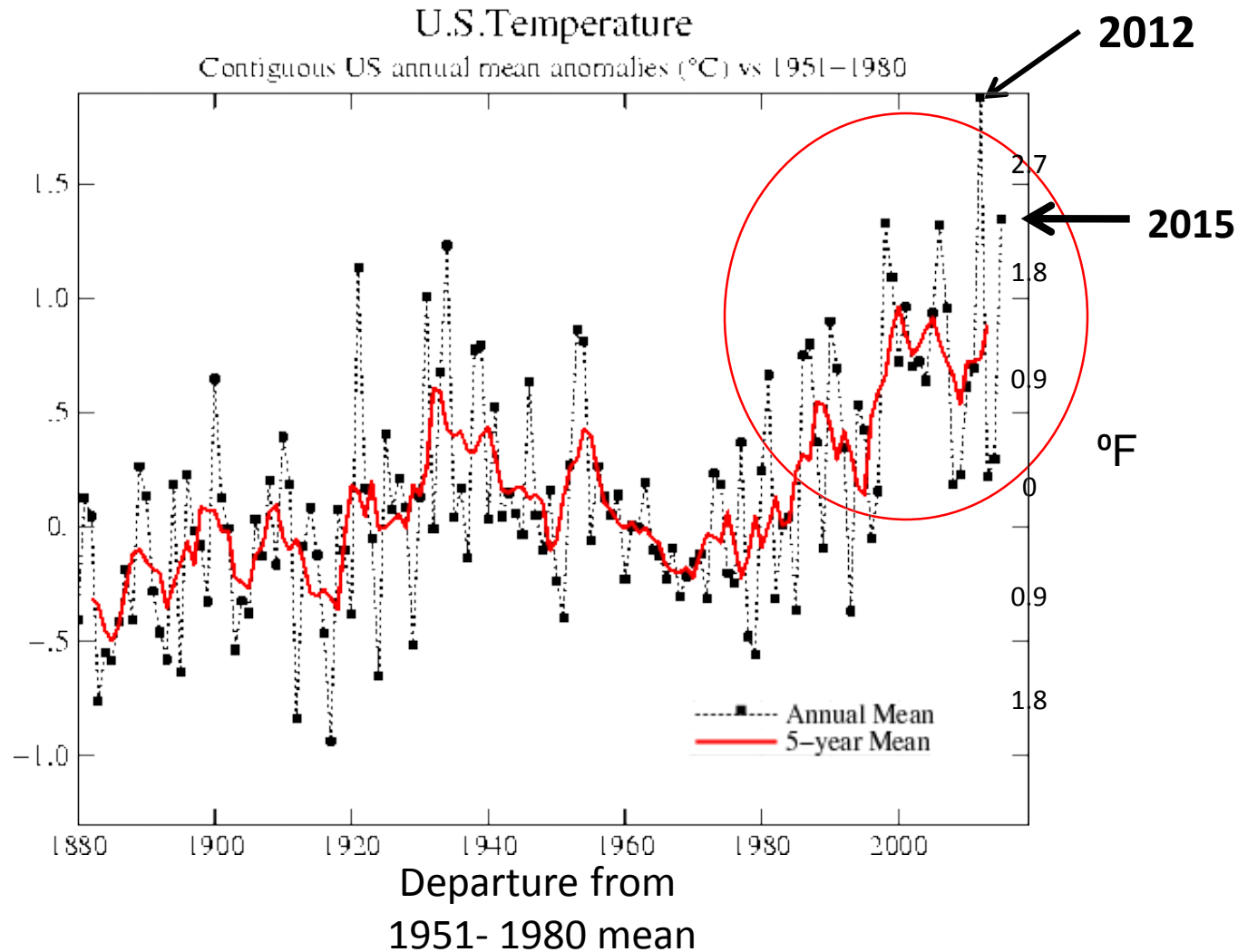


Visions of The Last 40 Years



U.S. Temperatures 1880 – 2015

Goddard Institute for Space Studies



Future Temperature Range (Beyond 2100)

