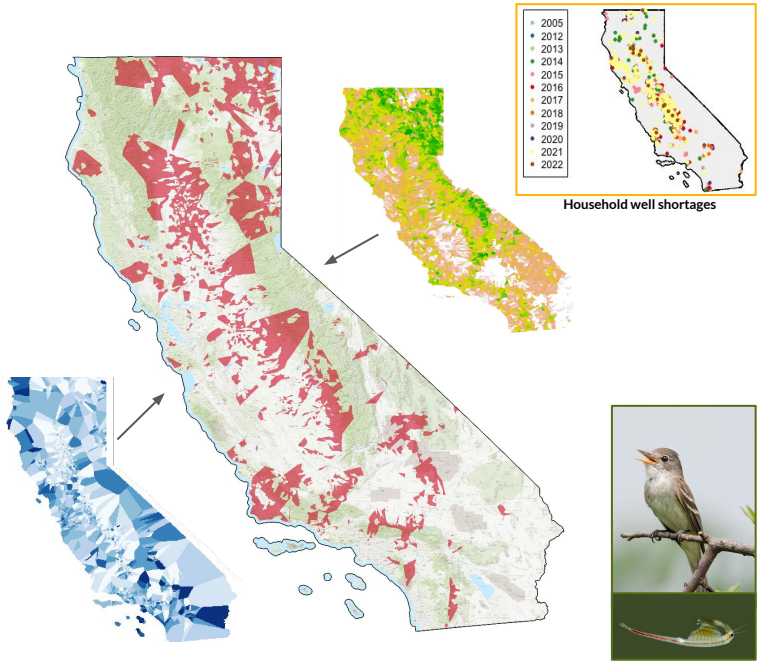
Policy Brief: Groundwater Recharge as a Conservation Priority for 30x30

Land conservation can protect groundwater reservoirs from depletion and degradation, but 30x30 does not currently consider groundwater conservation. Conserving land protects aquifers for human use and the ecosystems dependent on them (Collin & Melloul, 2001), and 30x30 has potential to contribute significantly to this goal. We identified regions of California with the highest groundwater vulnerability and conservation value to incorporate into 30x30 conservation priorities.

URGENT ISSUE IN CALIFORNIA: Groundwater depletion is an urgent conservation issue that *intersects with state food security and environmental justice priorities*. 85% of California's population uses groundwater in some form and underground aquifers provide over 80% of water needs in some areas of the state (Hanak et al., 2017). The Central Valley has recently experienced the most intense groundwater loss in the country (Scanlon et al., 2012) and under current trends California is on track to run out of groundwater by 2050 (J. Nation, personal communication).

RECOMMENDATION: Add groundwater recharge as an objective for 30x30 in recognition of the dependence that humans and ecosystems alike have on our water systems and reservoirs. Planners should consider groundwater vulnerability as a conservation metric, in coordination with existing state efforts such as the Sustainable Groundwater Management Act (SGMA).



Household well shortages

Our map (enlarged, center) highlights regions that are both groundwater-depleted (lower left) and critical for groundwater-dependent ecosystems (middle right). This layer could be added to existing conservation priority schemes.

Groundwater depletion is an environmental justice problem. Rural, low-income Latino communities are among those most impacted by water shortages (Becker, 2021) and 70% of people who reported household water supply shortages (map upper right) identified their dried-up well as the reason (CA DWR).

Groundwater depletion is a conservation problem. Low groundwater impacts terrestrial ecosystems and drains wetlands, which support a variety of unique and endangered wildlife. Within California, these include the southwestern willow flycatcher, fairy shrimp (both pictured), and many more.

Groundwater recharge builds climate change resilience. Climate change is projected to intensify the state's natural drought cycle, meaning that groundwater reservoirs, which are less impacted by drought than surface reservoirs, are a key buffer against climate change (CA Water Resilience Portfolio 2020).

Technical Summary

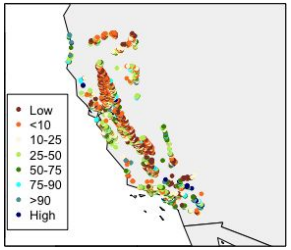
OVERVIEW: Groundwater depletion can decrease local drinking water availability and agricultural output, contribute to sea level rise, cause extensive property damage as a result of land subsidence, and reduce populations of wetland-dependent plants and animals (Konikow, 2014).

BACKGROUND: Land conservation helps to protect groundwater reservoirs.

Supply of groundwater is increased when land is protected from certain types of development because permeable surfaces, such as soil, allow precipitation (winter floods, spring storms) to recharge groundwater. Recommendation: *Zone land as parks or agricultural land instead of concrete urban areas. Remove or disincentivize structures that divert water away from the watershed.*

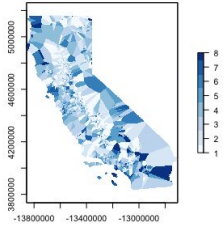
Groundwater **depletion can be reduced** by specifying the uses of land around the reservoir. Recommendation: *Limit development of grassy lawns or golf courses, subsidize growing crops based on their water usage.*

Groundwater Percentiles

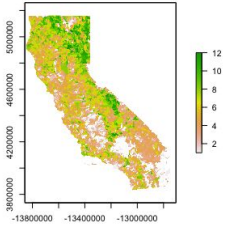


Riparian woodlands in the Central Valley

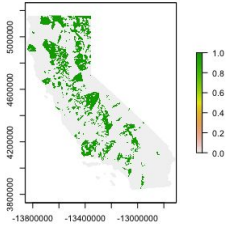
Groundwater Score



Groundwater Dependent Ecosystems



Prioritization



METHODS:

1. We weighted areas across California according to their level of groundwater depletion using well data (n = 3400) from the California Department of Water Resources, interpolated to cover the state. We sourced data for the distribution of groundwater-dependent ecosystems from Howard & Merrifield (2010).

2. Percentile values for groundwater depletion were converted into a cost score from 1 to 8 (1 is most depleted), and combined with a 0 to 12 score for the prevalence of groundwater-dependent ecosystems.

3. The final map provides a spatially explicit prioritization scheme, identifying areas with groundwater-dependent ecosystems and highly depleted groundwater.

Water Use and Agriculture: Policies such as "recharge crediting" easements address ways to balance these competing interests by rewarding farmers for using less water (Ayres et al., 2021).

CASE STUDY: Scott River basin alfalfa growers have been given emergency contracts to forego pumping of groundwater to augment river flows for coho and chinook salmon. Contracts lasted from 08/01/21 to 12/31/2021. The Scott River Water Trust is monitoring effectiveness (CA Water Resilience Portfolio Progress Report 2021).

DATA SOURCES: California Dept. of Water Resources SGMA Viewer; Howard and Merrifield, 2010. References list and image credits are included as supplementary material.

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