

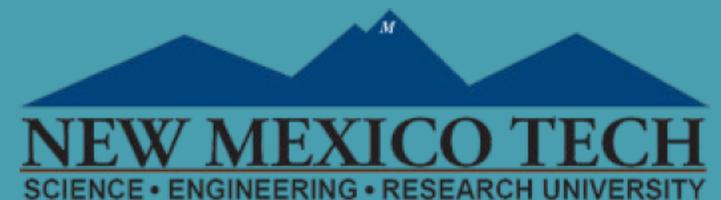
Water Scarcity and Climate Change in New Mexico

Stacy Timmons

Associate Director for Hydrogeology Programs
New Mexico Bureau of Geology and Mineral Resources



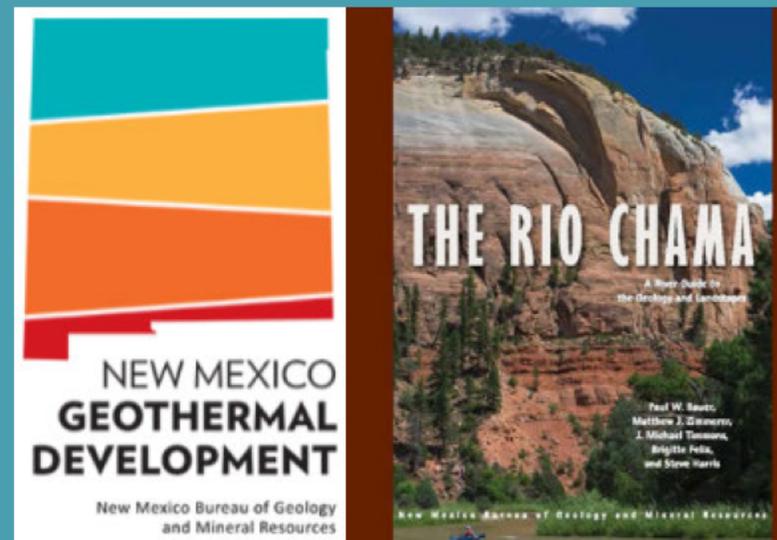
June 2025
NM Judicial Conclave



NM Bureau of Geology Has a Range of Programs

Non-regulatory, state geologic survey, providing science and service to NM since 1927!

- Geologic Mapping and Hazards
- Hydrogeology / Water Programs
- Energy
 - Oil/gas and geothermal
- Mineral Resources
- Laboratories
- Outreach and Education



WATER PROGRAMS AT NM BUREAU OF GEOLOGY



Aquifer Mapping and Monitoring Program

Regional short and long-term hydrogeology studies and mapping water quantity and quality
Groundwater level monitoring (currently



Water Data Initiative

Began in 2019, after the Water Data Act
Convening the work with multiple state agencies
Working to make NM water data more

*Currently 12 Full-time Staff (3 Managers), 10 Part-time staff.
We have 5 vacancies to fill now*



Water Education Program

For legislators, staff and state water leaders
Developed following the model of previous Decision Makers Conferences
Focusing on increasing awareness and education on critical water issues in NM

Climate Change in New Mexico Over the Next 50 Years: Impacts on Water Resources

Editors and Contributing Authors: Nelia W. Dunbar, David S. Gutzler, Kristin S. Pearthree, Fred M. Phillips, Paul W. Bauer

Contributing Authors: Craig D. Allen, David DuBois, Michael D. Harvey, J. Phillip King, Leslie D. McFadden, Bruce M. Thomson, Anne C. Tillery



WATER RESOURCES

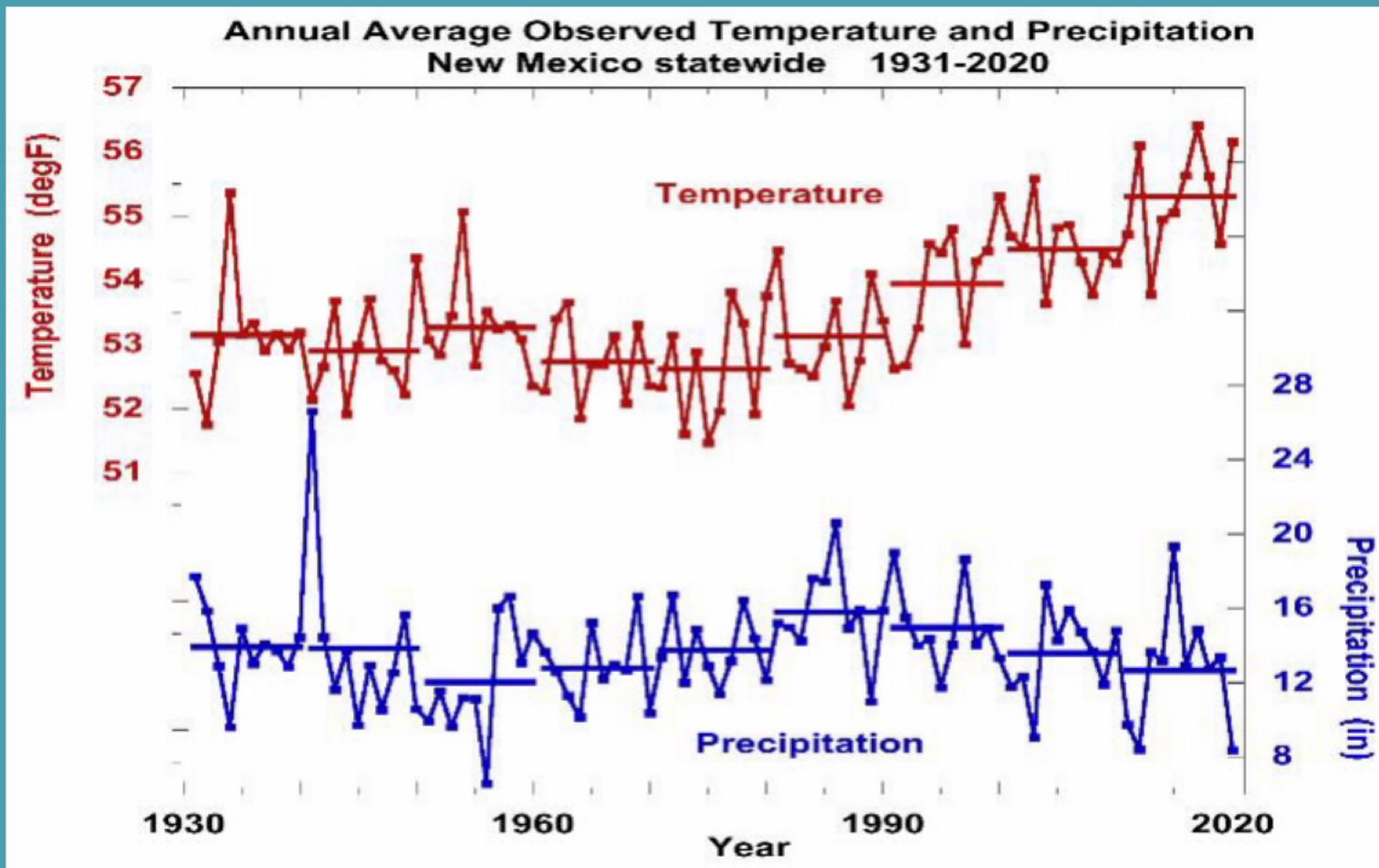
- Collaboration with the NMISC
- Experienced team of scientists
 - Fred Phillips, Dave Gutzler, Craig Allen, Dave DuBois, Mike Harvey, Phil King, Les McFadden, Bruce Thomson, and Anne Tillery
- Compilation and integration of existing data
- **ADD QR CODE to access this**

<https://geoinfo.nmt.edu/climatepanel>

Why do we need this?

