Assessment of Impacts of Climate on New Mexico Water Resources over the Next 50 Years

A Foundation for the New Mexico 50 Year Water Plan

A collaboration between two state-funded agencies

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
Earth Science for the 21st Century

Office of the State Engineer
nm
Interstate Stream Commission

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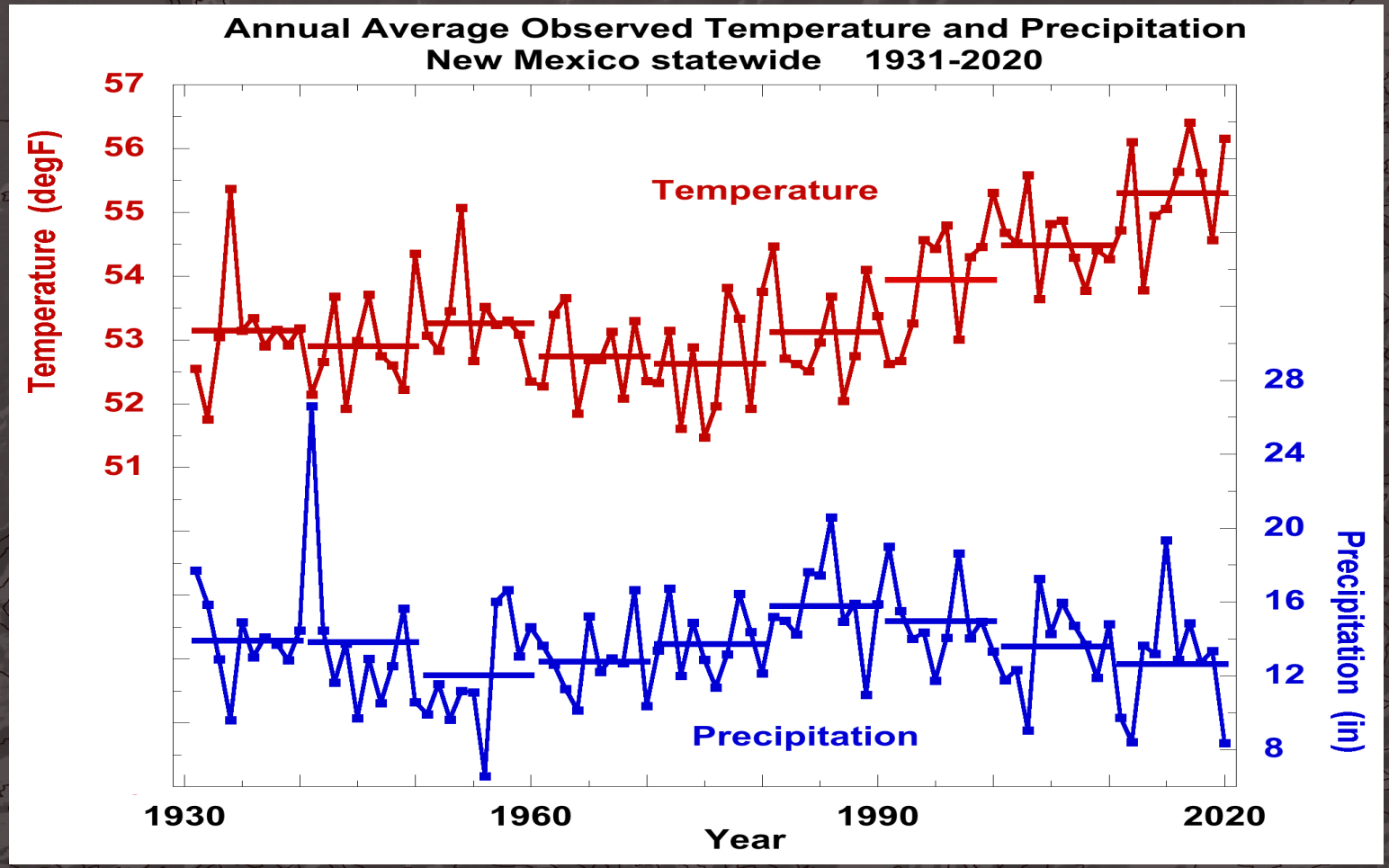
Why do we need this?

