

Where in the West?

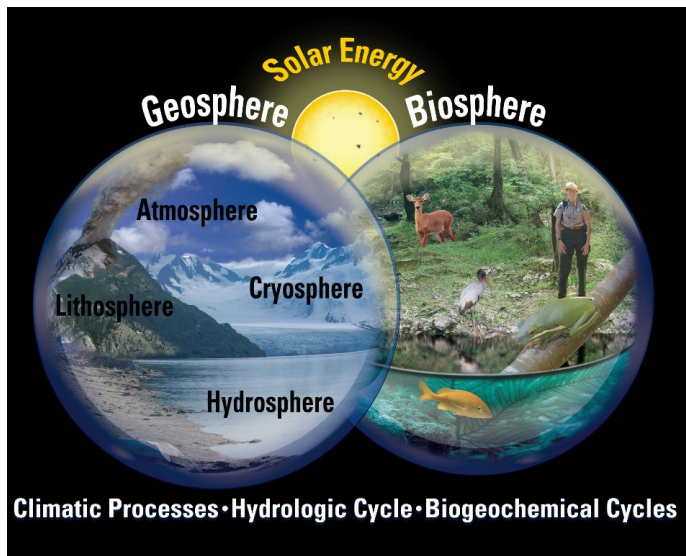
A geographer's perspective on climate change and occupational hazards in the Western States.

Teri Jacobs, Geographer
ORISE Research Participant, CDC NIOSH
WestON, Denver, Colorado Sept. 29-30, 2016





Why is a geographer's perspective important to occupational health? From Space to Place... "where" matters!

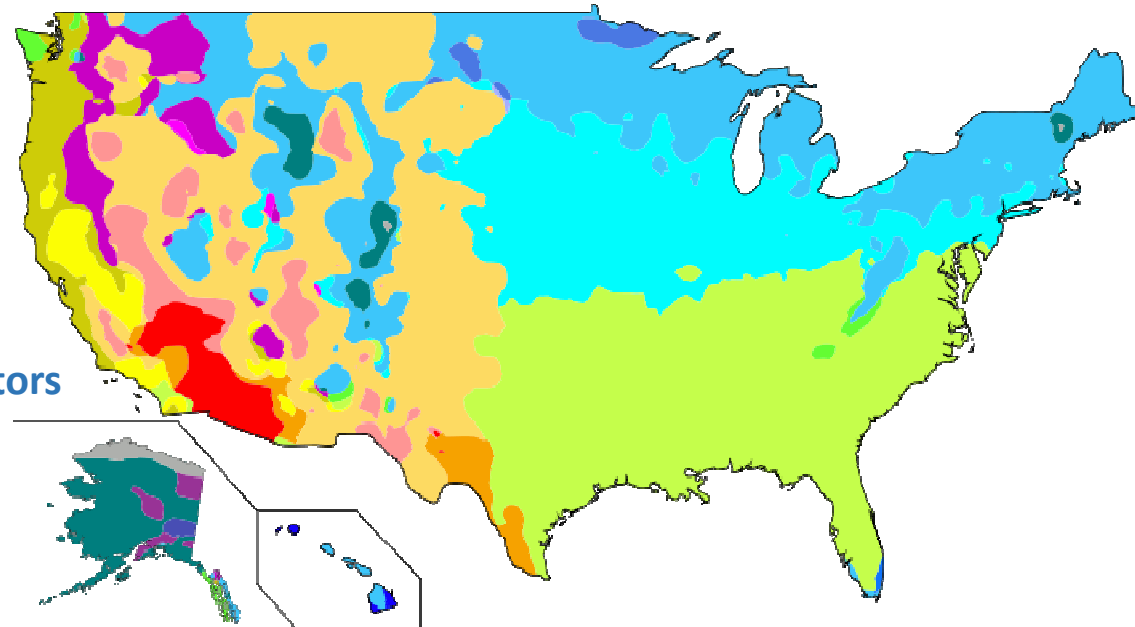


No two places have exactly the same climate.

United States map of Köppen climate classification

- Latitude
- Altitude
- Wind patterns
- Ocean currents
- Nearby water bodies
- Topography
- Vegetation
- Human land use/activity*

Climate Factors



- | | | |
|---|---|---|
| <ul style="list-style-type: none"> ■ Warm desert climate (BWh) ■ Warm semi-arid climate (BSh) ■ Cold desert climate (BWk) ■ Cold semi-arid climate (BSk) ■ Warm mediterranean climate (Csa) ■ Temperate mediterranean climate (Csb) ■ Warm oceanic climate/ Humid subtropical climate (Cfa) ■ Temperate oceanic climate (Cfb) | <ul style="list-style-type: none"> ■ Warm continental climate/ Humid continental climate (Dfa) ■ Temperate continental climate/ Humid continental climate (Dfb) ■ Cool continental climate/ Subarctic climate (Dfc) ■ Warm continental climate/ Humid continental climate (Dwa) ■ Temperate continental climate/ Humid continental climate (Dwb) | <ul style="list-style-type: none"> ■ Cool continental climate/ Subarctic climate (Dwc) ■ Warm continental climate/ Mediterranean continental climate (Dsa) ■ Temperate continental climate/ Mediterranean continental climate (Dsb) ■ Tundra climate (ET) |
|---|---|---|

