



United States Department of Agriculture
Southwest Climate Hub

Utah Climate Conversation: *Climate Informed Agriculture*



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Today's Conversation

Climate

- Terminology
- U.S. Climate trends
- Why these changes are occurring
- Local Climate Information

Climate Smart Agriculture

- How to start the conversation
- Available Resources
- Adaptation and Transformation

Discussion/Feedback





Adaptation and Transformation

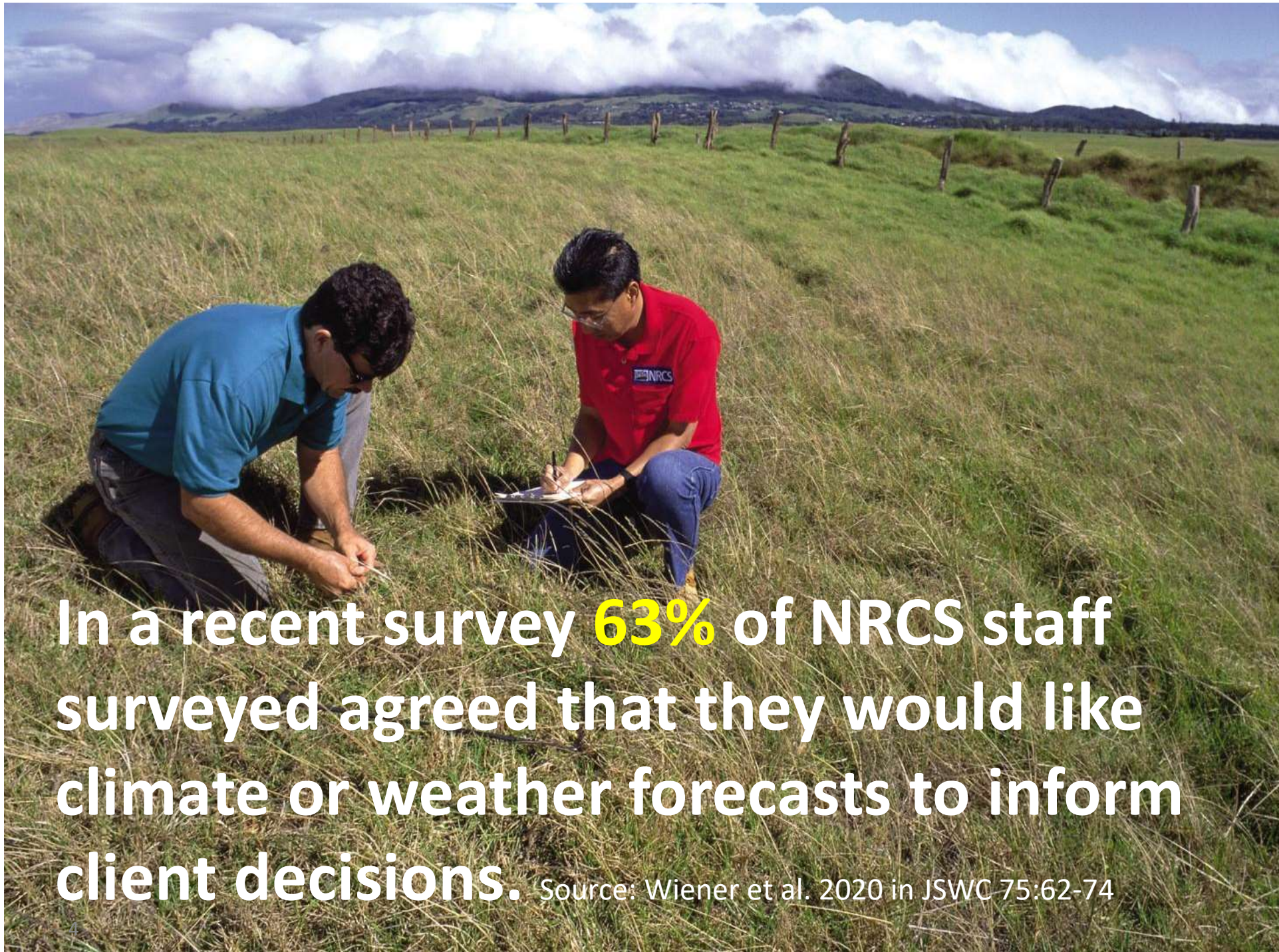


Concept (adaptation slide from Courtney)

Use ESD/S&T (with pictures)

Local Example (like irrigation w/no water or invasives or ?) State that can't be reversed

AZ – irrigation salted out or rangeland w/shrubs
– call Scott



In a recent survey **63%** of NRCS staff surveyed agreed that they would like climate or weather forecasts to inform client decisions. Source: Wiener et al. 2020 in JSWC 75:62-74



What words come to mind when you think of Climate Adaptation/Resiliency?

Click on link in the Chat box

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Northeast Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

Terminology



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Weather vs. Climate (Source: NOAA)

Weather reflects short-term conditions of the atmosphere

Climate is the average daily **weather** for an extended period at a certain location

Weather can change from minute-to-minute, hour-to-hour, day-to-day, and season-to-season. **Climate**, is the average of **weather** over time and space.

Climate is what you expect, weather is what you get.



Climate Smart Agriculture



Definition:

Agriculture that sustainably increases productivity, resilience (adaptation), reduces/removes GHGs (mitigation), and enhances achievement of national food security and development goals. (Source: Food and Agriculture Organization)

Other terms:

- Climate Informed Agriculture
- Climate Smart Farming
- Natural Climate Solutions
- Engineering with Nature
- Weather/Drought Resiliency

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Changes

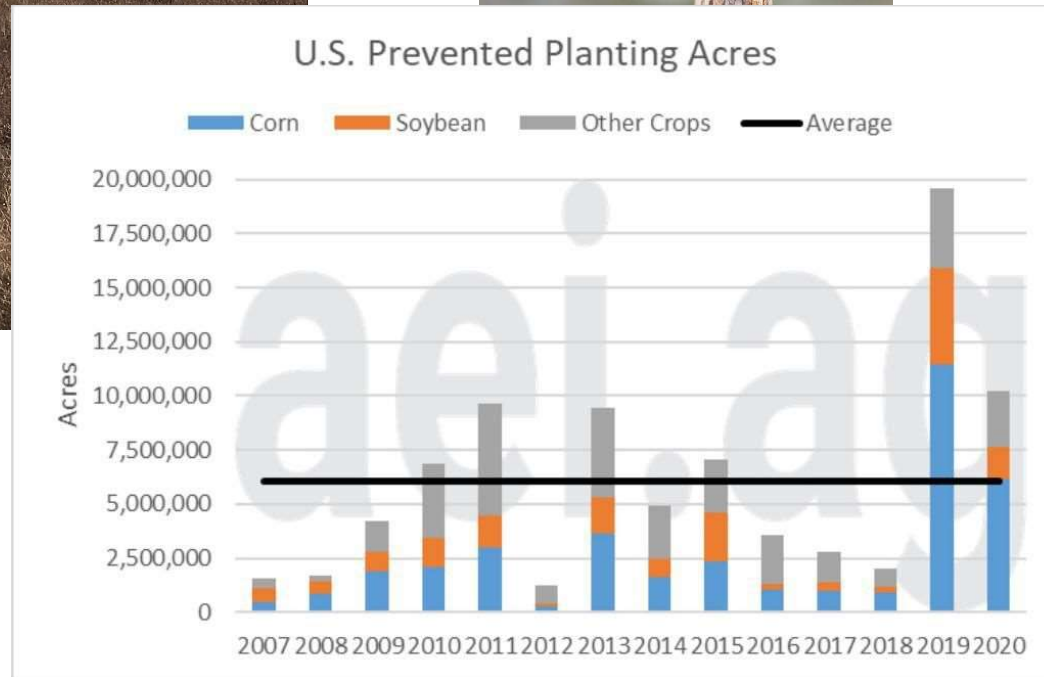


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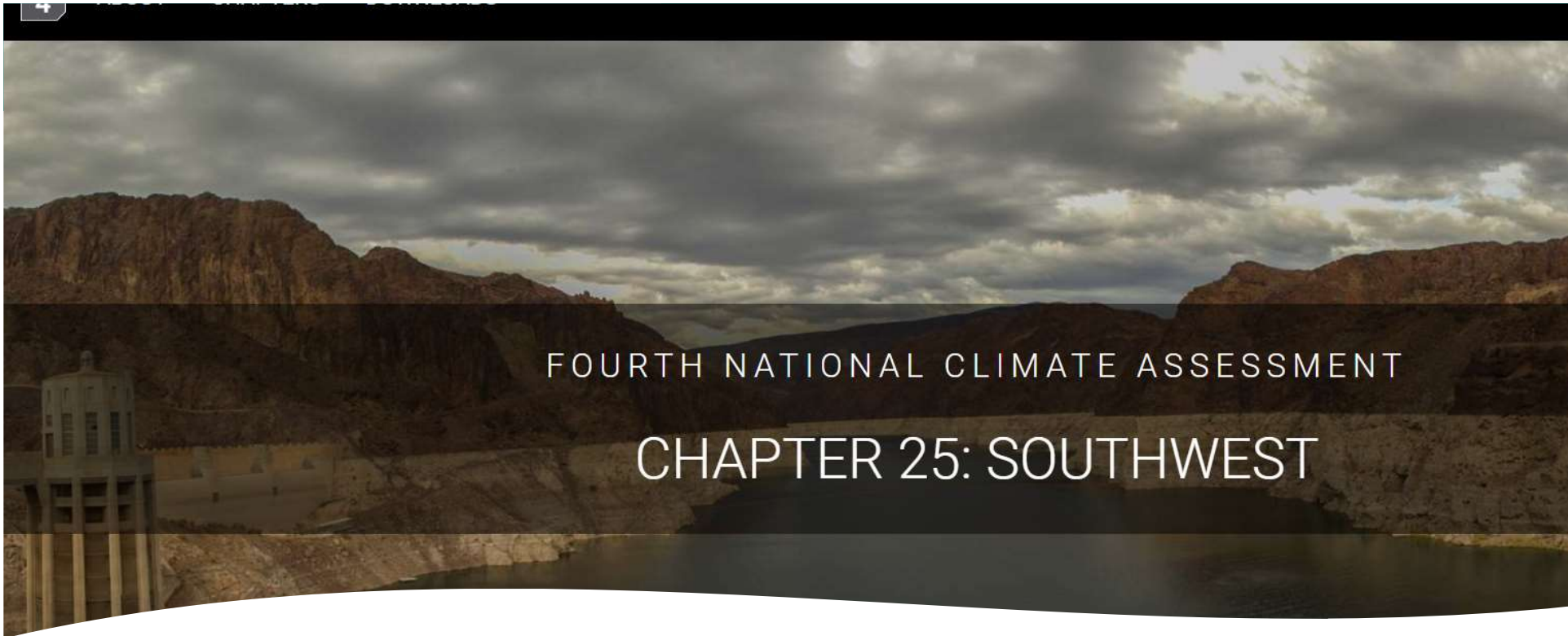


What changes in weather have you noticed in your lifetime?



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Fourth National Climate Assessment 2018

- 1,500 page congressionally mandated report done every four years by the US Global Change Research Program (federally funded).
- Lead agency: National Oceanic and Atmospheric Association (NOAA), many other partner contributors including USDA
- Official data source for USDA climate change information