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 decadally
4 of the 5 driest years since 1930 have occurred in the past two decades

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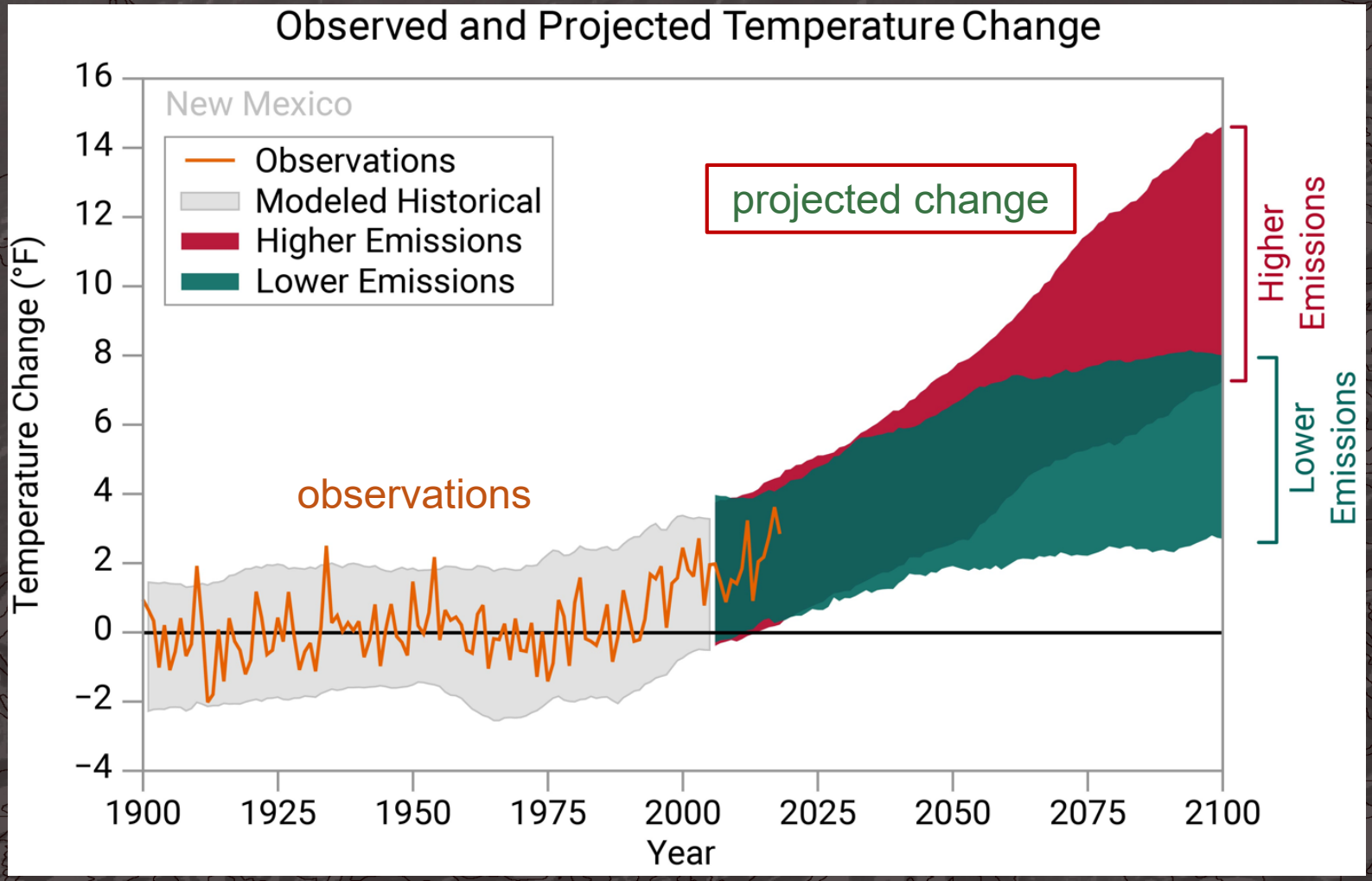
New Mexico's climate will continue to warm in response to increasing concentrations of atmospheric greenhouse gases