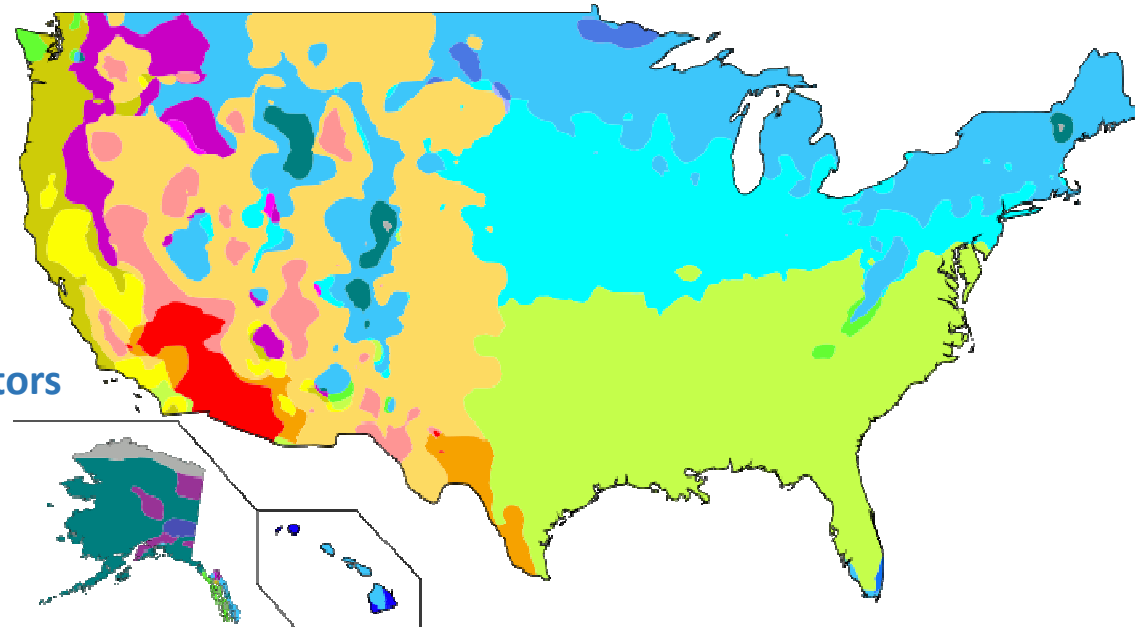
* Since agriculture began

Variations in Factors = Variations in Climate

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Climate Factors

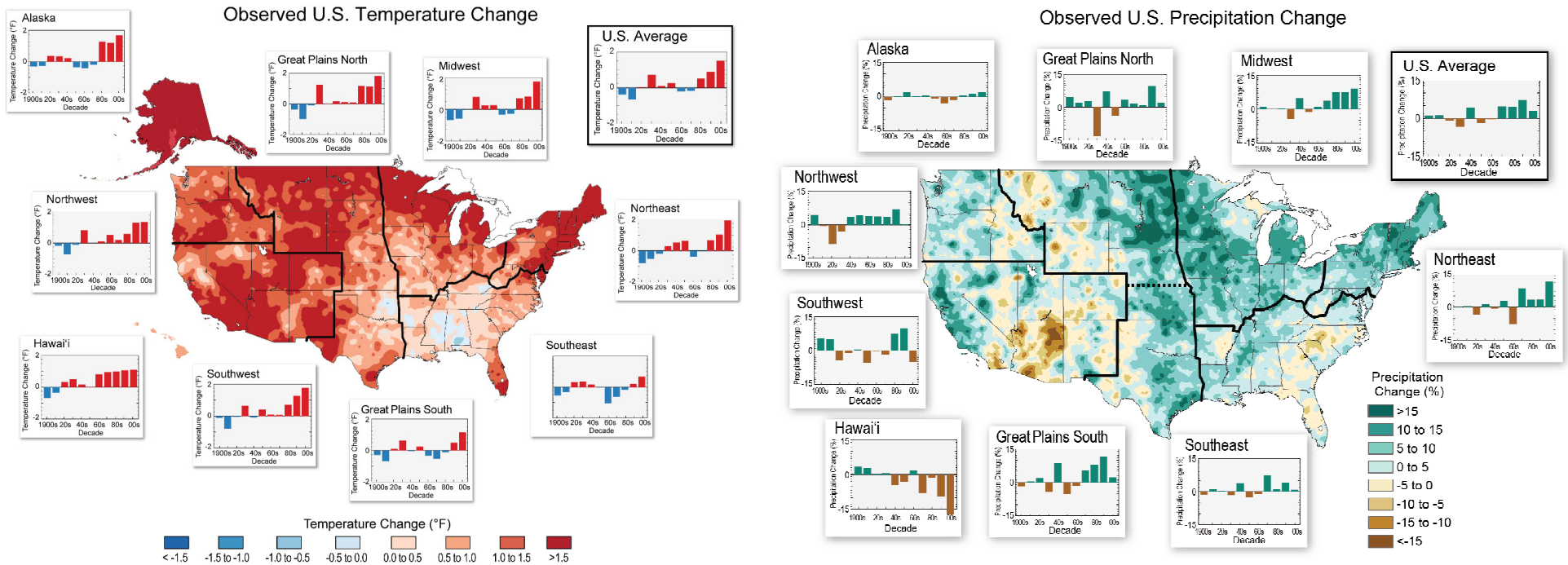


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* Since agriculture began



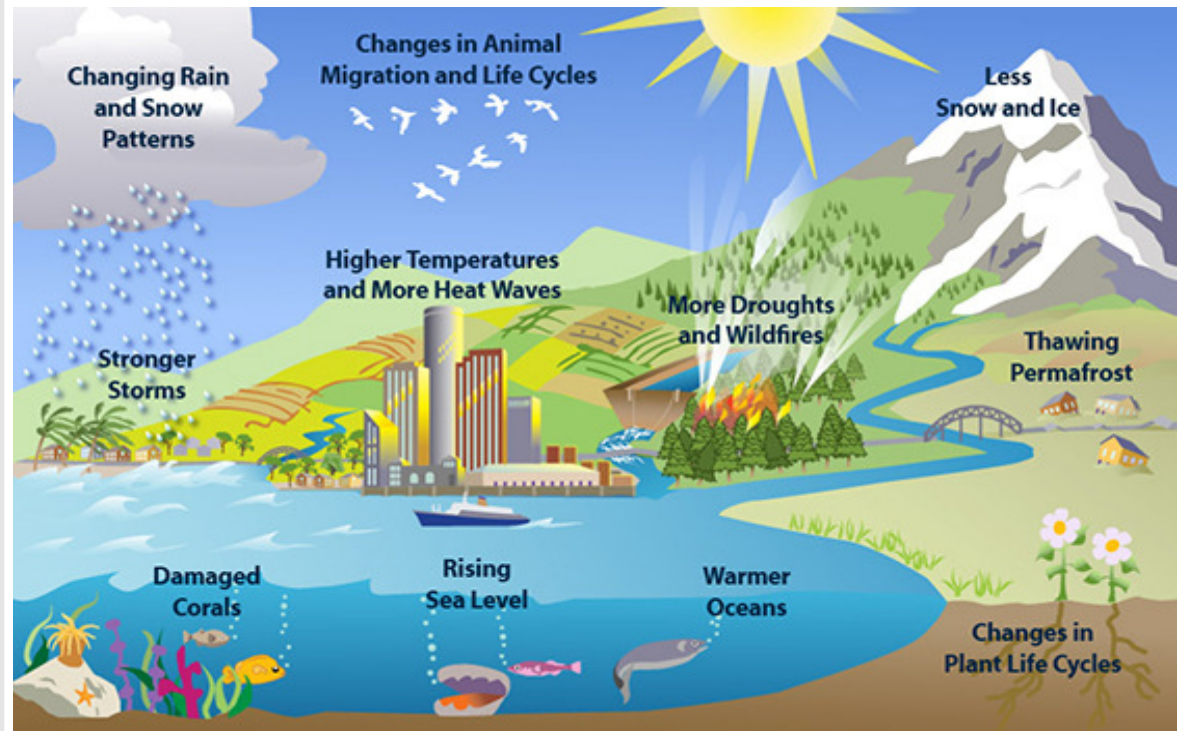
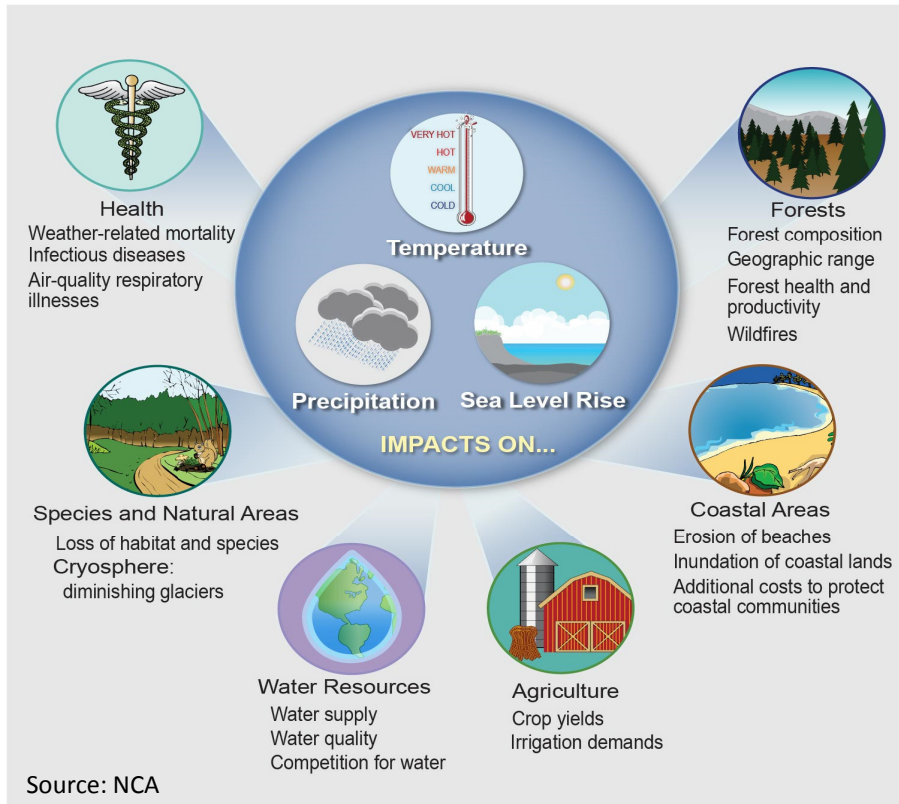
No two places will experience exactly the same climatic changes.