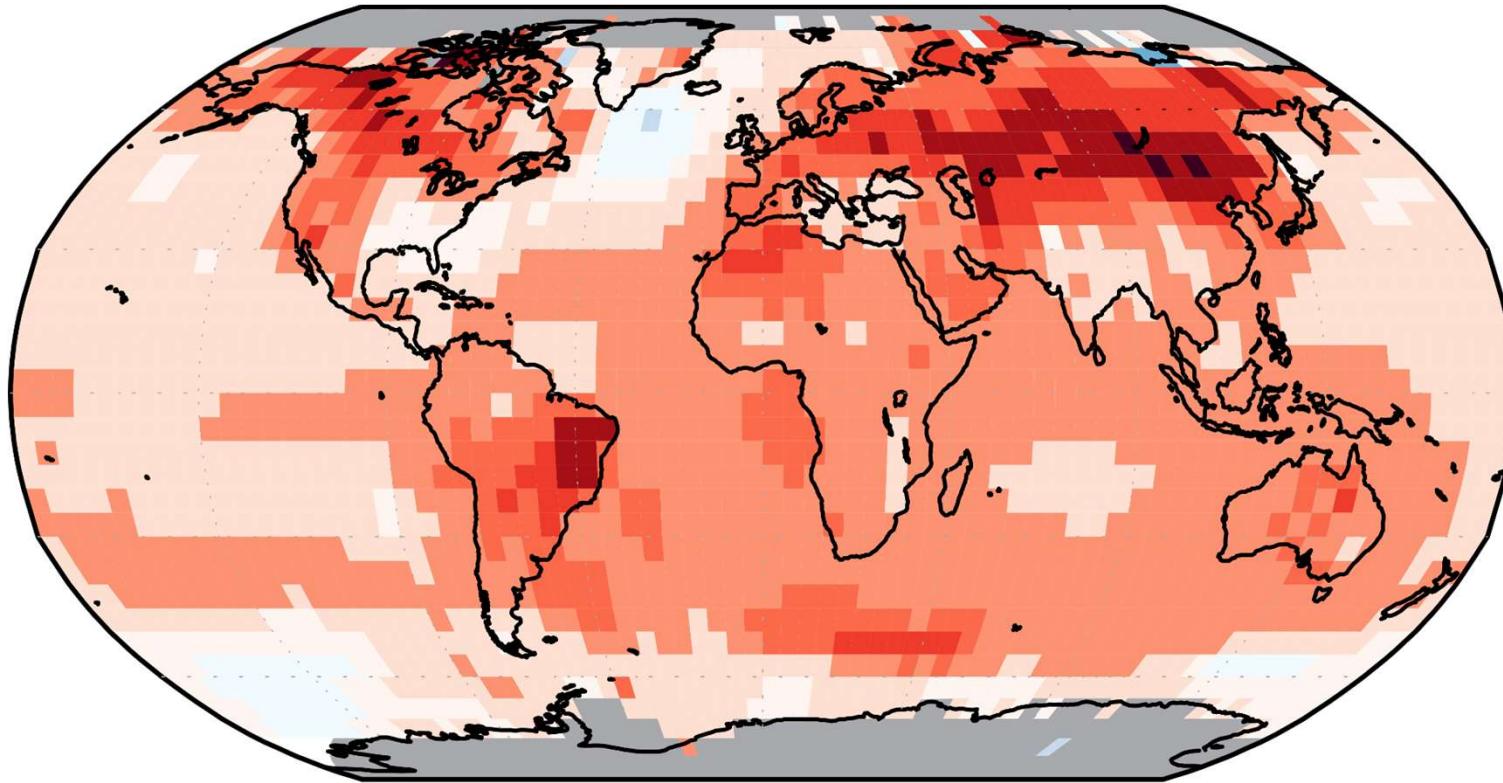
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Observed: Average Global Rise in Temperature of 2°F

(1880 – 2012)



Change in Temperature (°F)



-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5 3.0

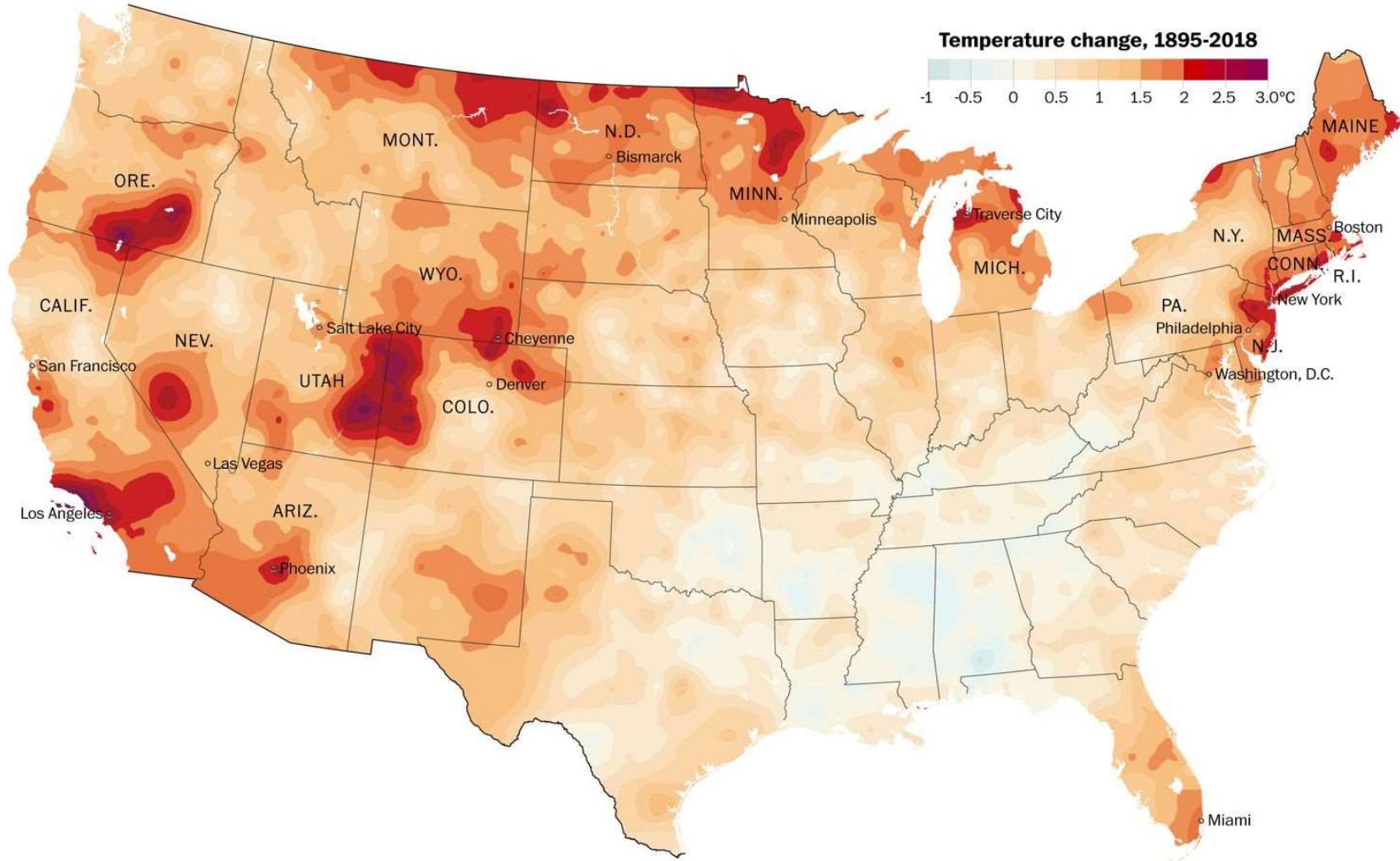
Source: Fourth National Climate Assessment 2018

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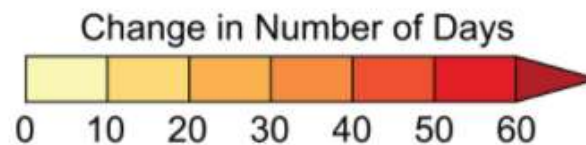
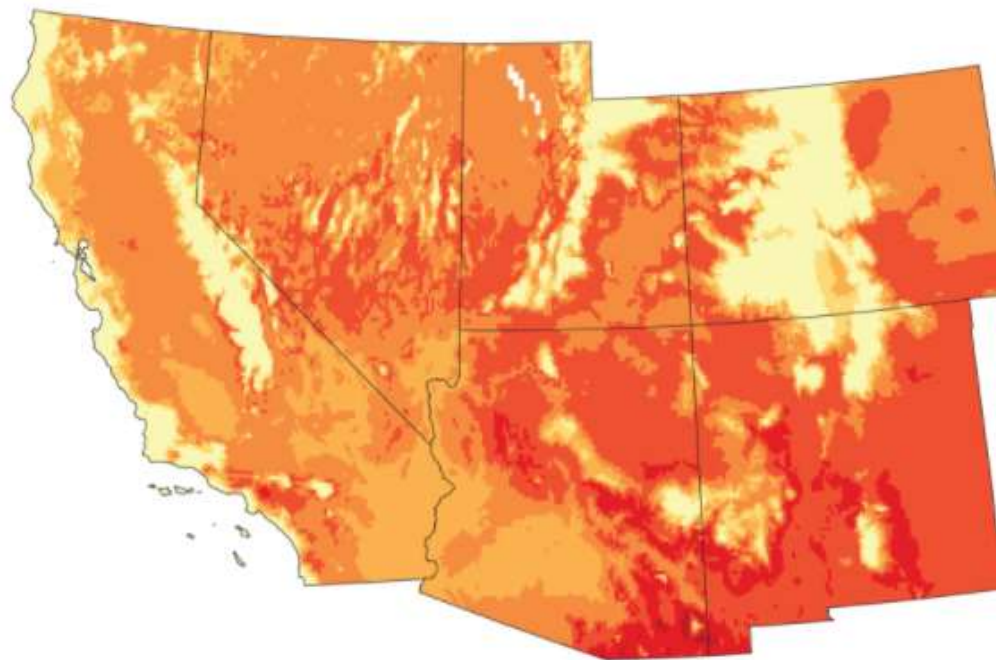


Observed: U.S. Change in Temperature (1880 – 2012)





Projected: Increase in number of days above 100 °F under a high emissions scenario by Mid-Century (2036-2065)



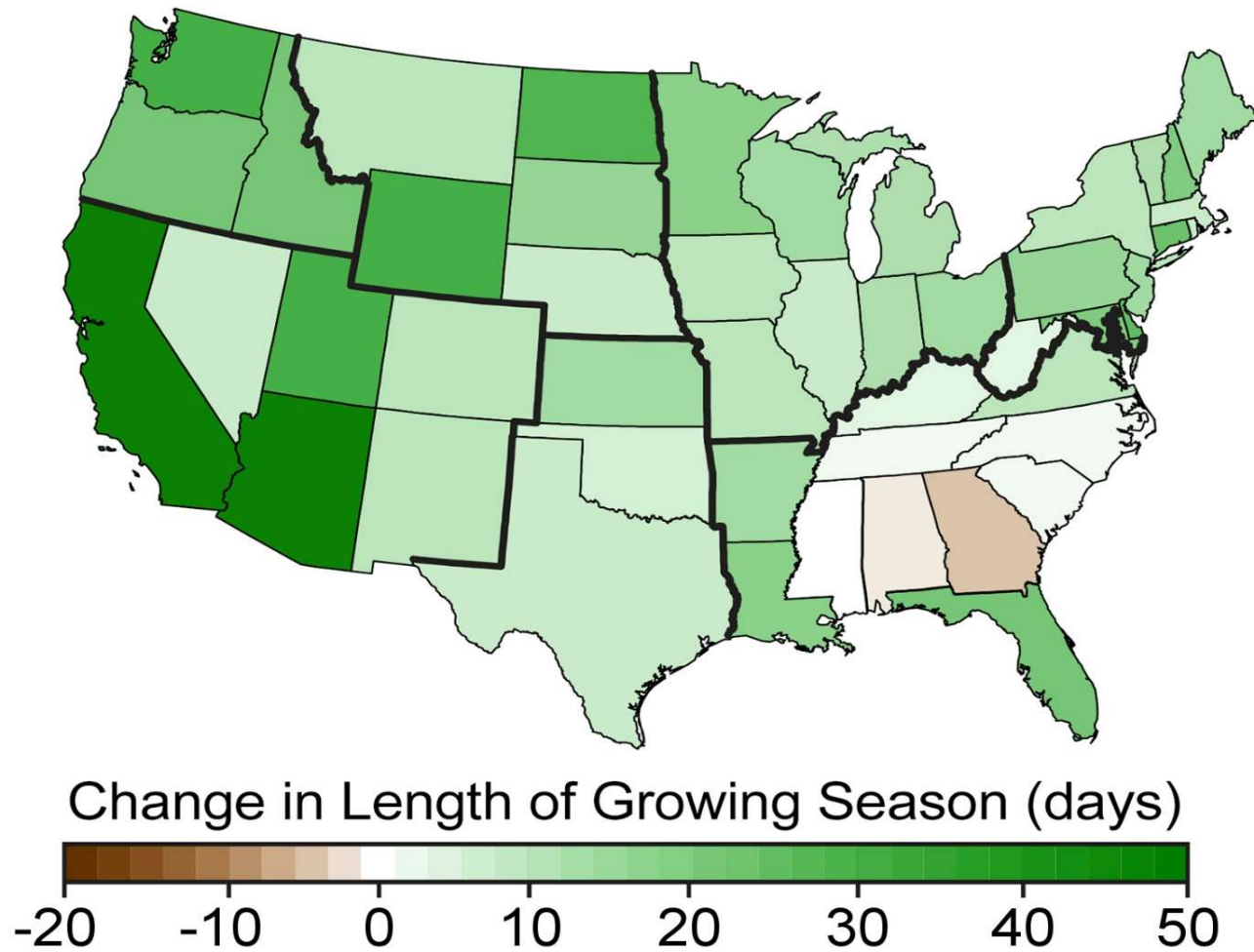
Source: Fourth National Climate Assessment 2018

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Observed: Change in Growing Season Length (1895 – 2012)