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

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An experienced team of New Mexico research experts was assembled to work together, to assess the state of knowledge and develop a review report

- Dave Gutzler (climatologist)
- Fred Phillips (hydrologist)
- Craig Allen (ecologist)
- Dave DuBois (climatologist)
- Phil King (civil engineer)
- Les McFadden (soil scientist)
- Bruce Thomson (environmental scientist/engineer)
- Anne Tillery (surface systems specialist)

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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
- Landscape change/fires/erosion
- Extreme precipitation and flooding
- Soils
- Water supply
- Water quality

The process……

February – June 2021:

- Zoom meetings to outline report chapters, and discuss each chapter's focus. Internal reviews by other team members, and by the three study editors

July 2021:

- Five scientists (four from NM, one from AZ) are providing independent reviews of the entire study document.

August 2021:

- Authors are presenting outreach/education webinars on their chapters, with Q&A sessions. Authors respond to independent reviews.

September-October 2021:

- Public comment period

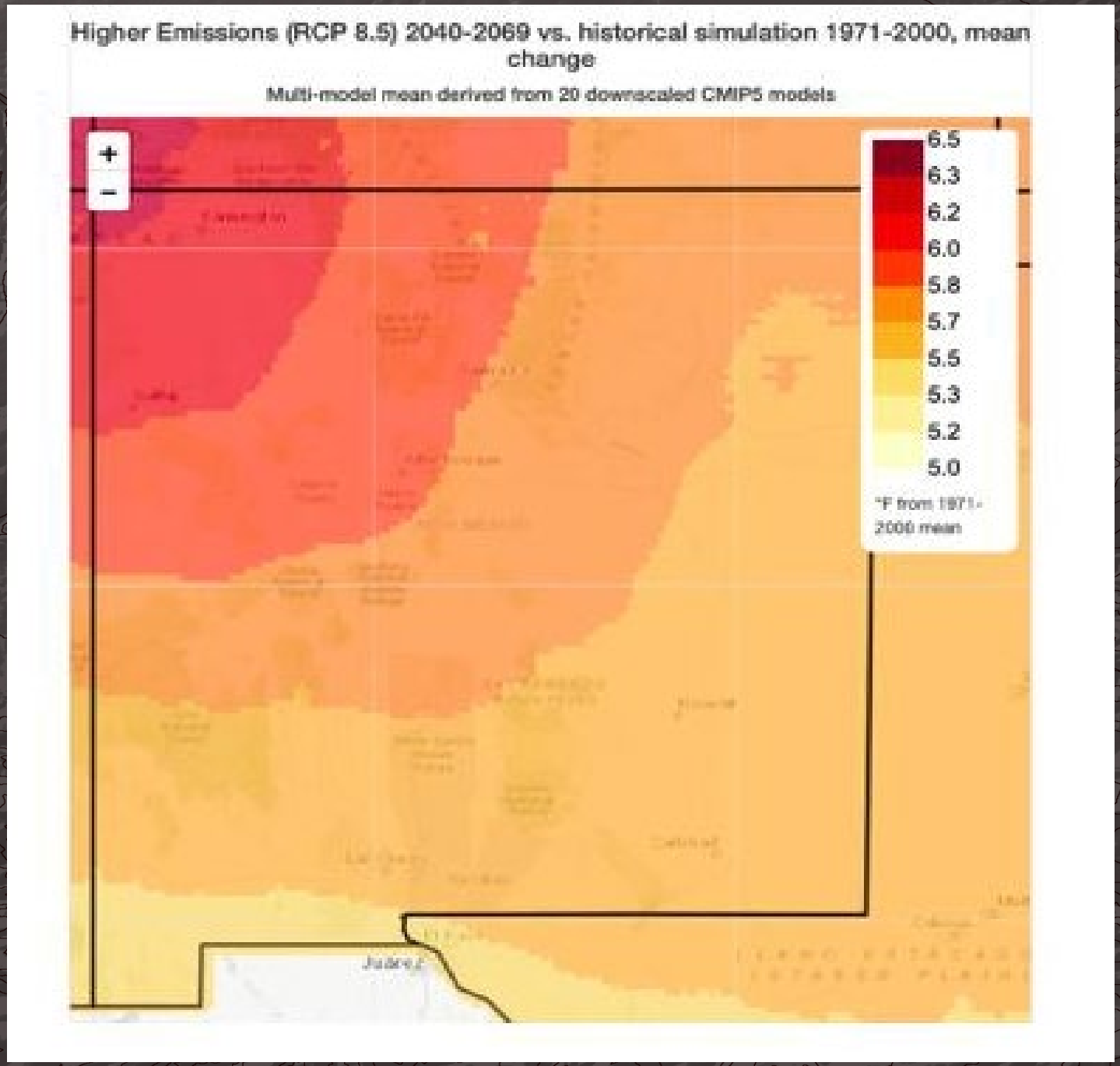
October – December 2021:

- Authors will modify the report to respond to public comments by the end of November

Ongoing – outreach, education, river chapter

Warming everywhere. Temperature rise non-uniform across the state of New Mexico

Bootheel is around a decade behind the NW corner



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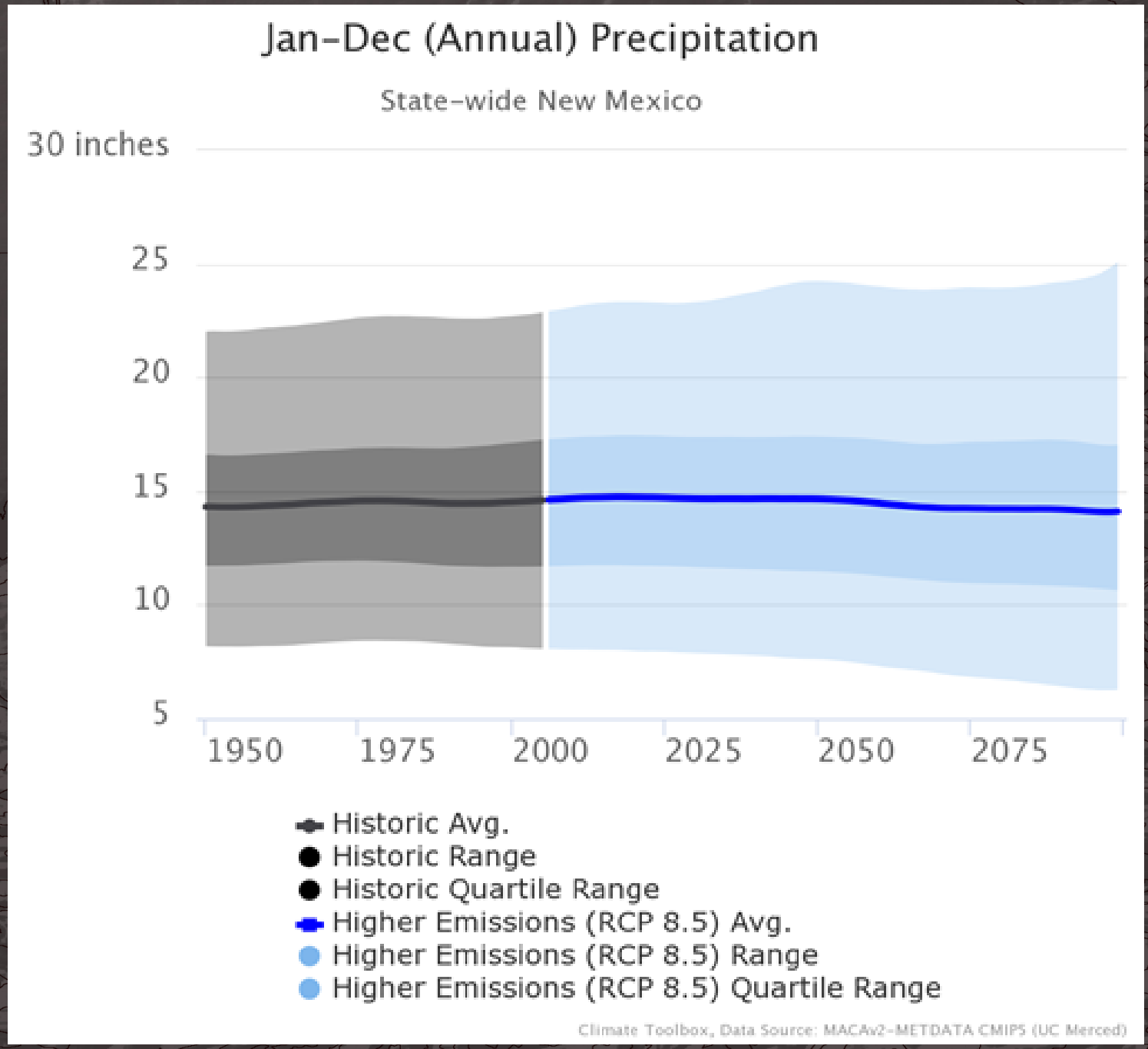
What will happen to precipitation?