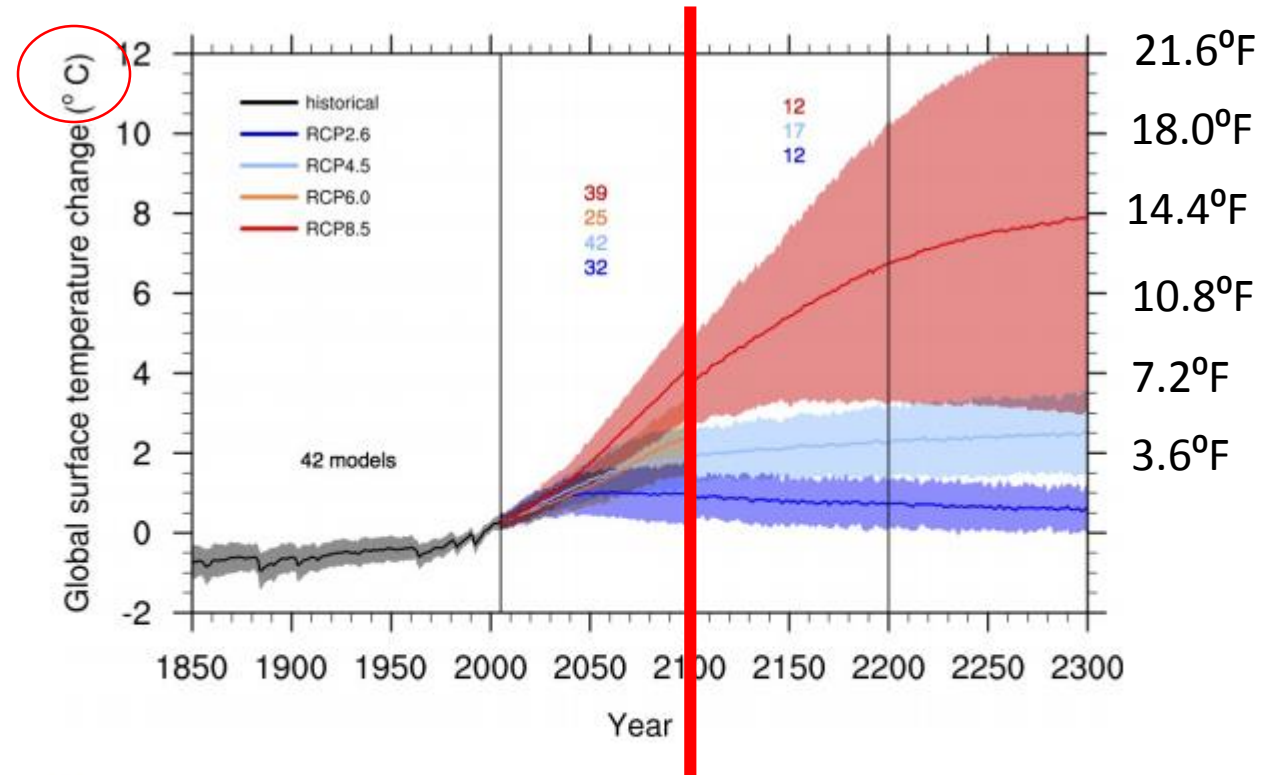


Figure 12.5: Time series of global annual mean surface air temperature anomalies (relative to 1986–2005) from CMIP5 concentration-driven experiments. Projections are shown for each RCP for the multi model mean (solid lines) and the 5–95% range (± 1.64 standard deviation) across the distribution of individual models (shading). Discontinuities at 2100 are due to different numbers of models performing the extension runs beyond the 21st century and have no physical meaning. Only one ensemble member is used from each model and numbers in the figure indicate the number of different models contributing to the different time periods. No ranges are given for the RCP6.0 projections beyond 2100 as only two models are available.

Managing the Unavoidable (Adaptation)

Managing ourselves and our environment in ways that minimize the threats posed;

Preparing ourselves and natural systems to withstand climate changes that are unavoidable and which we cannot minimize.

But this is not enough.....

Avoiding the Unmanageable (Mitigation)

