Ensuring Groundwater Security under Drought and Climate Change

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The Problem Statement

- Groundwater is a critical water resource that is being depleted worldwide. [1] Changes to the global hydrological cycle negatively impact groundwater availability.
- Increasing extreme weather events such as droughts drive local impacts to groundwater, and are predicted to increase under climate change by the end of the 21st century. [2]
- During droughts, groundwater levels and storage decline, often with insufficient recovery during wet periods. Changing climatic conditions will exacerbate this deficit and groundwater resources will continue to be depleted. [3]
- The complex challenges presented by groundwater security and drought resilience under climate change would benefit from interdisciplinary research. Current research rarely intersects nor integrates across these two problems. [4]
- Managing for the long-term effect of drought on groundwater depends on effective groundwater governance approaches and management programs the account for drought's physical and social impacts.

Policy Recommendations

- **Increase funding for and encouragement of interdisciplinary studies, e.g.**:
  - Asses local physical and social impacts of drought on groundwater
  - Investigate effectiveness of different groundwater governance and management approaches on increasing drought resilience

  Prioritize interdisciplinary research that:
  - Advances the availability of long-term groundwater data and information to understand the responses of groundwater systems to climate variability and change, e.g. improved and expanded groundwater monitoring efforts
  - Incorporates the compounded uncertainties in groundwater, drought and climate change research, which influence management decisions

  Provide incentives for groundwater management approaches and policies that can increase drought reserve supplies

Expected Impact of These Recommendations

- To enable and encourage integrative and multidisciplinary research, incentive structures, both within academic institutions and within science funding systems, will need to be established.
- The implementation of prioritized interdisciplinary research can facilitate scenario development to achieve a better understanding of the options available to reduce vulnerabilities in water-stressed geographies.
- Consideration and discussion of the effectiveness of alternative management approaches can inform and facilitate efforts to build trust and resolve conflicts.

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[1] (Konikow & Kendy 2005, Gleeson et. al. 2010, Famiglietti 2014, Brown 2015; Leahy 2015, Langridge et. al. 2016).
[2] (Gurdak et al., 2009, Mastrandrea et. al. 2009, IPCC 2013, Schewe et al., 2014, IPCC, 2007a,b, Ludwig et al., 2014).
[3] (Howitt et. al. 2015).
[4] (Allen et al., 2004; Brouyère et al., 2004; Hsu et al., 2007; Bates et al., 2008, Cisneros et al. 2014).