Because of increasing temperature, New Mexico will become more arid, even with uniform precipitation



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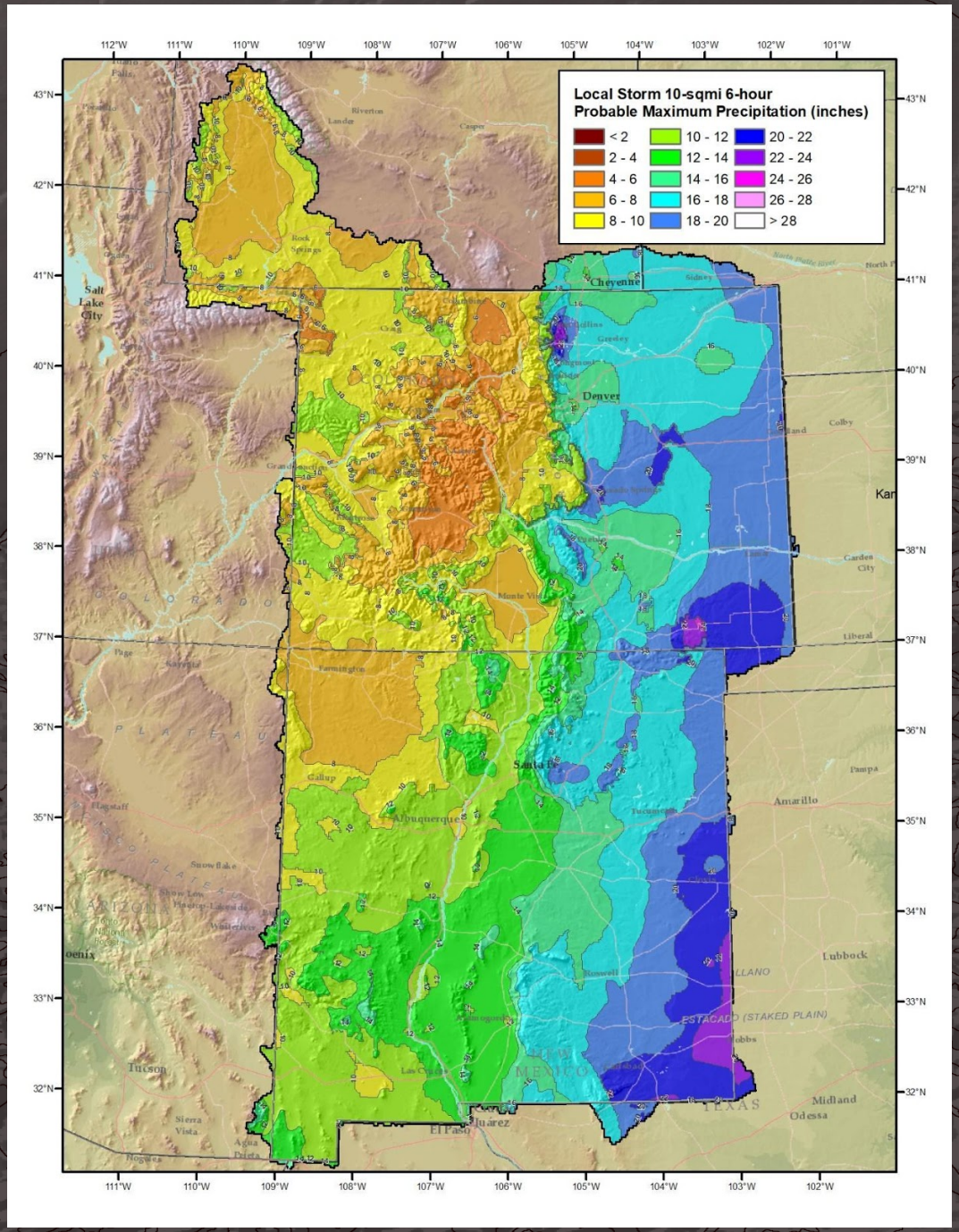
Extreme Precipitation

- Based on increased atmospheric moisture and temperature, more extreme precipitation events would be expected.
- Record over past 20 years is notably variable, so difficult to use past data to predict future behavior



