What Climate Change May Mean for the Albuquerque Region

- **Projections about how climate change may affect Albuquerque's water resources**
- **Scoping community vulnerability & hazards**
- **Questions and discussion**

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Climate Change in the US, US Global Climate Change Research Program, 2014

Climate Change Impacts in the United States

CHAPTER 20
SOUTHWEST

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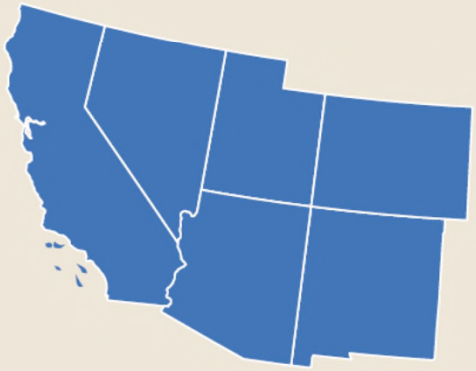
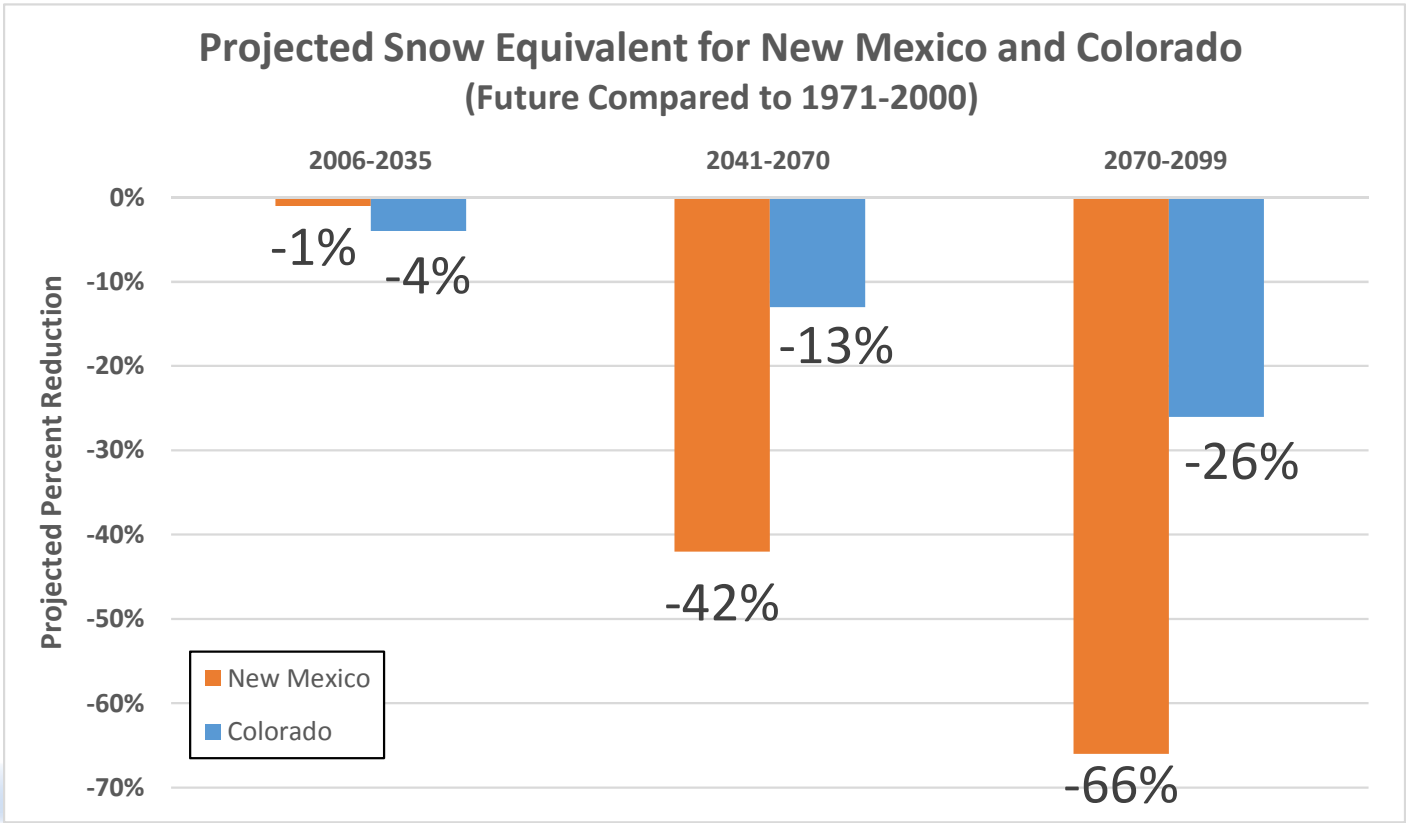


On the web http://nca2014.globalchnage.gov/report/regions/southwest

Big Picture Findings

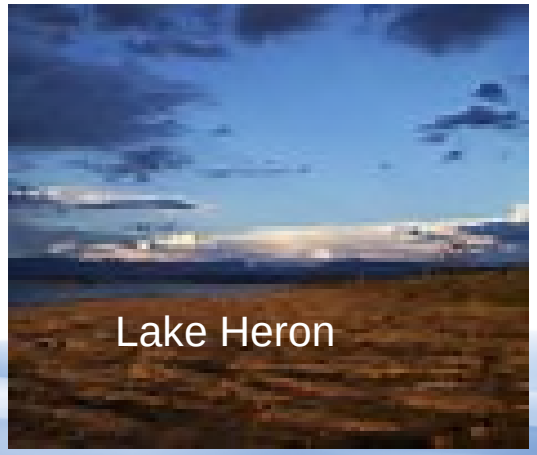
- Snowpacks and streamflows projected to decline - decreasing surface water reliability.

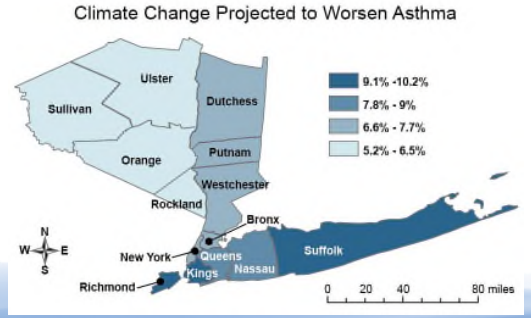
Mid-century, snow water equivalent is projected drop 42% in NM and 13% in CO compared to the 1971-2000 period.



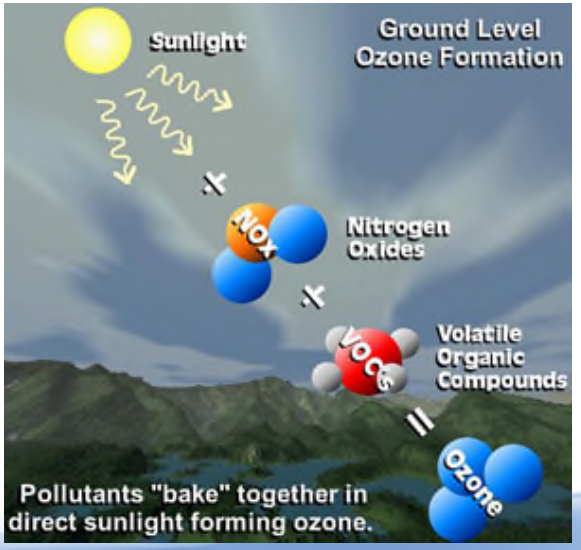
Big Picture Findings

- Regional temperatures projected to increase posing increased threats and costs to
  - public health
  - urban electricity
  - water supplies
  - ecosystems





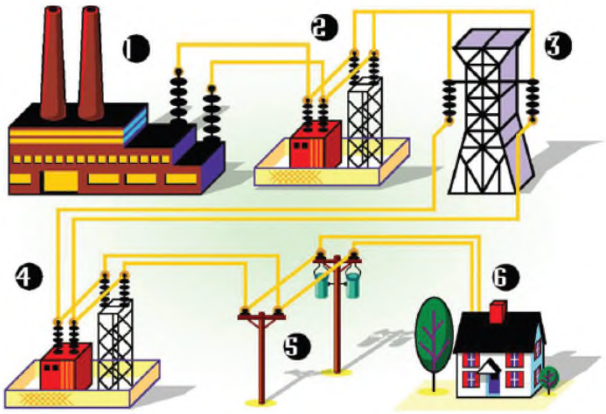
Source:CDC



Source: NASA

Big Picture Findings

- Severe and sustained drought will increase competition among farmers, energy producers, and cities.



