



Urban water conservation in Southern California

Motivating conservation through allocation and market incentives

Jim Bond • Mary-Sophia Motlow • Lauren Steely • Dean Wang
Project Advisor: Gary Libecap



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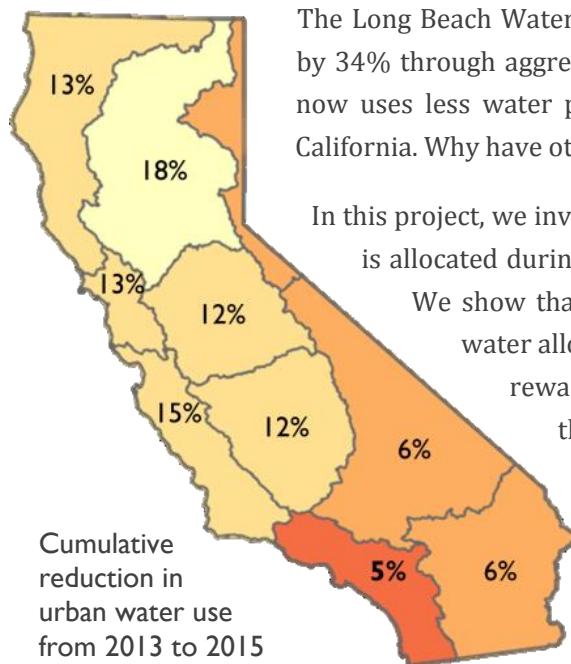
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Why aren't water agencies in Southern California conserving more in response to the drought?

Despite the ongoing 2012–15 drought, urban water agencies in Southern California have not responded aggressively to statewide calls for conservation. One year after Governor Jerry Brown called for voluntary 20% reductions in water usage, the South Coast region had achieved only a 5% reduction in water use, the smallest reduction in the state.



Gov. Jerry Brown declares drought emergency in California



The Long Beach Water Department has been an exception, reducing their water usage by 34% through aggressive conservation measures over the last 30 years. Long Beach now uses less water per person than almost every other urban agency in Southern California. Why have other agencies not undertaken similar conservation efforts?

In this project, we investigate whether the way that Southern California's water supply is allocated during a drought provides strong incentives for agencies to conserve. We show that an agency's conservation efforts in wet years lead to a lower water allocation in times of drought, punishing agencies who conserve and rewarding those who don't. We then develop a new allocation system that incentivizes conservation by allowing agencies to keep and trade rights to conserved water.

We begin with two questions:

1. How does the existing water allocation system encourage conservation?
2. Can we design an alternative system that better incentivizes conservation?

