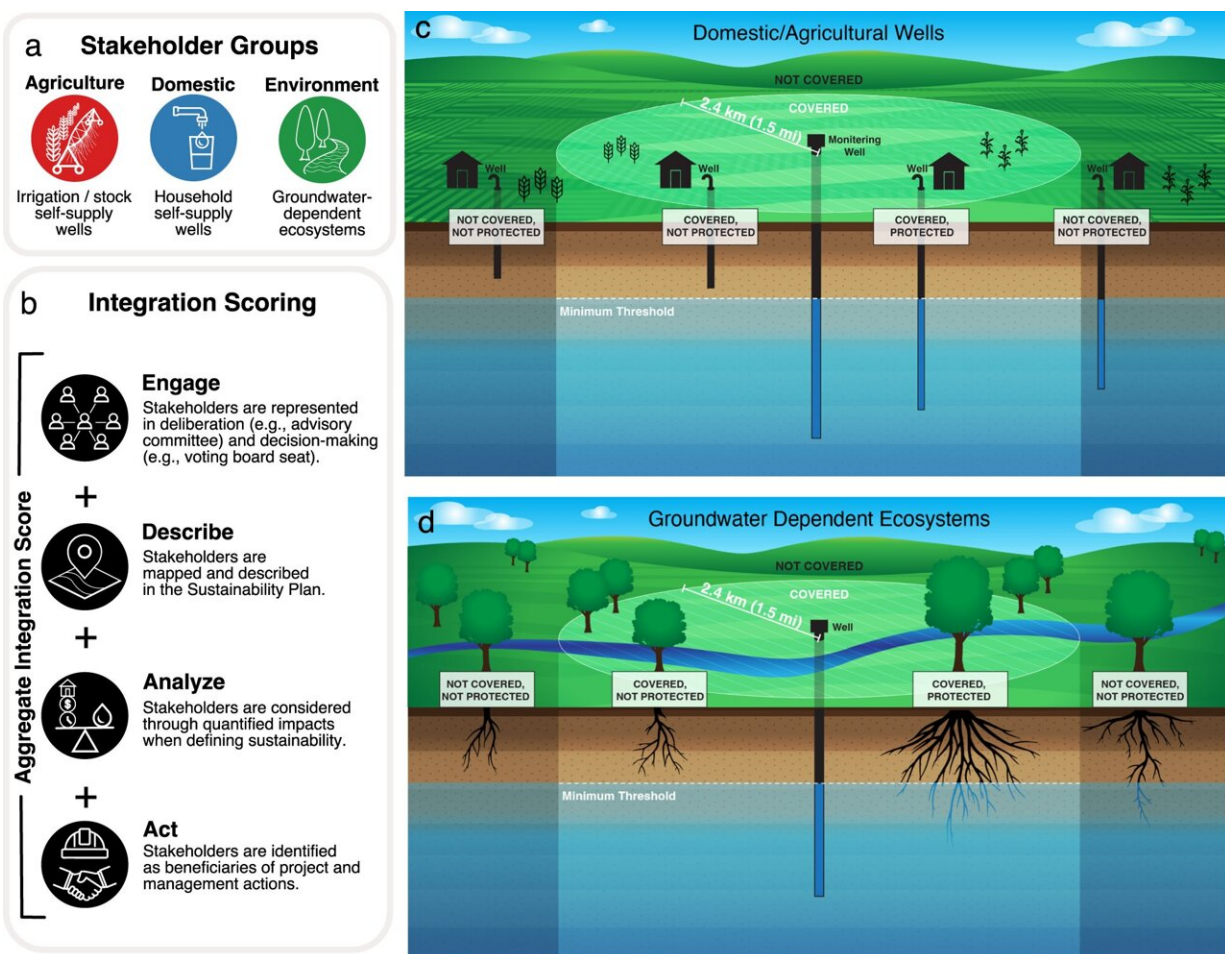


The more stakeholders are included in policy planning, the better their policies protect them

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Conceptual framework for evaluating Sustainability Plans and spatially assessing stakeholder protection. a Stakeholder groups and their definitions. b Stakeholder integration scoring components and their definitions. c, d Spatial assessment: for each instance of a stakeholder ((c) well or (d) ecosystem), we identified

monitoring wells that were at or within a horizontal distance of ~2.4 km (1.5 miles). Stakeholders nearby monitoring wells were considered covered and were assessed for how well the Sustainability Plan protects the stakeholder from losing access to water as a result of declining groundwater levels. Individual stakeholders not covered by a monitoring well were deemed not protected. For covered wells, protection was determined by comparing the depth of each stakeholder to the minimum threshold established at the nearby monitoring well. If the depth of a stakeholder was equal to or shallower than the minimum threshold at the nearby monitoring well, the stakeholder was not protected. Credit: *Nature Communications* (2023). DOI: 10.1038/s41467-023-39363-y

Having a seat at the table, and voices heard, makes a world of difference when it comes to natural resources. It sounds intuitive, but experts didn't have enough data to prove it until now.

A team of researchers from across the country pored over 108 groundwater management plans in California to see how well they protect stakeholders like domestic well users, farmers and ecosystems. They found that the plans that incorporated stakeholder input offered greater protection from groundwater depletion. Unfortunately, only 9% of the sustainability plans integrated these users in a comprehensive manner.

The findings have broad implications for resource management, both in California and abroad. The authors published their independent analysis in *Nature Communications*. The data and findings from this study were shared with different stakeholders and organizations, who have used it to inform [policy recommendations](#).

