

# Montana's Changing Climate

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photo credit: Rick & Susie Graetz



# 2017 MONTANA CLIMATE ASSESSMENT

Stakeholder driven, science informed

[montanaclimate.org](http://montanaclimate.org)



# CLIMATE CHANGE AND HUMAN HEALTH IN MONTANA

A Special Report of the Montana Climate Assessment

January 2021

[www.montanaclimate.org](http://www.montanaclimate.org)



Center for American Indian  
and Rural Health Equity



MONTANA HEALTH PROFESSIONALS FOR A HEALTHY CLIMATE



June 2021 | [www.gyclimate.org](http://www.gyclimate.org)

# GREATER YELLOWSTONE CLIMATE ASSESSMENT

Past, Present, and Future Climate Change  
in Greater Yellowstone Watersheds



[Montanaclimate.org](http://Montanaclimate.org)

[Gyclimate.org](http://Gyclimate.org)

[Montanaioe.org](http://Montanaioe.org)

# MONTANA CLIMATE ASSESSMENT



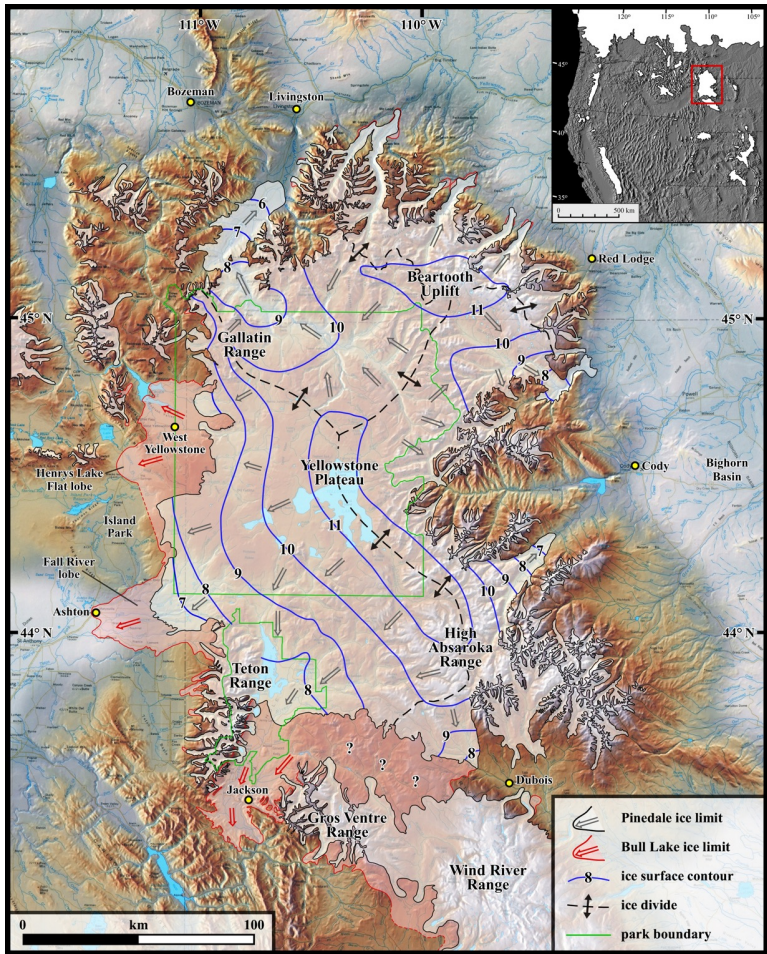
<http://montanaclimate.org>

# MCA Partners



Is Current Climate Change Unprecedented?