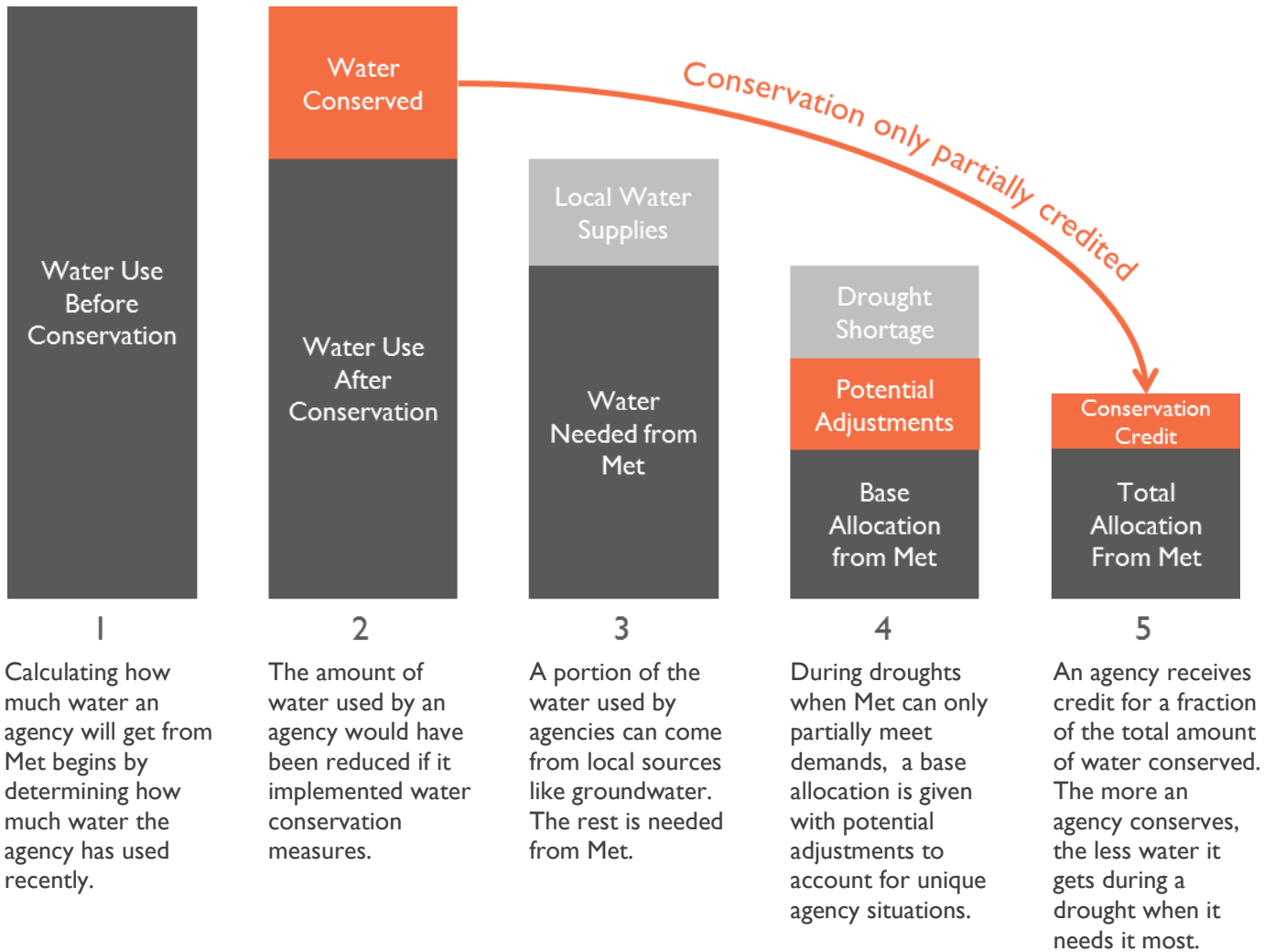


I. The existing system of water allocation

How much water does each water agency get during a drought?

We begin by analyzing the existing system of water allocation in Southern California. The Metropolitan Water District of Southern California (Met) provides water to the majority of cities in the region.

During water shortages, Met limits how much water agencies can purchase. Here, we show how Met calculates the amount of water for each agency, showing that when agencies conserve, they receive a smaller allocation.



The existing system discourages conservation in two ways



1. Use it or lose it

Water agencies which reduce their use through conservation lose their access to the conserved water. This water is then redistributed to other agencies in the system.



2. Conservation forgotten

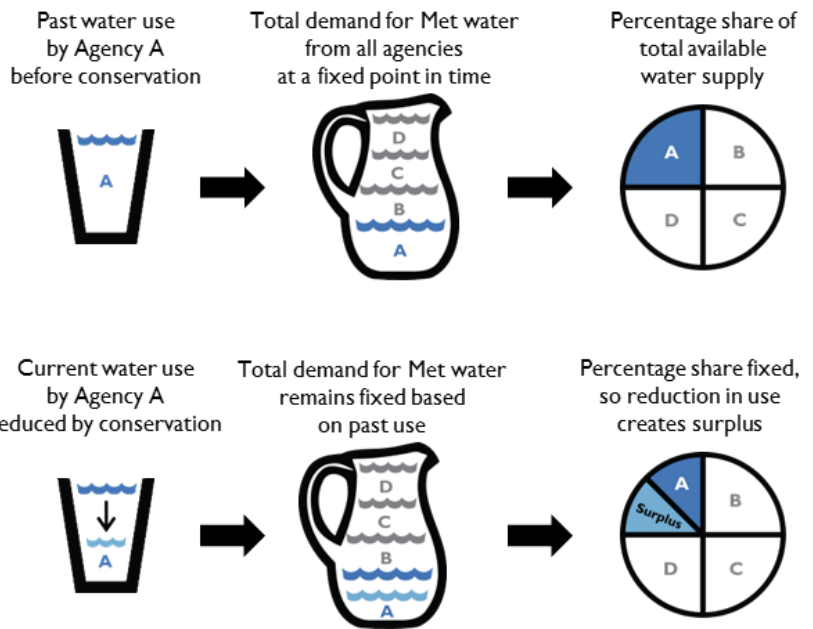
How much water an agency gets is based on their most recent water use. They are not sufficiently compensated for their conservation efforts over time.



2. Our alternative system of water allocation

How our alternative system allocates water

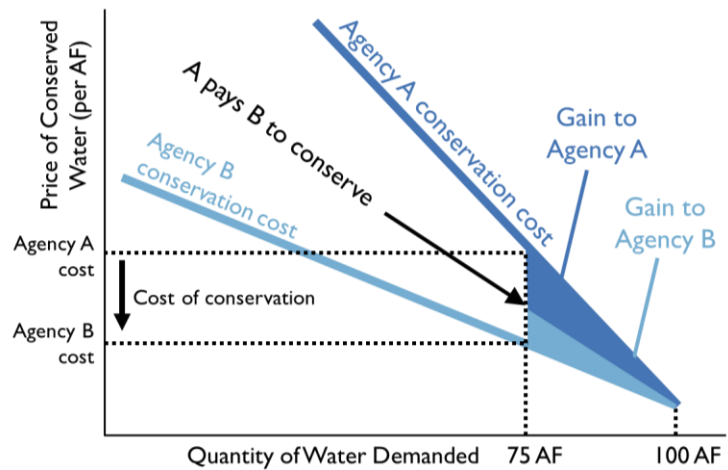
An agency's water allocation is based on their water use at a fixed point in time in the past. Adding the total past water use of all agencies determines what the total demand for Met water would be if agencies did not undertake any conservation. A percentage share of the total available Met water supply is then assigned to each agency.