Climate Impacts, Southwest Region – New Mexico, cont.

- Regional annual average temperatures projected to rise by 2.5^{o} to 5.5^{o} F by 2041-2070.
- Summertime heat waves projected to become longer and hotter.
- Decreased wintertime cold outbreaks.
- Reduced winter and spring precipitation.

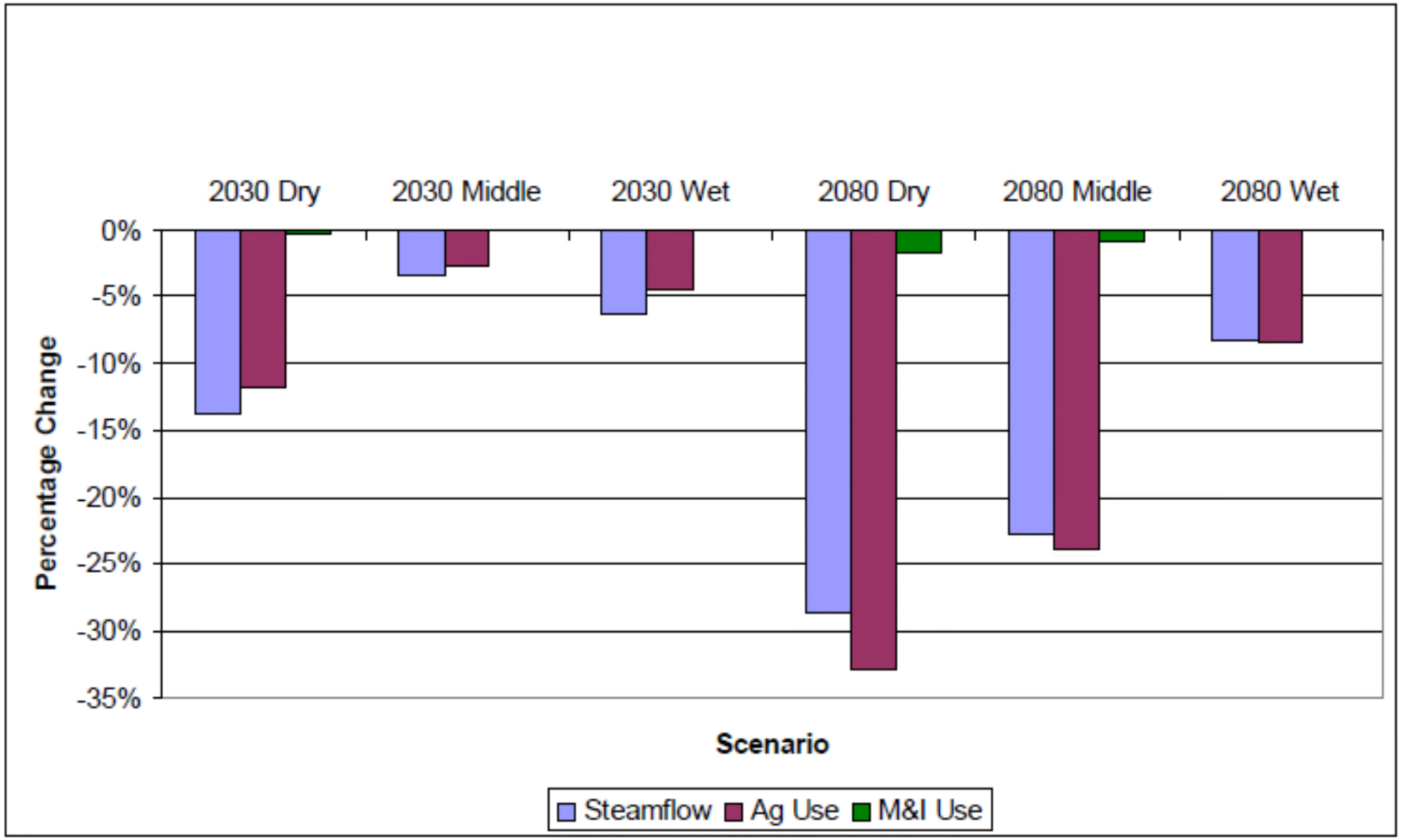
Climate Change and Its Implications for New Mexico's Water Resources and Economic Opportunity, NMSU & UNM, 2007

- **Comparing 2030 and 2080 to year 2000**
- Hydro-economic model of Rio Grande Watershed
- Climate change hydrologic responses, water demands and allocations to highest valued uses, and economic benefits/losses

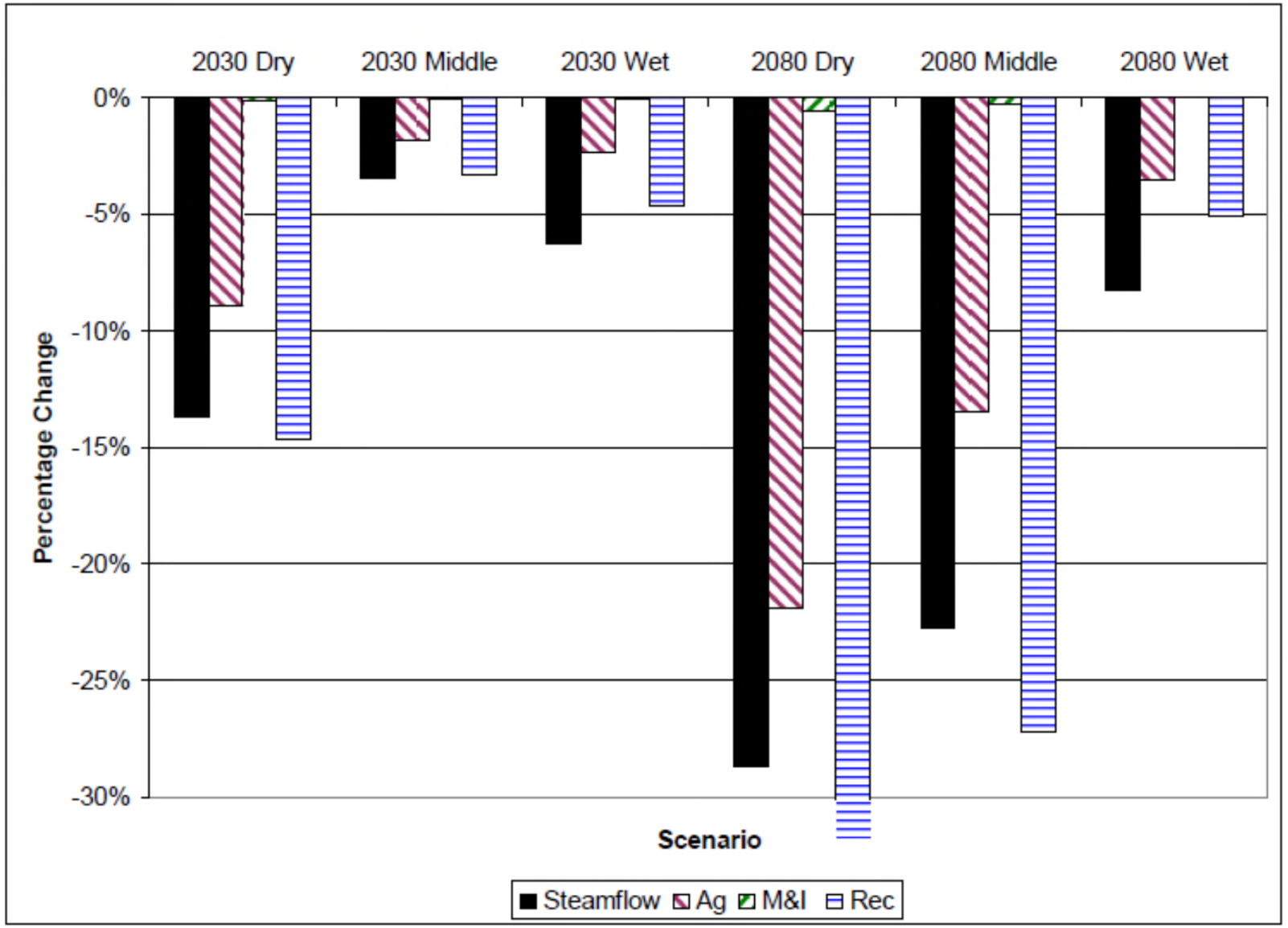
Some limits of the "hydro-economic" study…