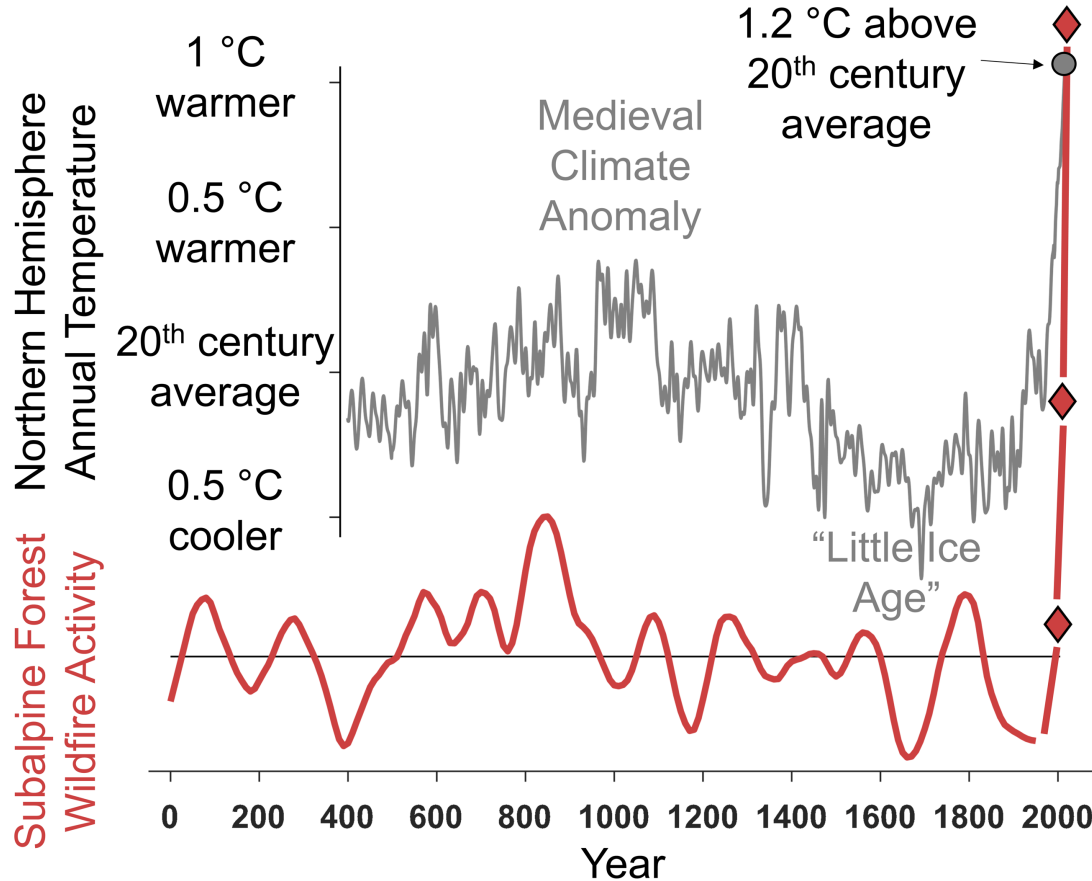


Licciardi & Pierce, QSR 2018

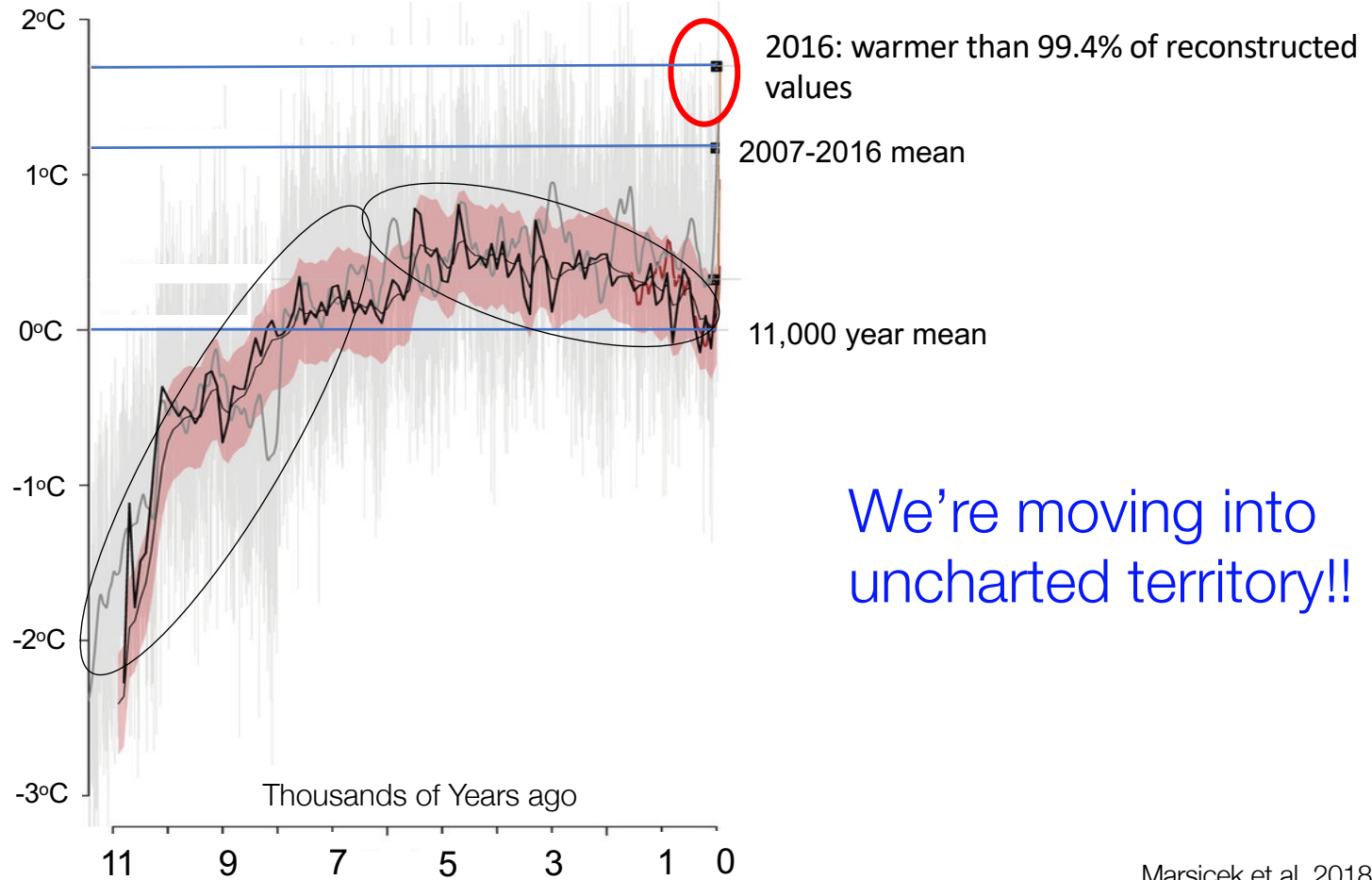


8-9°F cooling to make an ice age

# 2000 Years of Rocky Mountain Wildfires

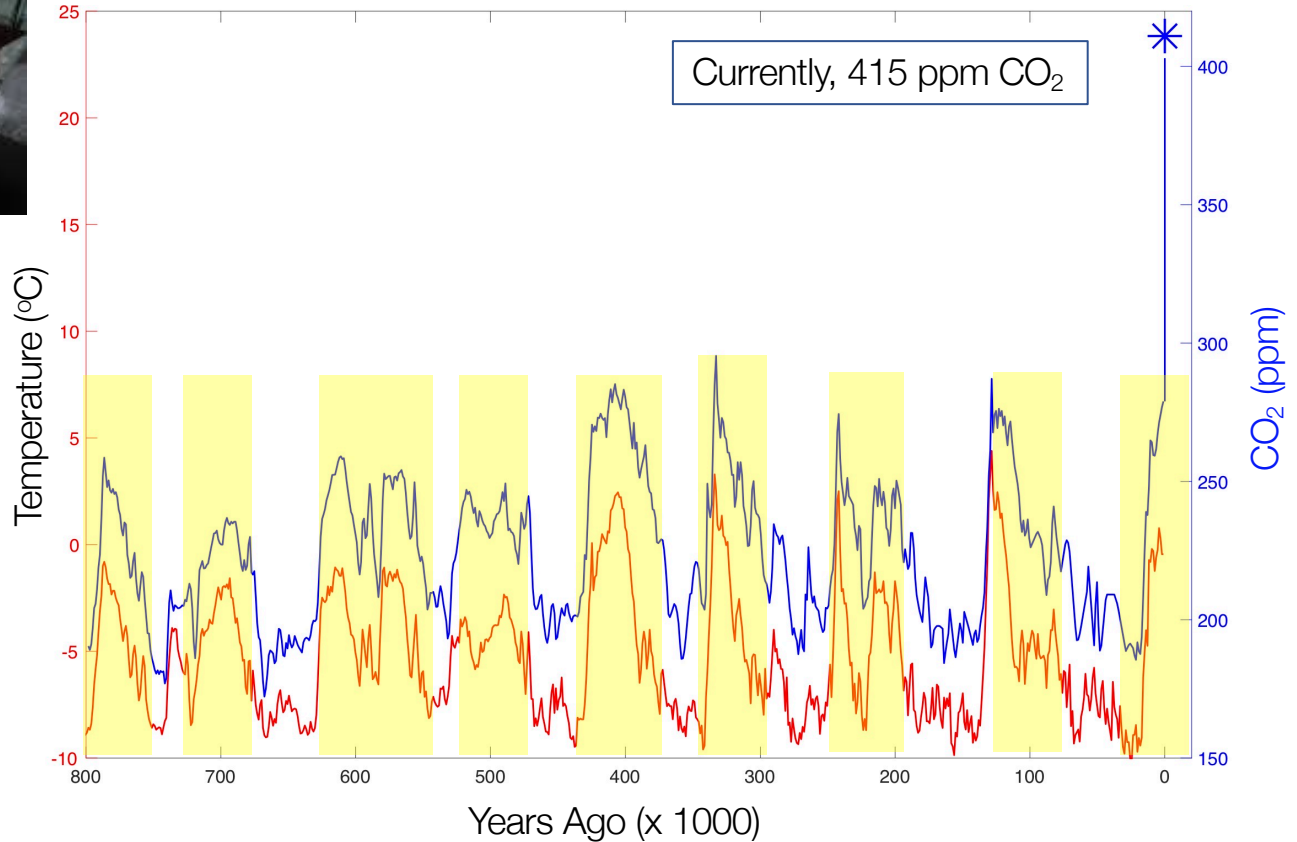


# 11,000 Years of Temperature Change





# 800,000 Years of CO<sub>2</sub>



Old Faithful  