Source: NOAA NCDC/CICS-NC. Temperatures and precipitation changes from 1991-2012

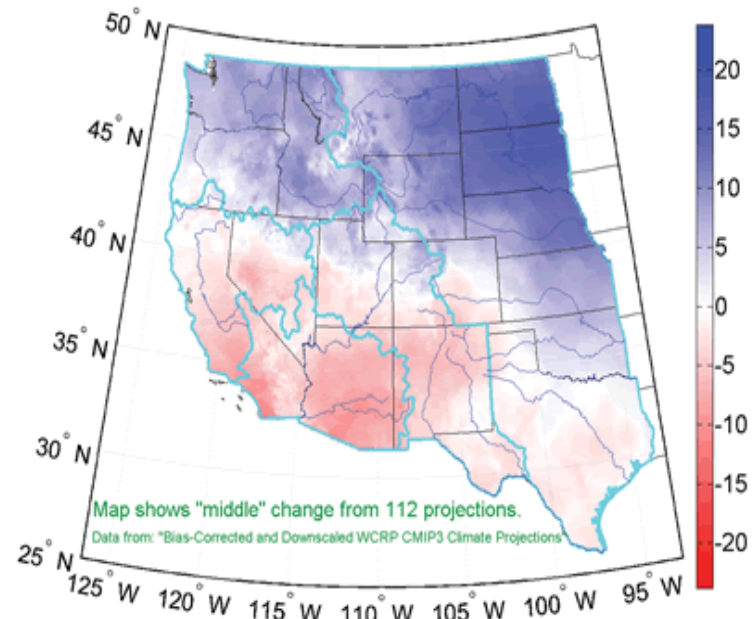
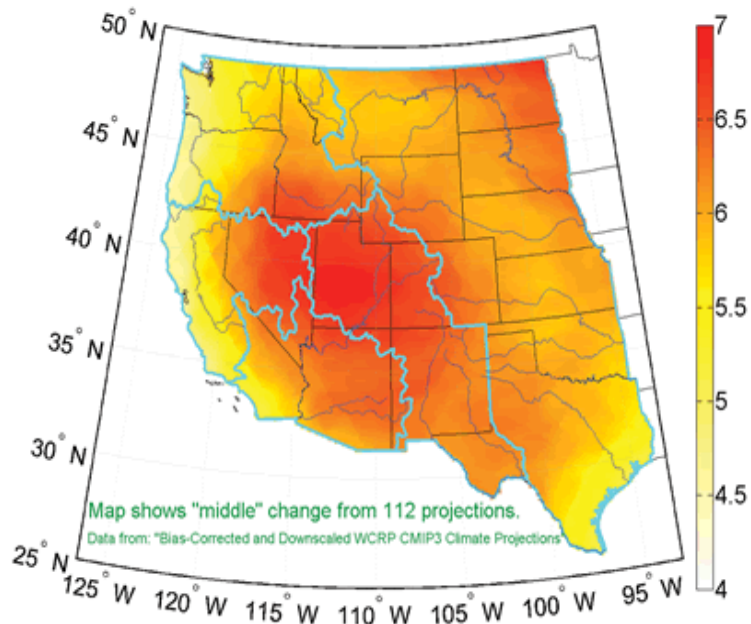


Potential Effects of Climate Change





Future Temperature and Precipitation Changes....Where in the West?

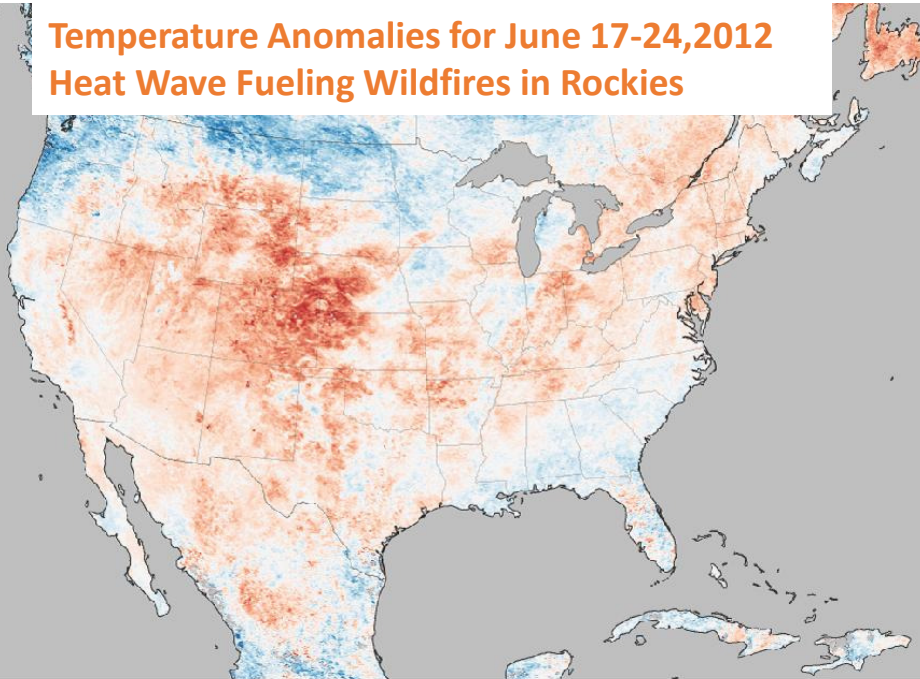


Source: Bureau of Reclamation <http://www.usbr.gov/research/climate/abstracts/downscaling.html>



Heatwaves...Where in the West??

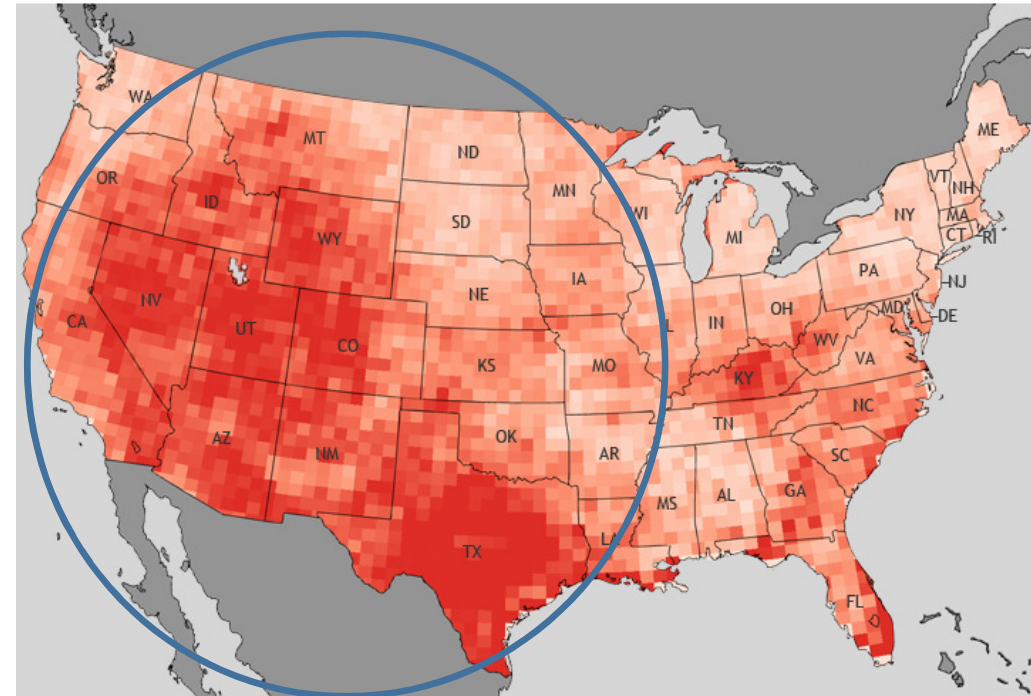
Temperature Anomalies for June 17-24, 2012
Heat Wave Fueling Wildfires in Rockies