New Mexico's climate is warming

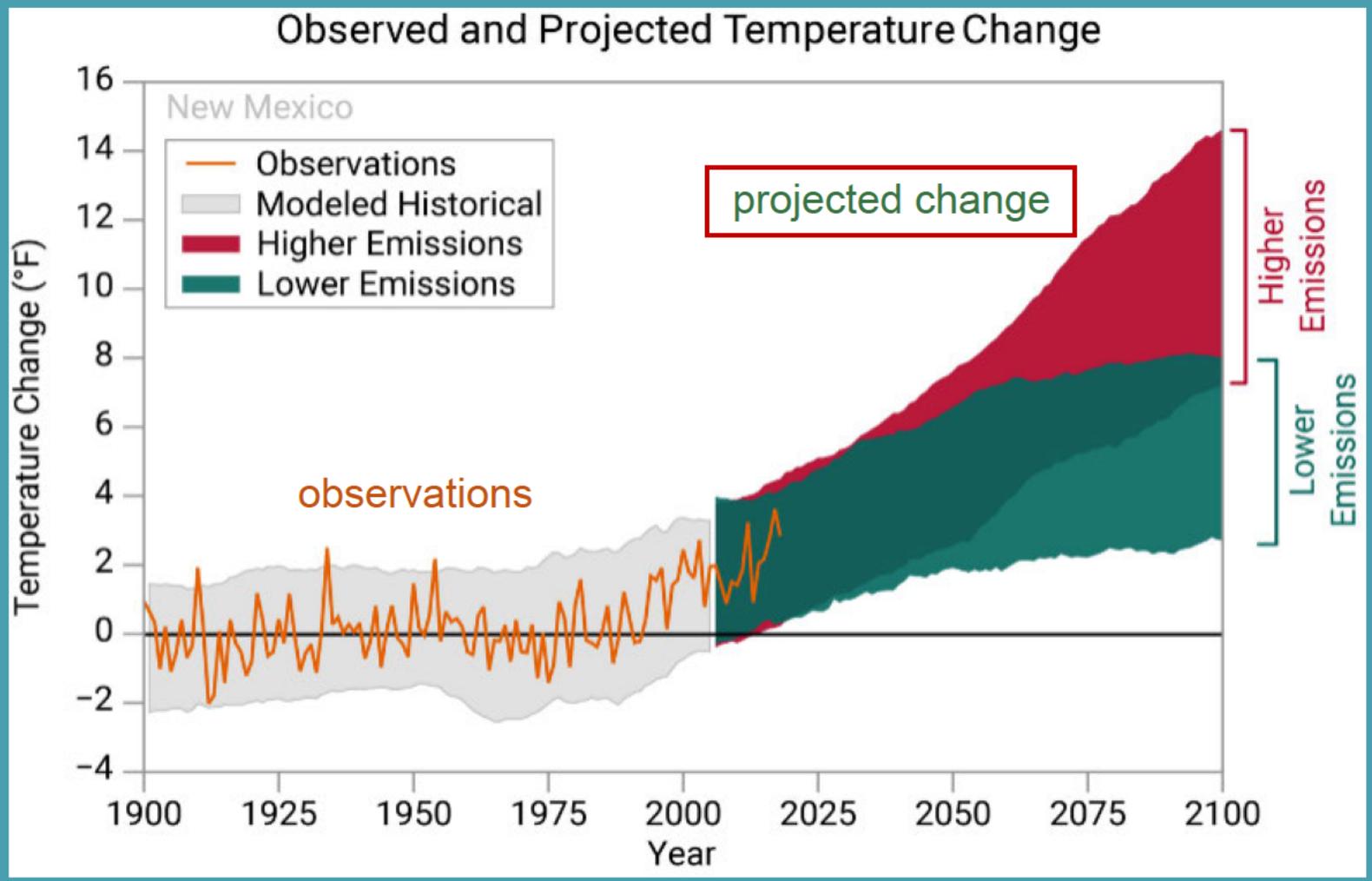
A new 50-year water plan for the state must account for ongoing and future changes to our climate and water resource reliability



Decade-average temperatures have been climbing steadily for the past 50 years

Precipitation has no clear trend but is hugely variable, annually and decadal
4 of the 5 driest years since 1930 have occurred in the past two decades

climate will continue to warm in response to increasing concentrations of atmospheric greenhouse gases



Red and **green** bands represent future temperature increases in NM projected by an ensemble of climate models, in response to **higher** or **lower** rates of future greenhouse gas emissions

Ground rules of the study

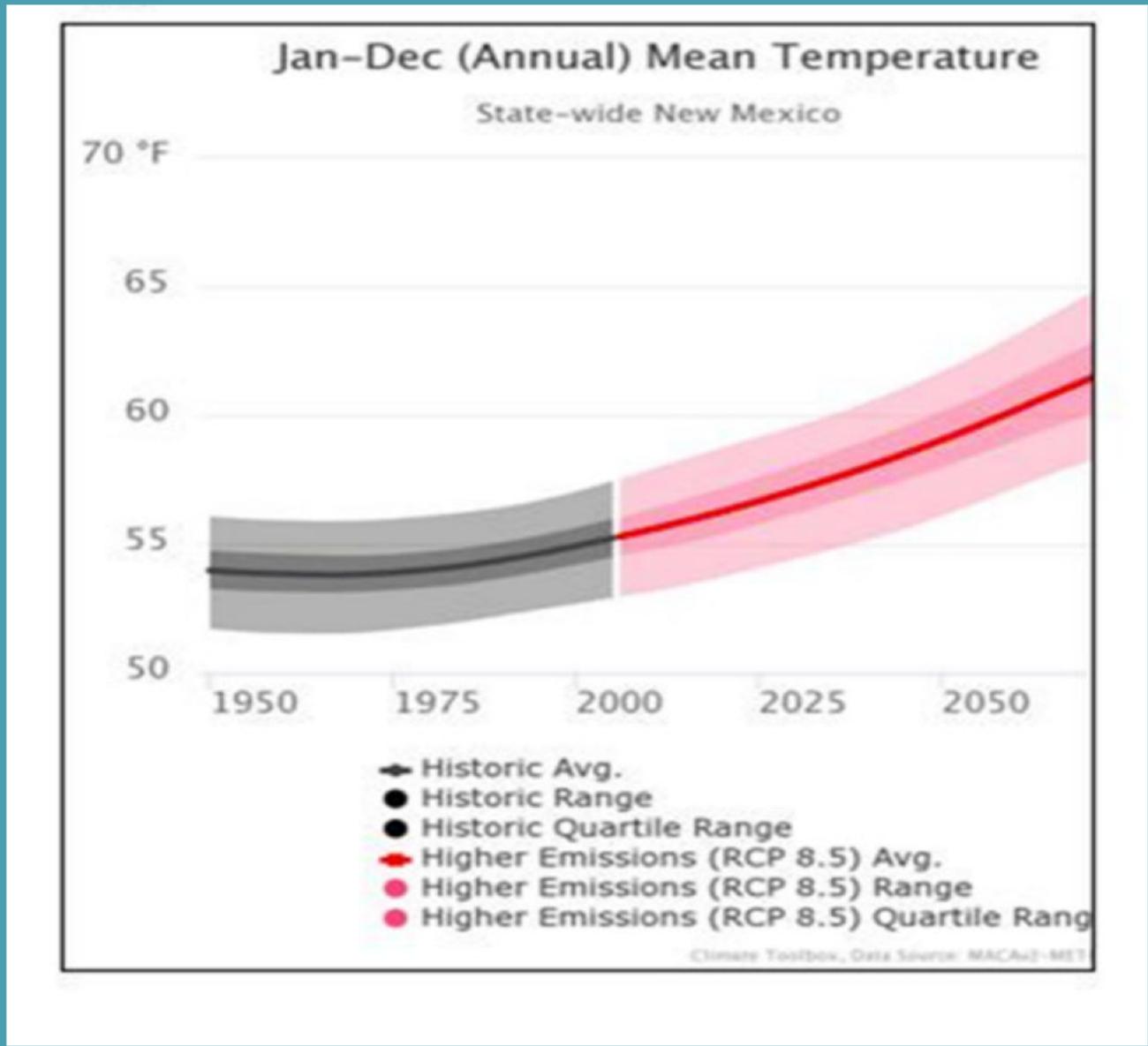
→ **Assess and synthesize recent scientific literature on climate, hydrology, and impacts of these changes**

- Future climate projections
- Changes to the surface water budget
- Ecological dynamics
- Impact on soils
- Landscape change/fires/erosion
- Surface water and groundwater
- Sedimentation in rivers
- Extreme precipitation and flooding
- Water quality

