Evaluating the Effectiveness of Collaborative Modeling Methodologies to Address Climate Change in Mountain Regions: A Case Study from the Sierra Nevada in the Western United States

The Truckee-Carson River System, CA-NV, USA

What are typical reasons for mismatches in scientific observations, human perspectives and socio-political responses?

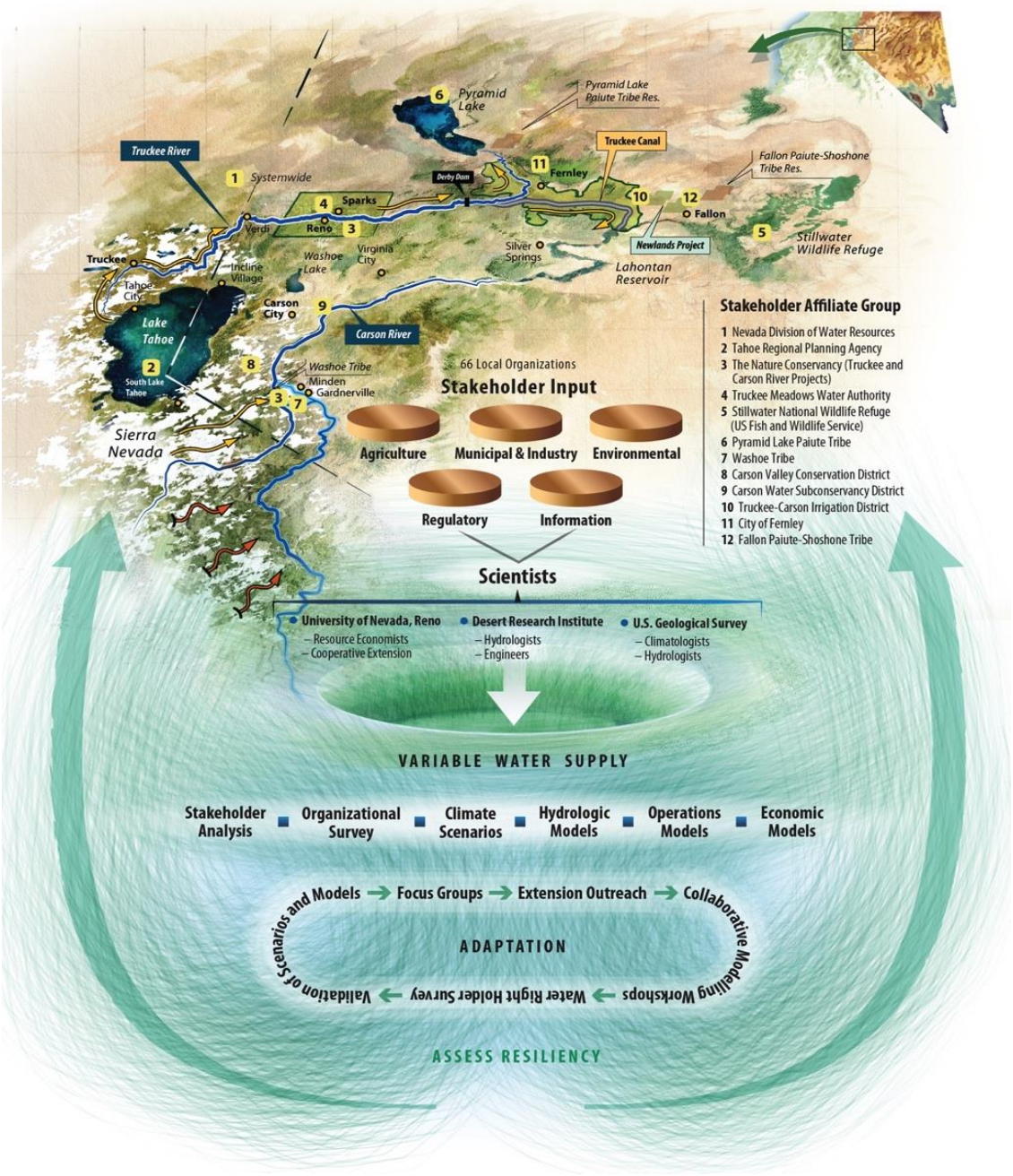
Loretta Singletary • Kelley Sterle
University of Nevada, Reno
Reno, Nevada, USA