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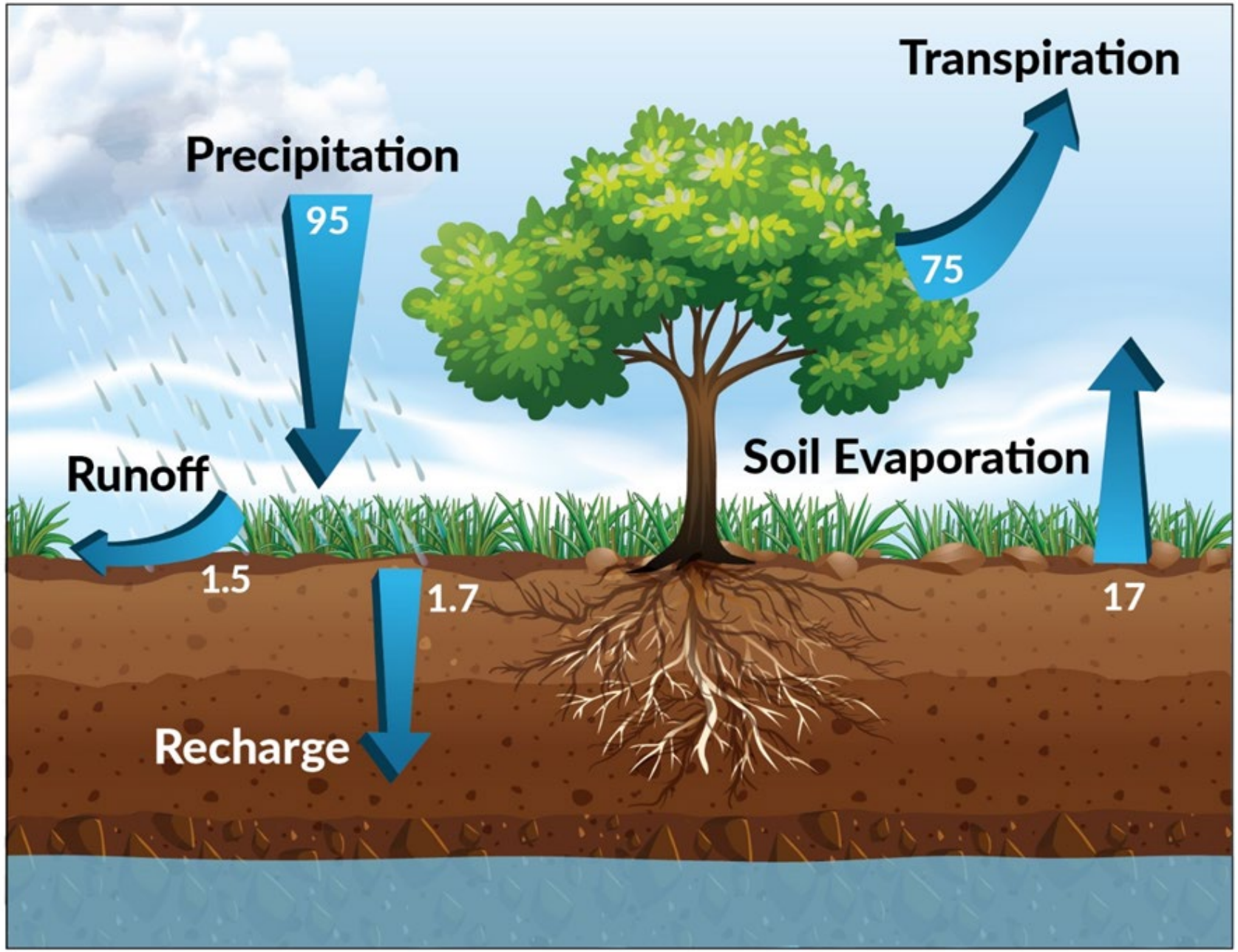
Land-surface water budget in New Mexico's arid climate

Numbers represent millions of acre-feet per year



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Chapter X. Summary of State-Wide and Regional Impacts of Climate Change on Water Resources