Land Surface Temperature Anomaly (°C)
-12 0 12

Source: NASA

Increase in heatwave duration

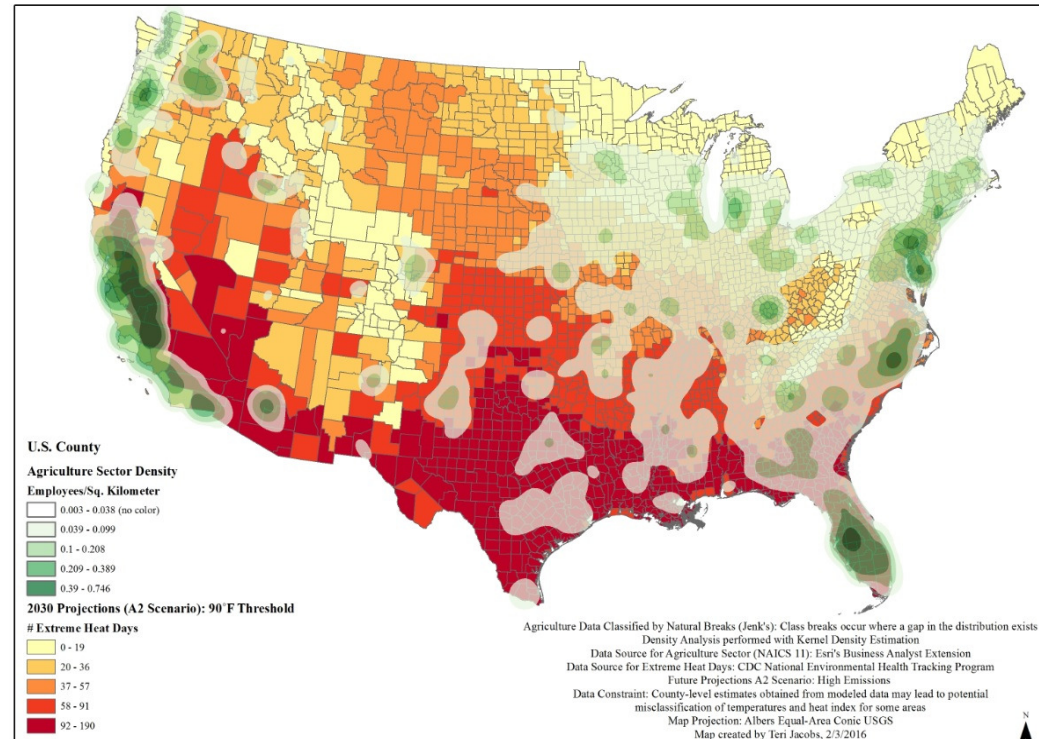
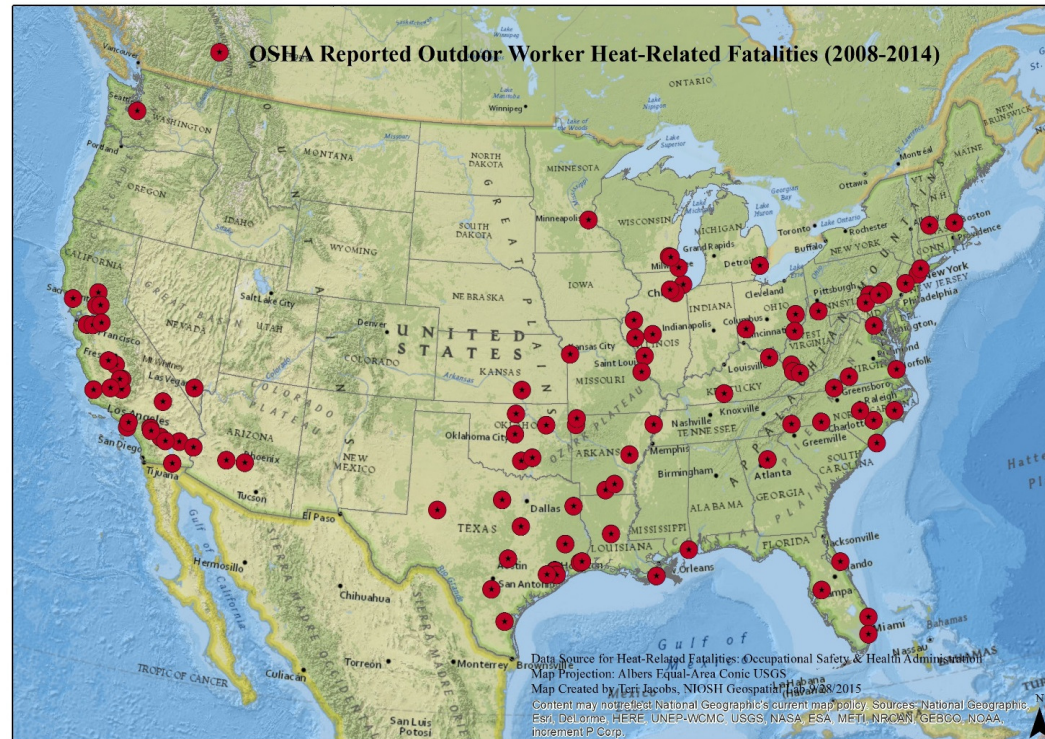


Factor of increase (2040-2070 vs. 1970-2000)
1 2+

Source: NOAA



Workers at Risk for Heat Stress...Where in the West??

