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Perspective

Overallocation, conflict, and water transfers

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Abstract
Grantham and Viers' article *100 years of California's water rights system: patterns, trends, and uncertainty* Grantham and Viers (2014 *Environ. Res. Lett.* **9** 084012) makes valuable contributions by mapping the disparities between California's legal allocations of water and actual water availability. This perspective article explains that those results both over- and understate the potential for conflict, but they nevertheless provide useful information for water policy analysts and educators. The results also provide compelling evidence of the need for water transfers and, unfortunately, the practical difficulties associated with achieving those transfers.

In the dry American Southwest, where water use has been vigorously litigated for well over a century, one might expect that every drop of water would be carefully allocated and meticulously tracked. In some places, that expectation reflects reality, but water managers in the American West, and particularly in California, often face major information gaps (Owen, 2012).

Grantham and Viers have taken a partial but meaningful step toward closing some of these gaps. Using geographic information systems, water rights and water use data, and a series of models, they compare the 'face value' of surface water appropriative rights in California to average annual streamflows. This allows a catchment-by-catchment evaluation of differences between water allocation and water availability. Grantham and Viers also analyze which categories of users hold those rights and how this distribution evolved.

Initially, their results seem alarming. California's rivers are systematically overallocated, they find, and in many catchments, the quantity allocated exceeds average annual flow by several hundred percent. The potential for conflict is obvious.

But California water allocation is always more complex than it initially seems, and there are several reasons why these results might overstate the threat of conflict. Legal allocations, as Grantham and Viers note, often exceed actual water withdrawals (California Court of Appeal, 2000). Most users also return some water to rivers, and their return flows then can be used again by someone else (Thompson *et al* 2013). Consequently, the existence of a gap between *legal allocations* and water availability doesn't necessarily mean there is a gap between *water demand* and water availability. And even if the latter gap does exist, prior appropriation law's defining trait, at least in theory, is a priority system designed for the specific purpose of coping with shortage (Thompson *et al* 2013). The fact that allocations exceed flows, in short, is a red flag for potential conflict, but not necessarily an indication of actual problems.

On the other hand—and as Grantham and Viers also note—there are several ways in which their results are likely to understate the potential for conflict. Perhaps most importantly, they have modeled the physical availability of water.

But environmental constraints preclude pumping California's rivers dry, and *legal* availability is therefore lower—sometimes substantially so—than *physical* availability (Hanak *et al* 2011). They also have modeled average flows, and conflicts intensify in years like 2014, when flows are below average (Owen, 2008). Their comparison also does not include major water users that are outside the appropriative rights system, like holders of riparian rights and groundwater pumpers. The latter group is particularly enormous, both in terms of the number of pumpers and the amount of water they use (Choy and McGhee 2014). Groundwater pumping reduces the amount of water discharging from aquifers into surface waterways, again lowering, and sometimes eliminating, flows (Glennon 2002). Actual water availability, in short, is often much less than their results suggest.

Yet even if Grantham and Viers' study supports only a preliminary understanding of California water systems, their results are important in several ways. First, educators should find the article quite useful for explaining the historic development and current geography of California water rights. Second, their catchment-by-catchment comparisons provide a useful first step toward building more inclusive models.

The third, and more complex, implication concerns the possibilities for adjustment. Grantham and Viers argue that pervasive gaps between physical water availability and paper allocations demonstrate the unlikelihood of major new appropriations from California waterways. Instead, they argue, reallocation is the future. That claim echoes arguments often made in the literature of water policy and law; many analysts have argued for major reallocation, often through water trading (Adler 2008). But Grantham and Viers' results show that trading, while perhaps necessary, is going to be even more difficult to implement than many analysts have recognized.

The reason is straightforward: in a highly over-allocated catchment, water uses tend to be practically and legally intertwined, and intertwinement makes trading messy. One user's return flows will be a key part of another user's supplies (Thompson *et al* 2013). The water that leaks out of an upstream ditch and enters a shallow aquifer will then recharge the river, serving other users downstream. Water that one user claims a right to, but rarely actually diverts, again will benefit other users. Inefficiency, in short, has its beneficiaries, and those beneficiaries have lawyers. But water transfers generally involve reducing inefficiencies. Typically, a water user somehow reduces its water use—perhaps by lining a leaky ditch or by switching to a more efficient irrigation system—and attempts to sell the right to use the resulting surplus. Or, alternatively, the water user simply sells the portion of its right that it was rarely exploiting anyway. In an overallocated catchment, those changes will have ripple effects on multiple downstream and junior users (as well as the natural environment), and those other users may appeal to other provisions of California water law, including a traditional water law doctrine known as the 'no injury rule,' to try to block the change (Gould 1988).

That does not mean that transfers cannot occur. To provide one example, several major California water agencies agreed in 2003 to the largest set of water transfers in the history of the American West. Hundreds of thousands of acre-feet of water would shift from agricultural use in the Imperial Valley to urban water suppliers in coastal Southern California. But the transfer also will have collateral consequences on water users and environmental systems that had become dependent upon IID's inefficiencies. Those impacts in turn have spawned litigation, which continues to this day (United States Court of Appeals for the Ninth Circuit, 2014). What Grantham and Viers' data show, unfortunately, is that this is not likely to be an atypical situation. The paradox of pervasive overallocation may be that even as it heightens the need for water transfers, it also intensifies their collateral consequences, making them more difficult to achieve.

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