California’s Fourth Climate Change Assessment – Technical Reports

TITLE

CLIMATE ADAPTIVE RESPONSE ESTIMATION: SHORT AND LONG RUN IMPACTS OF CLIMATE CHANGE ON RESIDENTIAL ELECTRICITY AND NATURAL GAS CONSUMPTION

CITATION


ABSTRACT

Climate change projections are for higher temperatures and extreme droughts by the end of the 21st century. This will alter the natural recharge of groundwater, including decreased inflow from runoff, increased evaporative losses, and warmer and shorter winter seasons, impacts that are likely to exacerbate already existing groundwater overdraft in many basins. Additionally, the imported surface water that can be delivered from the Central Valley Project (CVP) and State Water Project (SWP) to areas reliant on this water for groundwater recharge and consumptive use is projected to be less reliable and more expensive. Yet groundwater is a critical water supply source during drought when it compensates for reduced surface water supplies. The need for proactive adaptation strategies to address the extreme droughts projected under climate change are frequently discussed, yet there are limited examples of such groundwater management strategies. This paper therefore explores:

1) How groundwater management agencies are planning for drought

2) What new approaches are currently being used that show promise for addressing the more extreme droughts projected under climate change?

First, the paper provides a review of the research on drought and groundwater management including strategies currently used to address drought. Second, case studies illustrate newer and varied approaches being used to reduce drought impacts. Highlighted are the different approaches used by groundwater managers to both increase storage and develop drought reserves. These strategies can help to reduce vulnerability to the extreme droughts projected under climate change. Two additional case studies discuss the limits of a drought reserve strategy and indicate that more is needed under climate change to address the range of basin conditions and the varied needs of communities reliant on groundwater.

Several overall groundwater management trends are noted:
- A shift from voluntary to mandatory requirements for the sustainable management of groundwater after the 2014 passage of SGMA;
- An increase in the use of recycled water from 190,000 AF in 1976 to 714,000 AF in 2016 that can be used for groundwater recharge to enhance storage;
- An increase in the development of groundwater drought reserves; Suggested future research projects include:
  - Benefits and challenges of long-term strategies to manage groundwater under climate change and extreme droughts;
  - Practices implemented during past droughts that were effective in reducing drought vulnerability in subsequent droughts

The different approaches presented in this paper to increase groundwater storage specifically for use during drought are important first steps to proactively manage groundwater to adapt to the higher temperatures and future extreme droughts projected under climate change.

**HIGHLIGHTS**

Highlights from our review relevant to current planning for drought are listed below.

- Climate change projections are for more extreme droughts and higher temperatures by the end of the 21st century.
- An explicit mention of groundwater droughts is missing from standard drought categories
- A snow drought, where higher temperatures under climate change reduce snowmelt and change the timing of runoff, will affect imported surface water supplies that many groundwater basin managers rely on for consumptive use and for groundwater recharge.
- Drought planning and groundwater management plans rarely intersect. Drought plans give limited attention to sustaining groundwater over the long term, while groundwater plans provide limited attention to drought including the extreme droughts under climate change.
- Limited explicit incentives exist in SGMA for pro-active long-term strategies that account for the extreme droughts projected under climate change.
- Imported surface water remains a major supply source for water purveyors, but the use of recycled water and other water supply sources (e.g. stormwater capture, desalination) have increased since the 1976 drought.
- Regulating groundwater withdrawals are generally modest in scope and less employed than supply-side groundwater management strategies.
- Approaches to recharging aquifers have increased including for example flooding fields for both irrigation and recharge.

**ACCESS**

For access to the full report, please email Leah.Fisher@sgc.ca.gov
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