"It's a big deal that we found empirical evidence that stakeholder integration leads to better protection," said co-lead author Debra Perrone, an assistant professor in UC Santa Barbara's Environmental

Studies Program. "There are very few published papers that show this connection empirically."

"I was pretty stunned," added co-lead author Courtney Hammond Wagner, formerly a postdoctoral scholar at Stanford University and now at the U.S. Department of Agriculture. "I thought this was going to be a different paper."

An ambitious aim

By 2014, more than a century of unregulated pumping in California had dried up wells, depleted aquifers and even sunk the ground level in many parts of the state. Meanwhile, the region was gripped by unprecedented drought. In dire straits, California passed the Sustainable Groundwater Management Act (SGMA), the first statewide effort to regulate groundwater resources.

Recognizing the complexity of the task at hand, the new legislation took a decentralized approach to groundwater management. The state tasked newly formed, local groundwater sustainability agencies with bringing their basins into balance within 20 years by reducing pumping or increasing groundwater recharge. Plans also needed to avoid undesirable results such as:

- lowering groundwater levels;
- losing groundwater storage;
- seawater intrusion,
- land subsidence;
- deteriorating groundwater quality;
- and losing streamflow.

If a local agency failed to meet the sustainability targets as set, the State Water Resources Control Board would step in to take the helm.

A bevy of groundwater sustainability plans have come out since SGMA was passed. But because planning is a local process, it wasn't clear how the effort was adding up overall. To answer this question, co-lead authors Perrone, Wagner and Melissa Rohde worked in collaboration with a forum of NGOs tackling groundwater issues in California. Together, they evaluated how well the sustainability plans integrated and protected stakeholders.

Evaluating impact

The authors surveyed 108 management plans, encompassing more than 160,000 pages of text. They came up with a rubric to evaluate stakeholder integration across three groups: domestic users, agriculture and ecosystems. The authors looked at how informed stakeholders were, how much representation they had, and whether their water needs were integrated into the plans. Most importantly, they examined whether stakeholder input had an impact on the protection of wells and ecosystems in the final plan.

How well a plan protected various stakeholders depended on where it set the aquifer's minimum thresholds, namely the lowest the water table can dip before potentially causing an undesirable result. Only wells deeper than the minimum threshold are protected by the management plan, and the same is true for plant roots in ecosystems. For the sake of caution, the authors also assumed that any well or ecosystem more than 1.5 miles away from a monitoring well was not protected.

Groundwater users and ecosystems are only protected by a management plan if their wells or roots extend below the minimum threshold the policy established for the underlying aquifer. Otherwise, their access to water can't be guaranteed.

The study distills years of painstaking analysis. It took an entire summer

to train the eight co-authors who combed through the lengthy technical documents, and another year and a half to actually go through the management plans.

"I was disappointed to see how many of the state's wells and ecosystems are not being protected by SGMA," said Rohde, an independent environmental consultant who worked at The Nature Conservancy during the study. A mere 9% of plans integrated all three stakeholder groups. The 108 management plans failed to protect 60% of agricultural wells, 63% of domestic wells and 91% of groundwater-dependent ecosystems. What's more, 40% of the state's wells and 87% of the state's groundwater-dependent ecosystems are outside the basins regulated by SGMA.

These shortcomings were especially true for stakeholders with less political and [economic power](#), like small farms and disadvantaged communities, terms that are defined by the state and federal governments. "Economically vulnerable groups were not only less integrated into the planning process, but they were also less protected," Perrone said.

However, in the few cases where stakeholders were integrated into the planning process, management policies protected their interests rather well. "This suggests that if we can design our policies to more explicitly require stakeholder integration, we can likely get better outcomes for stakeholders," Perrone explained.

"I did not think we would find a relationship between stakeholder integration and protection," Wagner added, noting how many variables can affect a policy's outcome: geography, climate, economics, demographics, etc. "And yet," she said, "we still saw a strong indication that stakeholder integration was associated with better protection. That blew me away."

Broad implications

SGMA was designed with adaptation in mind. Legislators knew it wouldn't be perfect at first, so they built in opportunities to evaluate and improve. This study presents one such evaluation and offers the chance to correct course.

That said, the stakes are high. Farmers and communities are running out of water and ecosystems are in decline. So, if management plans aren't protecting [stakeholders](#), are they failing?

"SGMA is unfortunately not living up to its fullest intent, in the sense that a large majority of wells and ecosystems are not being protected by these [groundwater](#) sustainability plans," Rohde said. "But, the results are also a reminder of how difficult it can be to fully engage diverse stakeholder groups with different needs and values, especially after a long legacy of [groundwater depletion](#)."

"SGMA is a great example of how discretion is a double-edged sword," Perrone added. "It offers a lot of flexibility, which is great for local control, but it's at the cost of concrete guidance."

"To correct course," Rohde said, "state and local agencies need to be more intentional about ensuring that everyone is at the table and has the technical and financial resources to integrate their [water needs](#) into the plans."

Sustainability policies are on the rise globally to address some of society's tough challenges, such as climate change, biodiversity loss and natural resource depletion. "But in order to be successful, these plans must intentionally be inclusive of diverse stakeholder needs, especially those groups that have been disenfranchised or historically marginalized," Rohde said.

More information: Debra Perrone et al, Stakeholder integration predicts better outcomes from groundwater sustainability policy, *Nature Communications* (2023). [DOI: 10.1038/s41467-023-39363-y](https://doi.org/10.1038/s41467-023-39363-y)

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