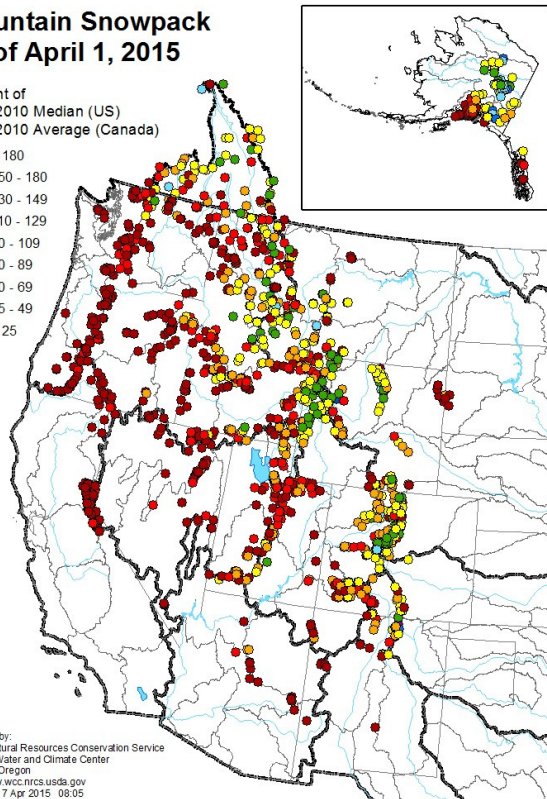




Mountain Snowpack as of April 1, 2015

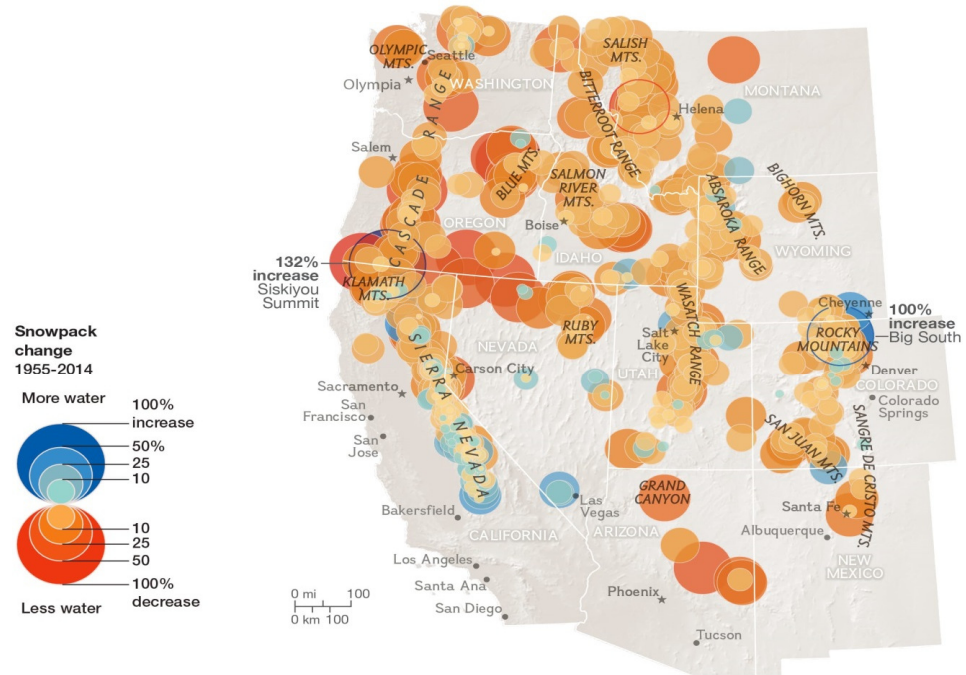
Percent of
1981-2010 Median (US)
1981-2010 Average (Canada)

- > 180
- 150 - 180
- 130 - 149
- 110 - 129
- 90 - 109
- 70 - 89
- 50 - 69
- 25 - 49
- < 25



Prepared by:
USDA Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
<http://www.wcc.nrcs.usda.gov>
Created: 7 Apr 2015 08:05

Snowpack Changes...Where in the West??



Snowpack change 1955-2014

More water increase

100%
50%
25
10

10
25
50
100% decrease

Less water decrease

VIRGINIA W. MASON AND KELSEY NOWAKOWSKI, NGM STAFF. SOURCES: NATURAL RESOURCES CONSERVATION SERVICE; CALIFORNIA DEPARTMENT OF WATER RESOURCES; DARRIN SHARP AND PHILIP MOTE, OREGON STATE UNIVERSITY



Reduced Snowpack



Western Precipitation

When? Winter

Where? Mountains



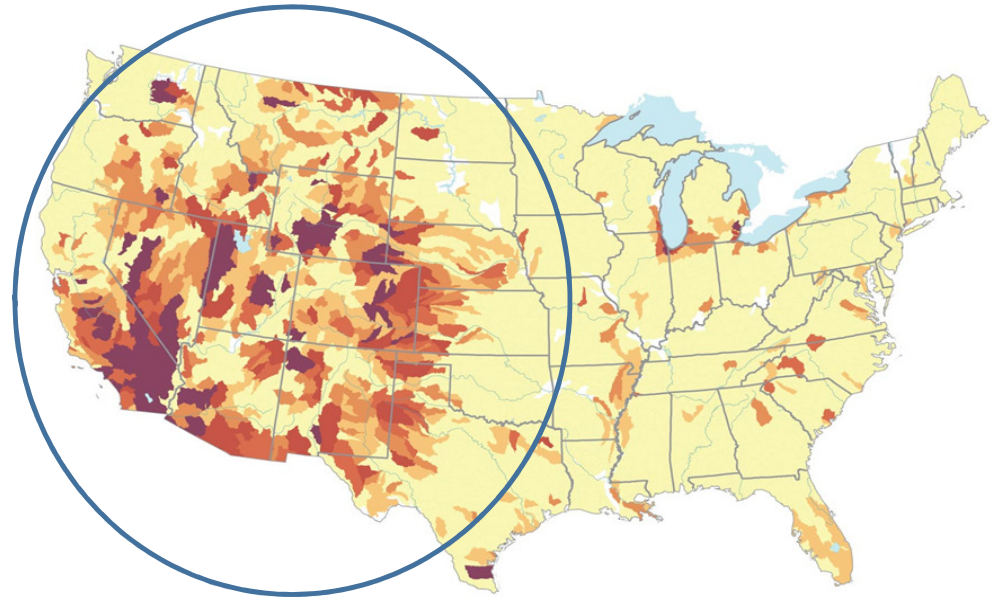
Water Vulnerability

When? Summer

Where? Lowlands



Water Stress in the U.S.