stopped during  
a megadrought  
in 1233-1362

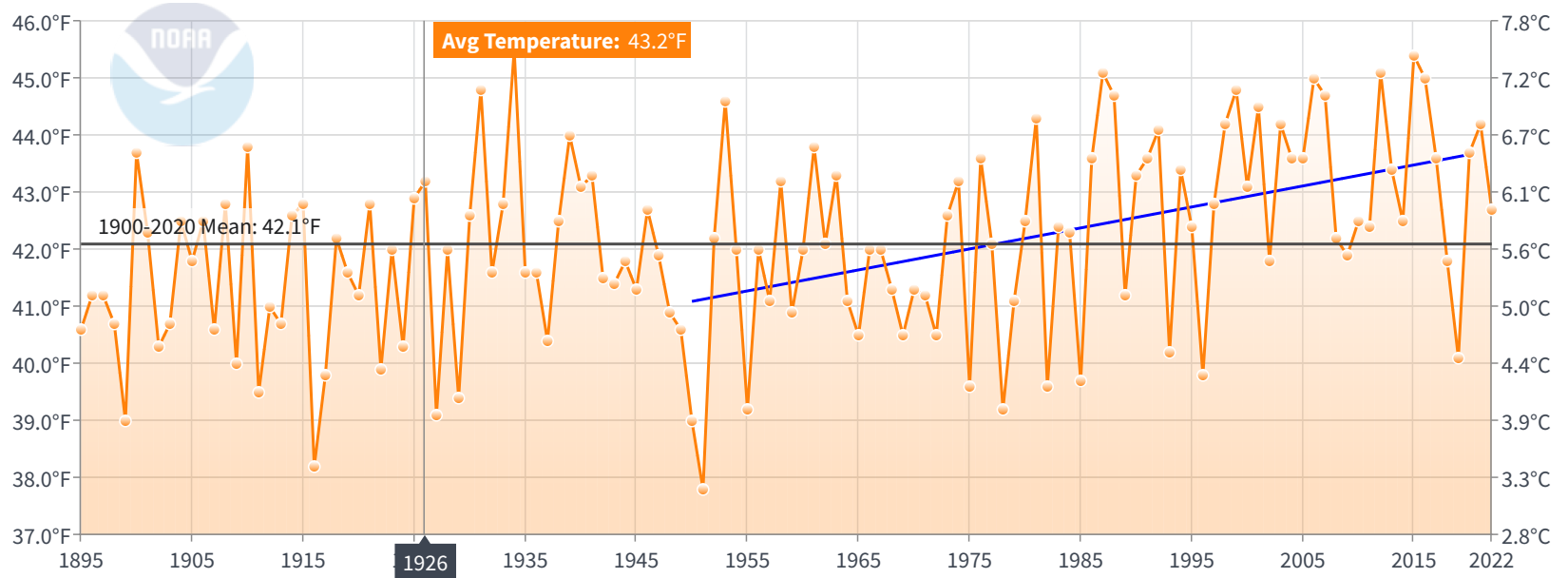


# Since 1950, it's gotten 2.8°F warmer.

## Montana, Climate Division 4 Average Temperature

January-December

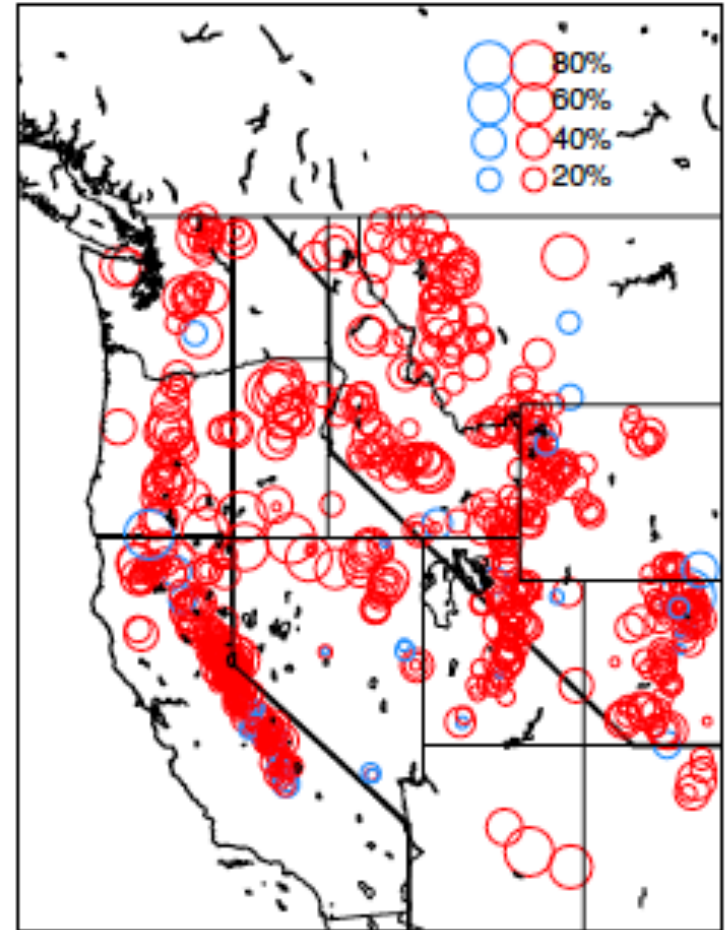
— 1950-2020 Trend  
(+3.7°F/Century)