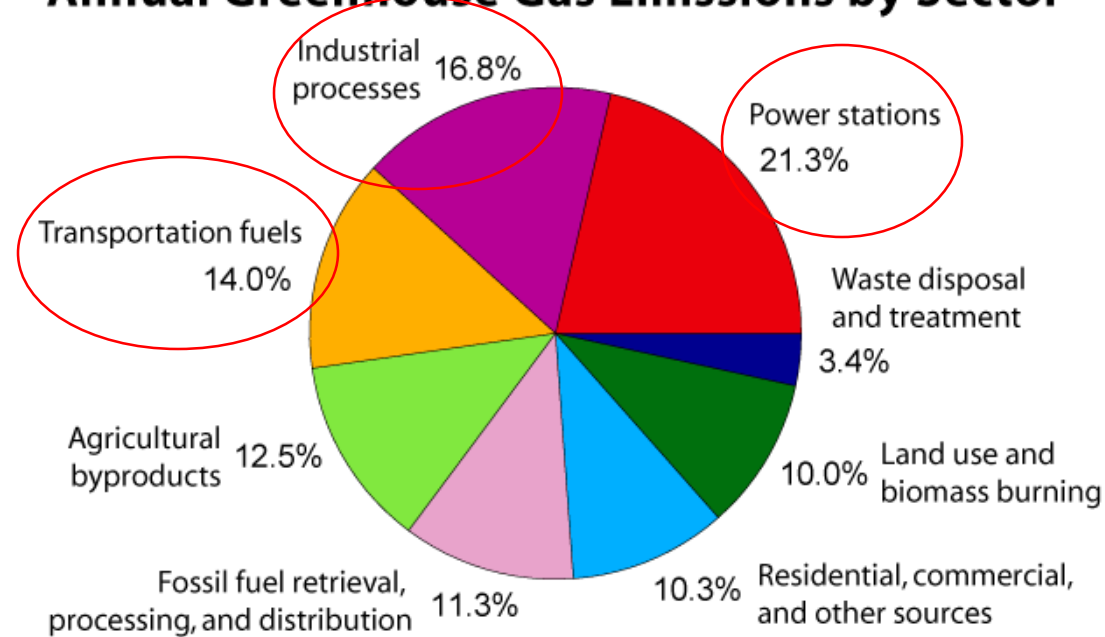
Reducing the release of greenhouse gases into our atmosphere.

Bierbaum, R and J. Holdren, JP, MacCracken, M, Moss RH, Raven PH. 2007 Confronting climate change: Avoiding the unmanageable and managing the unavoidable. <http://www.sigmaxi.org/about/news/UNSEGonline.pdf>

- Greenhouse gases released by human activity:
- Carbon dioxide, methane, oxides of nitrogen.

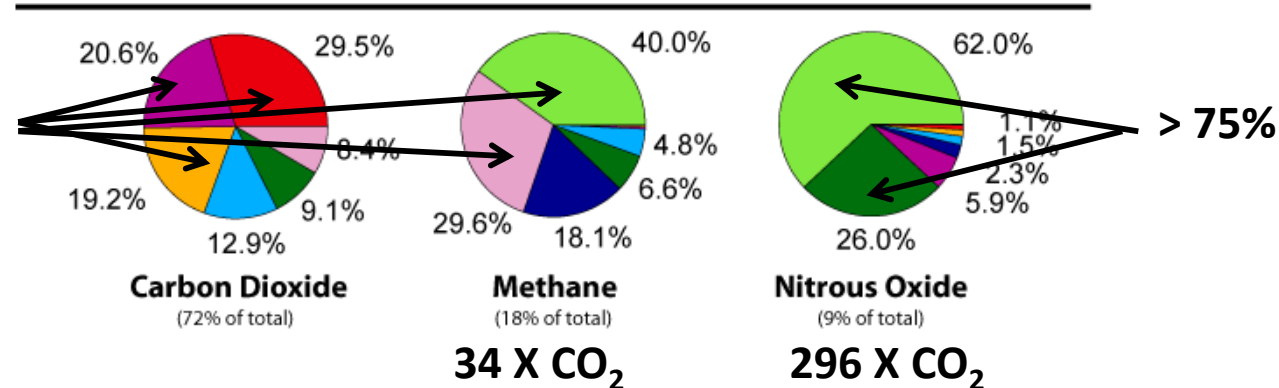
The Problem?