Nelia W. Dunbar, Fred M. Phillips,
David S. Gutzler

Image from outlookmaps.com

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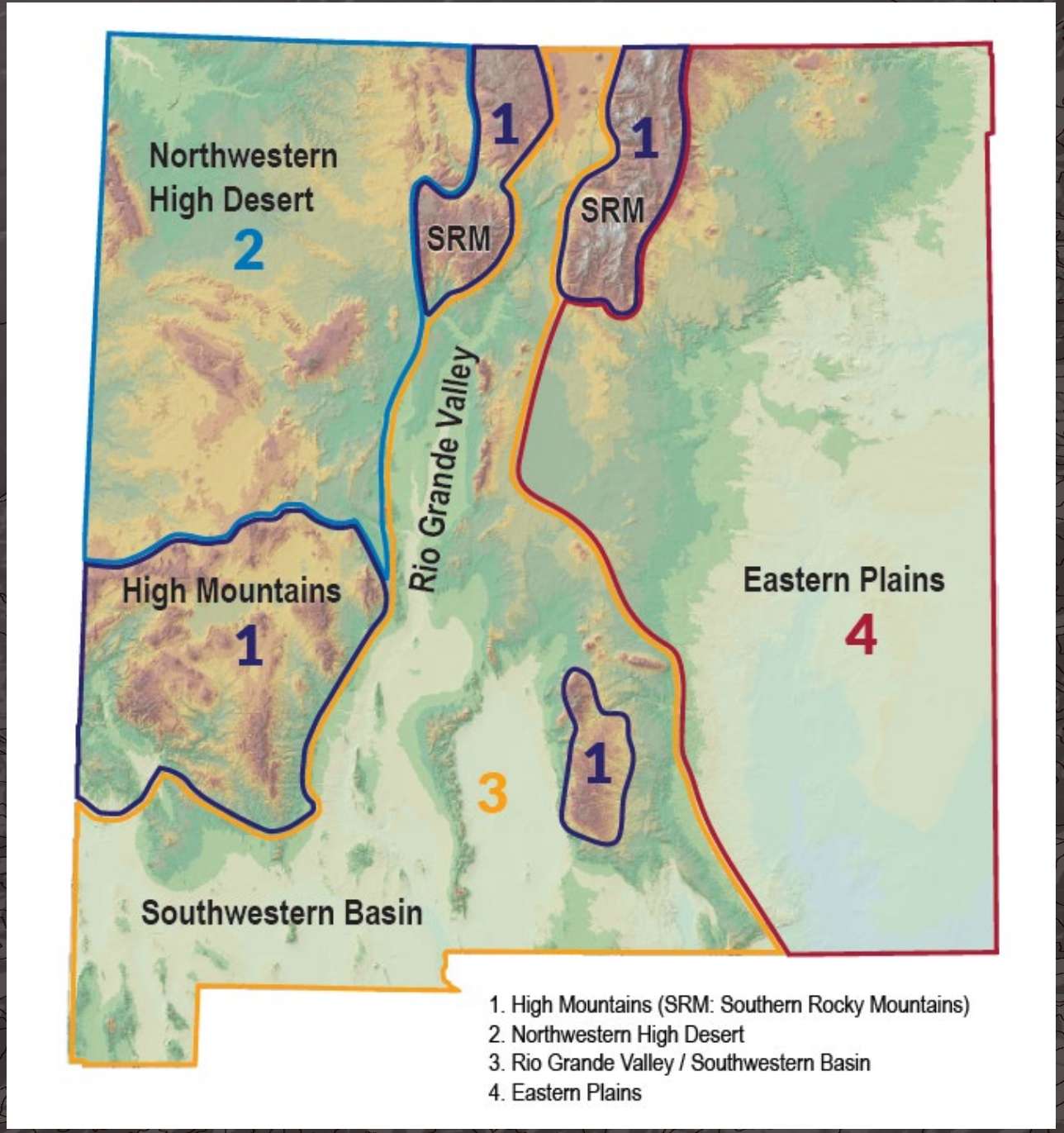
Differences across the state

The dominant impact of increasing temperature on water resources will be different in different parts of the state. We identified 4 sections of the state where impacts are likely to be similar. Within these broad regions, there may also be elevation- and topographically related variations.

- High Mountains
- Northwest High Desert
- Rio Grande Valley/Basin and Range
- 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

- Rio Grande Valley/Basin and Range
  - 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

Chapter XI. Data Gaps and Research Directions

PRECIPITATION

- Further assessment of extreme precipitation and seasonality of precipitation
- Better understanding of snowmelt runoff

MODELS

- Fine-tuning local climate models, allowing determination of the most probable climate outcomes, as well as better understanding of clouds in GCMs
- Calibrated hydrological model for recharge and runoff specifically for NM
- Simpler vegetation dynamics models that incorporate disturbance processes

OBSERVATIONAL DATA GAPS

- Quantitative and geographically distributed measurements of NM aquifer water levels and public accessibility of such data
- Soil moisture
- Impact of climate change of water quality
- Hydrological response to watershed vegetation changes
- Timing of landscape readjustment to climate disturbance
- Studies of soil, plant communities, and landscape characteristics in high elevation mountain ranges where recharge and runoff occur
- Long-term ecological monitoring and research to understand response of NM ecosystems to climate change, and associated ecohydrological reponses