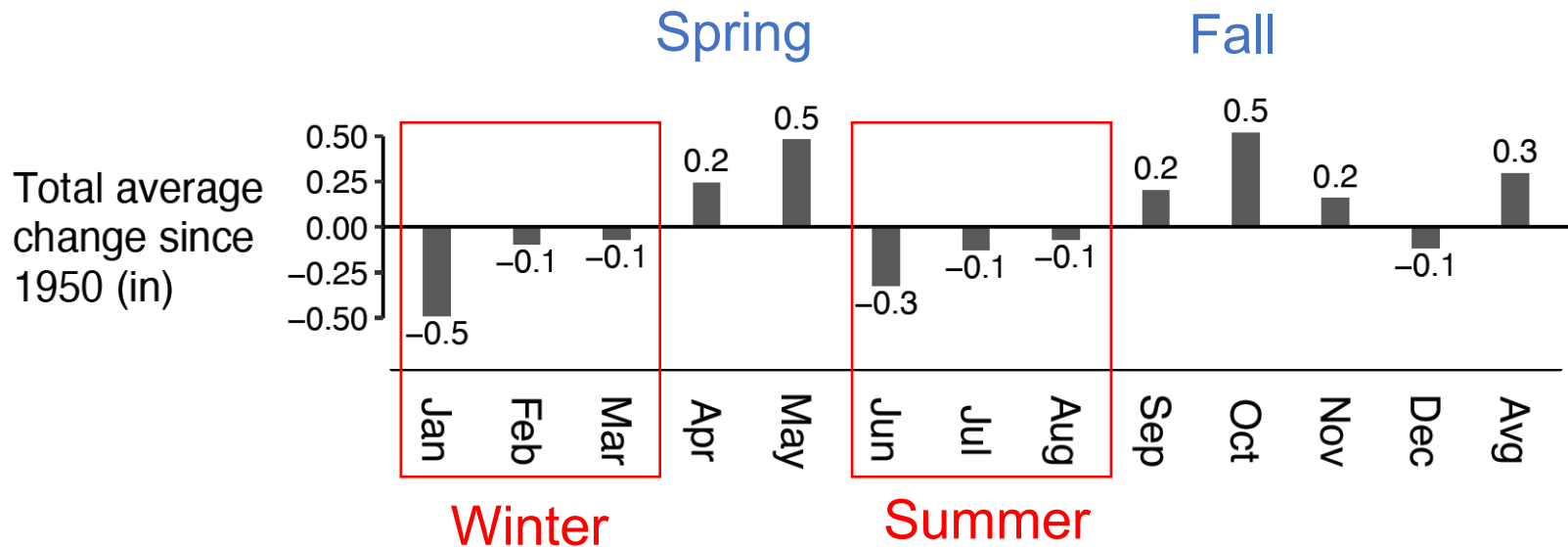
Since 1950, April 1 snowpack has decreased by 20-80% in MT.



*Credit: Jackson Rohleder / MTFP*

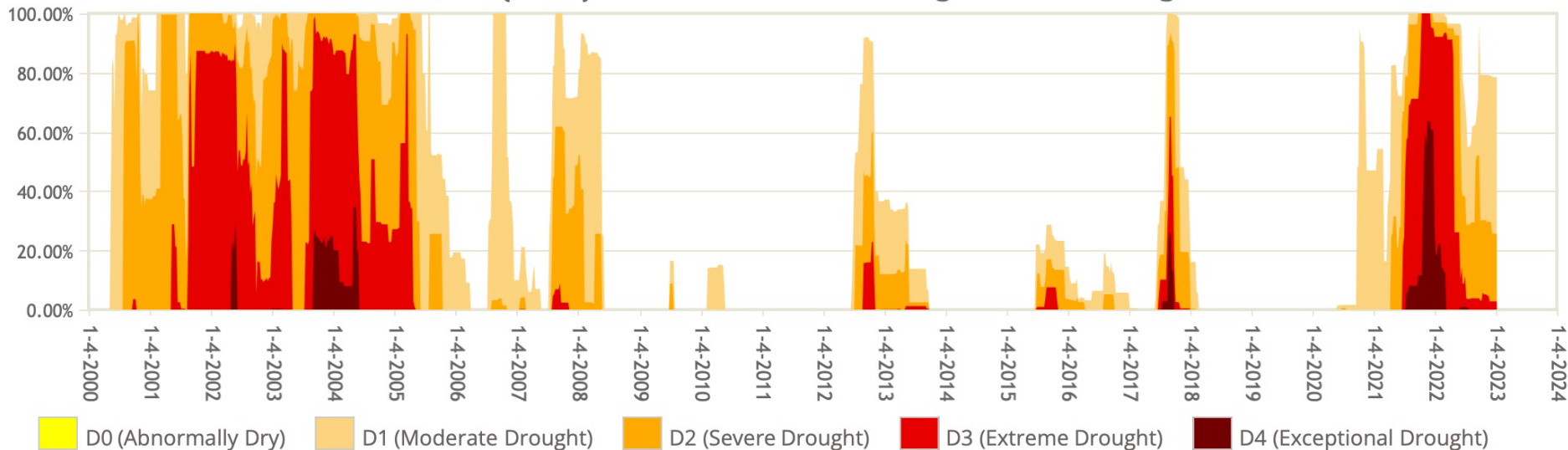


Since 1950, the season of precipitation has changed.