Annual Greenhouse Gas Emissions by Sector



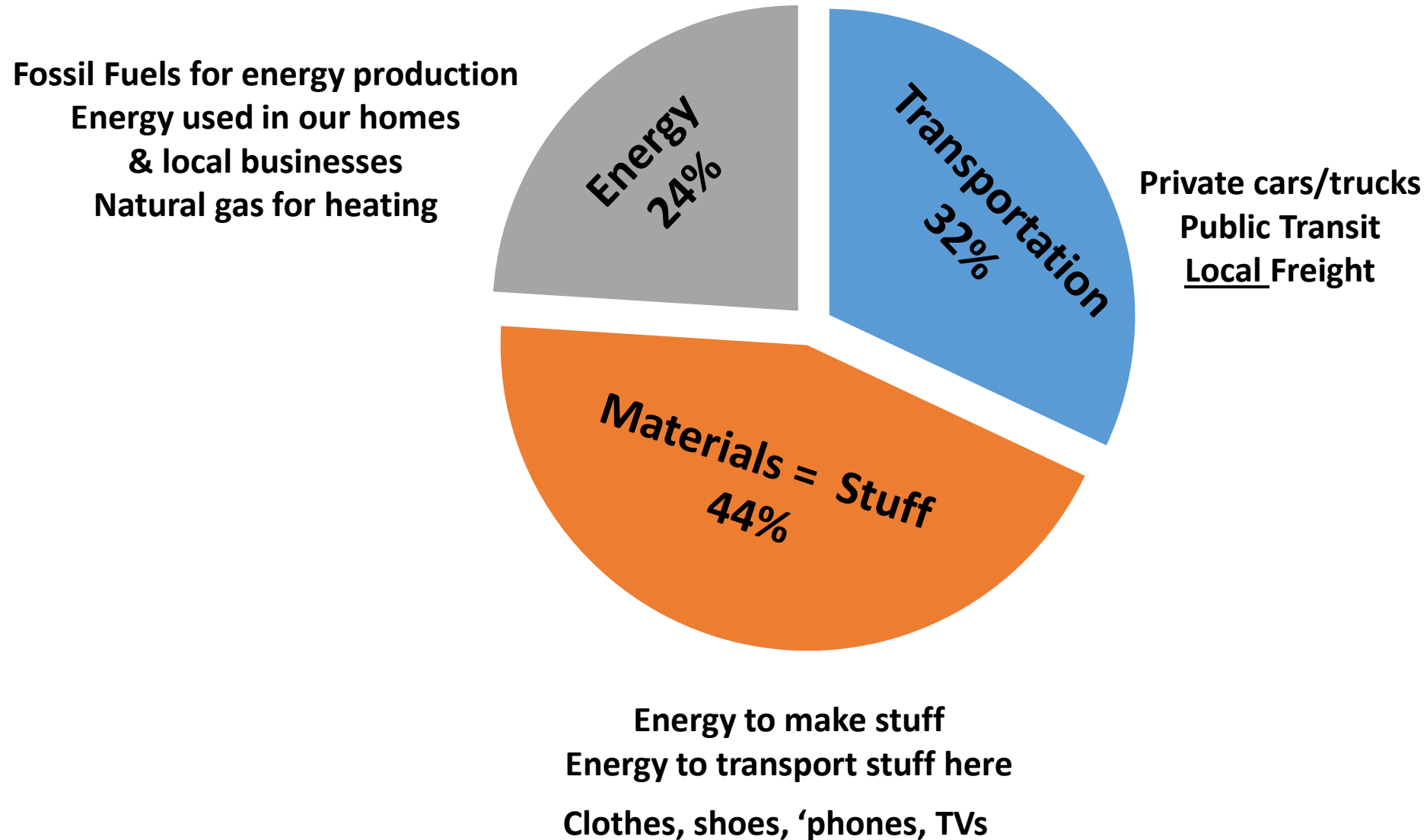
BUT

Approximately 75%



http://en.wikipedia.org/wiki/Greenhouse_gas

Rogue Valley: Use of These Fuels

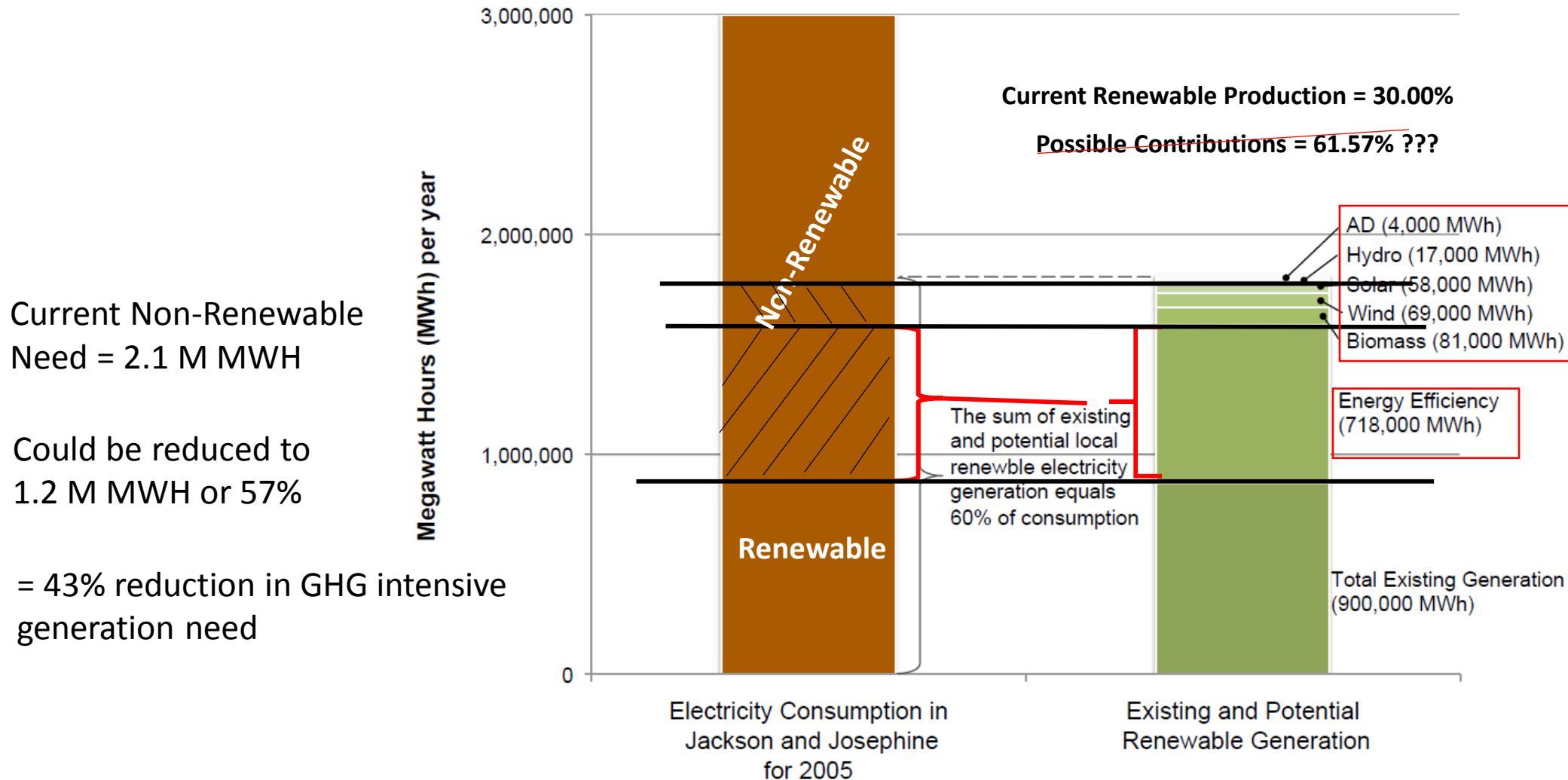


Areas To Address Individually

- Energy Consumption
 - Transportation
 - Stuff

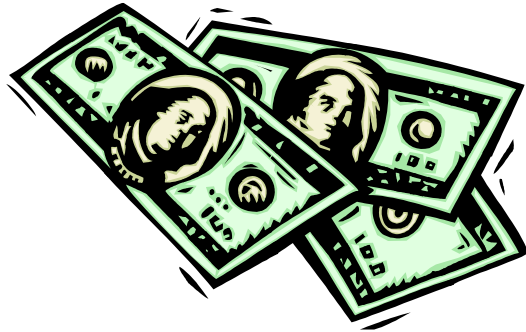