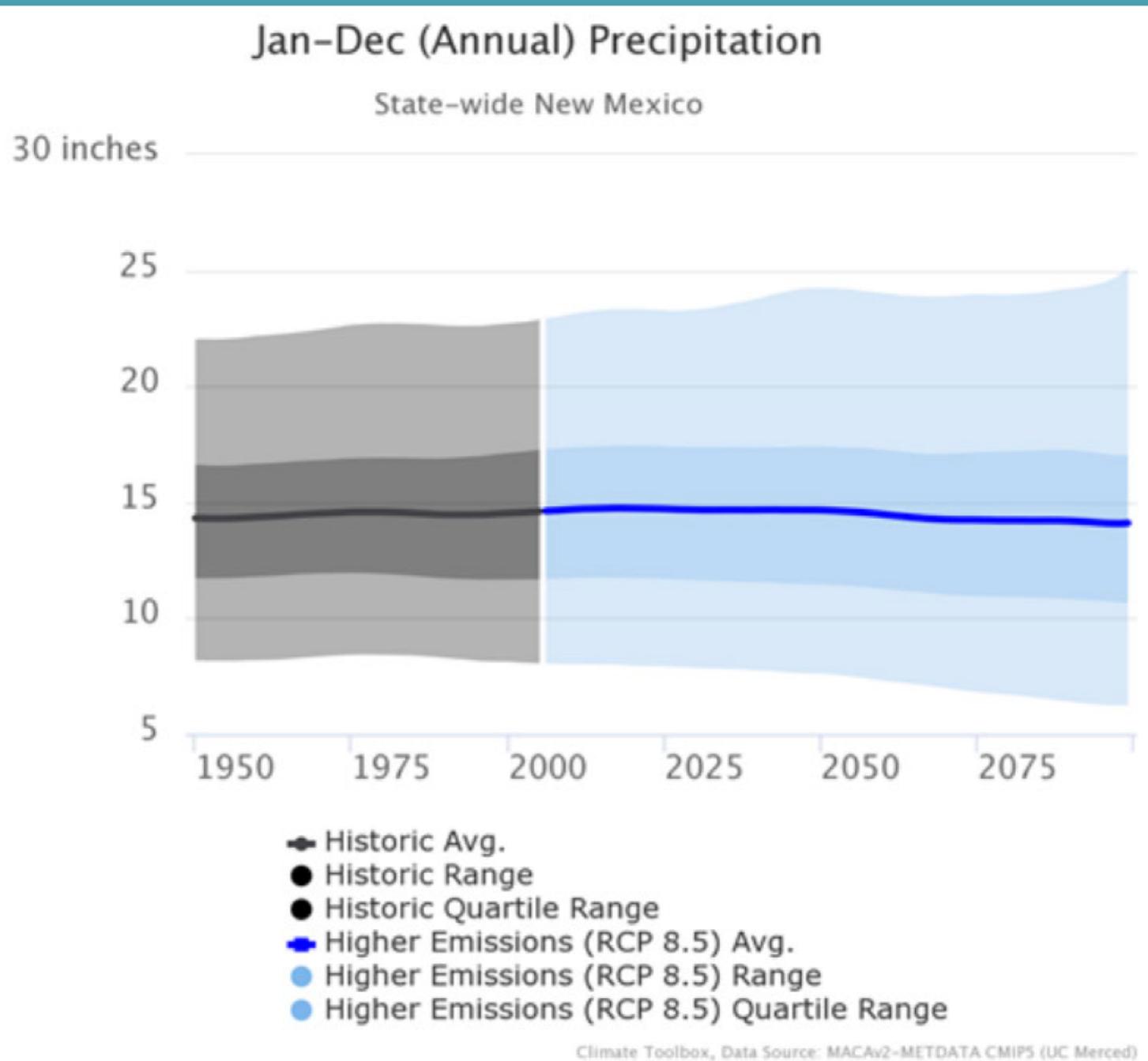
Climate change is impacting New Mexico's water resources in multiple ways

- Lower streamflow and recharge because of increased aridity
- Greater interannual variability in precipitation
- More extreme precipitation events
- Hotter, more severe droughts
- Decreasing snowpack → earlier and diminishing snowmelt runoff
- Greater demands on groundwater
- Vegetation stress
- Increasing catastrophic forest fires
- Increasing flooding and sedimentation in rivers
- Irreversible damage to soils through loss of vegetation and erosion
- Degraded quality of surface waters

Future Climate Projections

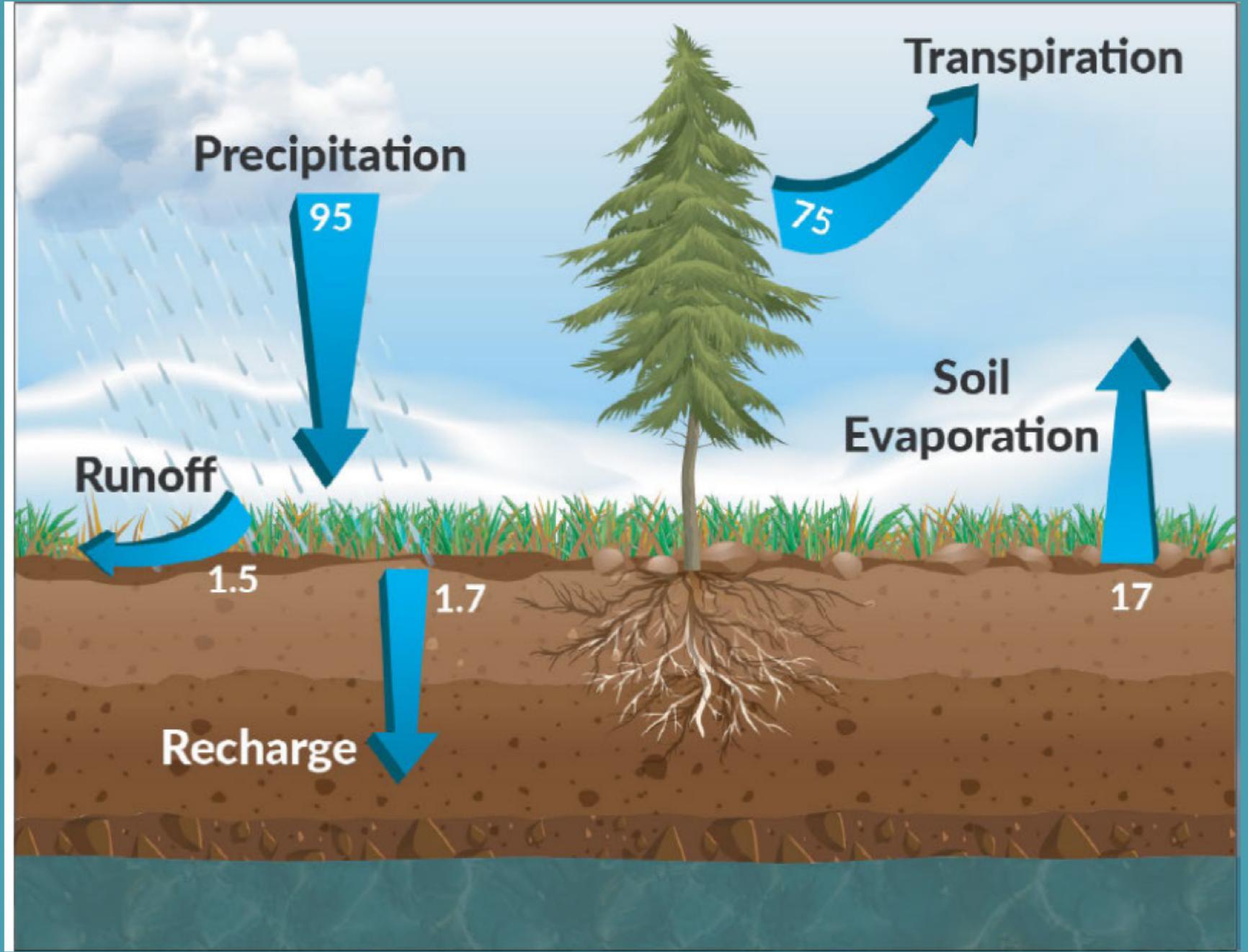


Average Precipitation



Land-surface water budget in New Mexico's arid climate

Numbers represent millions of acre-feet per year



Even with no trend in precipitation, New Mexico will become more arid because of increasing air temperature

- The amount of water that air can “hold” goes up as the air temperature rises (a $\sim 2^{\circ}\text{F}$ increase in temperature allows air to hold 7% more water vapor).
- Liquid water will be lost more rapidly from leaves and soil.
- Dry soil absorbs more precipitation than wet soil, causing less runoff and recharge.