# Since 2000, two prolonged droughts in central Montana

## Central, MT (2404) Percent Area in U.S. Drought Monitor Categories



# LONG-TERM & RECENT CLIMATE CHANGE

## Long-term

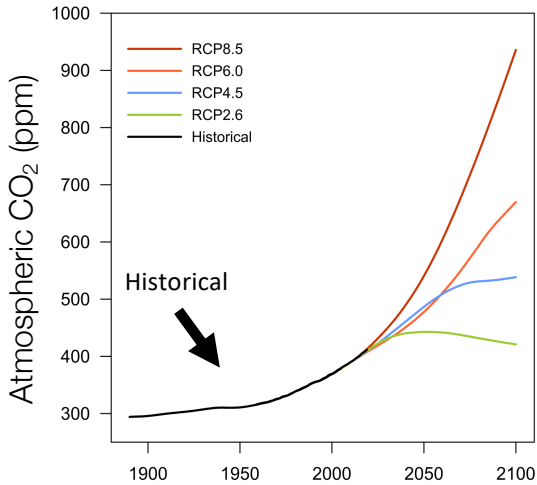
- Recent temperatures: high or higher than any period in the last 20,000 years
- Recent drought: less severe than other droughts in the past
- Recent CO<sub>2</sub> levels higher than any period in the last 3.3 million years

## Since 1950

- Significant warming, less snowfall, earlier snowmelt and runoff
- Season of precipitation has changed.
- 21<sup>st</sup> century droughts lasting multiple years.

# Projections of Future Climate

IPCC Emissions Scenarios (AR5)

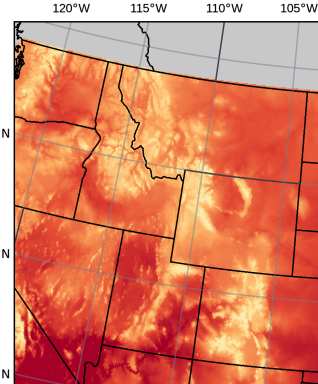
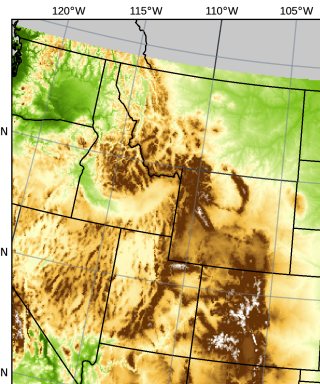
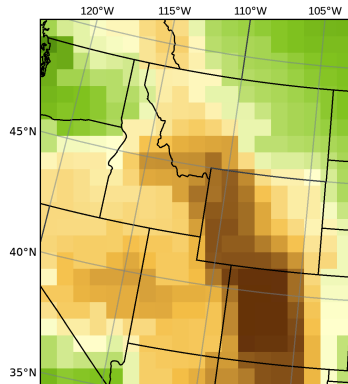
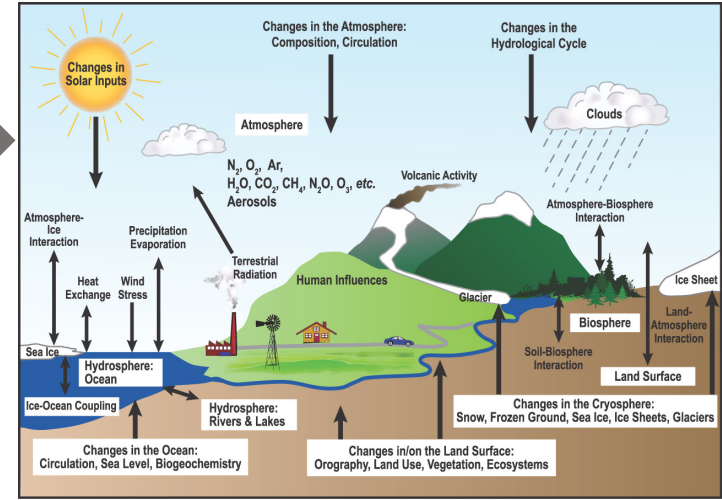