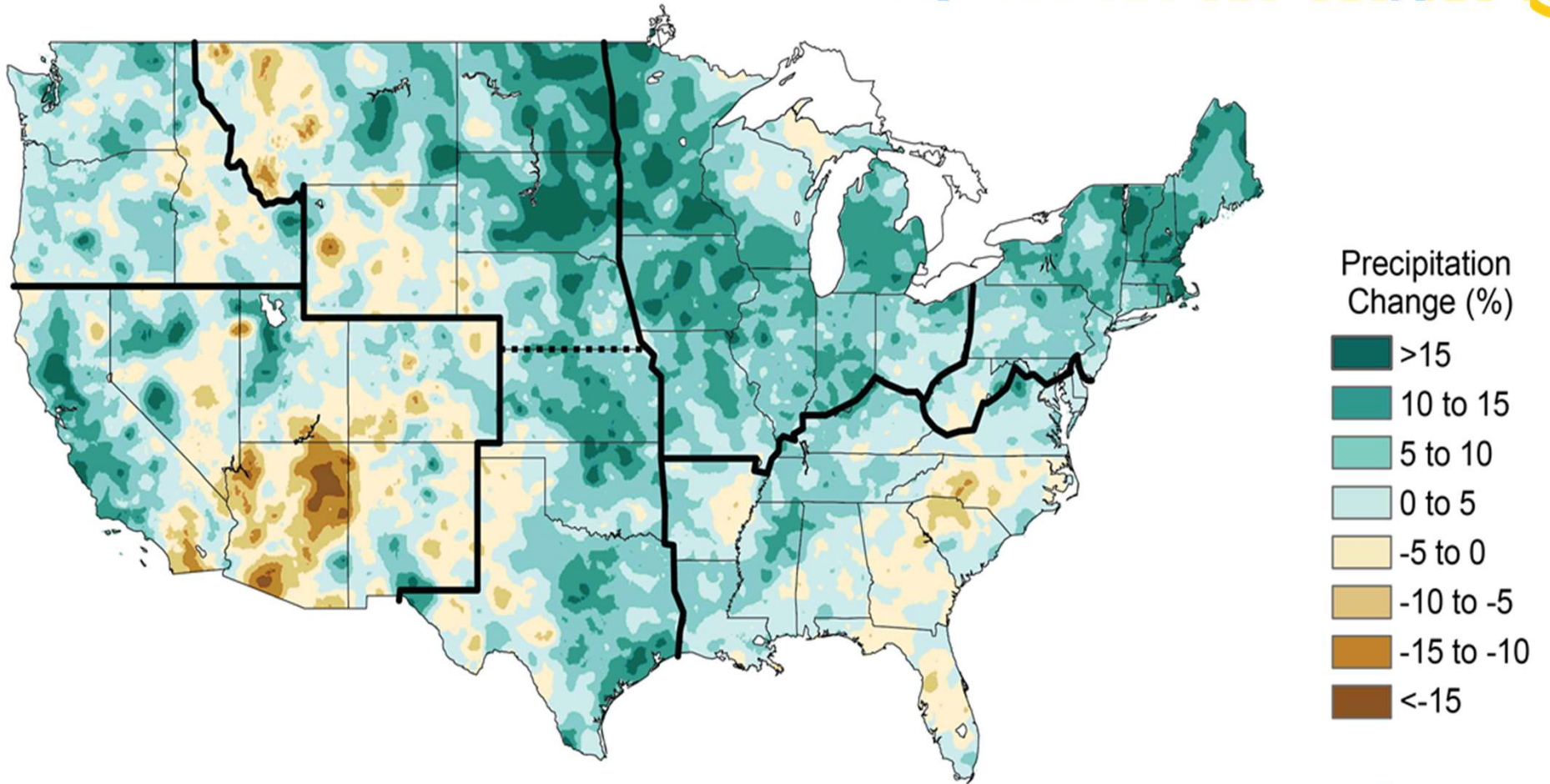
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Source: Fourth National Climate Assessment 2018



Observed: US Annual Precipitation Change



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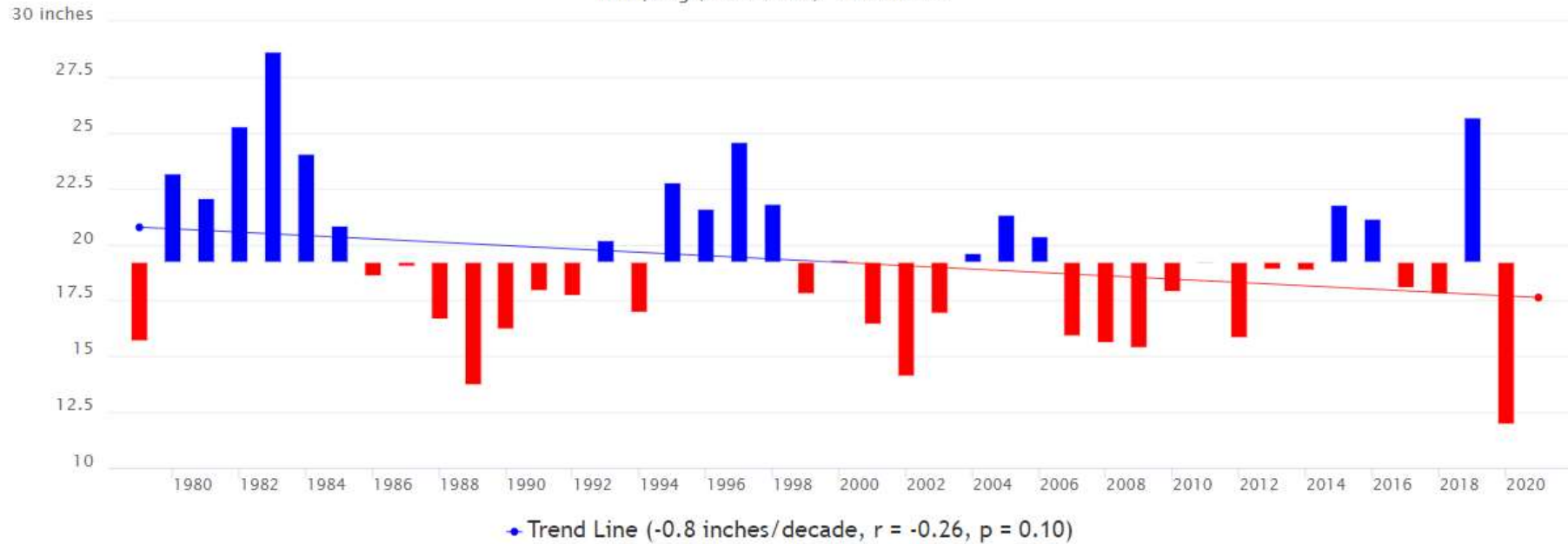


Utah Observed Precipitation Changes



January–December Precipitation

Utah, Avg (1979–2020): 19.2 inches



Climate Toolbox, Data Source: gridMET (UC Merced)

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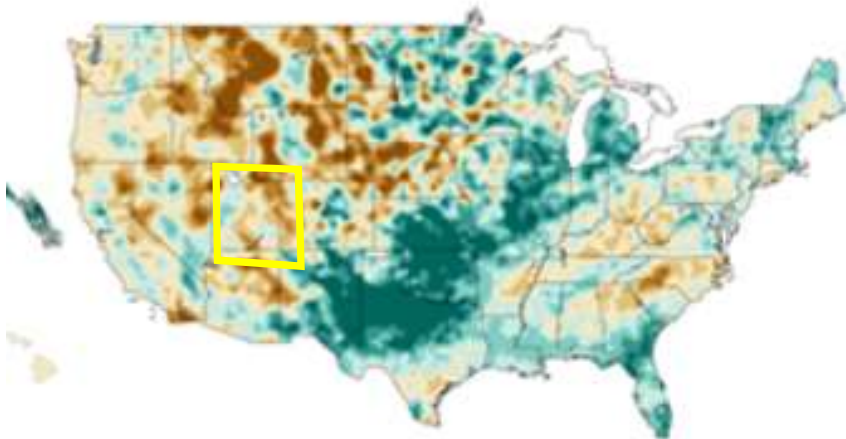


Observed: Precipitation Timing Changes

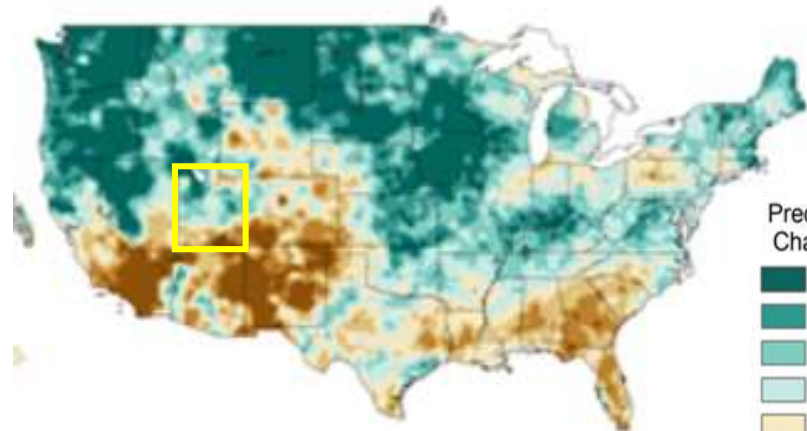
(1986-2018 to 1901-1960)



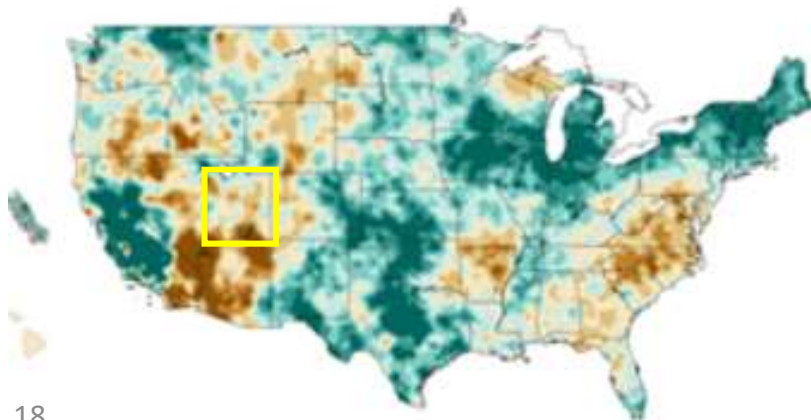
Winter Precipitation



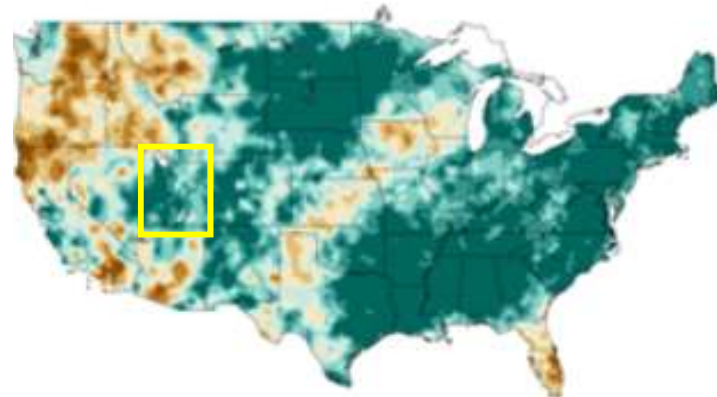
Spring Precipitation



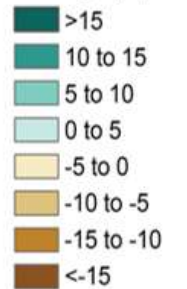
Summer Precipitation



Fall Precipitation



Precipitation Change (%)



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How does this climate information factor into understanding specific Agricultural production systems?

Alfalfa

Pasture

Rangeland

Livestock

Hemp

Barley

Corn

Winter/Spring Wheat

Fruits and Vegetables

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Why Are These Changes Happening?