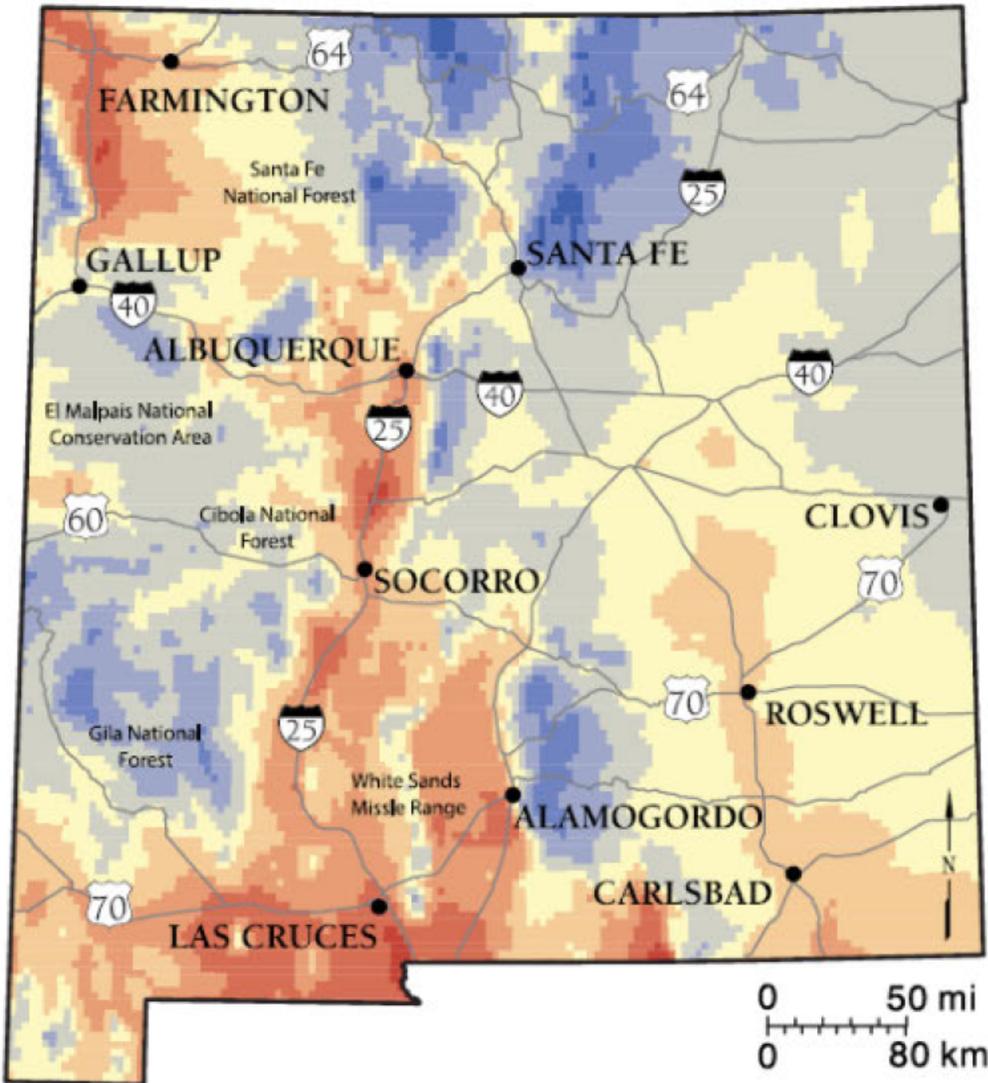
Aridity Increases



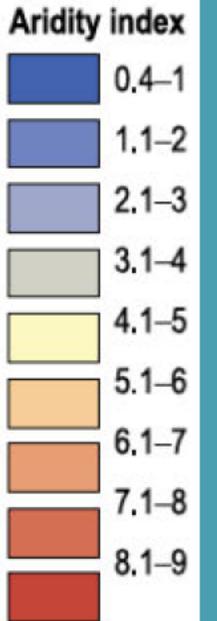
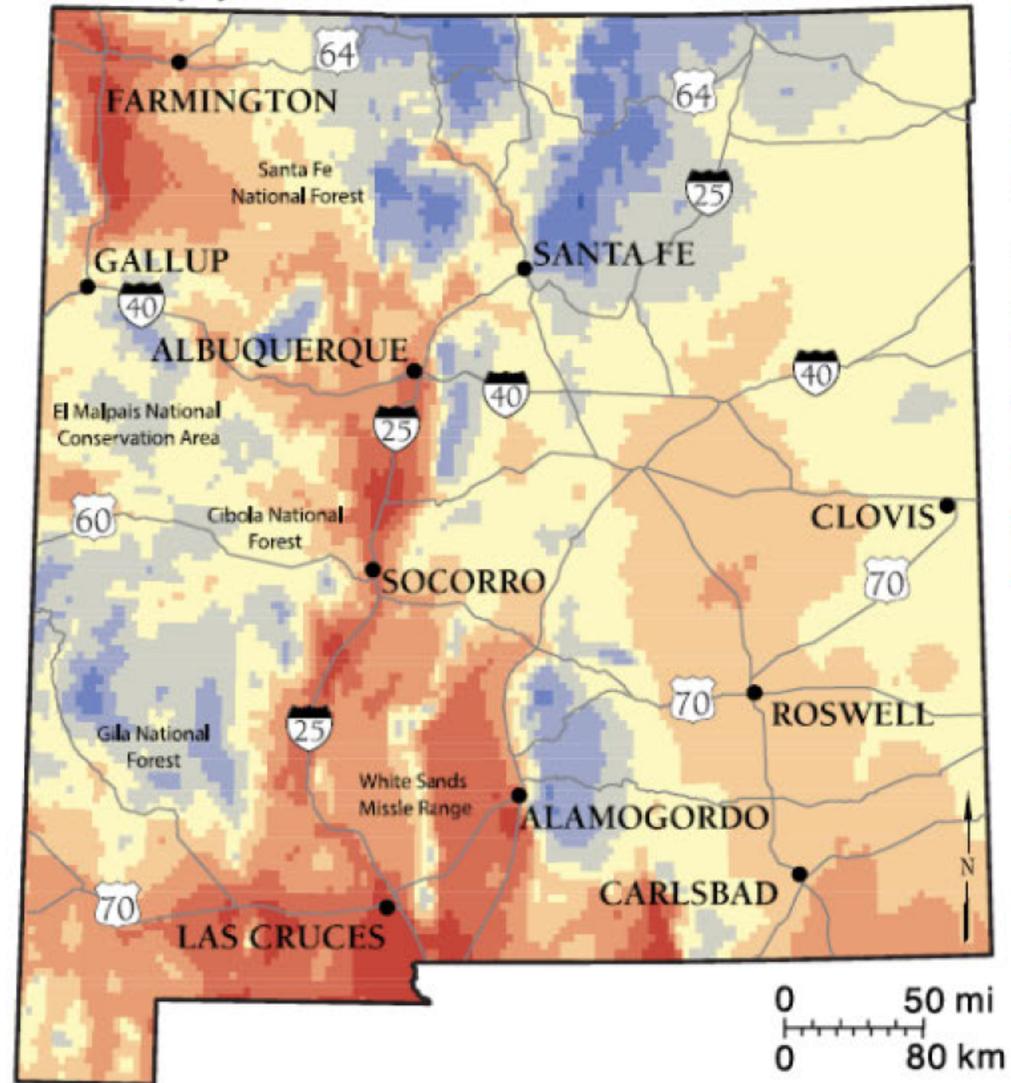
More Severe Droughts