← RCP8.5  
No mitigation

← RCP4.5  
Stabilization

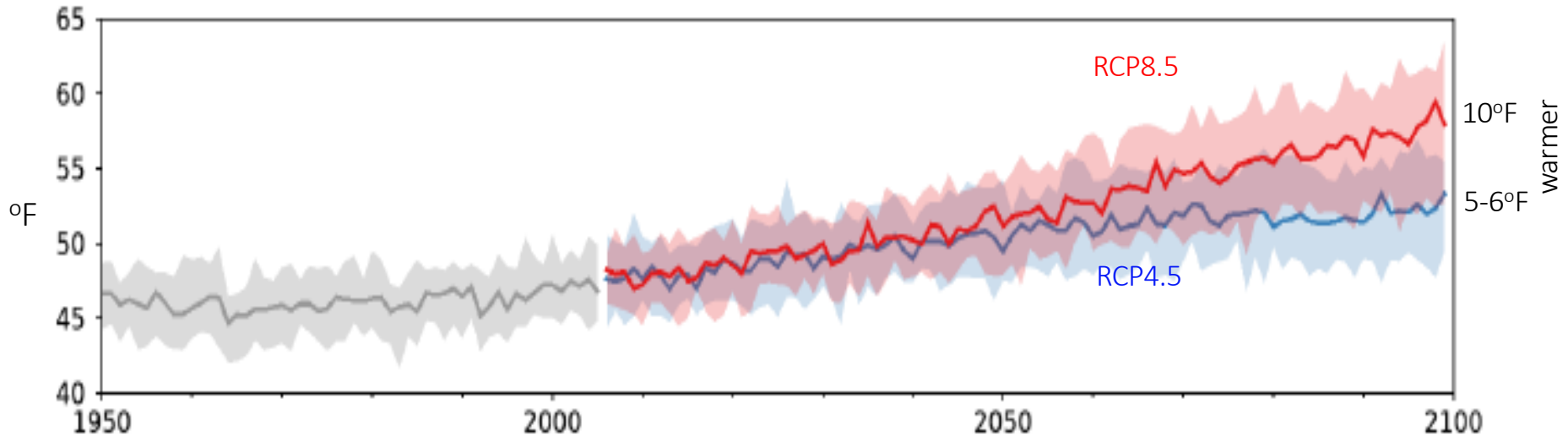
20 GCMs

Downscaling





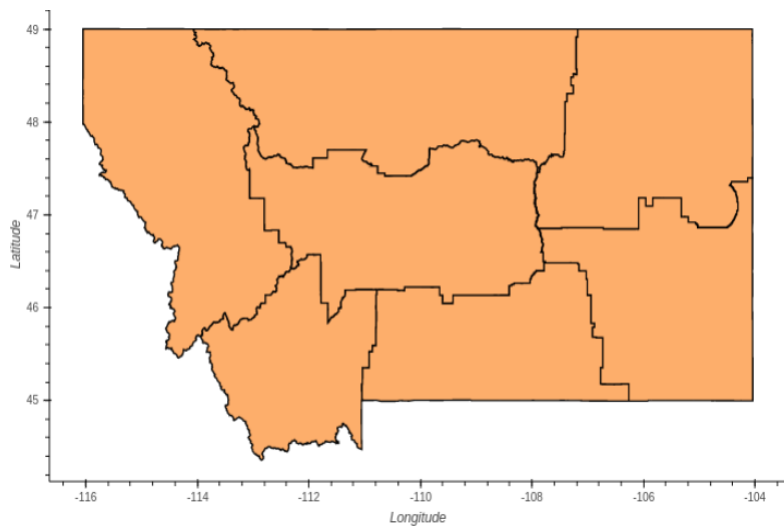
# Mean Annual Temperature: Petroleum County



From USGS National Climate Viewer

# Annual Temperatures by Mid-Century

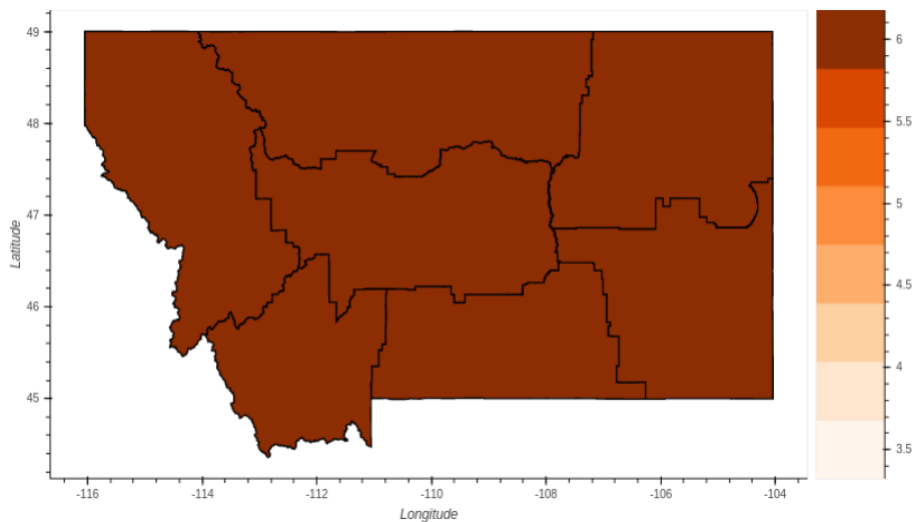
RCP 4.5 (2040-2060)



4.5°F increase

(minimum: 2.7°F, maximum: 6.1°F,  
model agreement: 100%)

RCP 8.5 (2040-2060)

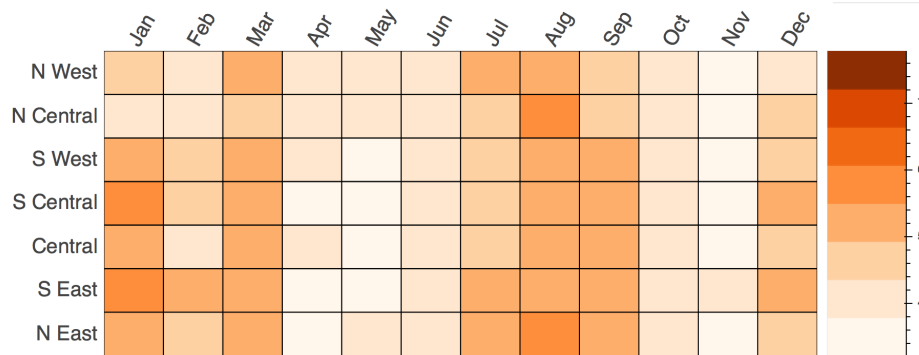


6°F increase

(minimum: 4.0°F, maximum: 8.2°F,  
model agreement: 100%)

# Monthly Temperatures

RCP 4.5 (2040-2060)

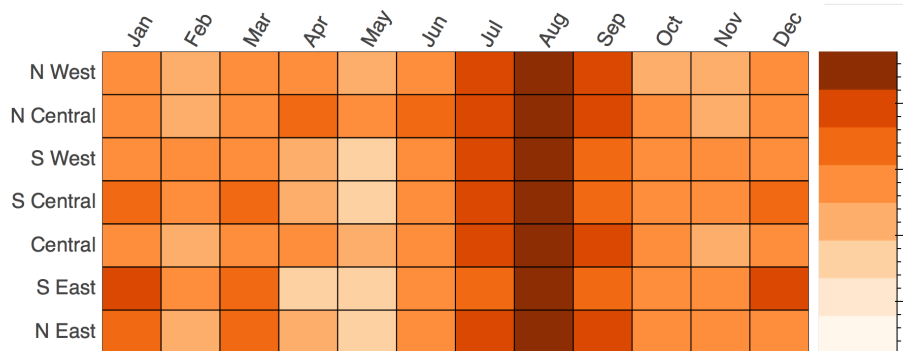


Greater warming in:

Winter: 4 to 5°F

Summer: 5 to 5.5°F

RCP 8.5 (2040-2060)