- Does not address/reflect institutional constraints to water use and transfers in the state.
  - Uses economic theory to project "highest use" of water.
- Does not project ACTUAL allocations.
- Somewhat dated.
- Can be used as an illustration of growing competition for water during climate change.

Projected Streamflow and Water Use Changes by Sector and Scenario



Projected Streamflow and Economic Output Changes by Sector and Scenario



Projected Annual Economic Impacts by Sector (yr 2000 dollars)

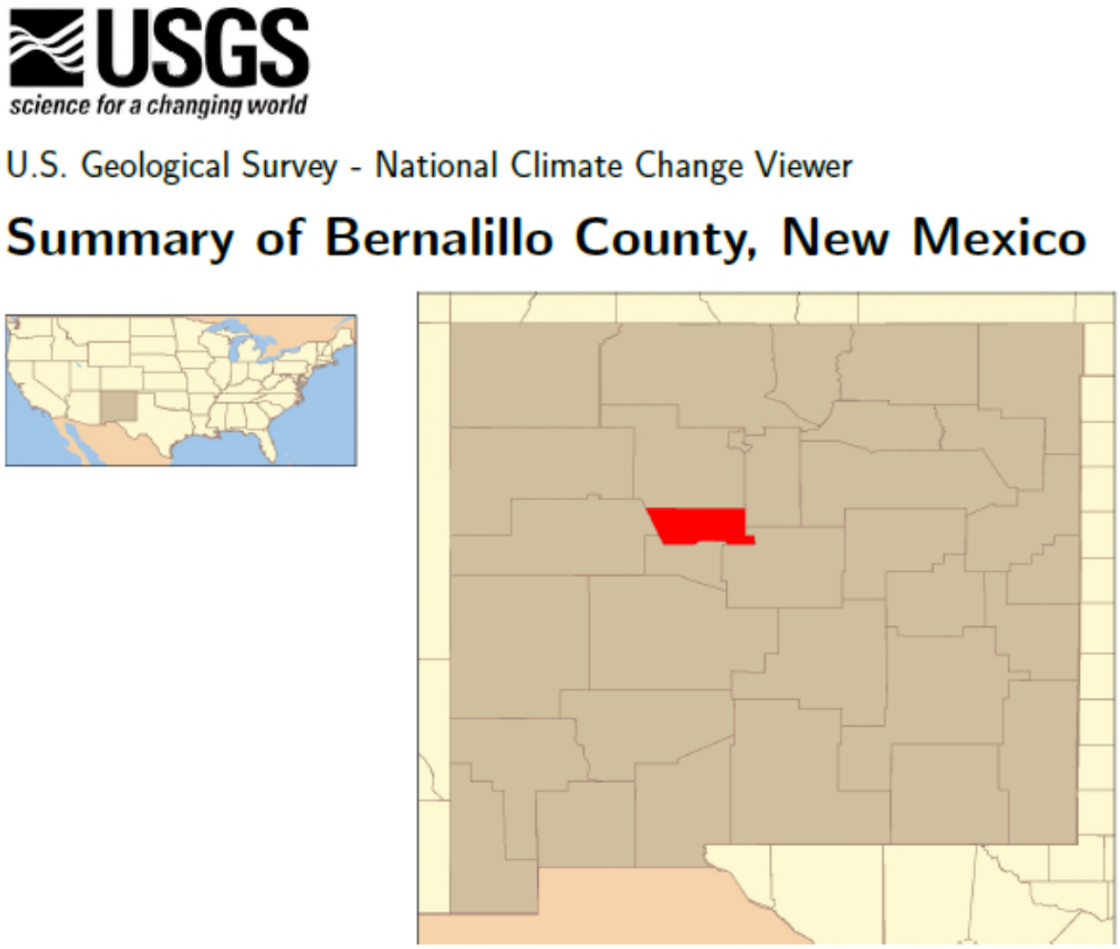
Year/ Scenario	Direct Economic Impacts (in year 2000 dollars)				Direct & Secondary Impacts
	Agriculture	Municipal/ Industrial	Reservoir/ Recreation	Total Direct Impacts	Total
2030 Mid-Range Scenario	-7M	-0.6M	-0.7M	-8.3M	-13 to 25 M
2080 Mid-Range Scenario	-51M	-6M	-5M	-62M	-93 to -185M

Big Picture Findings

- Supply of water declines while demand increases.
  - 15% mid-range increase in water prices by 2030
  - 103% mid-range increase in water prices by 2080
- Significant direct and secondary economic impacts.
- Agricultural sector could face largest economic impact.
- Reduced streamflows = reduced assimilative capacity.
  - Maintaining water quality will be more difficult and more costly for dischargers

National Climate Viewer, U.S. Geological Survey

- **Comparing 1950-2005 baseline to 2050-2070**
- Climate Model Intercomparison Program (CMIP)
- Downscaled 30 (CMIP) non-dynamic climate models
- Shows individual model results and “mean” model