Projected Regional Electrical Energy Solutions

Figure ES-1: Summary of renewable energy technologies, by feasibility criteria.



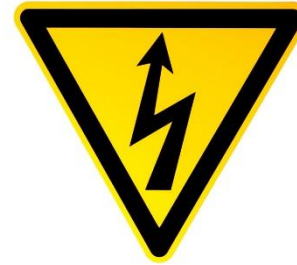
We Have Choices! Individually & Collectively

Back in the Day...

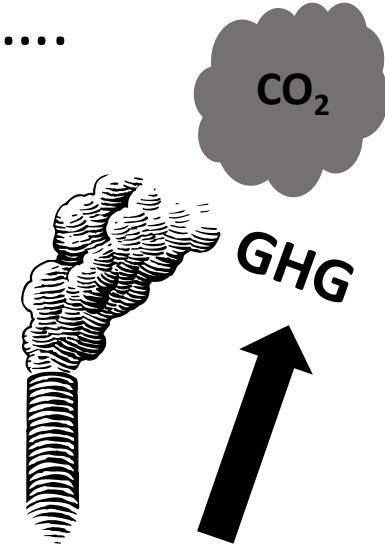


Money inflows
& outflows

Now....



Energy
Accounting



Carbon
Accounting



Hopium



ANY COMMENTS OR
QUESTIONS ?????