RESEARCH PARTNERS

FUNDING AGENCIES

Collaborative Modeling Research Design

- Convenes researchers and identified local stakeholders to assess river system's climate resiliency and climate science adaptation and information needs
- Researchers harness local knowledge to:
  - Specify hypothetical yet plausible climate scenarios
  - Inform theoretically-grounded hydrologic, operations and economic models
  - Review model results with stakeholders to further prioritize research activities
- Ongoing interactions to ensure results are useful to local stakeholders (Singletary and Sterle, 2017; 2018)



Who are our stakeholders?

Utility districts, water purveyors, wastewater treatment facilities, public works

Watershed and river restoration, wildlife and land managers, tribal communities

Municipal & Industrial

Environmental

Agricultural

Regulatory

Agricultural irrigation and conservation districts, water purveyors, tribal communities

Federal, state, local and tribal regulators of water law, river operations and use

Collaborative Modeling Primary Data Collection Methods

Iterative Interaction Method	Purpose
Face-to-face semi-structured interviews (~1.5 hrs)	Track shifts in water supply challenges, adaptation strategies, and barriers; identify Stakeholder Affiliate Group Refine science information needs
Phone interviews (~1 hr)	
Focus groups (~2 hrs)	Convene local managers with researchers to inform and validate model simulations Prioritize ongoing research activities Evaluate stakeholders' perceptions of progress
Workshops (5 hrs)	

Collaborative Modeling Results

- Co-produced knowledge via variety of research methods/products:
  - Qualitative and quantitative data collected 2015-2019 demonstrate ongoing adaptation strategies, implementation barriers and climate information needs
  - Stakeholder informed climate “stress-test” scenarios guided by climate scientists’ expertise
  - Hydrologic and river operations model simulations assessed effects of climate scenarios on water availability which challenge managers’ ability to meet diverse and competing water demands
  - Econometric models assessed the economic performance over time of prior appropriation doctrine as a water allocation mechanism

Stakeholders reported that collaborative modeling produced:

- Useable climate impact information and viable adaptation strategies
- Improved stakeholder communication and coordination to enhance system-wide climate resiliency
- Collaborative research that increased local capacity to adapt to climate-induced water supply variability
- Facilitated and supported local climate adaptation through development of plausible climate scenarios to explore hydrologic and operational implications
- Identified and consistently engaged key stakeholders in collaborative research that facilitated social learning
- Provided iterative, structured interaction between stakeholders and interdisciplinary researchers to ensure useful results to local decisions
- Combined diverse, practical knowledge with unbiased climate research
- Effectively utilized extension as a boundary organization to conceptualize, implement, and formatively evaluate efficacy of collaborative research design

Retrospective Evaluation Results

- Elements of collaborative modeling research that can be improved to increase adaptive capacity:

With regards to research procedure, stakeholders requested:

1) incorporate more than one key stakeholder from each water use group
2) conduct educational workshops across the river basin to educate public
3) increase communication with more frequent engagements

With regards to research substance, stakeholders requested:

1) incorporate scenarios of population growth and development
2) expand scope to examine implications for water quality
3) provide one-on-one support to integrate results into local adaptation planning

Thank you!

Publications featured today:

❖Sterle, K. & Singletary, L. (Submitted). Supporting Local Climate Adaptation through Knowledge Co-production: Outcomes from a Collaborative Modeling Research Project in the Western United States. *Climate Services.*

❖Singletary, L. & Sterle, K. (2018). Participatory Research to Assess the Climate Resiliency of Snow-fed River Dependent Communities: A Collaborative Modeling Case Study in the Truckee-Carson River System. In Lachapelle, P.R. and Albrecht, D. (Eds.), *Addressing Climate Change at the Community Level in the United States.* Community Development Research and Practice Series, New York: Routledge.

❖Singletary, L. & Sterle, K. (2017). Collaborative Modeling to Assess Drought Resiliency of Snow-Fed River Dependent Communities in the Western United States: A Case Study in the Truckee-Carson River System. *Water,* 9(99), 1–19.