On the web http://www.usgs.gov/climate_landuse/clu_rd/nccv.asp

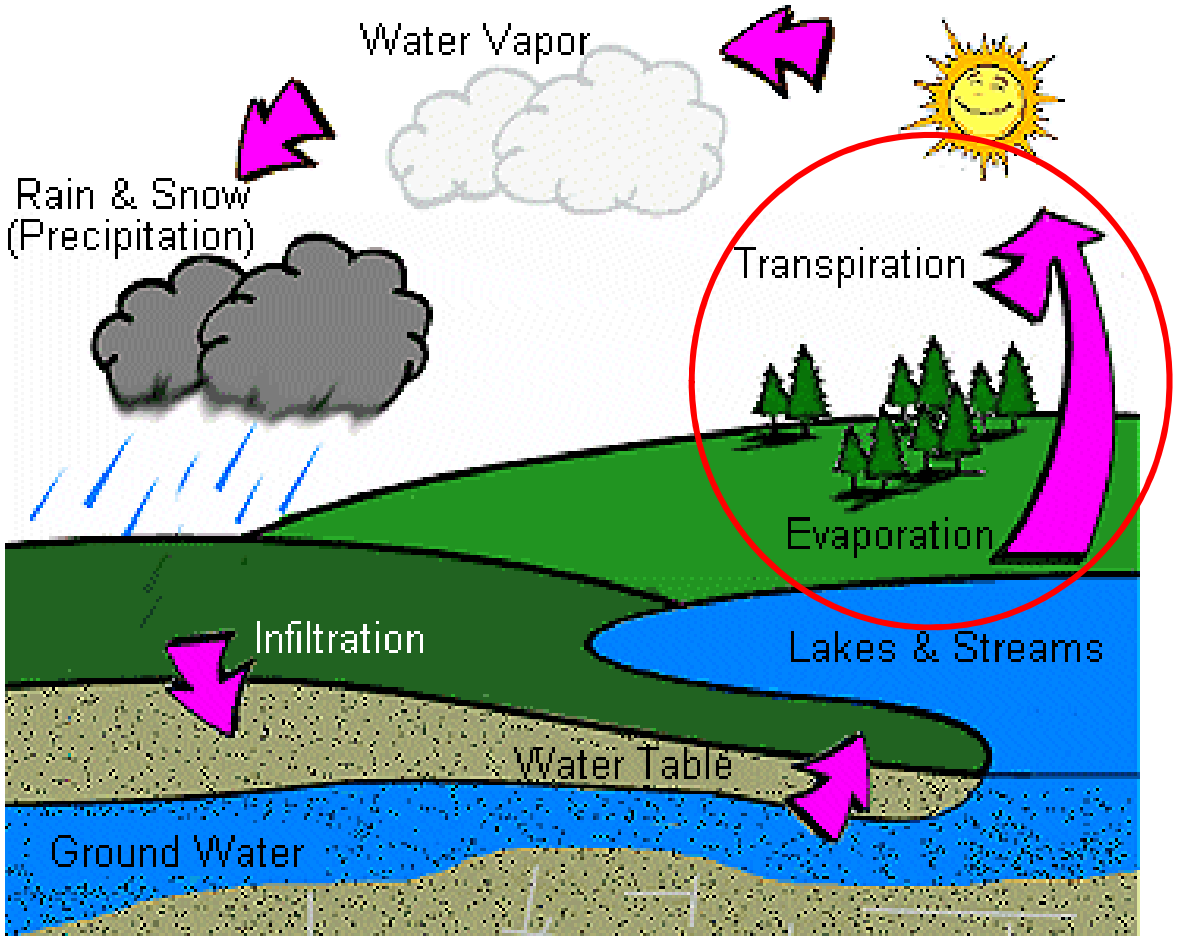
National Climate Change Viewer, Bernalillo County, NM USGS – Mean Model Results

- Temperature
  - Projected 7.2^{o} F increase in average annual maximum temperature.
  - Projected 6.2^{o} F increase in average annual minimum temperature.
- No change in annual *mean* precipitation
- 0 – 0.2 in/month mean decrease in snow (Nov. –Apr)
- 0.1 in/month mean decrease in runoff (Feb-June)

No change in mean annual precipitation? So what's the problem?

Models don't predict much change in annual precipitation, but large increases in evapotranspiration.

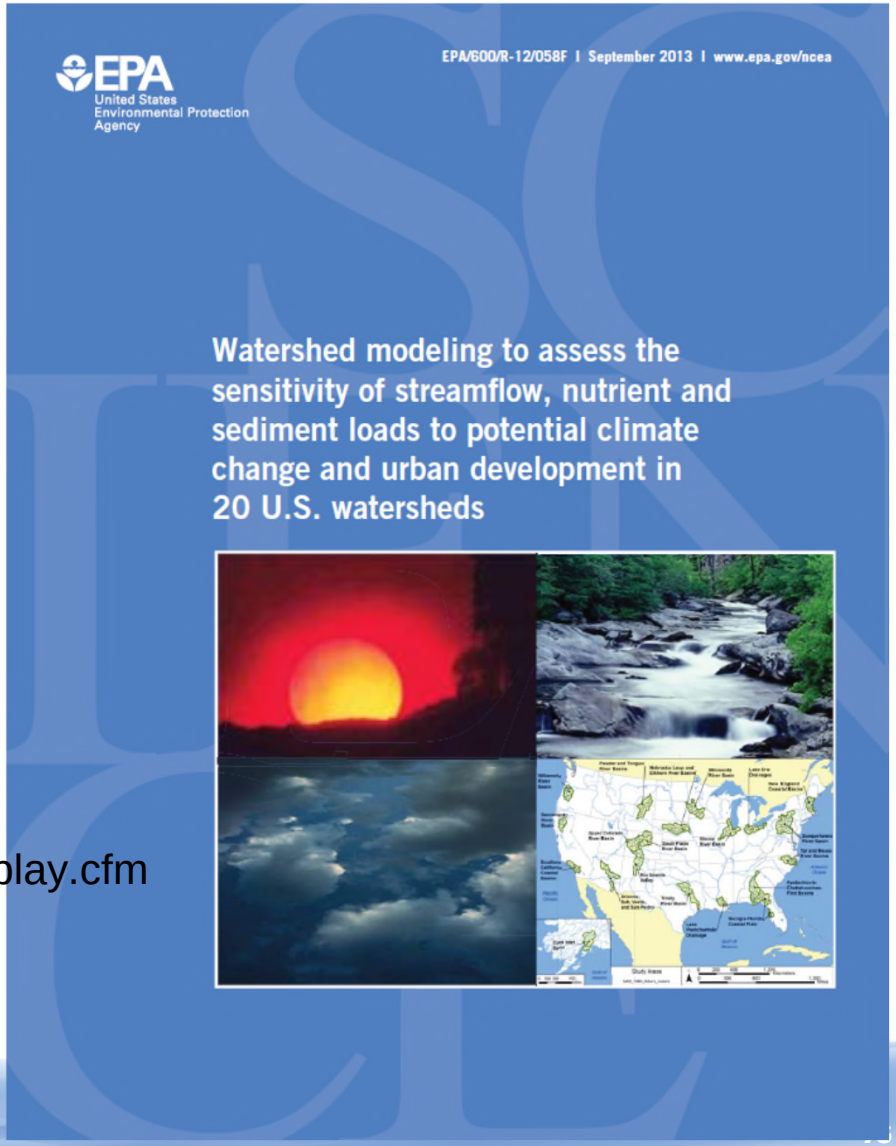
Change in runoff is the difference between precipitation and evapotranspiration.