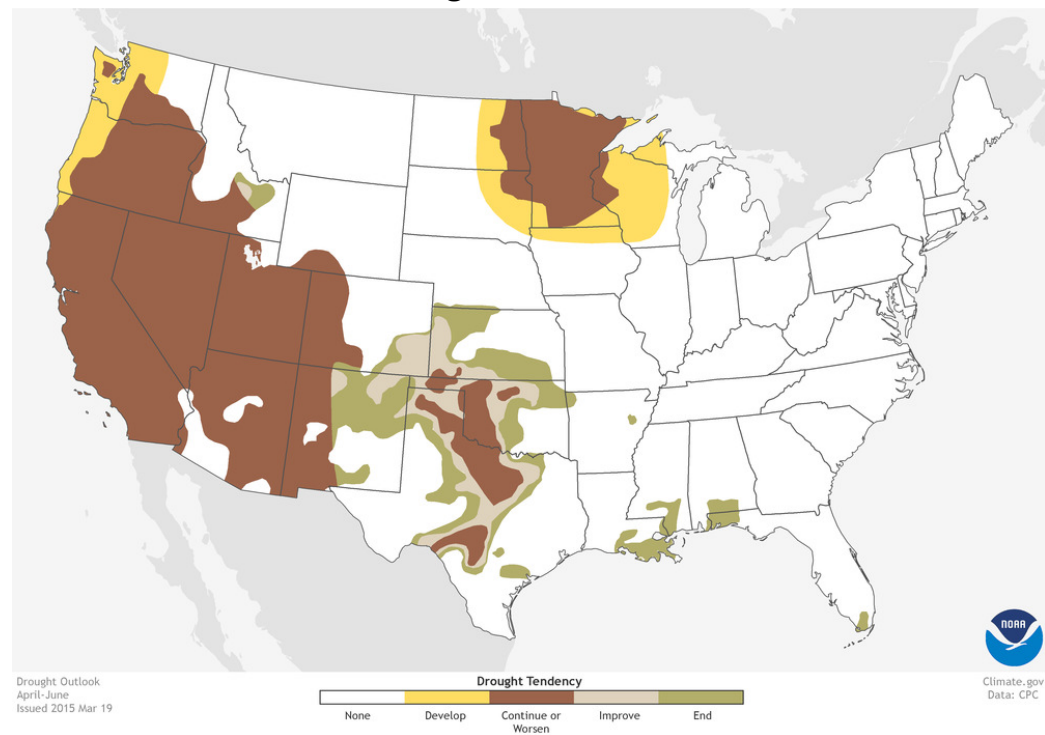


Source: NOAA



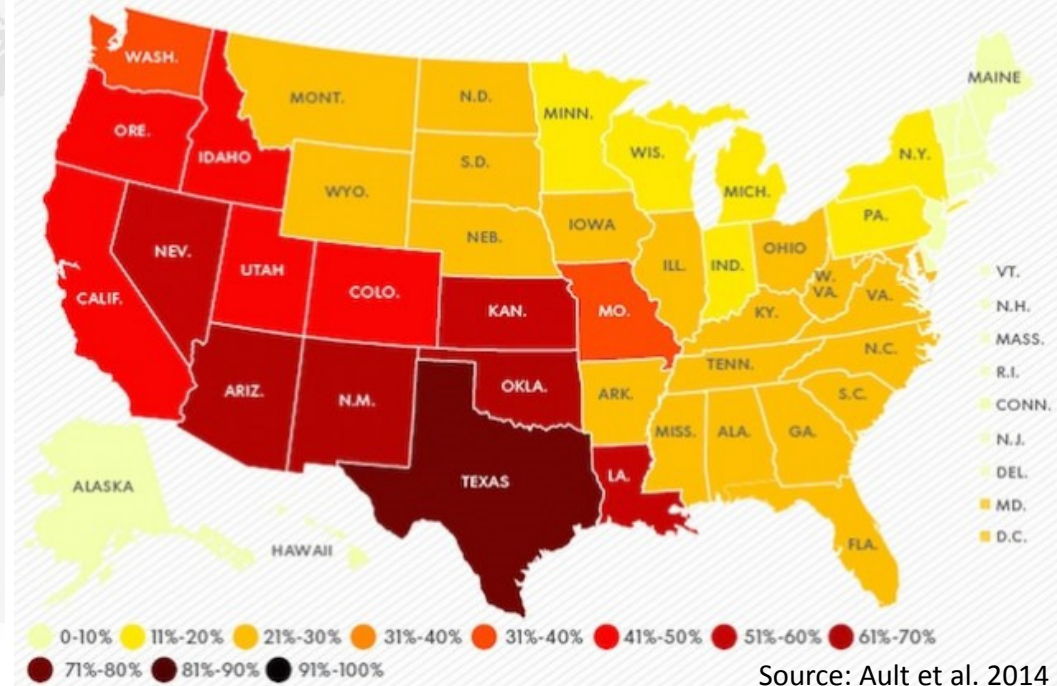
Droughts...Where in the West??

2015 Drought Season Outlook



FUTURE DROUGHTS

The risk of a decade-long drought within the next century is highest in Texas and the Southwest.

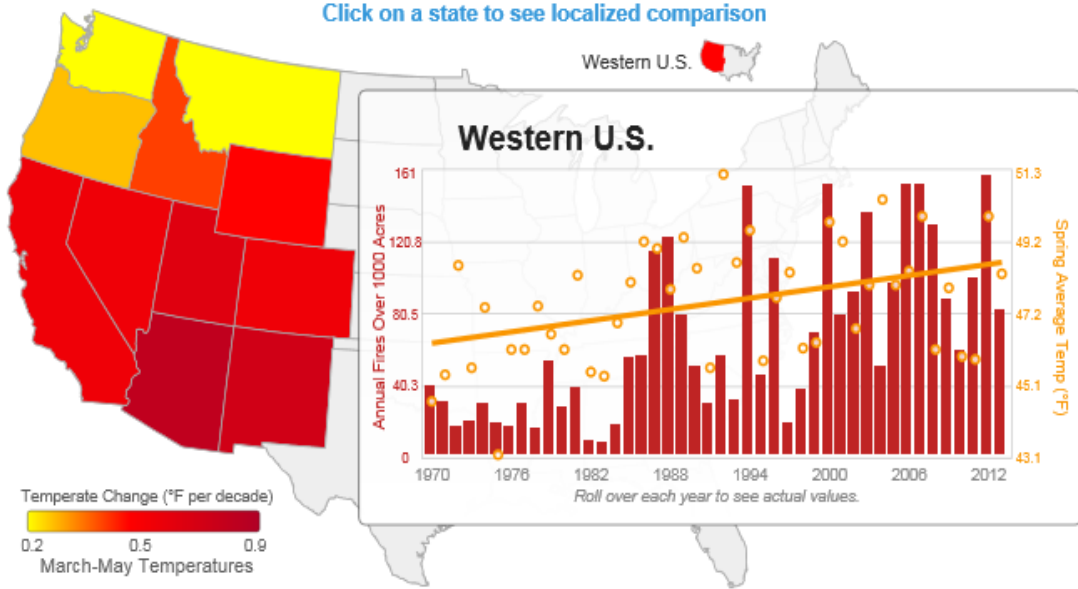




Western Wildfires On the Rise

Warmer Temperatures Increase Fire Risk

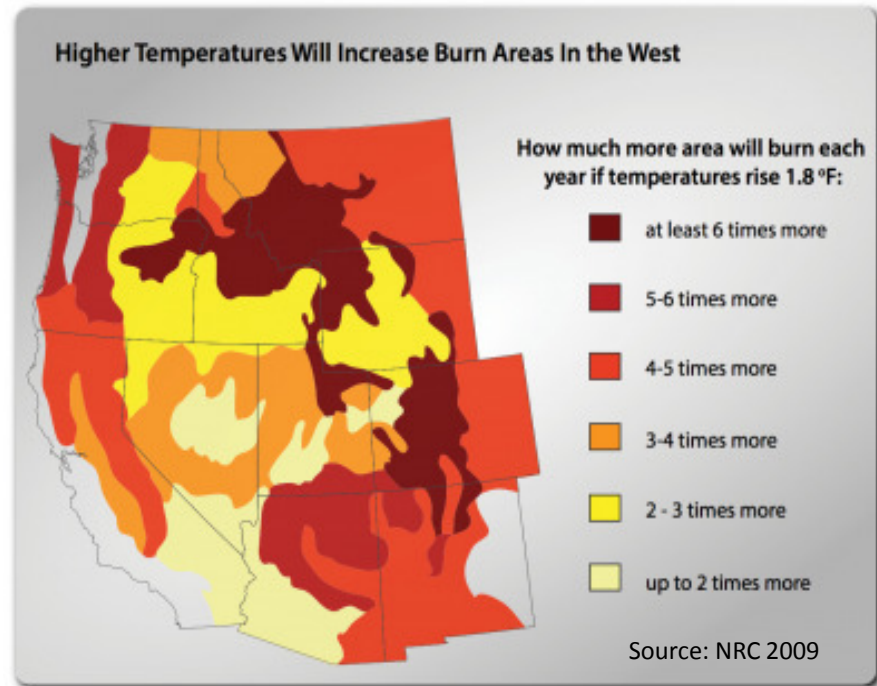
[Click on a state to see localized comparison](#)



Western U.S. wildfires have increased dramatically since 1970. Years with warmer spring and summer temperatures tend to have the most fires. In the coming decades, more warming and shrinking snowpack in the West is expected to cause even more big fires.

CLIMATE CENTRAL

Wildfires...Where in the West??