Aridity Index = Average Potential Evapotranspiration/Average Precipitation

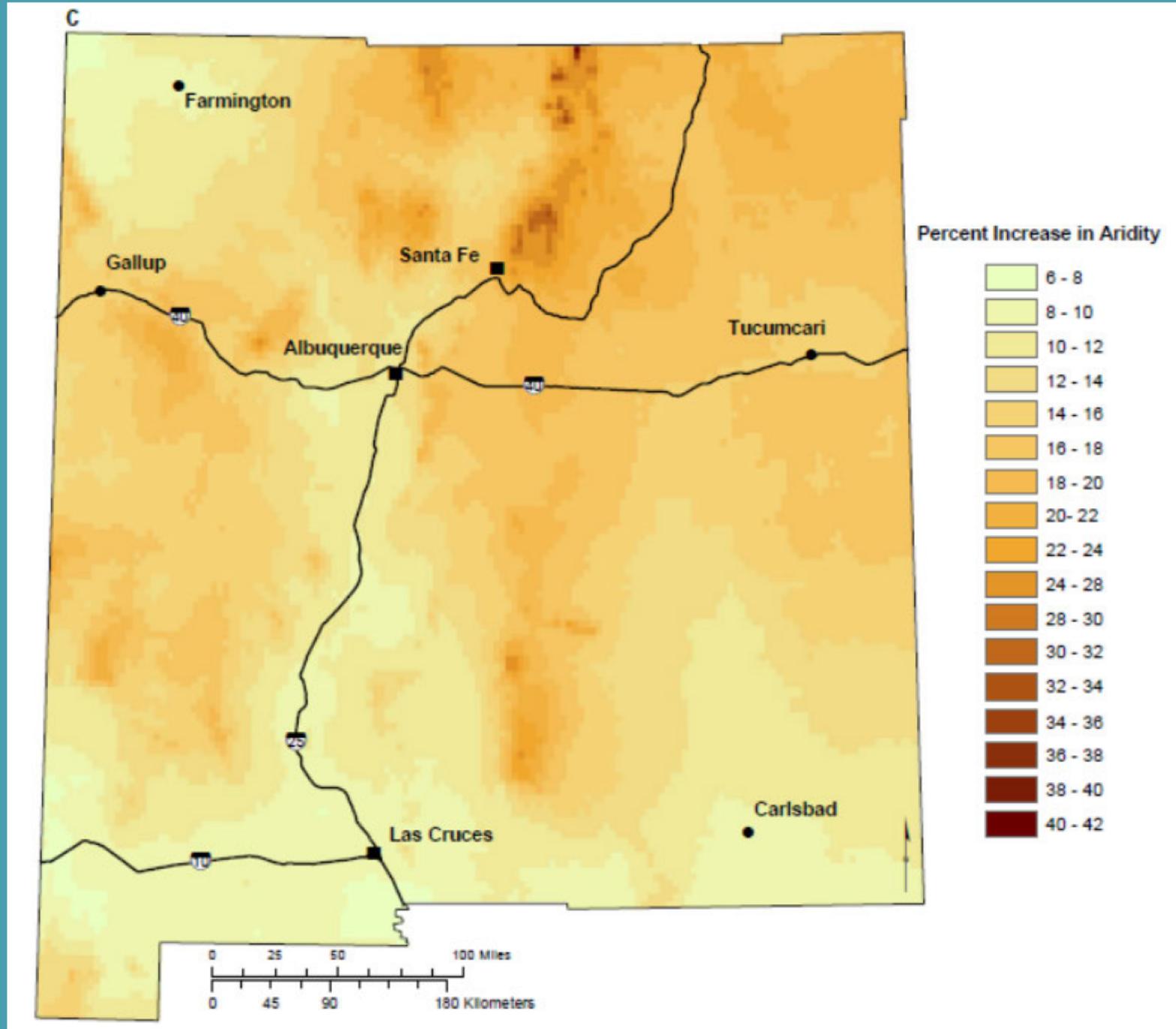
A Historical 1970–2020



B Future projection 2040–2069

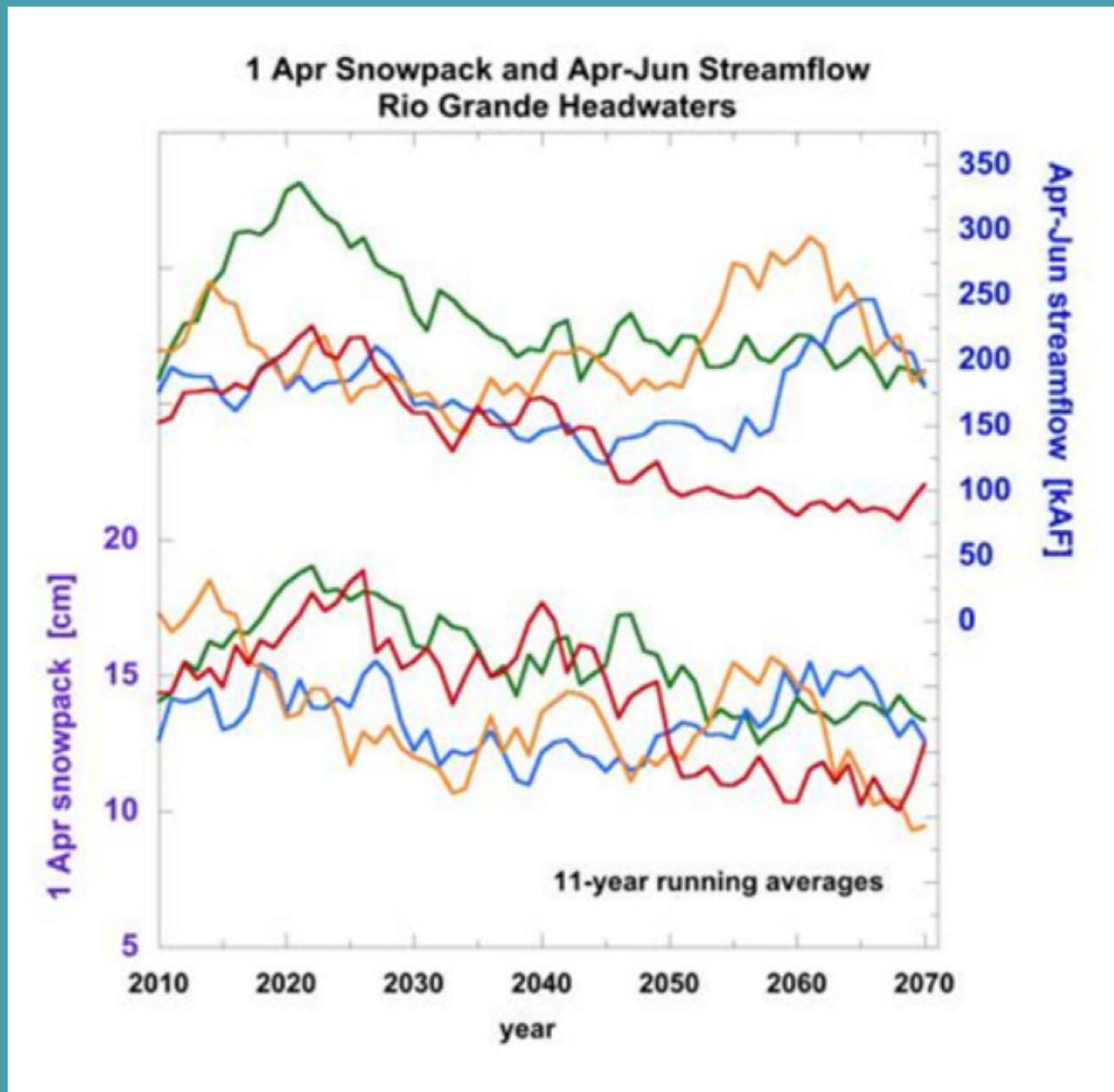


Percent increase in aridity index between 2040-2069 and 1970-2000



Snowpack and spring streamflow will decline

Different colored lines represent 4 individual simulations that show range of future projections



Extreme Precipitation

- Based on increased atmospheric moisture and temperature, more extreme precipitation events would be expected.
- Although NM record over past 20 years is notably variable, integrated data from SW US indicate increasing extreme precipitation events