Watershed Modeling to Assess…Climate Change and Urban Development, USEPA, 2013

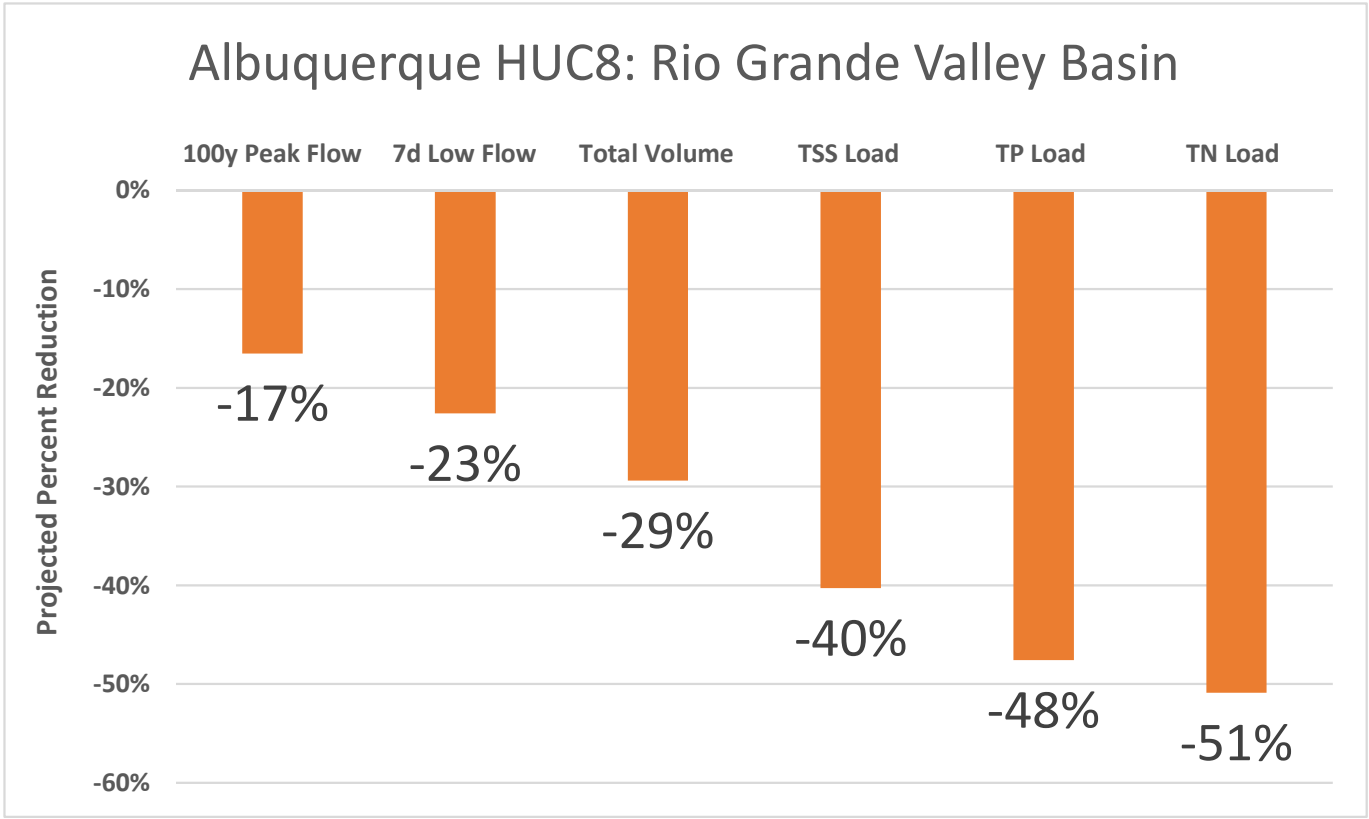
- **Comparing 1971-2000 baseline to 2070**
- Watershed simulations SWAT
- Downscaled 6 dynamic climate models
- Includes projected mid-century urban-residential development
- Shows individual model and ensemble model results
- Shows 20 watersheds and subwatersheds to 8-digit HUC

On web http://cfpub.epa.gov/ncea/global/recordisplay.cfm



Rio Grande at Albuquerque – Mid Century Compared to 1971-2000

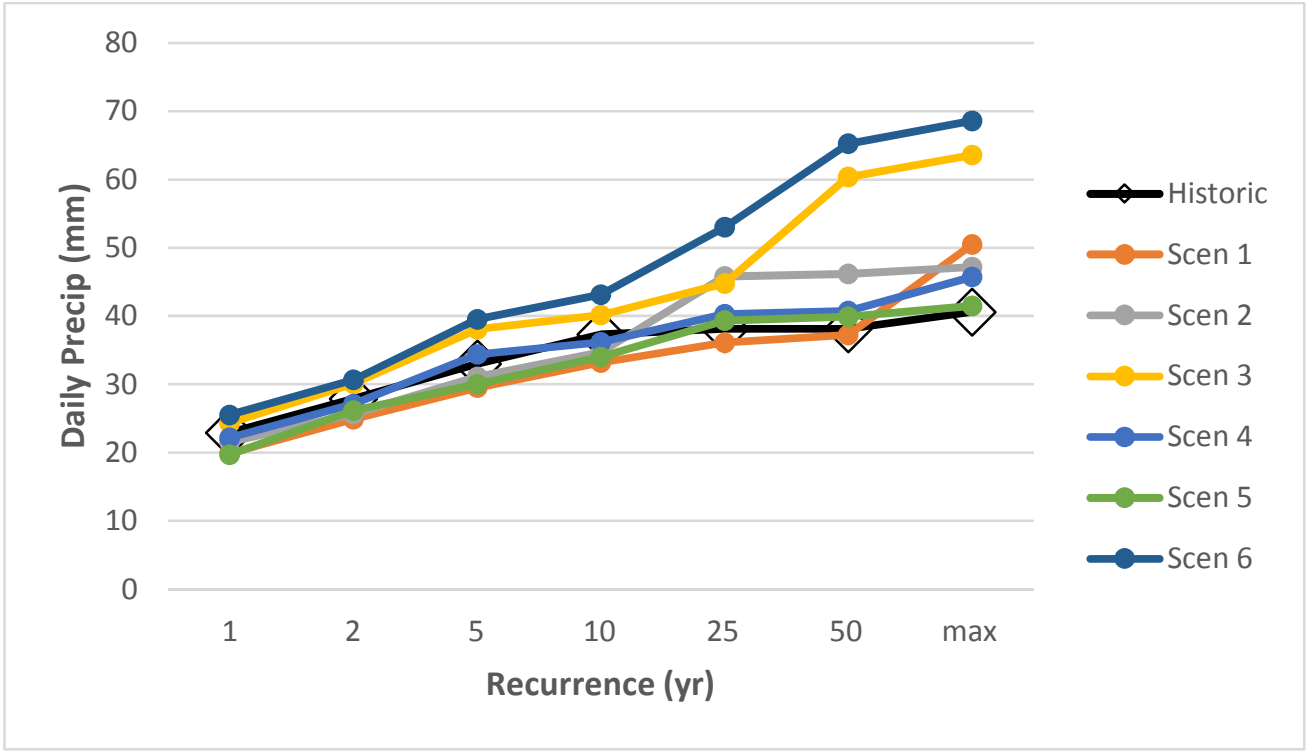
Given climate and urban development projections, the model ensemble for the Rio Grande at Albuquerque projects significant reductions in volume, flow, and loading at mid-century.



What about intensity of precipitation projected at Jemez Dam? Looking at the six climate change models…

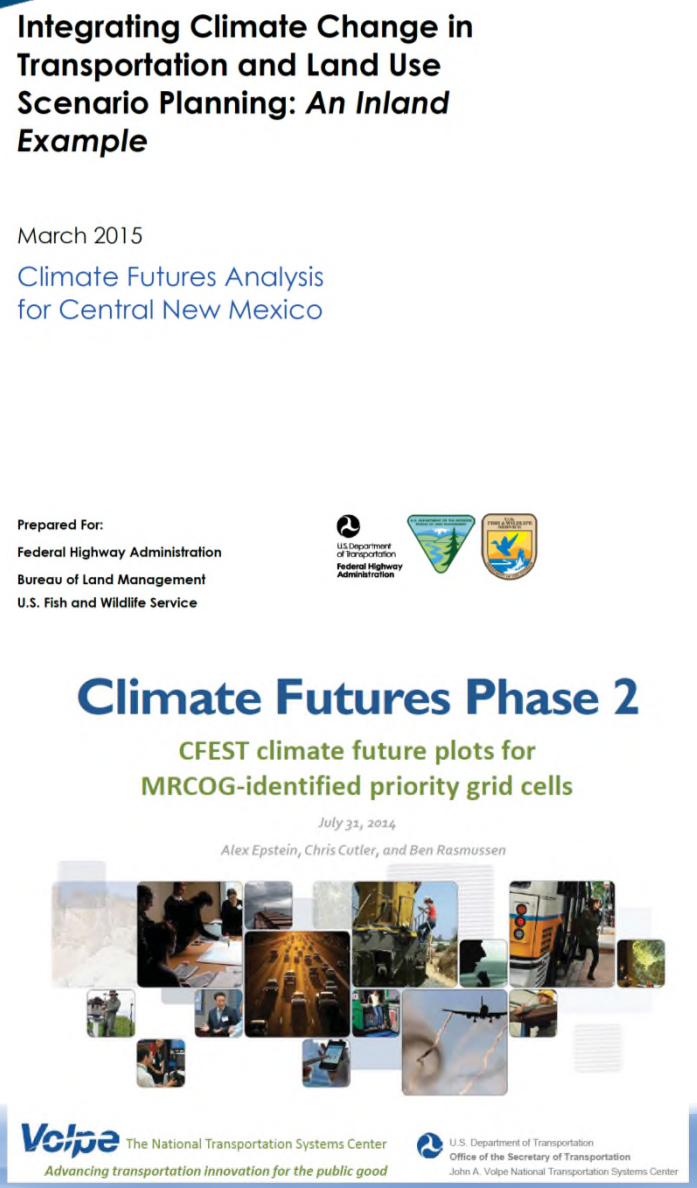
Up to the 25-year storm event, rainfall intensity is similar.