Firefighters on Wildfires



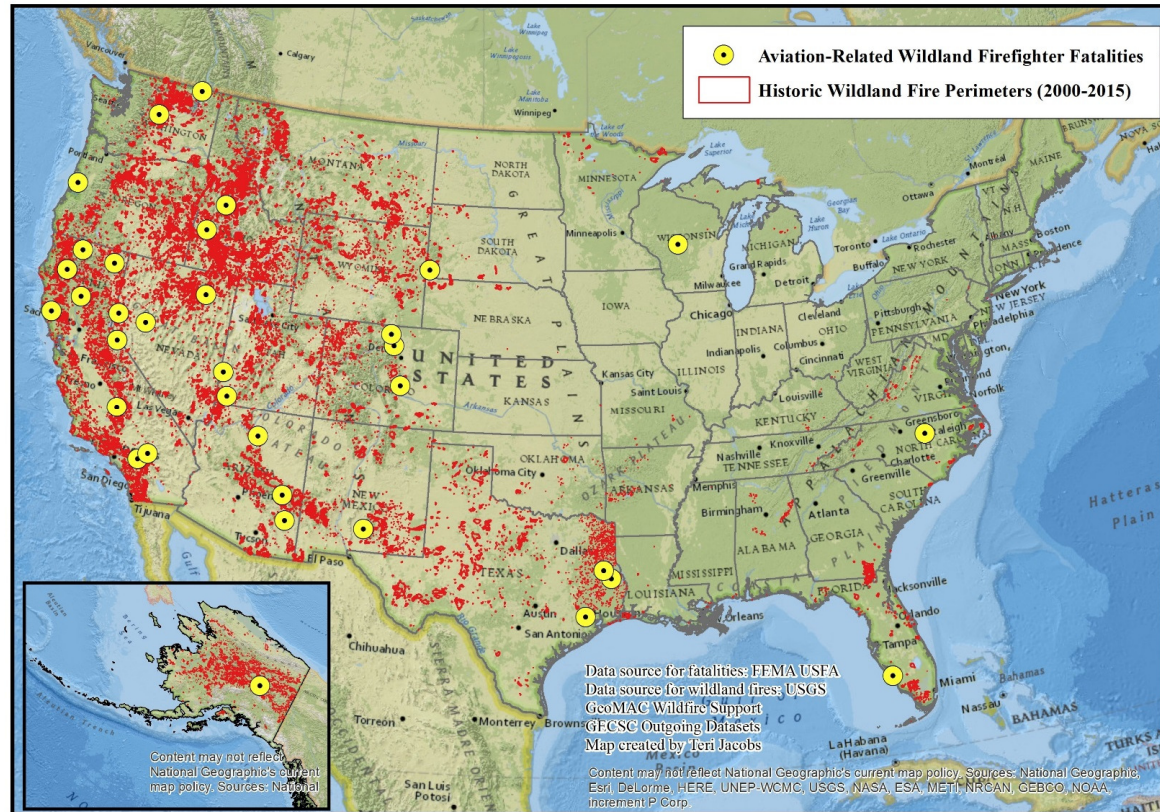
Year-round fire “season”



Bigger
Faster moving
Unpredictable
More destructive

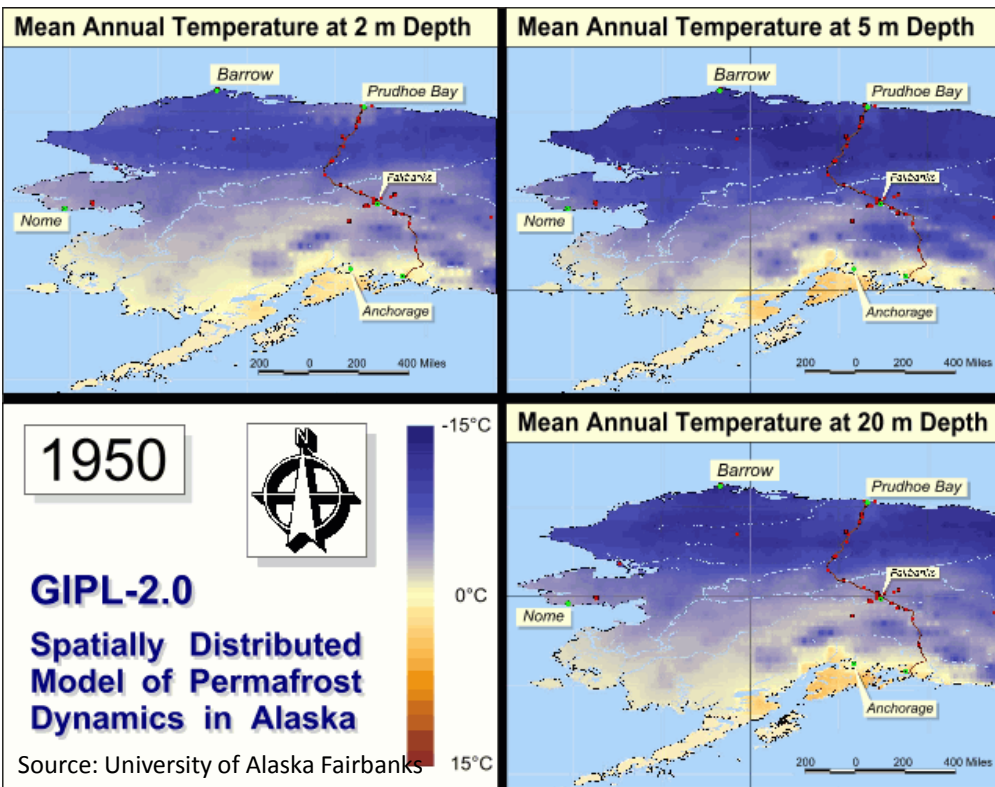


~~Cool Night Air~~



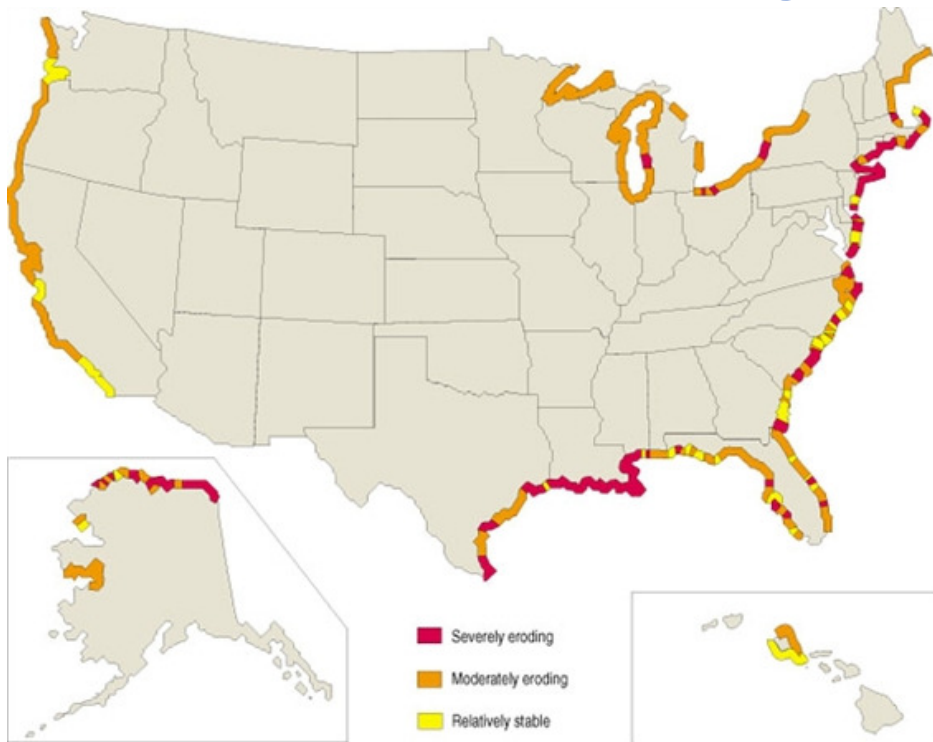


Permafrost Thaw...Where in the West? Rather, Where in Alaska??





Coastal Erosion and Flooding from Sea Level Rise...Where in the West??