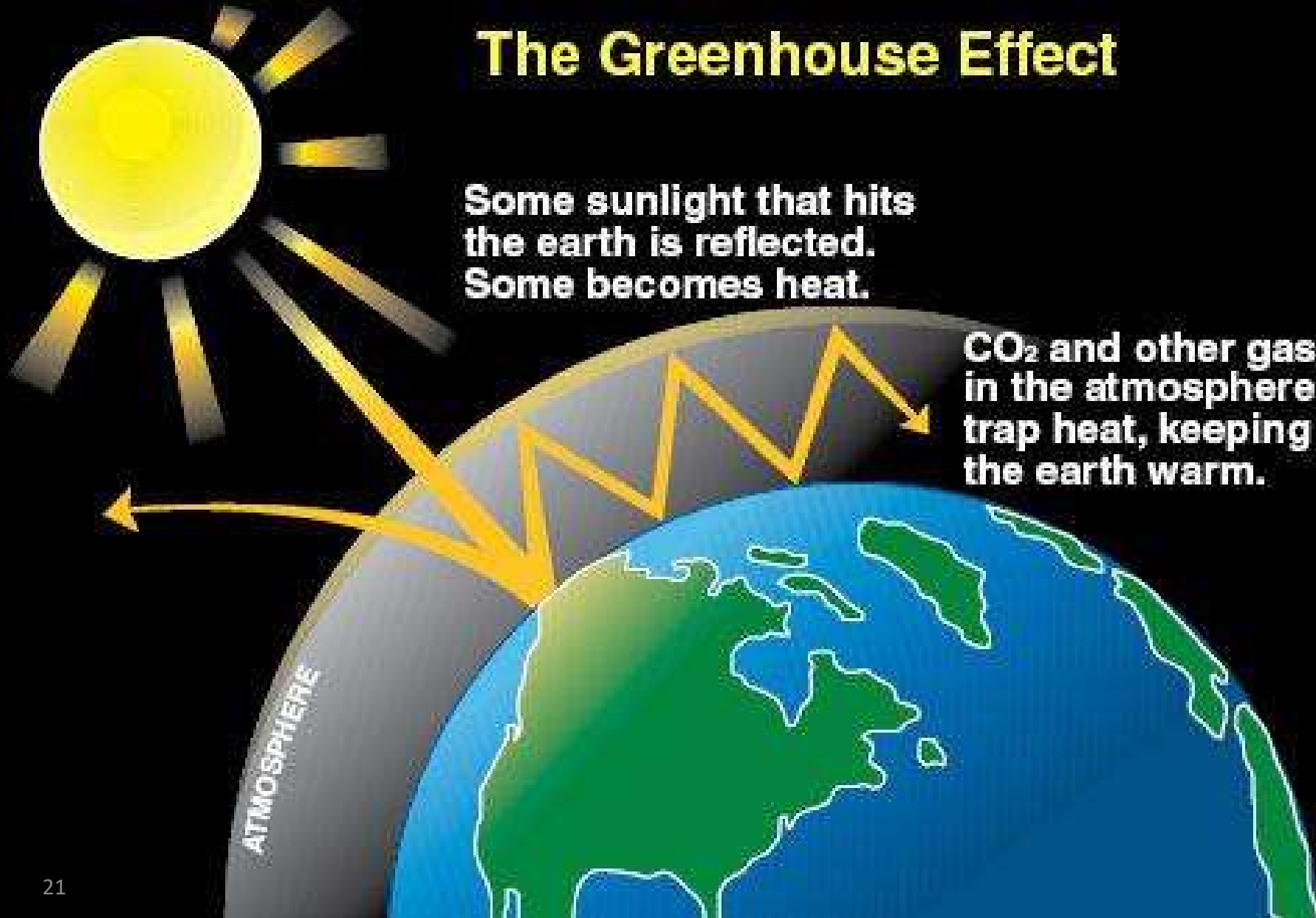
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The Greenhouse Effect

Some sunlight that hits the earth is reflected. Some becomes heat.

CO₂ and other gases in the atmosphere trap heat, keeping the earth warm.



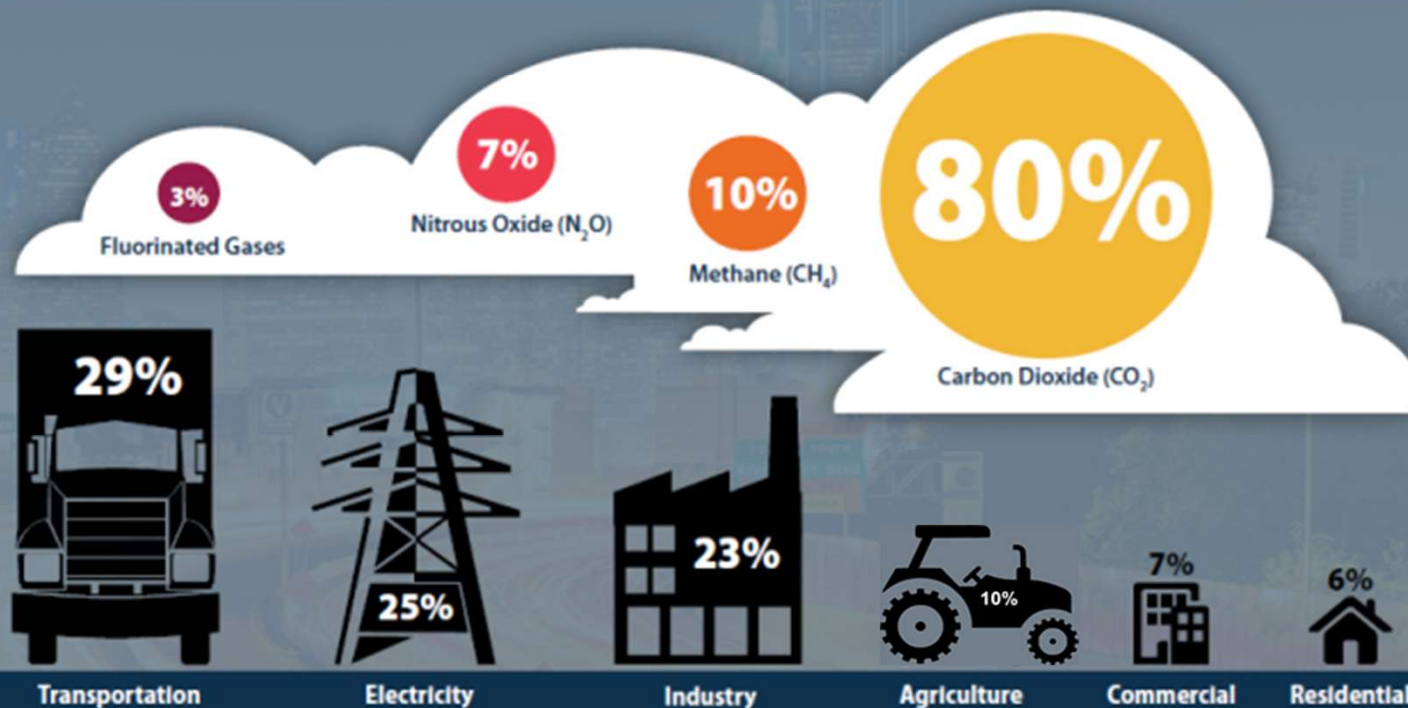
Fast Facts

1990-2019

National-Level U.S. Greenhouse Gas Inventory

U.S. Greenhouse Gas Emissions in 2019*

Total U.S. Greenhouse Gas Emissions by Economic Sector in 2019*

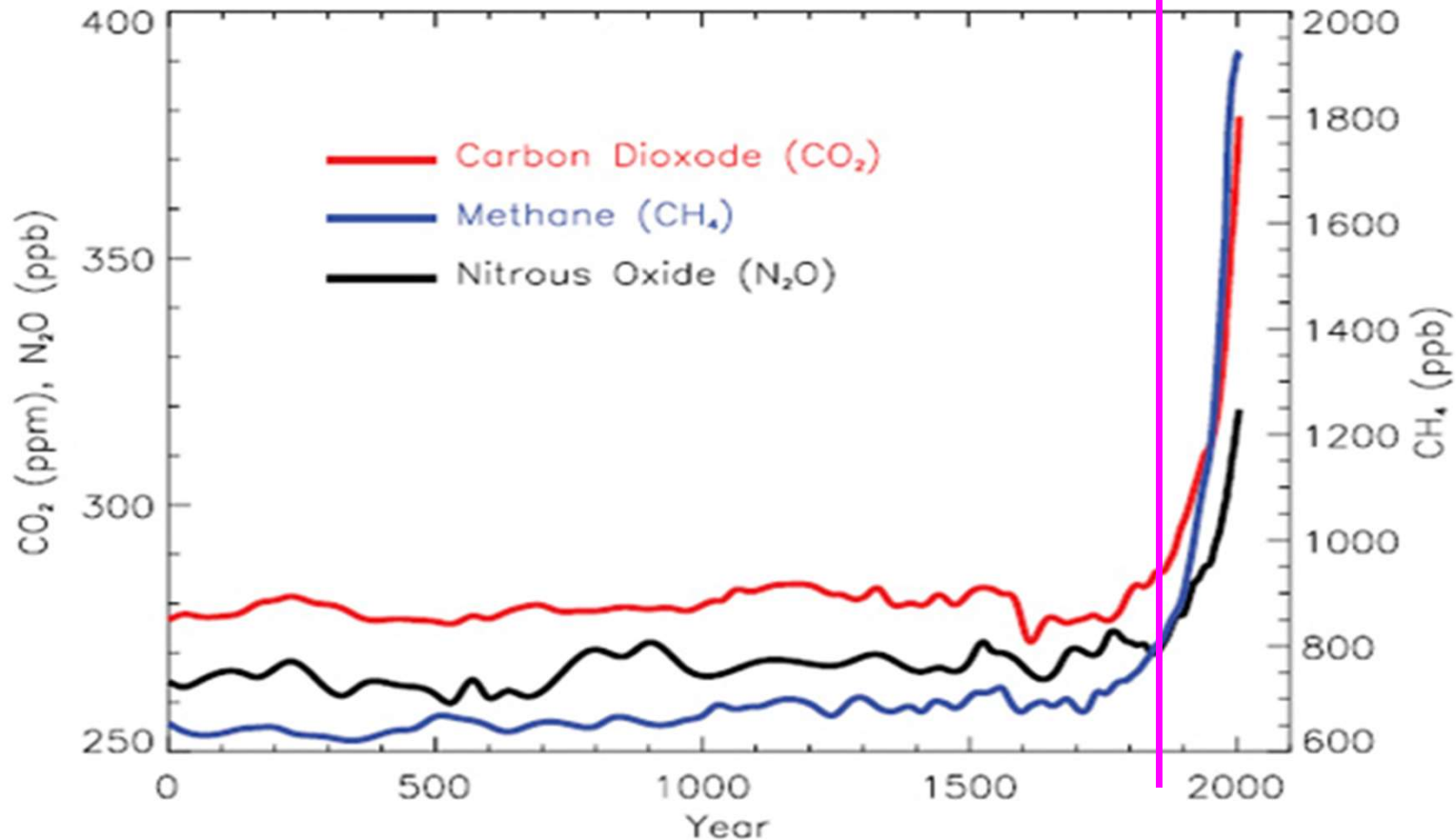


U.S. Greenhouse Gas Emissions

2019 Total Emissions	2018-2019 Change	1990-2019 Change
6,558 million metric tons of CO ₂ equivalent	↓ -1.7% total emissions	↑ 1.8% total emissions
CO ₂ emissions from fossil fuel combustion: 74.1% of total emissions	↓ -2.2% CO ₂ emissions	↑ 2.8% CO ₂ emissions
CO ₂ removals by forests and other lands: 12.4% of total emissions	↓ -2.7% CO ₂ emissions from fossil fuel combustion	↑ 2.6% CO ₂ emissions from fossil fuel combustion

* Percentages may not add to 100% due to independent rounding and the way the inventory qualifies U.S. territories (not shown) as a separate sector. Emissions from Land-Use, Land-Use Change and Forestry are reported separately and not shown in the figure.

Concentrations of Greenhouse Gases (year 0 – 2005)



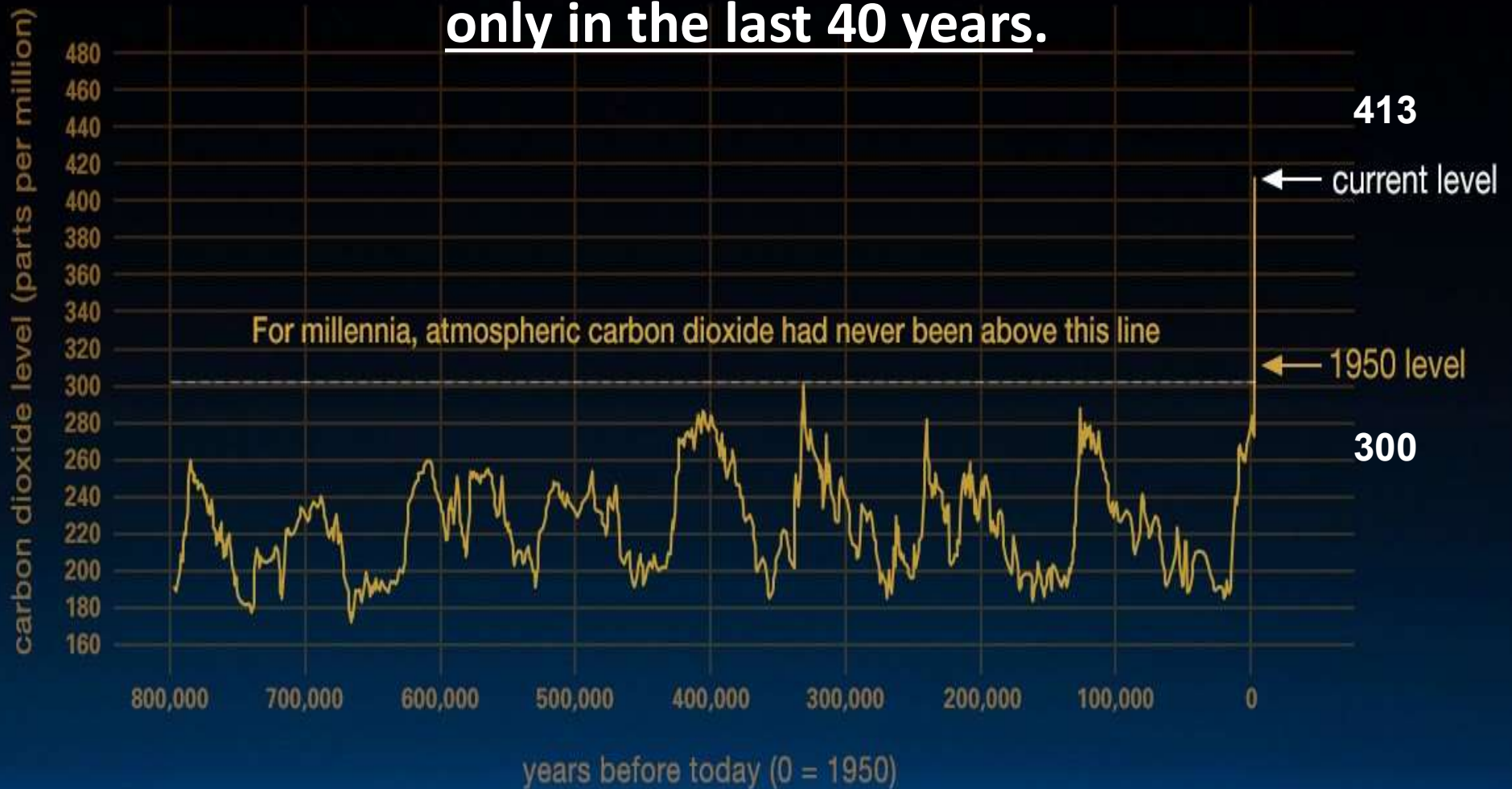
End of 1800s: Beginning of 2nd industrial revolution, electric lights invented, and introduction of the automobile.