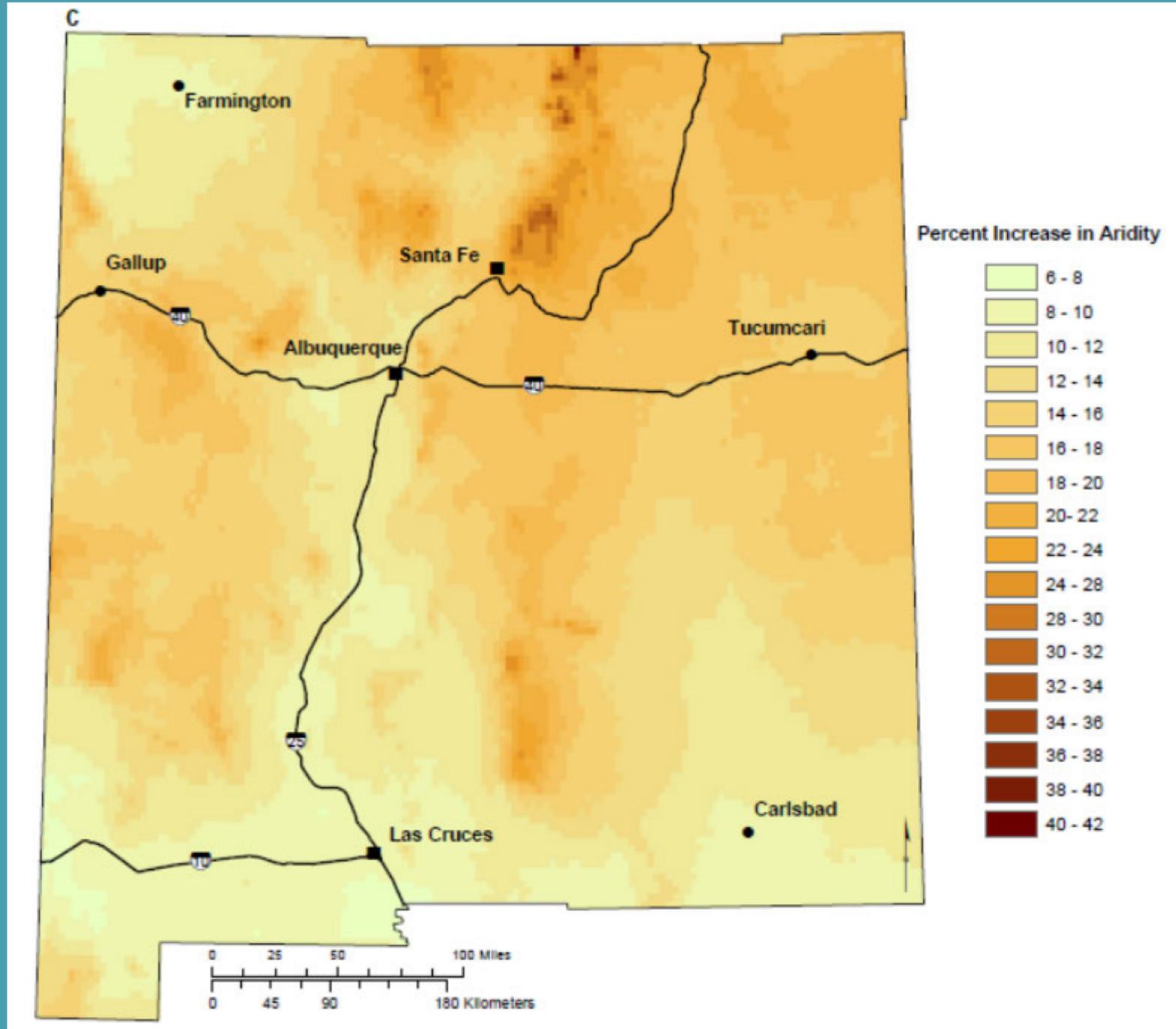
Photo by Dana Ulmer-Scholle

Impact on New Mexico Rivers

- Over next 50 years, flow will decline by 16-28%
- Due to extreme precipitation and fire-drive disruption of watersheds, the amount of sediment delivered to rivers will double
- Beds of undammed rivers will be built up
- Reservoir capacity will be reduced
- Channels will narrow



