Climate Change: Projected Effects on New Mexico Stream and River Ecosystems

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Main Points

- ~ Decadal-scale oscillations between drought and wet periods
- ENSO has major influences on NM stream flow
- Variation in stream flow higher than variation in precipitation
- Warming and drying will increase variation in stream flow
- Fish and non-flying invertebrates at greatest risk, especially high elevation populations
ENSO & NM Stream Flow

Variation in discharge in New Mexico streams and rivers is closely tied to ENSO.
Spring Runoff & ENSO

![Graph showing cubic meters of runoff during La Niña, Non ENSO, and El Niño conditions. The graph compares Gila and Pecos regions.](image)
Historical Flows on the Gila
(arrows = strong El Niño, solid symbols = La Niña)
Temperature, Precipitation, and Runoff

Increased temperatures and decreased precipitation are associated with increasing nonlinearity.
Elevation & Precipitation-Stream Flow Relations

- Mean Precipitation = 859 mm
  \[ y = 2.8909 + 1.5967x \quad R^2 = 0.770 \]

- Mean Precipitation = 705 mm
  \[ y = 0.19785 + 2.4052x \quad R^2 = 0.684 \]

- Mean Precipitation = 578 mm
  \[ y = -17.650 + 3.4948x + 9.7247x^2 \quad R^2 = 0.815 \]
Winter Precipitation and Summer Runoff

In lower elevation NM basins, changes in winter precipitation can produce counterintuitive changes in summer runoff.
Precipitation & Rio Salado Summer Flow

Observations
- No correlation between total summer precipitation and Rio Salado flow
- Lower winter precipitation followed by order-of-magnitude increases in summer flows

Proposed Mechanisms
- Higher vegetative biomass increases infiltration
- Greater land-air temperature gradient increases intensity of thunderstorms
- Drier winters result in more hydrophobic soils
Conclusions

- Better ENSO representation in GCMs critical for predicting effect of global warming on NM stream and river ecosystems.
- Warming and drying will lead to more variable stream and river flows.
- Effects of warming on stream and rivers will vary substantially across New Mexico’s complex geography.
Acknowledgements

Dave Gutzler, Cliff Dahm, Loren Potter, Carolyn Enquist, and the Hydrogeoecology Research Group.

Also the Huajatolla weather gods that have me trapped in a southern Colorado blizzard.