Source: [Intergovernmental Panel on Climate Change Fourth Assessment Report 2007](#)

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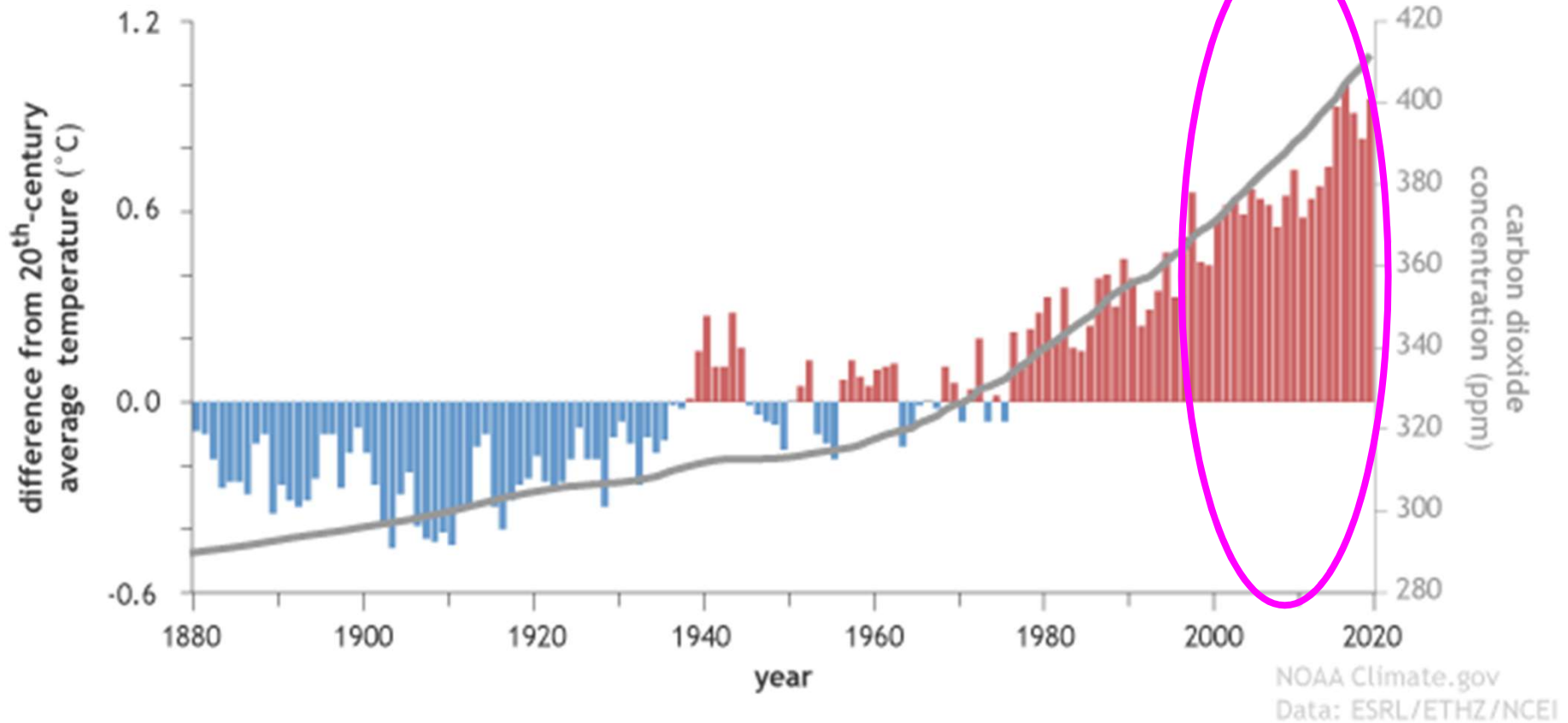
Half of human-related CO₂ emissions has occurred only in the last 40 years.



Source: Data: Luthi, D., et al.. 2008; Etheridge, D.M., et al. 2010; Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO₂ record.

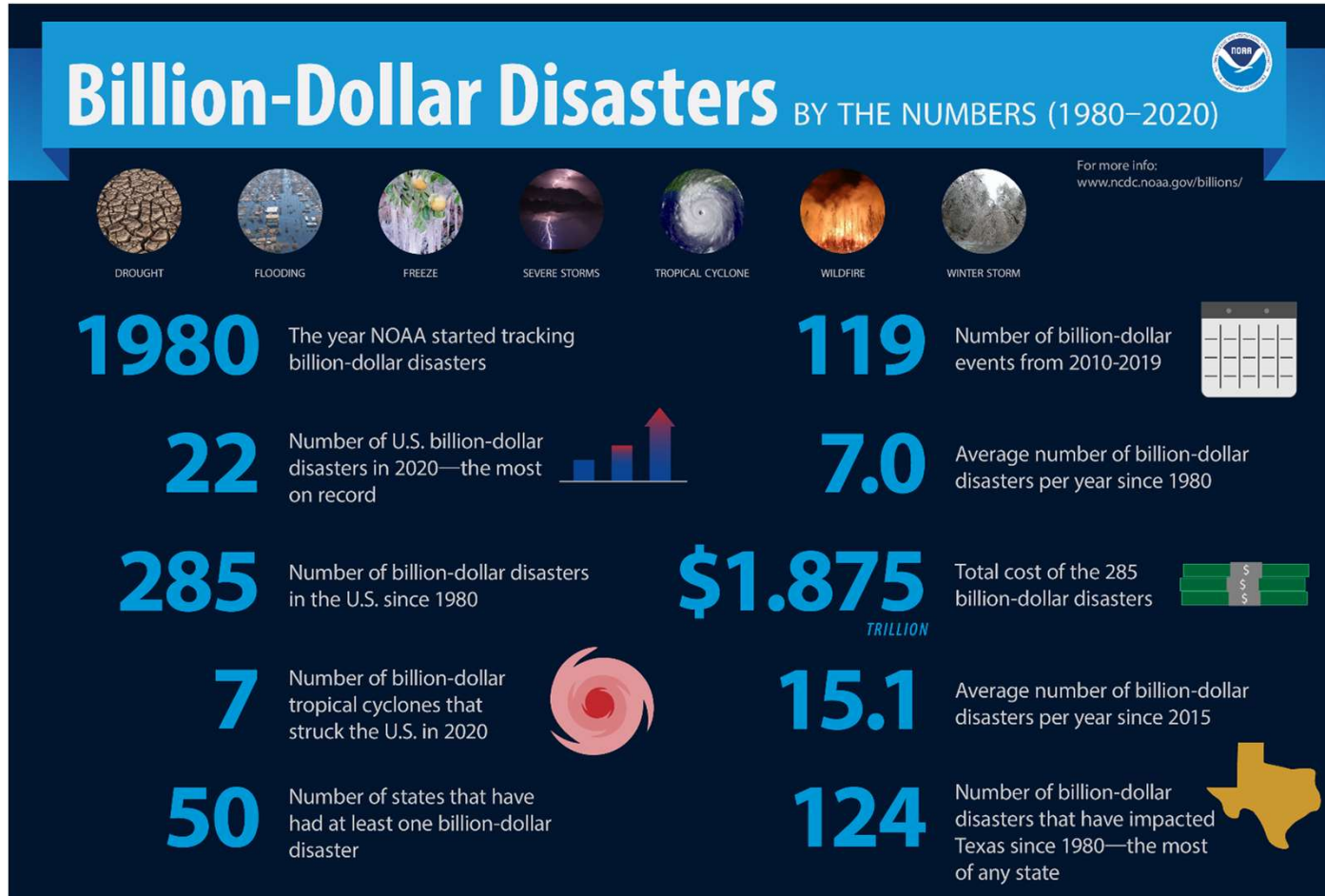
Temperature Has Risen Along With Levels of Greenhouse Gases

Atmospheric carbon dioxide and Earth's surface temperature (1880-2019)





US Billion Dollar Disaster Events 1980 - 2020



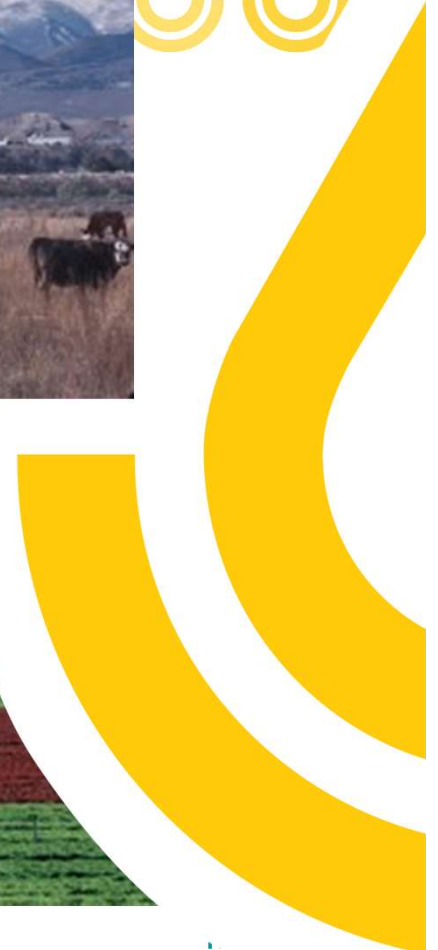
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Source: NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2021).



Local Climate Changes and Trends



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Southwest Things to Think About



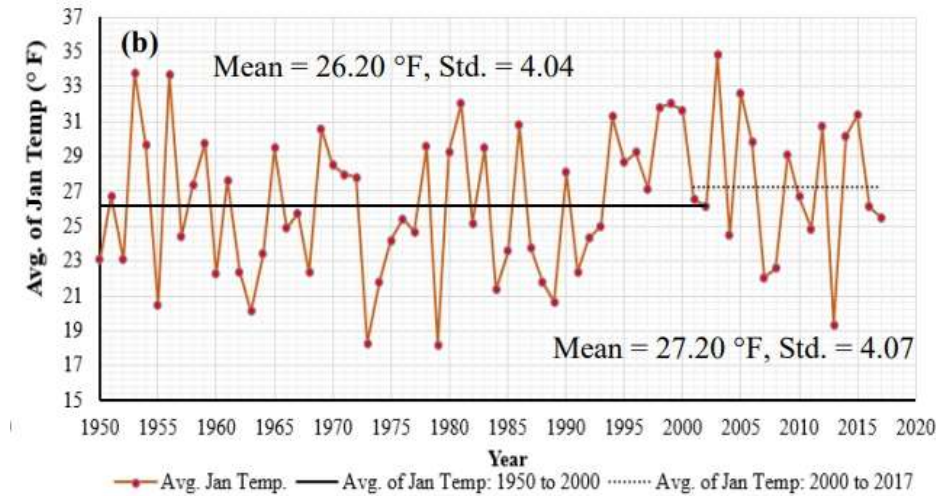
- Mega Drought
- Water Scarcity
 - Ground
 - Surface
- Annual and Seasonal Average temperatures are increasing. August 2020 was the warmest month on record in 146 years.
- Native Americans and historically underserved populations are among the most at risk from climate change.