Percent increase in aridity index between 2040-2069 and 1970-2000

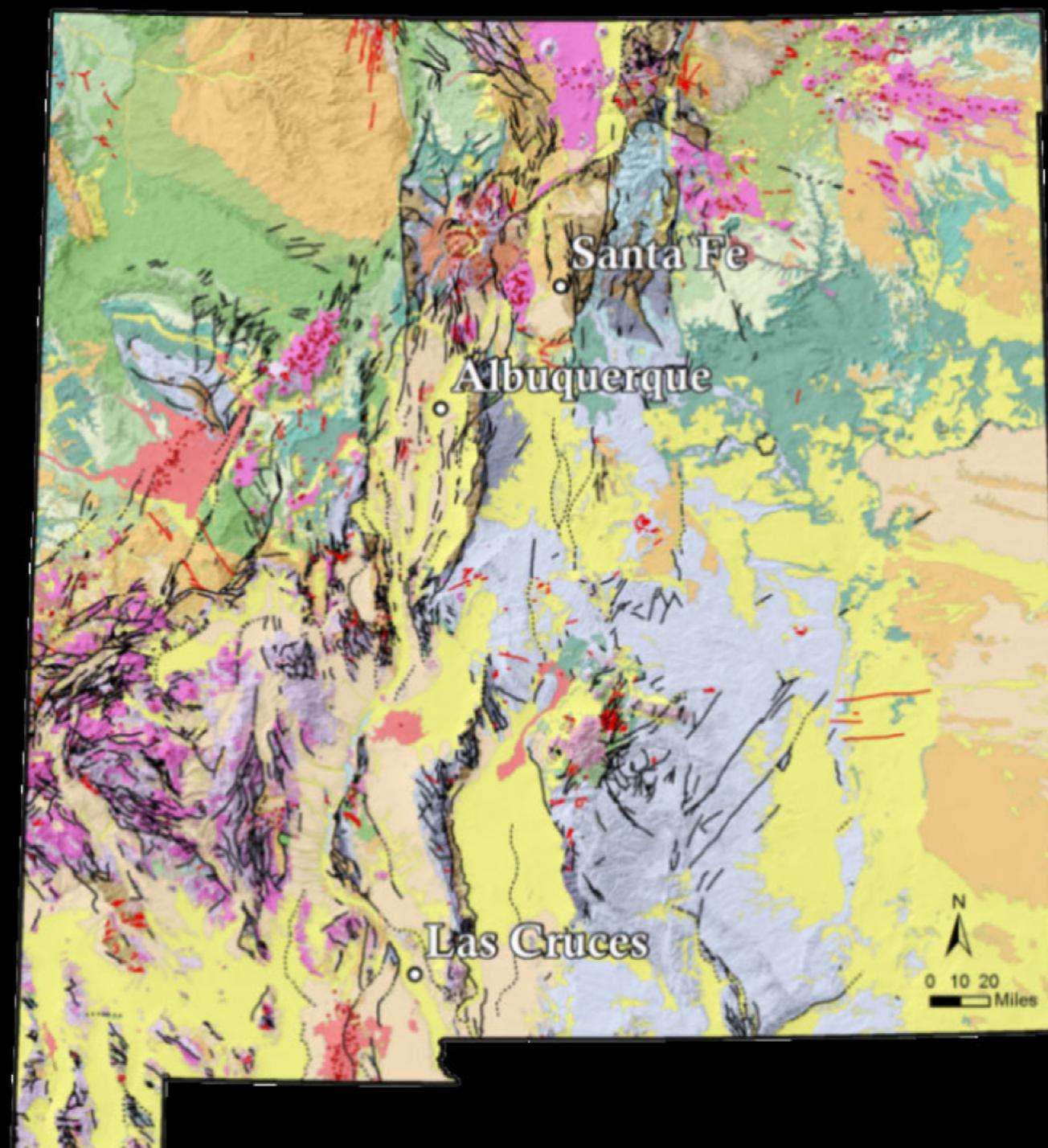


GROUNDWATER IS NOT EASY TO CHARACTERIZE

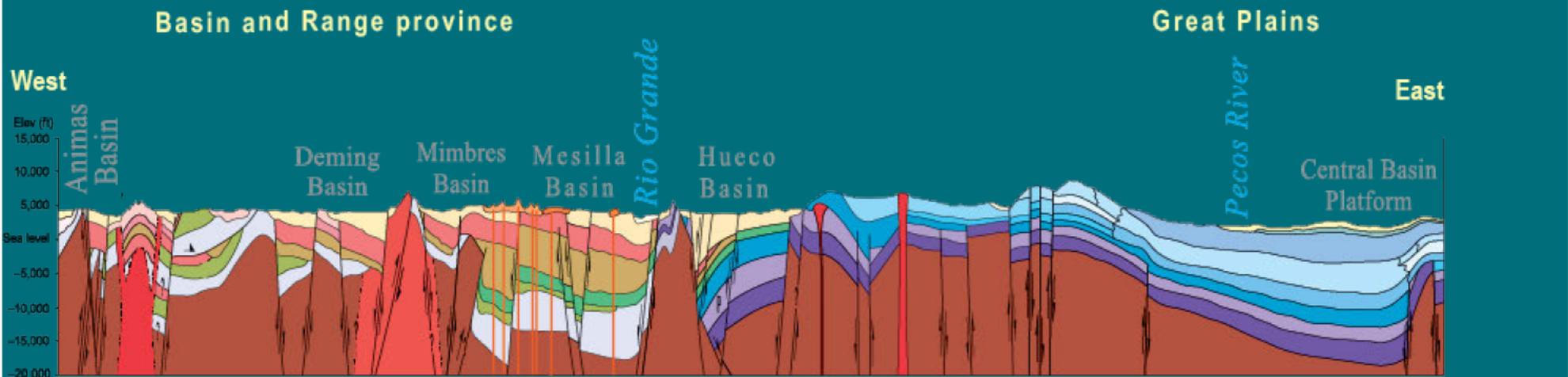
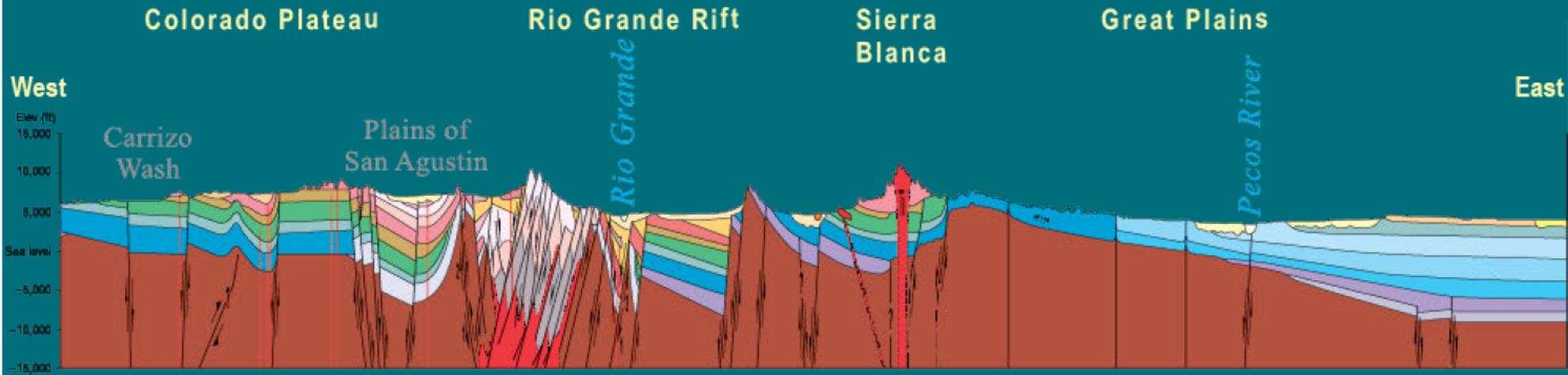
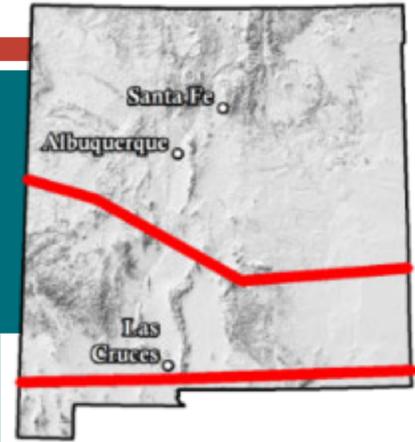
- * New Mexico's geology is complex
- * Defining boundaries of aquifers/aquifer systems requires detailed geologic and hydrologic information.

Questions we need to answer:

1. How much groundwater is available?
Water planning and management
2. What is the groundwater quality?
Fresh or brackish water
Contaminants
3. Is there recharge to the groundwater?
Sustainability
Connection of aquifers or rivers



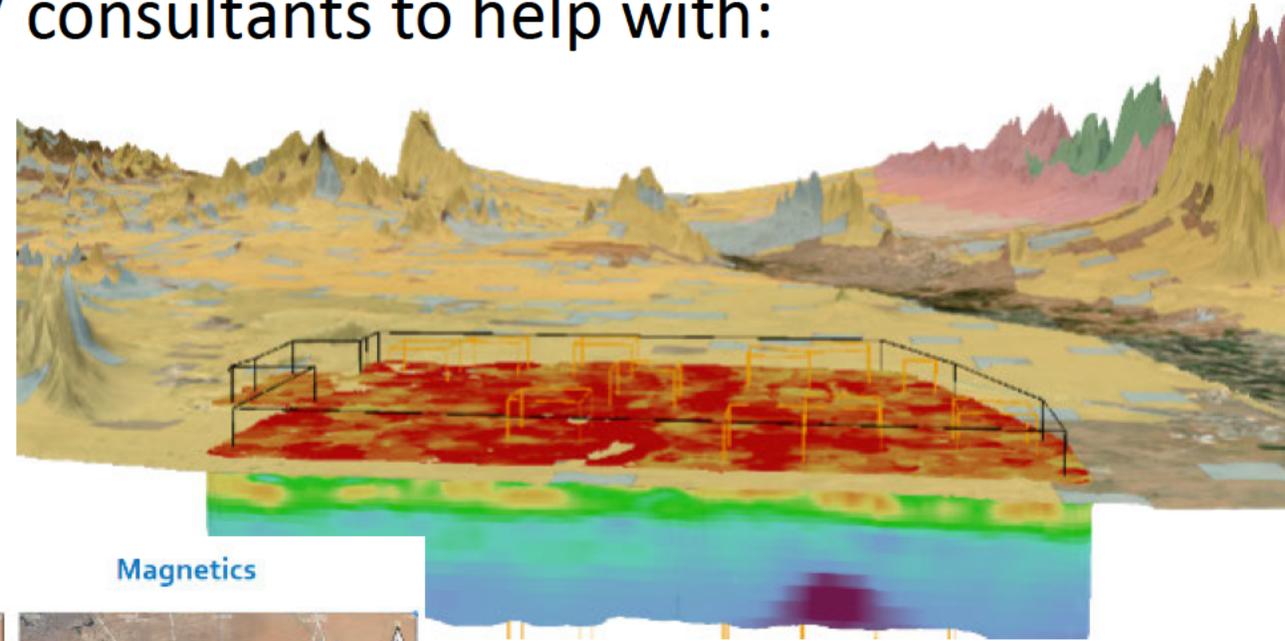
COMPLEX GEOLOGY = COMPLEX HYDROLOGY



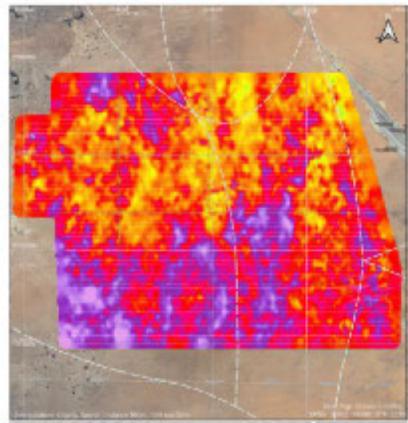
New data collection and work ahead

Working on RFPs to procure vendors / consultants to help with:

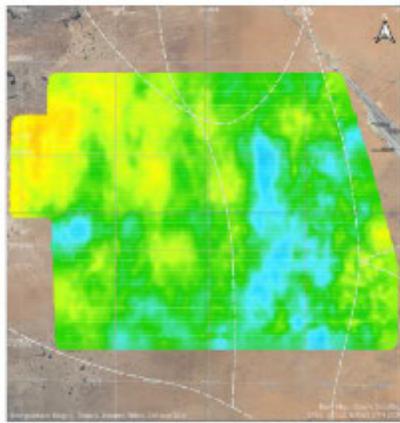
- Geophysical data collection
- Hydrogeologic characterization
- Data development
- Model development
- Well drilling