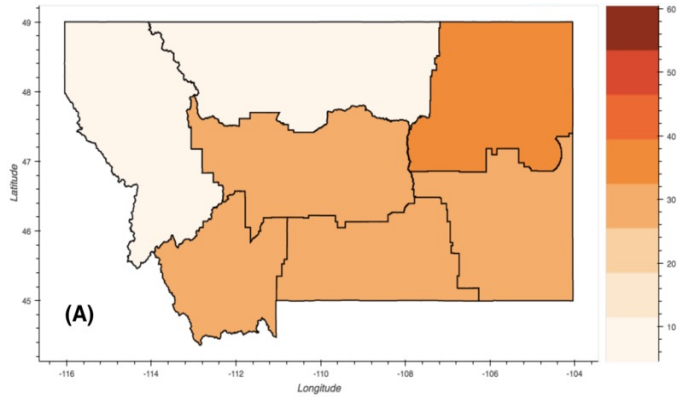
Winter: 5 to 7°F

Summer: 6 to 7.5°F

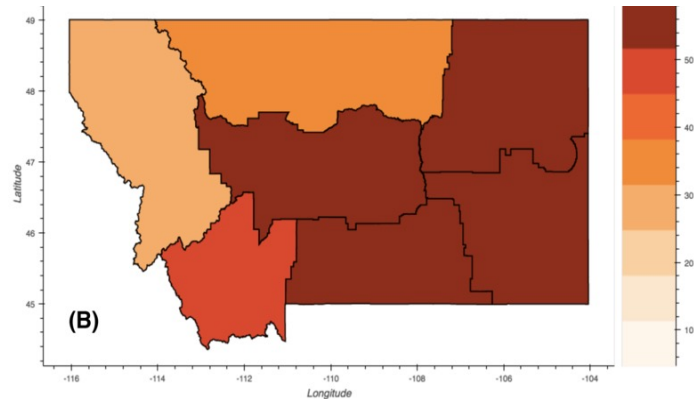
(100% model agreement)

# Rising Temperatures exacerbate Drought

RCP 4.5 (2040-2060)



RCP 8.5 (2040-2060)

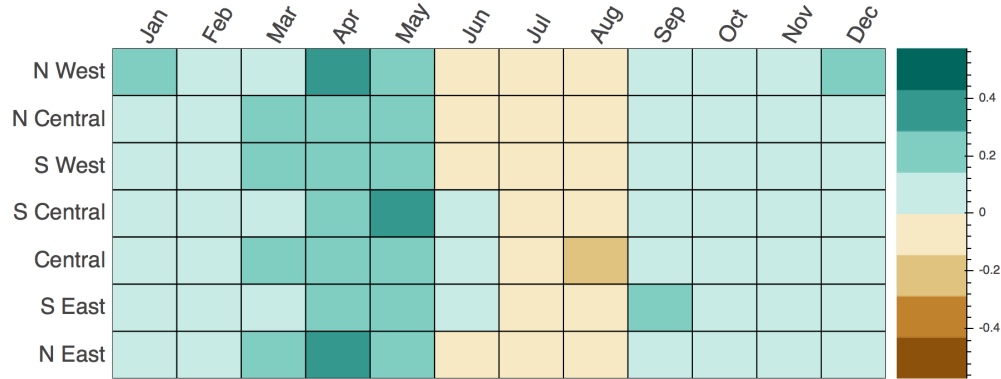


Increased days  $>90^{\circ}\text{F}$   
(up to 35 additional days)



# Monthly Precipitation

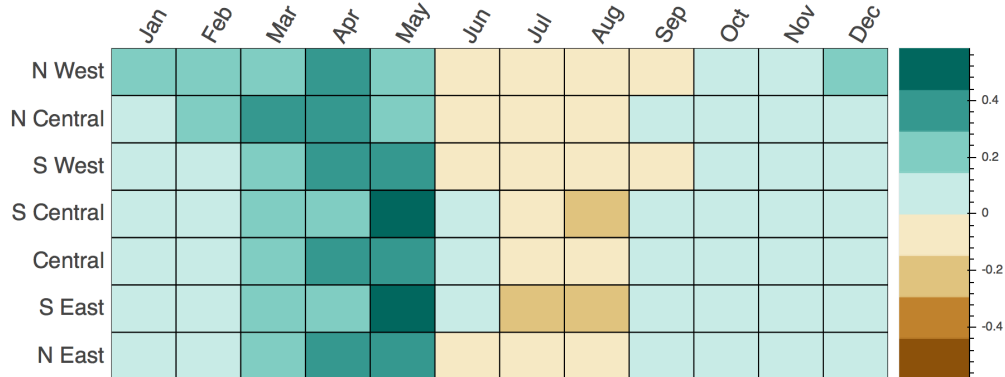
RCP 4.5 (2040-2060)



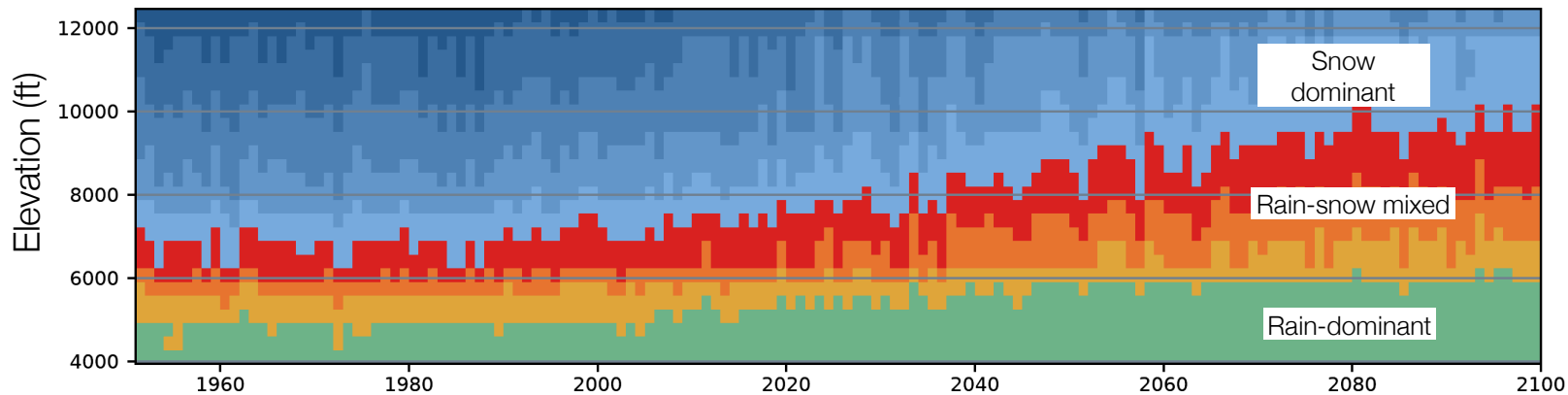
Increases in winter, spring, and fall  
(>85% model agreement)

Decreases in summer  
(65% model agreement)