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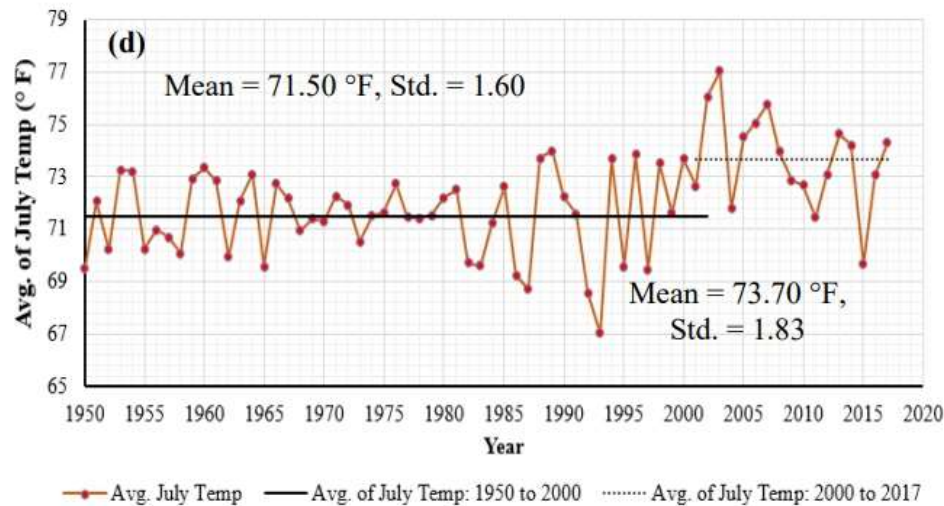
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What has changed in Utah?



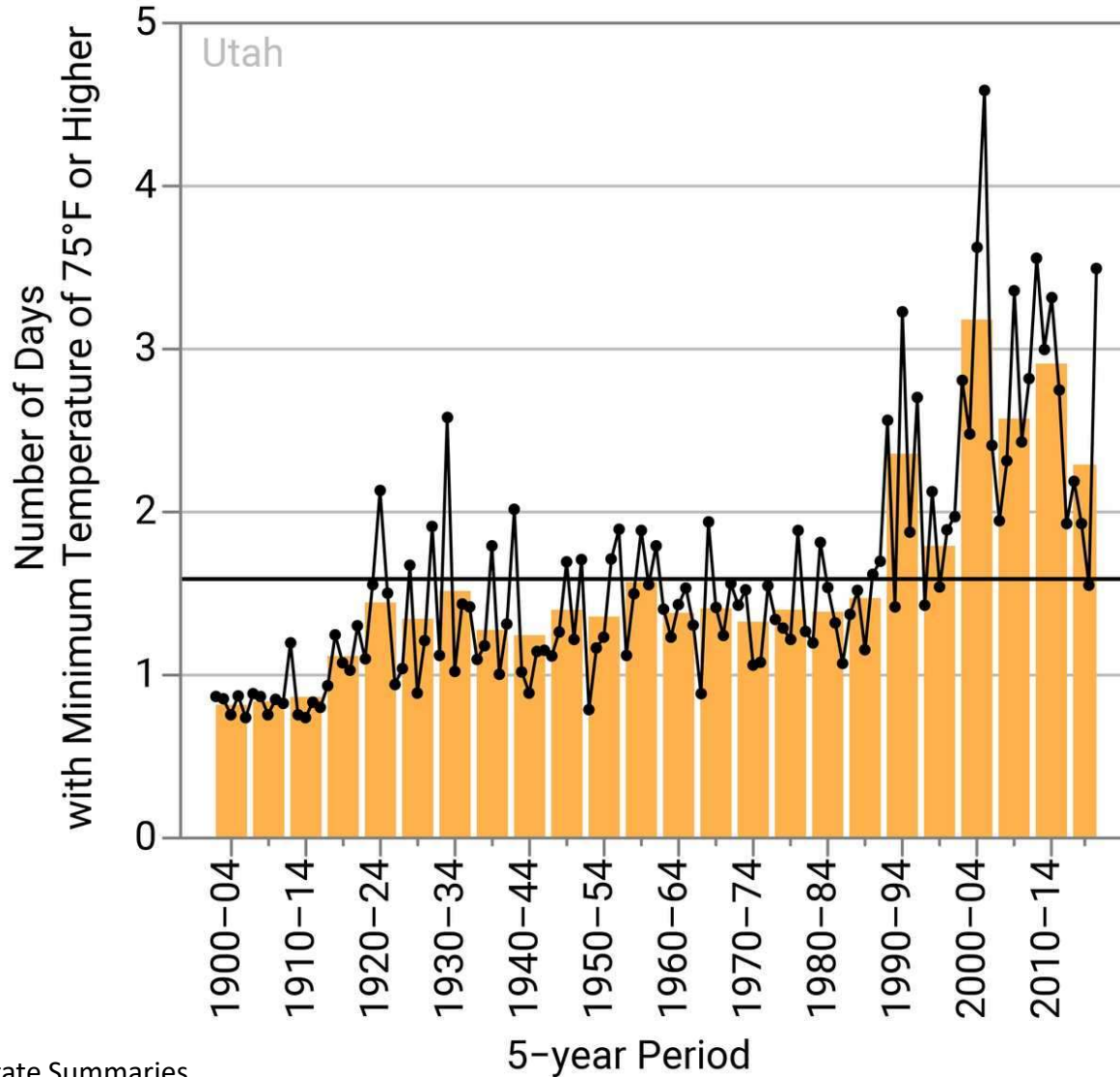
7





Utah

Observed Number of Very Warm Nights



Source: NOAA State Summaries

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What management changes have you seen producers adopting to adjust to changing weather/climate conditions?

enter in chat box

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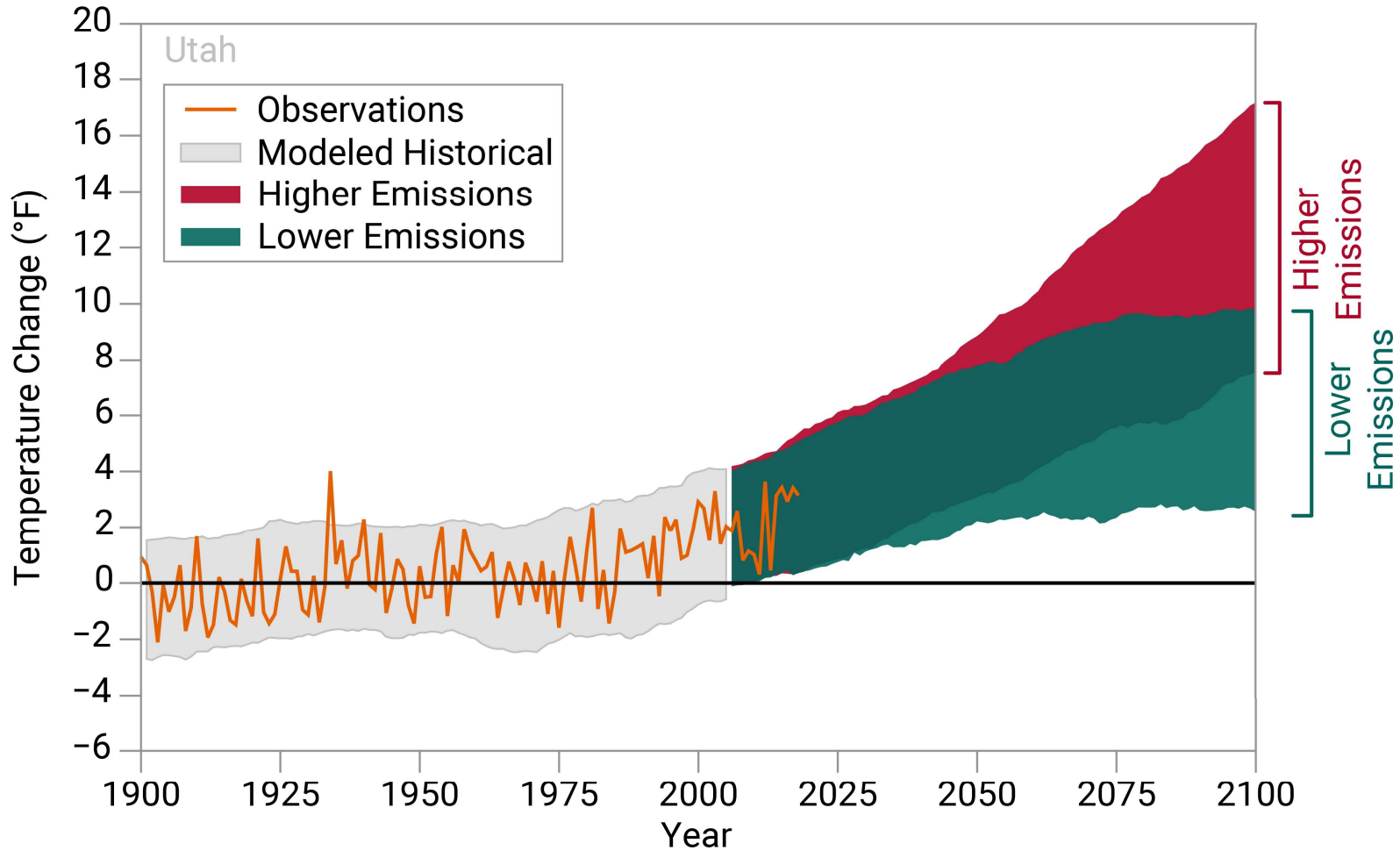
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Utah



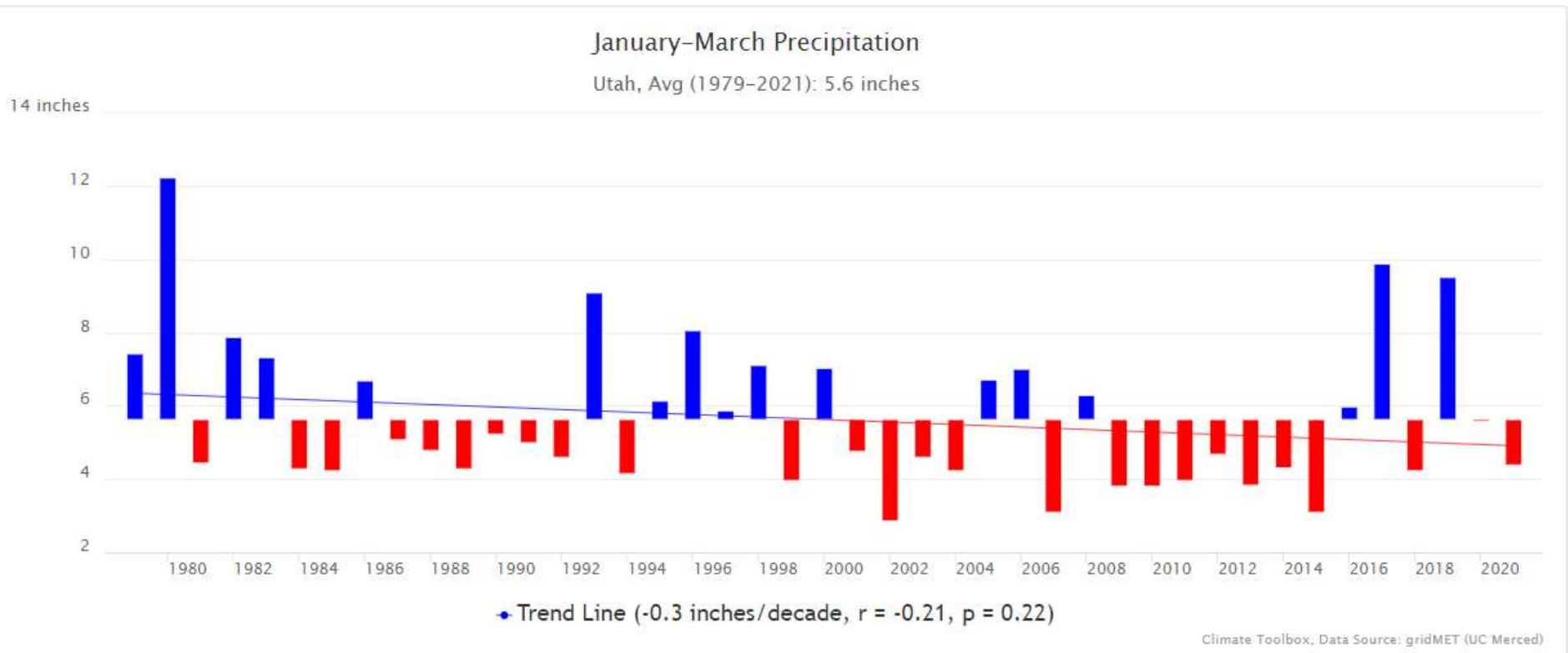
Observed and Projected Temperature Change



Source: NOAA State Summaries



Utah 1980-2020 Observed Change in Precipitation (January-March)