50-year and max year events are projected to increase 10 mm or approx. 0.4 inches (mean of models).



Mid Region Council of Governments Study

- **Comparing 2040 to baseline (1950-1999)**
- Used different climate models to develop 5 "climate futures"
  - Warm wet
  - Hot wet
  - Warm dry
  - Hot dry
  - Central
- Evaluated different grids in the MRCOG region, including Albuquerque

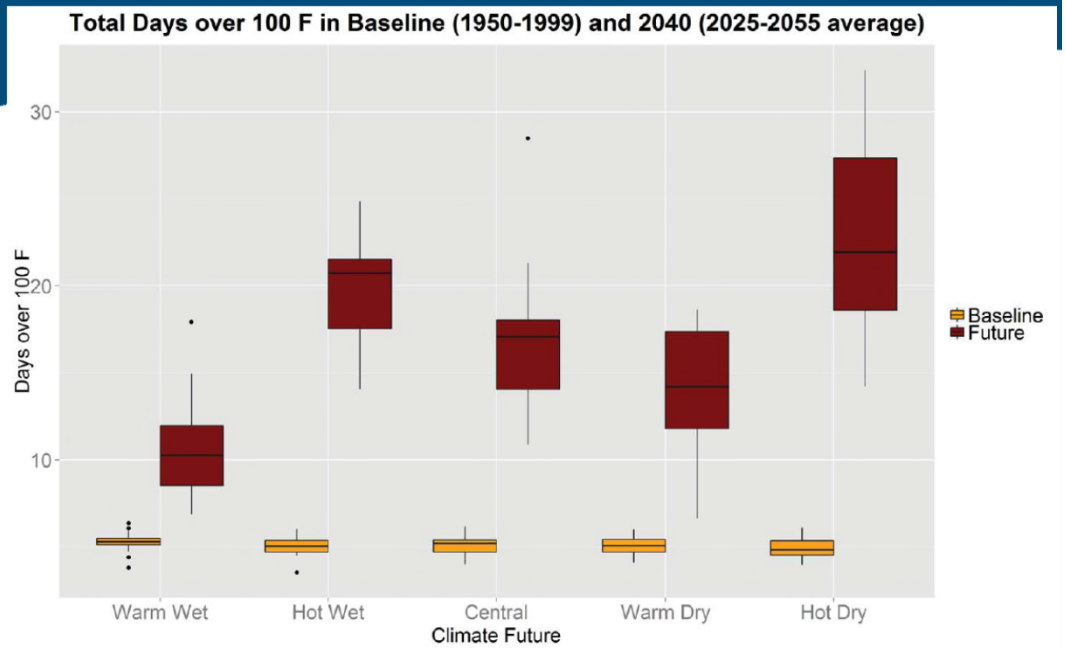


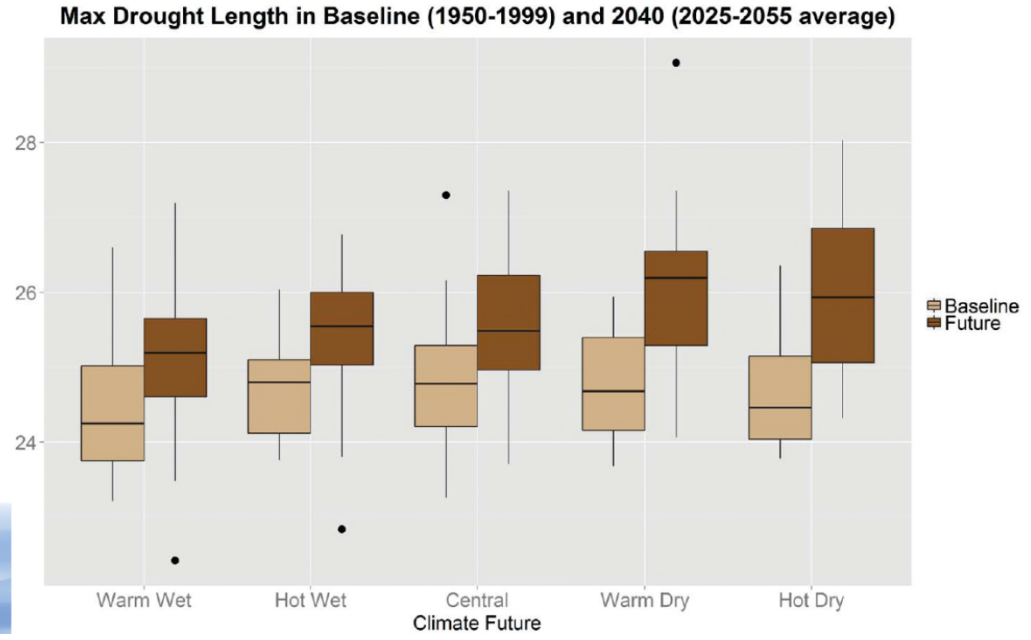
Mid Region Council of Governments Study – City of Albuquerque Grid

Projections show

4X the annual days over 100° F by 2040 for Albuquerque.

Statistically significant increase in length of droughts.