RCP 8.5 (2040-2060)

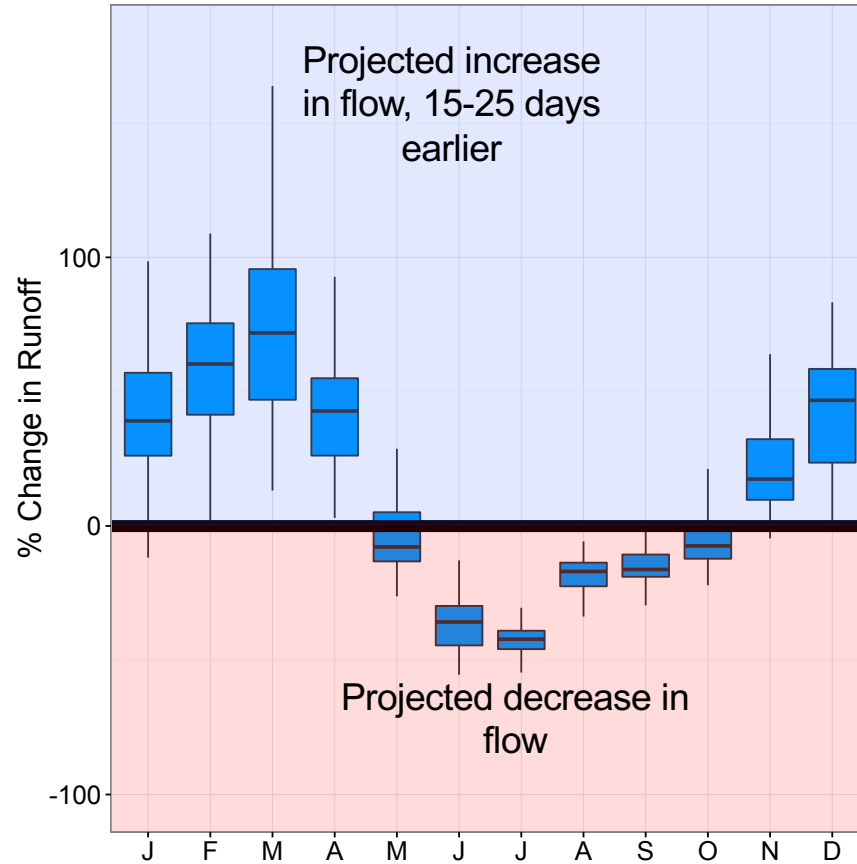


# Snow-to-rain Transition in Greater Yellowstone (RCP4.5)



# Streamflow Projections—Clarks Fork

Snowmelt-dominated rivers in the western & north-central Montana



# CLIMATE PROJECTIONS FOR CENTRAL MT

Warming of 4-6°F by 2040; as much as 10-11°F by 2100

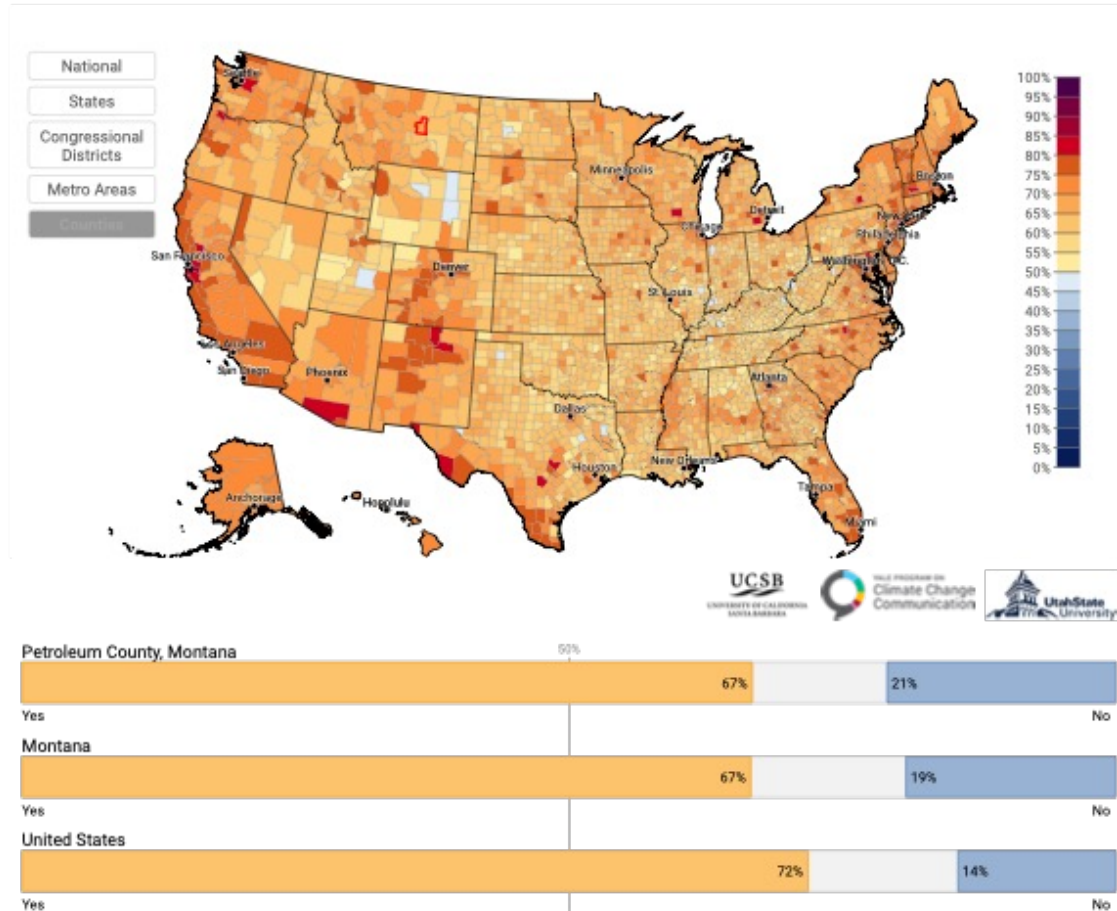
Greater proportion of precipitation as rain instead of snow

Snowmelt & runoff earlier in spring, water shortages in summer

More 30+ days over 90°F and less days below freezing



# Estimated % of adults who think global warming is happening



# Estimated % of adults who think global warming will affect them