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Drought

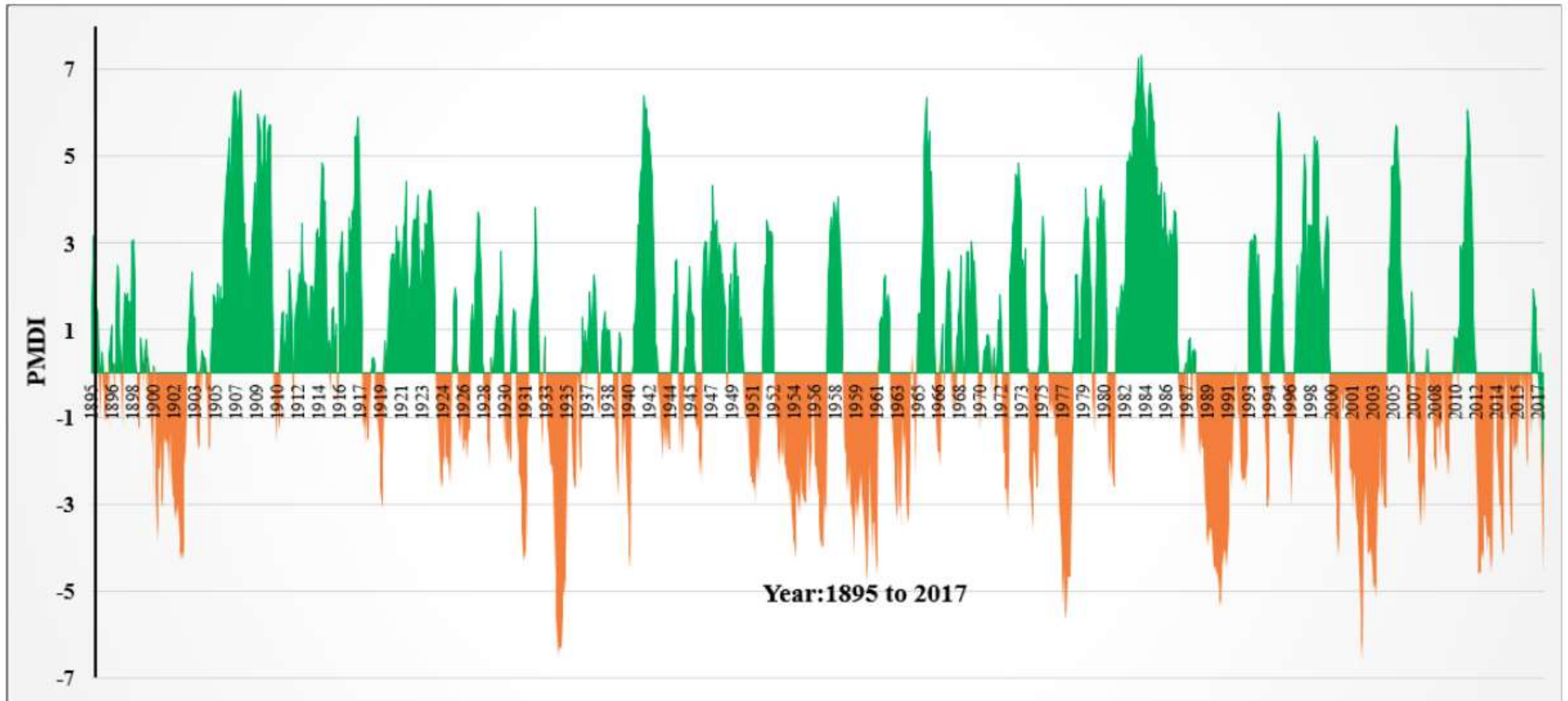


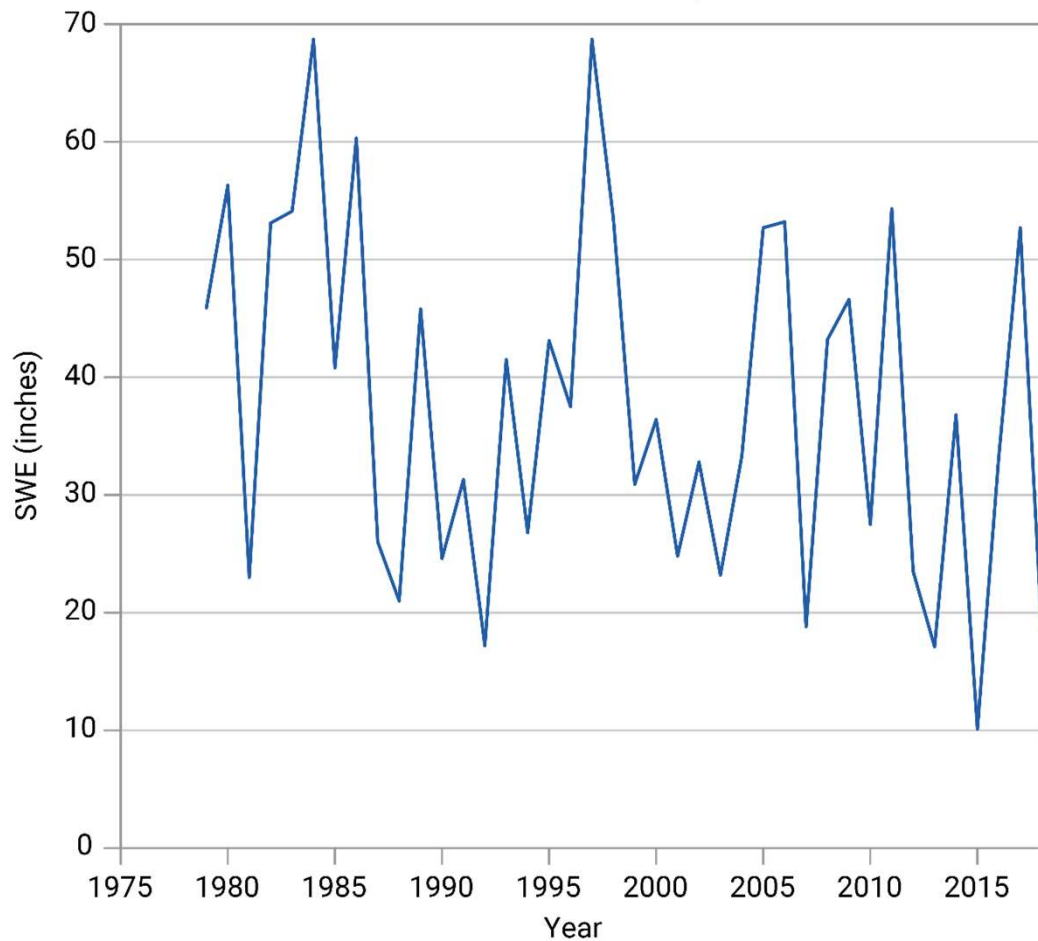
Figure 14: Historical drought records in the Utah based on the Palmer Modified Drought Index (PMDI) for the period 1895 through 2017. Data source:

<https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp#>

Utah snowpack

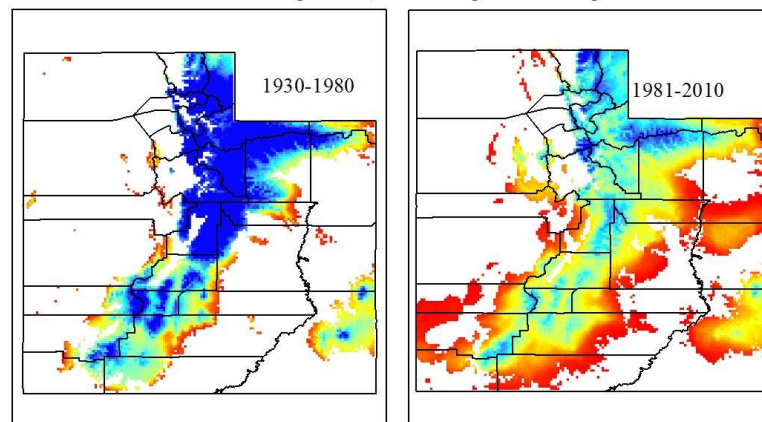


April 1 Snow Water Equivalent (SWE)
at Ben Lomond Peak, UT



Source: NOAA State Summaries

Snow Water Equivalent, mean of April 1st in the period of



Counties
swe, mm
Value
High : 1136.33
Low : 0

<https://climate.usu.edu/snowSwe.php>

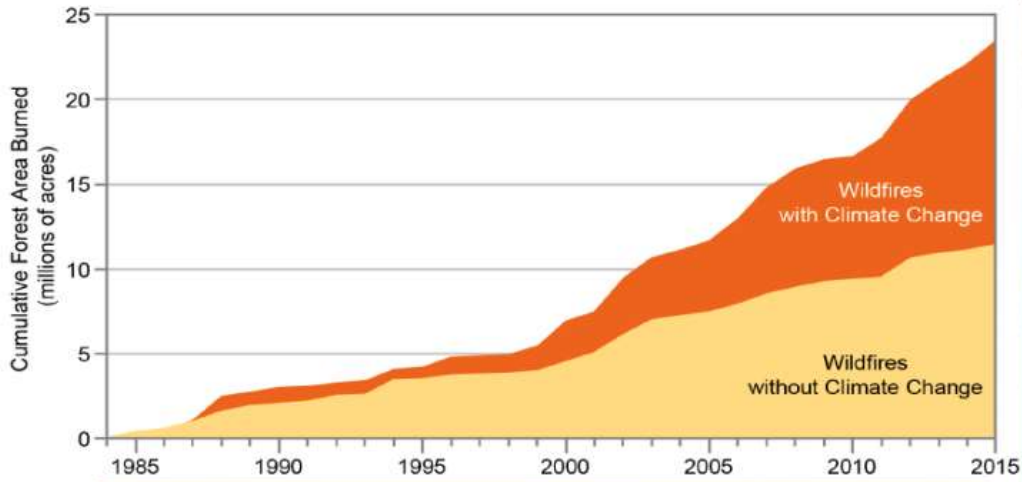
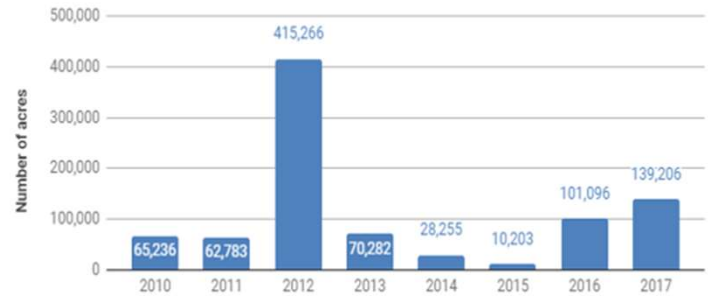
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Wildfire

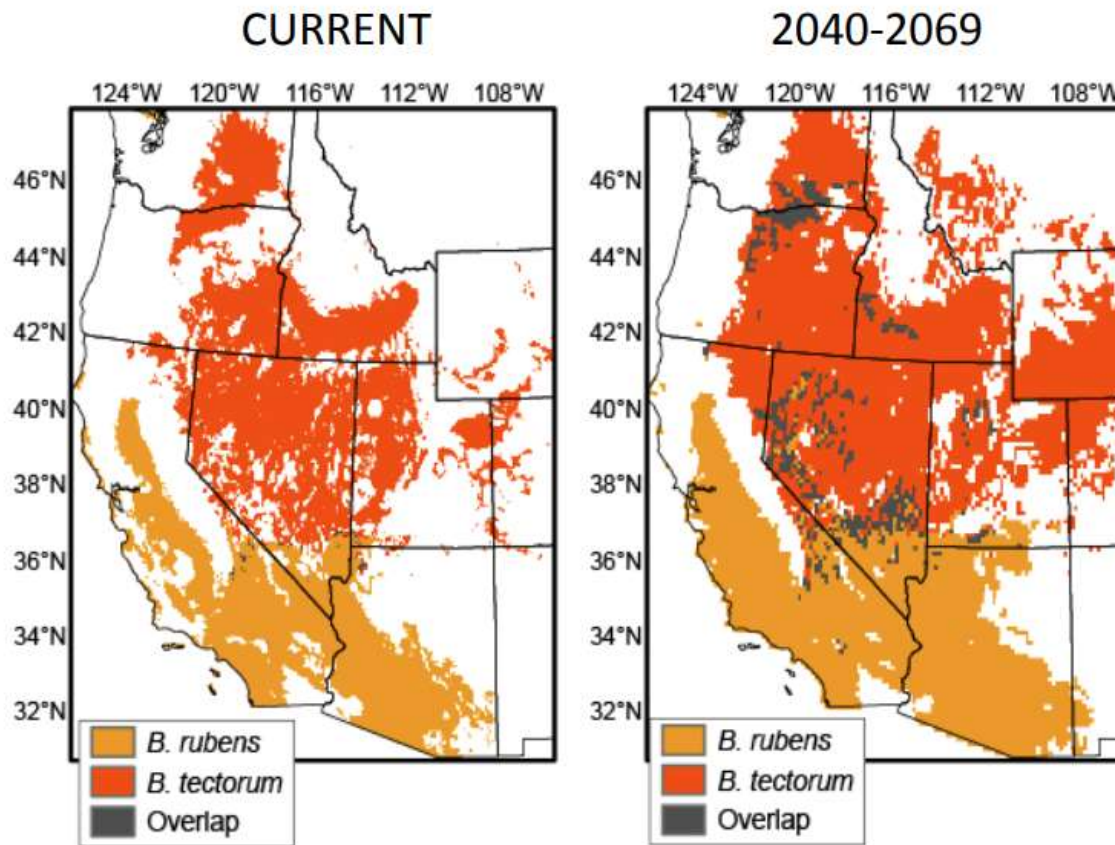
Utah Wildfire Incidents
(2010 - 2017)





Invasive species

Climate suitability for cheatgrass and red brome



from Bradley et al. in revision

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What do we need to do help Utah adapt to climate change?