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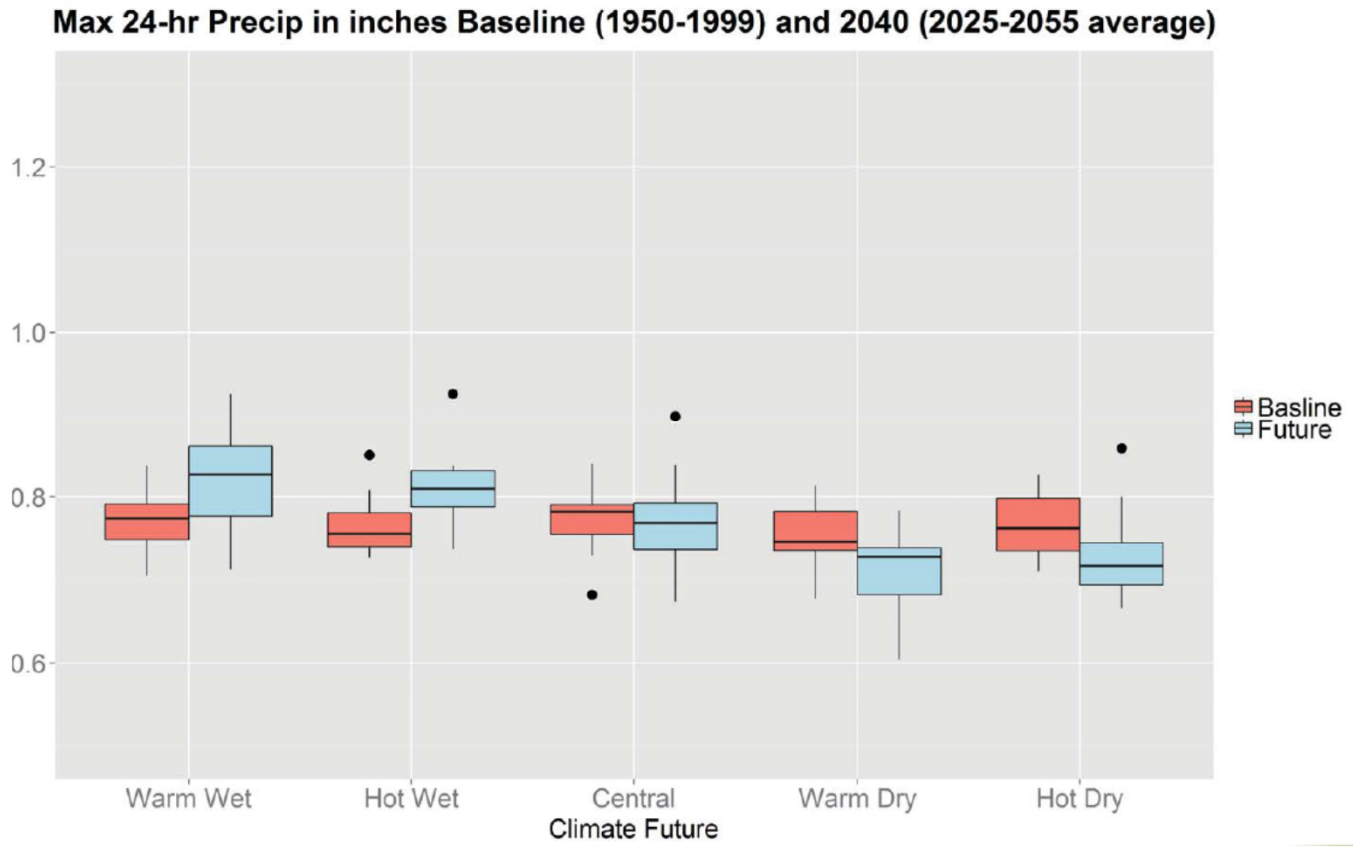
Mid Region Council of Governments Study – City of Albuquerque Grid

High variability in projections of monthly average precipitation for Albuquerque.

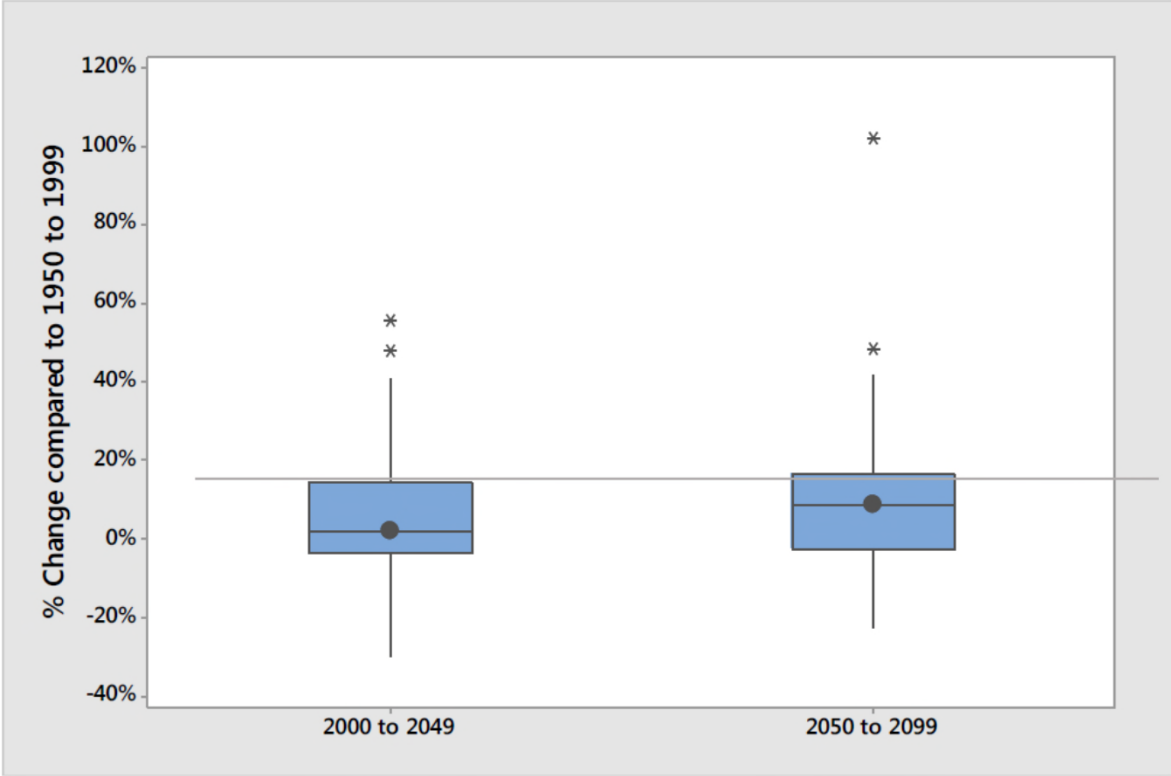
Modest increases and decreases projected for maximum 24 hour events.



Related Study: Flood Risk Analysis Potential Impacts of Climate Change, Southern Sandoval Co AFCA

Projections show no change in rainfall intensity/flooding risk through mid-century.

A 10 percent increase in the 100 year storm event projected by end of century, resulting in 25% increase in peak flow.



Percent change in 100-year 24-hour precipitation for Upper Calabacillas Arroyo

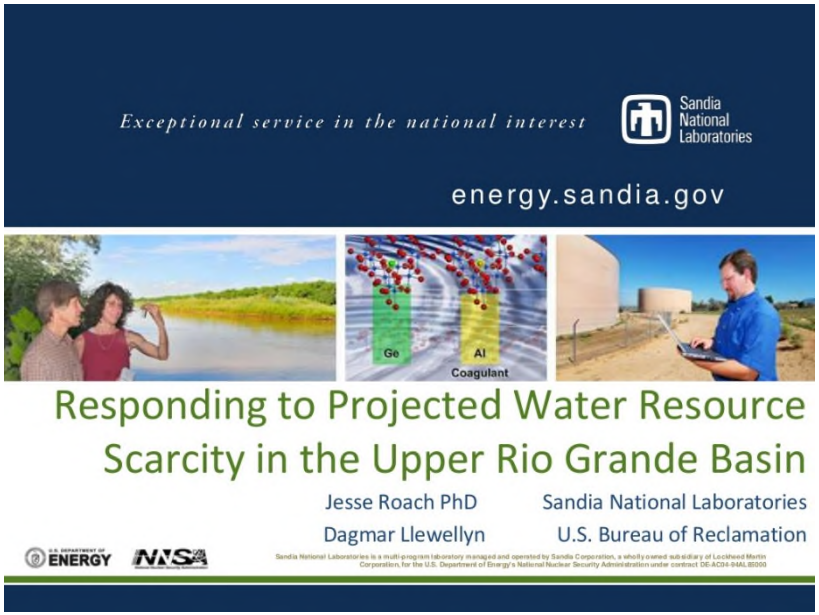
Upper Rio Grande Impact Assessment, Sandia National Lab and U.S. Bureau of Reclamation, 2013