Under the alternative system, when an agency conserves, their allocation will not be reduced. The amount of water an agency receives will now be greater than their needs, resulting in a surplus that can be sold to another agency.

Benefits of trading conserved water

Under the alternative system, when the cost of conservation for Agency A is higher than for Agency B, Agency A can pay Agency B to conserve. Agency A benefits by acquiring water or meeting conservation goals at a lower cost than if they had conserved on their own. Agency B benefits by receiving payment in excess of what it costs them to conserve.



Our new system fixes these problems and encourages conservation



1. Secure right

Agencies which reduce their use through conservation are able to keep the conserved water as a buffer supply during drought. Agencies can also trade this conserved water, providing further incentives for conservation.

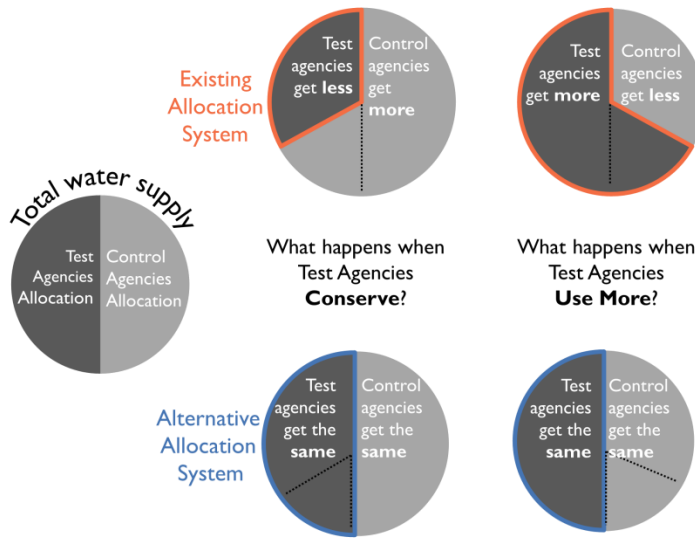


2. Fixed point in time

Because the allocation is based on a fixed point in time rather than an agency's most recent use, agencies are not penalized for reductions in water use achieved over time.



Comparing the existing and alternative systems

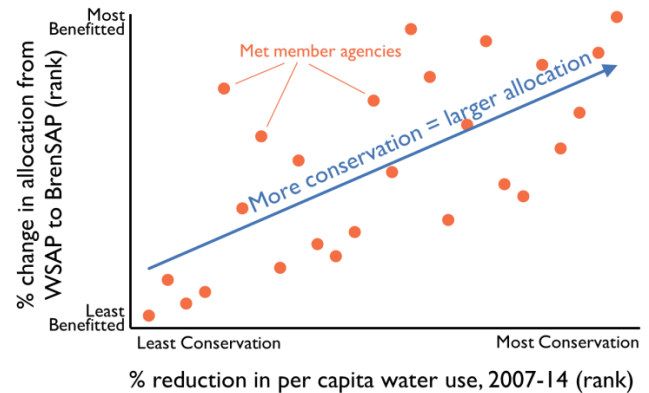


Under the existing system, the water made available by conserving agencies is redistributed to other agencies. Conserving agencies are not compensated for the water they provide to the system. When agencies use more, they get more, leaving less water for other agencies.

Under the alternative system, agencies receive the same allocation regardless of recent water use. When agencies use more their demand will exceed their allocation, resulting in a deficit. When agencies conserve their allocation will exceed their demand, resulting in a surplus.

Our system rewards conservation

Our alternative system was designed to give agencies that have done the most conservation more water than they would have under the existing system. To test this, we ranked agencies according to their conservation and analyzed how much more water they would receive under the new system.



Incentivizing water conservation

The challenge for California over the next century is to live within our current water supplies even as our population and economy grow. To do so, we must better manage our demand by identifying methods to incentivize conservation.

Drawbacks of the existing system

Costly additional supplies. When Met cannot supply enough water to meet all water demands, it must seek out costly additional supplies from groundwater, desalination, or agricultural fallowing.

No conservation incentive. Agencies are better off increasing their water demand before a drought in order to secure a larger share of the supply when a water shortage occurs.

Advantages of our alternative system

Promotes conservation. Conservation creates resiliency to future droughts and population growth by allowing us to make more efficient use of our scarce water supply.

Generates flexibility. Agencies with a surplus allocation have the flexibility to sell their conserved water, use it for local development, or store it for future years.

Environmental benefits. Less water needed to meet human demands reduces the need for environmentally destructive water infrastructure projects and more water left in rivers.