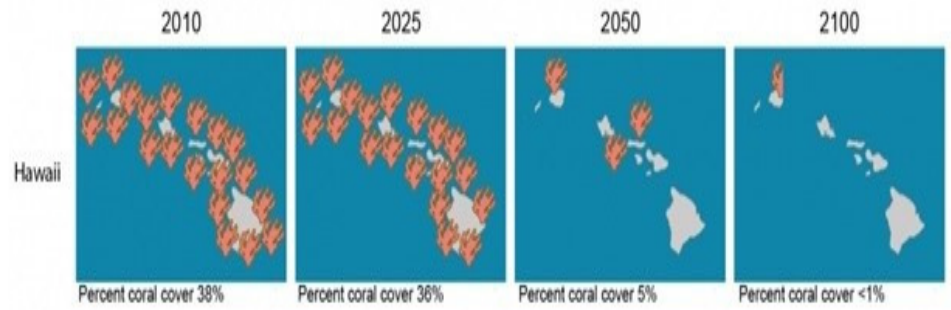
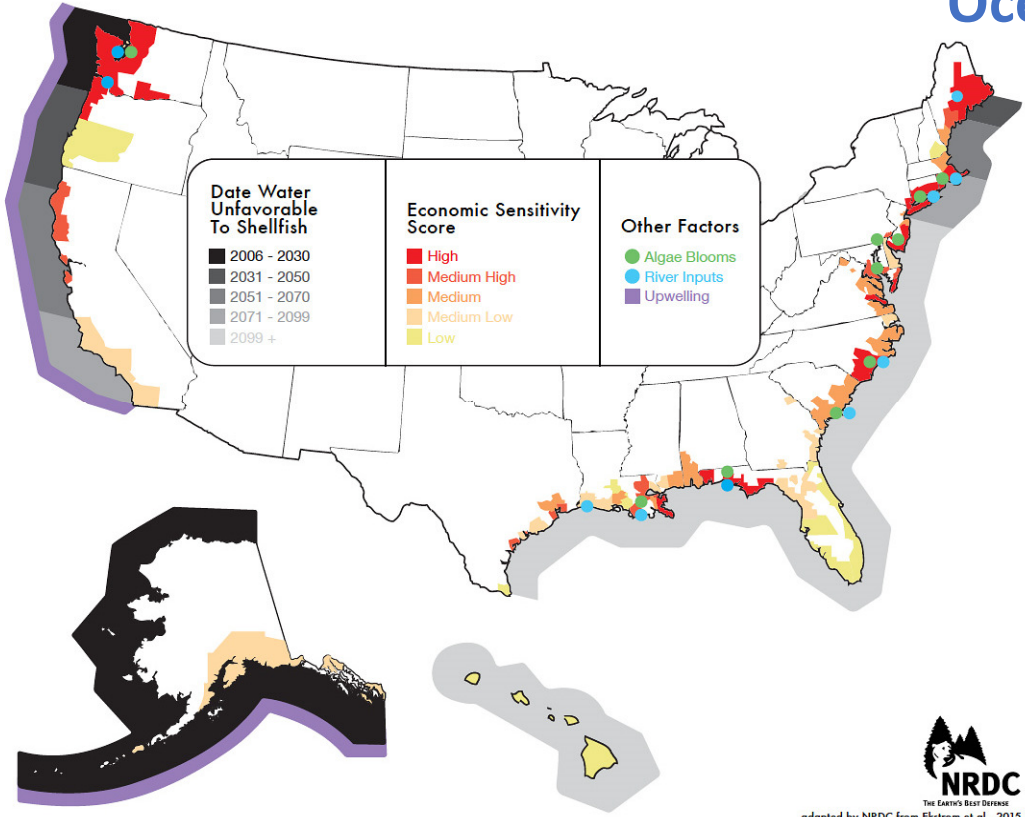


Coastal Erosion from Sea Level Rise

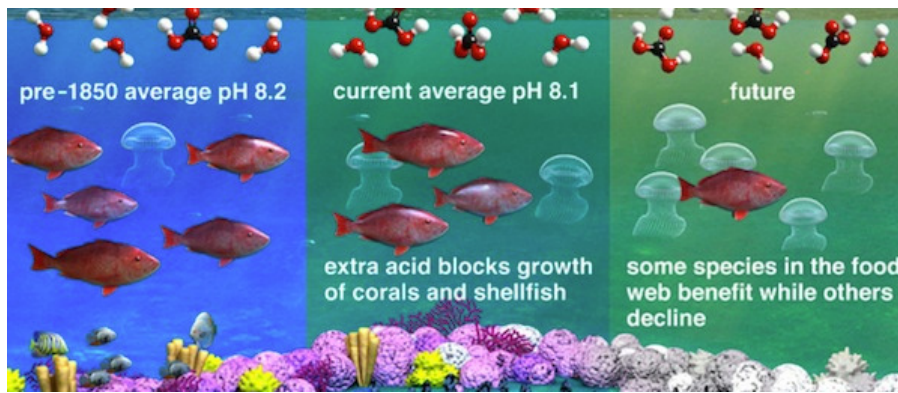




Ocean Acidification...Where in the West??



Source: EPA





Warming Oceans (Alaska)



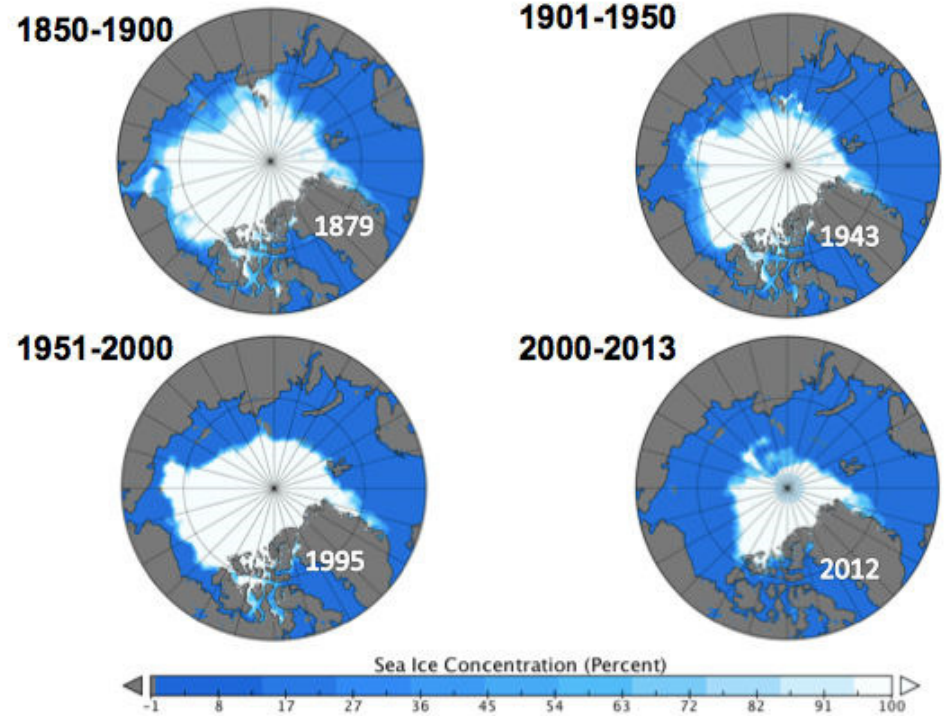
HOT Declining Sea Ice



HOT Stormier Seas



HOT Threatened Coasts
Erosion
Storm Surges
Coastal Flooding
Community Relocation



Source: Walsh et al. 2016



Occupational Safety & Health



Increased risk of illness, injury, or death

Heat Stress, Disaster Response,
Hazardous Working Conditions,
Poor Air Quality



**Increased stress and associated effects on
physical and mental health**

Traumatic Incident Stress, Lost Wages
& Employment, Threats to Food &
Water Security



The work can't get done without them.





Takeaway Points!!!!

With an interdisciplinary approach, we have opportunity to identify....

...**where** occupational hazards may occur

...which occupations and industries may be most sensitive to climate change

...what measures may be implemented to protect higher risk worker groups



Thank You!!! 😊

Contact Information:

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Cover and banner photo taken by Teri Jacobs in Denali National Park, Alaska 8/22/16