- Ranchers
- Irrigated/Dryland Farmers
- Rural/Urban water needs
- Agricultural survival strategies

Place thoughts in the chat box

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Available Resources



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USDA Climate Hubs



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Southwest USDA Climate Hub



- ❖ Headquartered at the USDA-ARS Jornada Experimental Range on the New Mexico State University campus in Las Cruces, NM
- ❖ Provide information and technology to guide climate-informed decision making by farmers, ranchers, forest landowners, Native American tribes, natural resource managers and technology transfer specialists
- ❖ Science driven, stakeholder centered, efficient, cooperative partnerships with federal, state and local organizations

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Southwest USDA Climate Hub



Climate Hubs Supporting NRCS

Increase **partnership reach** and **science connections**

- Drought Learning Network (focus on how not what)
- Peer-to-peer knowledge transfer
- Tribal Engagement
- SW Beef Project
- ARID Project

Provide **Tools** to inform Decision-making

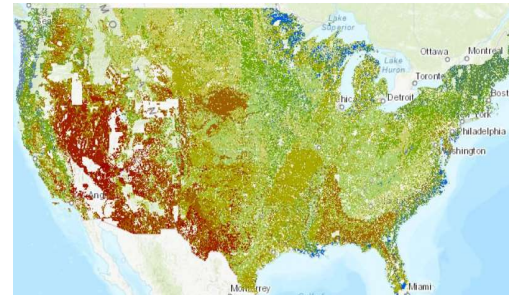
- Grass-Cast
- AgRisk Viewer
- CocoRaHS
- Beef Decision Toolshed

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USDA Resources



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What other partners/resources are available in Utah?

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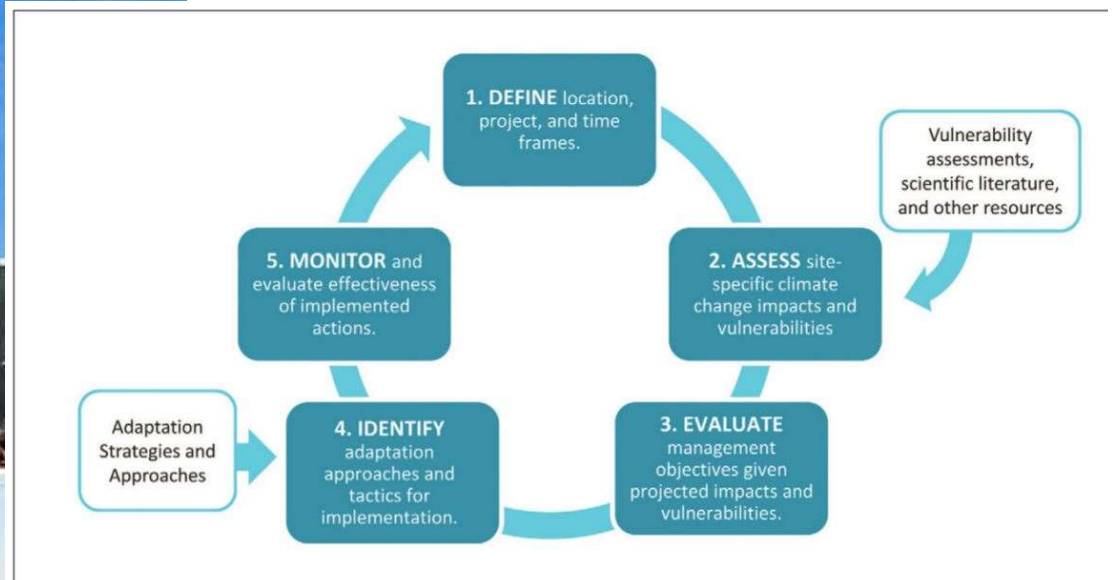
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ADAPTATION RESOURCES FOR AGRICULTURE

Responding to Climate Variability and Change
in the Midwest and Northeast



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Climate Informed Agriculture and NRCS



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Where to Start the Conversation About Climate Informed Agriculture

- Understand the Climate Information for your area:
 - **NOAA State Summaries**
<https://statesummaries.ncics.org/>
 - **Weather Explorer to see a county level view of historic and projections:** <https://crt-climate-explorer.nemac.org/>
 - **US Drought Monitor and other resources:** www.drought.gov
 - **USDA Climate Hubs:**
<https://www.climatehubs.usda.gov/hubs/southwest>





Where to Start the Conversation About Climate Informed Agriculture

- NRCS professionals know the Landscape and Operation Vulnerabilities
 - Lowlands
 - Steep slopes
 - Poor soils
 - Overgrazing
- Will current practices be sufficient to address the extremes and changes in a changing climate?
- Think through specific crops/operations you are familiar with to see what else can be done to adapt?



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MAXIMIZE CONTINUOUS LIVING ROOTS

- Crop Rotation
- Relay Crops
- Forage and Biomass Planting
- Perennial Crops
- Cover Crops

MINIMIZE DISTURBANCE

- No-till
- Reduced Tillage
- Controlled Traffic
- Avoid Tillage When Wet
- IPM

4

SOIL HEALTH PRINCIPLES

Nutrient/
H₂O Mgt

MAXIMIZE BIODIVERSITY

- Crop Rotation
- Rotational Grazing
- IPM
- Pollinator Plantings
- Organic Fertilizers
- Legumes in Mix
- Agroforestry
- Cover Crops
- Crop/ Livestock Integration

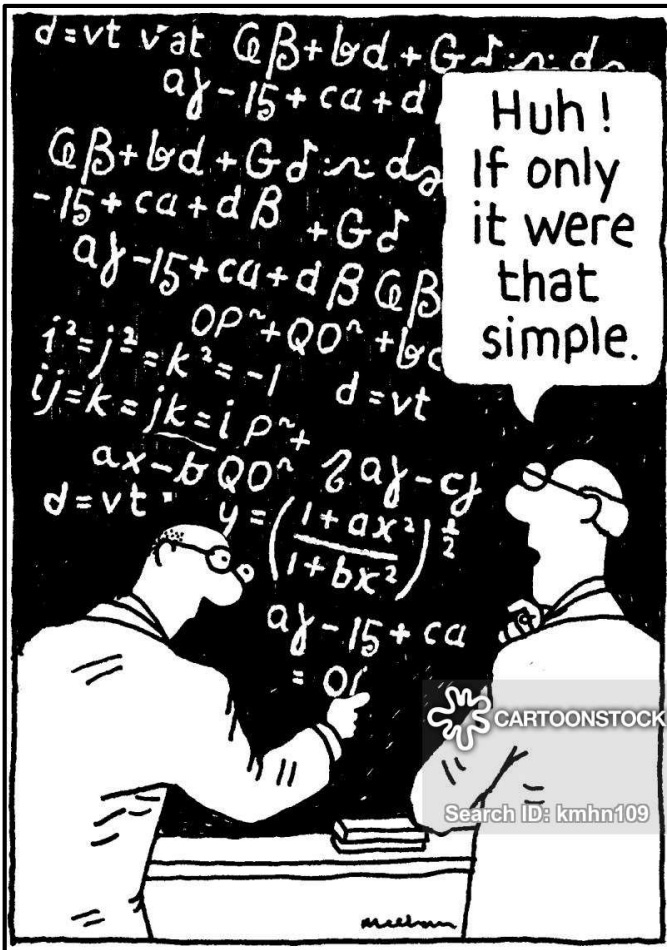
MAXIMIZE SOIL COVER

- Mulching
- Reduced Tillage
- Forage and Biomass Planting
- Residue Retention
- Cover Crops
- Green Manures

Where to Start the Conversation About Climate Informed Agriculture

- Continue Promoting Keystone NRCS Campaigns
 - Soil Health
 - Contingency plans
 - Drought
 - Flooding
 - Extreme heat
 - Cold Snaps
 - Blizzards

Relaying the information



NRCS has been translating science into information and actions that agricultural producers can use since its inception in 1935

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Local, trusted messengers are the most effective communicators.



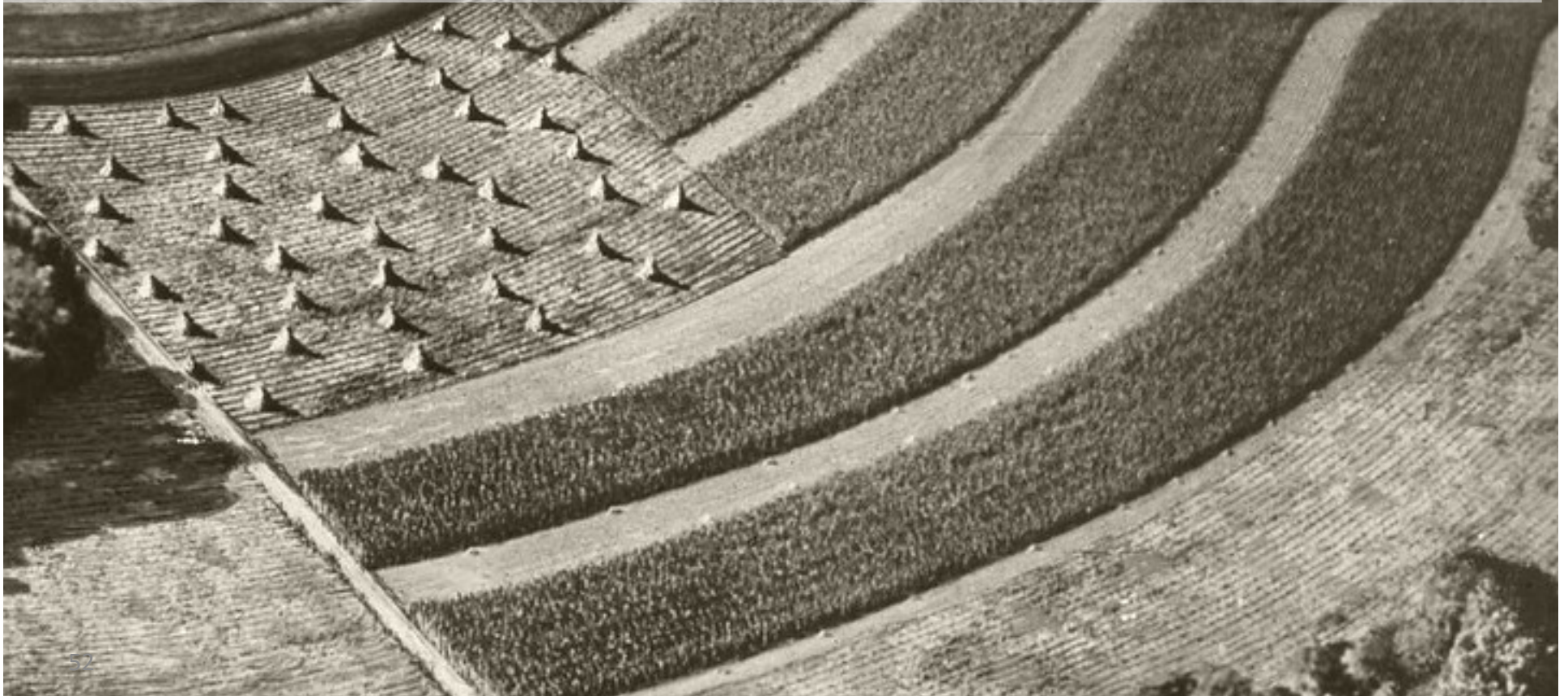
Source: McKenzie-Mohr, Doug, (2011). *Fostering sustainable behavior: an introduction to community-based social marketing*, 3rd edition. Gabriola Island, BC: New Society Publishers. <https://www.cbsm.com/book/>

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NRCS Vision: A world of clean and abundant water, healthy soils, resilient landscapes, and thriving agricultural communities through voluntary conservation.





We need your feedback!



Please complete 2-minute survey by following the link in the chat box.

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Available Resources:



Southwest Climate Hub: <https://www.climatehubs.usda.gov/hubs/southwest>

Drought.gov - <https://www.drought.gov/>

Drought Monitor - <https://droughtmonitor.unl.edu/>

AgRisk Viewer - <https://www.climatehubs.usda.gov/hubs/southwest/tools/agrisk-viewer>

Climate Smart Restoration Tool - <https://climaterestorationtool.org/csrt/>

LOCA Historic and projections:- <https://scenarios.globalchange.gov/loca-viewer/>

Fourth National Climate Assessment - <https://nca2018.globalchange.gov/chapter/1/>

Climate toolbox - <https://climatetoolbox.org/tool/future-climate-dashboard>

EPA Climate Scenarios Map:

<https://epa.maps.arcgis.com/apps/MapSeries/index.html?appid=3805293158d54846a29f750d63c6890e>

Fire Science: <https://greatbasinfirescience.org/tools-trainings/climate-adaptation-integration-tool-cait/>

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