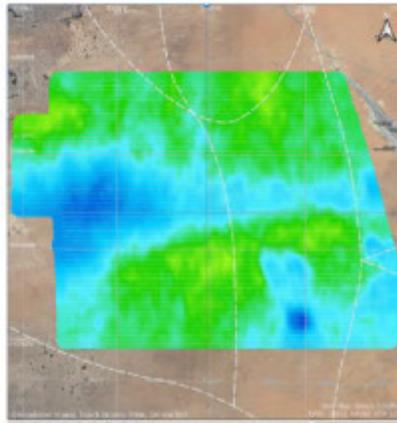
Shallow EM



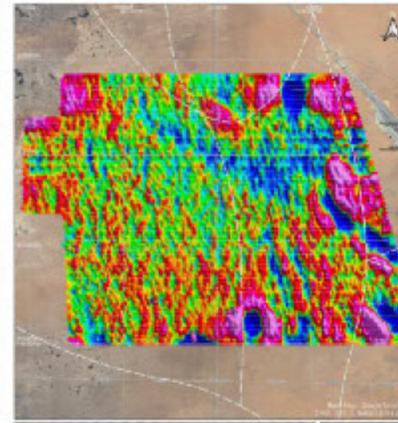
Medium EM



Deep EM



Magnetics



*Santa Teresa NM Project –
Preliminary, example data acquired by the
NM ISC, not for redistribution*

Collaboration and creative solutions are needed

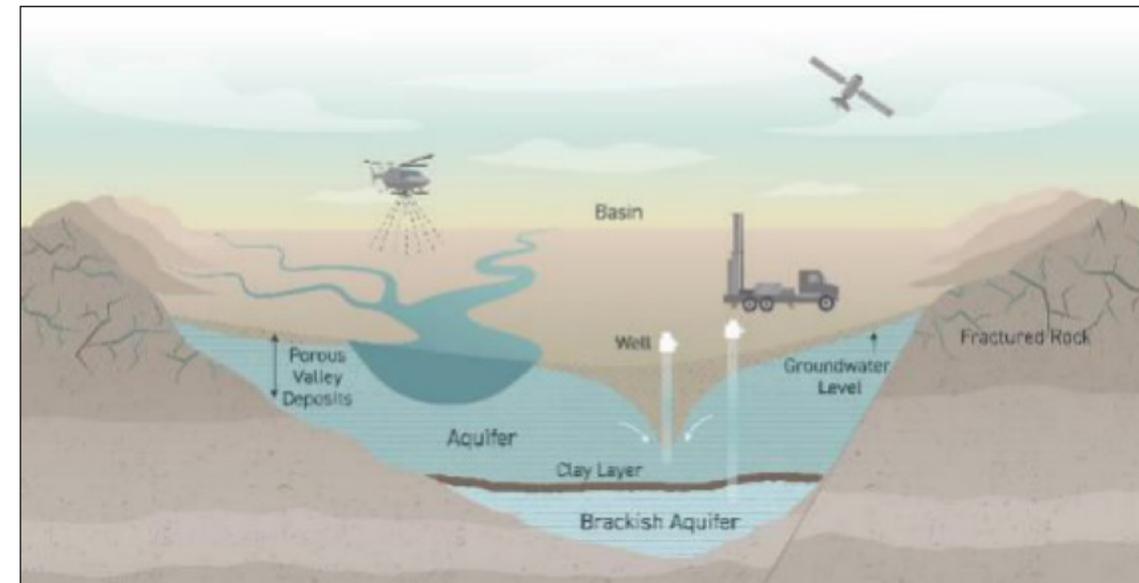
Projects underway or starting soon

1. Regional groundwater studies
2. Geophysical data collection
3. Drought Hazard Mitigation - groundwater level monitoring network *pending
4. Drilling new wells *pending



Earth observation data /tools we use often:

- GRACE
- OpenET
- NDVI



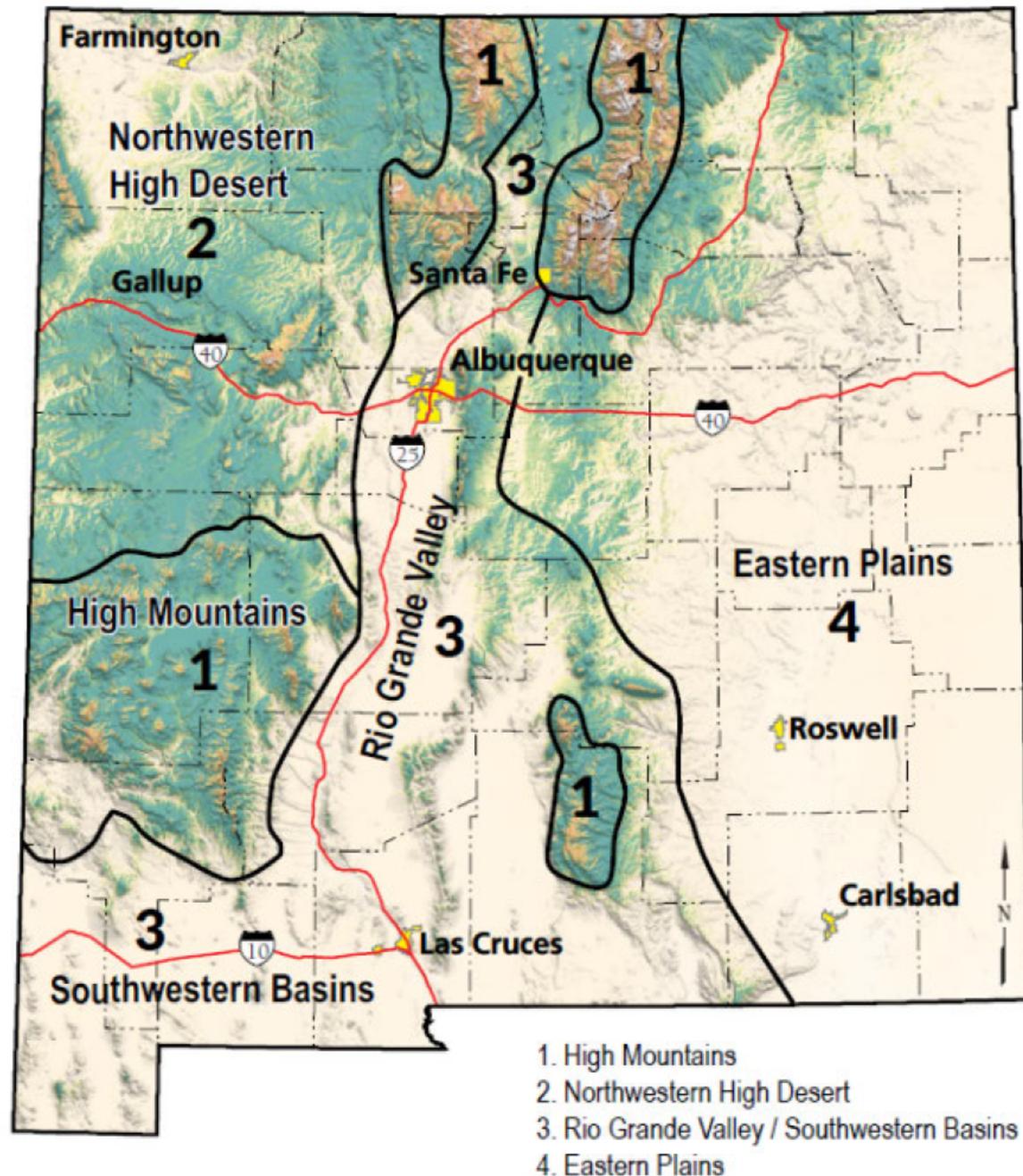
Add slides about groundwater changes in regions

- Clovis Portales
- Albuquerque

Statewide and Regional Impacts

New Mexico is a state characterized by varied landscape. Increasing temperature will have different impacts on different parts of the state. We identified 4 regions which may experience similar impacts.

1. High Mountains
2. Northwestern High Desert
3. Rio Grande Valley/SE Basins
4. Eastern Plains



Dominant Impacts by Region

- **High Mountains**
 - Will be most impacted by climate change, and impacts will be felt throughout the state. Less snowmelt and higher evapotranspiration
 - Changes to plant communities and increased wildfire will be felt not only in the mountains, but also in “downstream” areas
- **Northwestern High Desert**
 - Loss of soil
 - Increased dustiness
 - Increased arroyo incision
 - Possible transition from grasses to shrubs

Dominant Impacts by Region

- **Southwest Basins/Rio Grande Valley**
 - Lower river flows (25% lower flow in Rio Grande in 50 years), changes in timing of runoff, trending earlier
 - Greater loss of water from reservoirs (with a 5 degree temperature increase, Elephant Butte will lose 2 additional feet of water per year)
- **Eastern Plains**
 - Extreme precipitation events
 - Loss of soil, increased desertification
 - Increased dustiness

Questions?

[Redacted]

[Redacted]



Photo by Matthew Zimmerer