RECLAMATION
Managing Water in the West

West-Wide Climate Risk Assessment: Upper Rio Grande Impact Assessment

U.S. Department of the Interior
Bureau of Reclamation
Upper Colorado Region
Albuquerque Area Office

December 2013

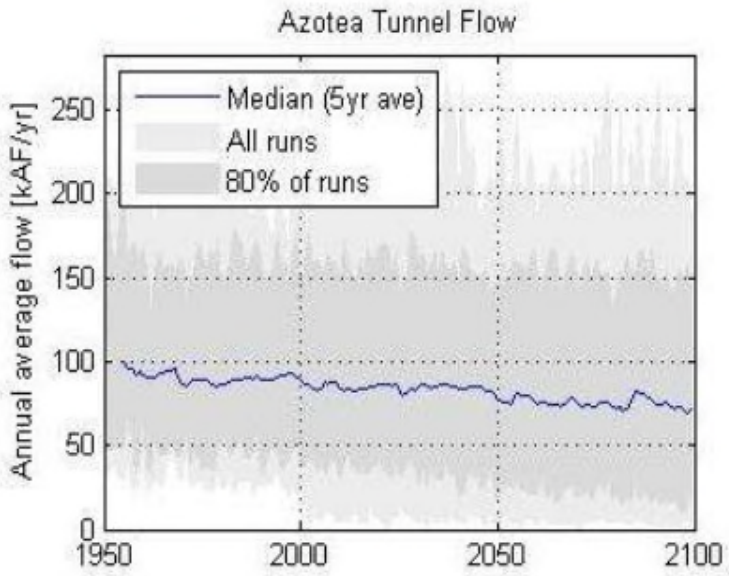


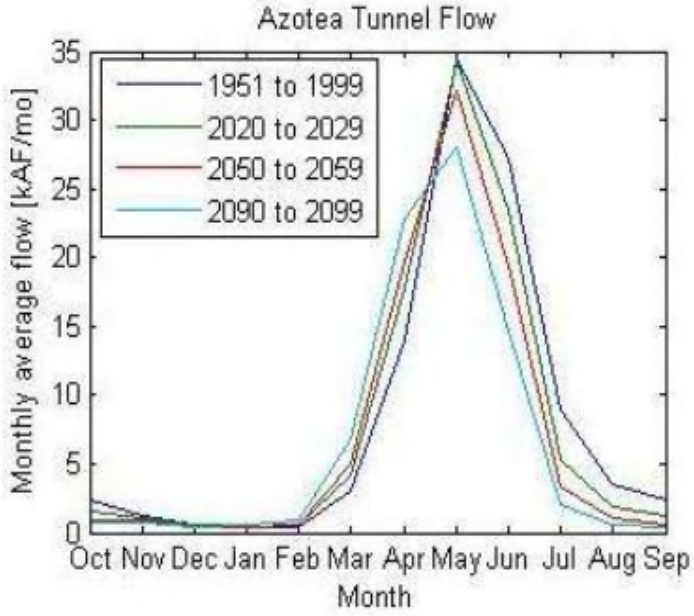
On the web:
http://www.usbr.gov/WaterSMART/wcra/reports/urgia.html
http://www.slideshare.net/fullscreen/atlanticcouncil/water-in-the-west-session-3-jesse-roach/2

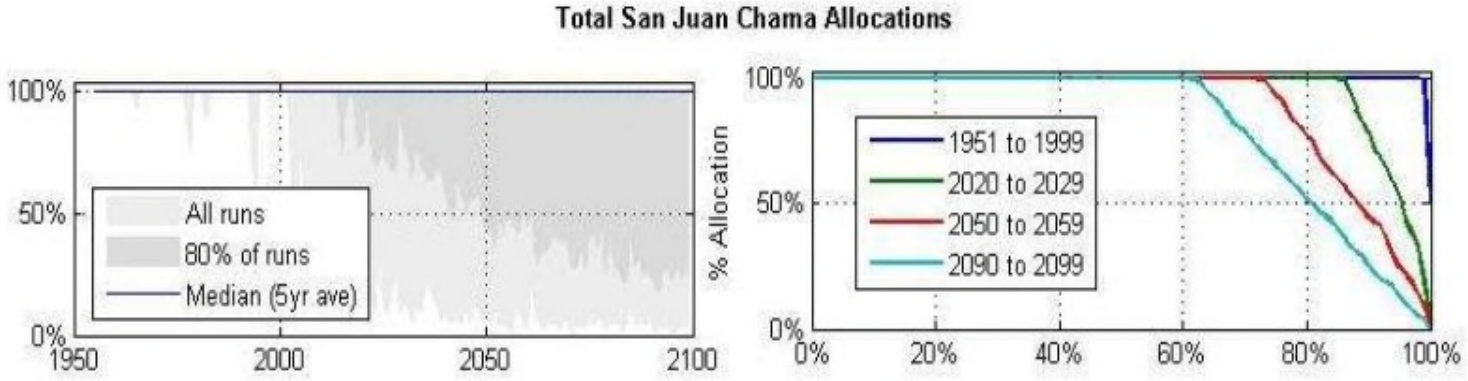
Projected Supply Reductions

Sandia National Laboratories

- Imported water (San Juan – Chama Project). ~15% reduction







Big Picture Findings (compared to 1950-1999 baseline)
Note: Study does not consider projected growth of region

- Colorado and Rio Grande flows projected to decrease 33% during 2050-2099
- San Juan-Chama Project Flows
  - San Juan flows projected to decrease 25% by 2050-2099
  - San Juan Chama Project allocations projected to decrease 15% (due to engineered storage)
- San Juan Chama project allocation shortfalls
  - 72% of allocation projected by 2050s
  - 62% of allocation projected by 2099

Big Picture Findings
Note: Study does not consider projected growth of region

- Already problems using allocation due to drought
  - Water shortages
  - Wildfires and ash ladened water
- Hydropower- Projected decrease of 50% by 2099
- Water quality – concentrations of sediment, nutrients, and salt may increase

Community vulnerability & hazards in Albuquerque associated with these climate change projections

- Projections about how climate change may affect Albuquerque's water resources
- Scoping community vulnerability & hazards
- Questions and discussion

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Regional and Localized Vulnarability & Hazards for Albuquerque Region

- Regional – Community Wide
  - Insufficient water supplies for drinking, industry, farming
  - Heat-related illnesses and deaths
  - Disruptions to energy supplies (and chain of effects on water and wastewater utilities)
  - Water quality and habitat impacts
- Localized
  - Increased wildfires (and related property and health impacts)
  - Continued flooding (with no or slight increase in 50 year and greater storm events) through mid century

Four Vulnerability/Opportunity Areas

- Glenrio
- South Broadway
- Mid-Valley
- Ventana Dam Area

We will focus on portions of these districts in our charrette.

Example On-Line Tools to Conduct Local Vulnerability & Hazards Assessments

Climate Change Resilience Evaluation and Awareness Tool CREAT, USEPA

- New on-line tool to assist drinking water and wastewater utility owners in understanding climate change threats and risks to their utilities

http://water.epa.gov/infrastructure/watersecurity/climate/creat.cfm

Example On-Line Tools to Conduct Local Vulnerability & Hazards Assessments

Climate Registry for the Assessment of Vulnerability, CRAVe, USGS

- Access to information about climate change vulnerability assessments, leveraging work from multiple agencies.

https://nccwsc.usgs.gov/crave/

Example On-Line Tools to Conduct Local Vulnerability & Hazards Assessments

Virtual Framework and Vulnerability Assessment Scoring Tool (VAST)

- Spreadsheet based guide to walk agencies through the vulnerability assessment process for roads and highways.

http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/gulf_coast_study/phase2_task6/page04.cfm

Questions and Discussion