Valuing Water in a Changing World: Lessons from Santa Fe

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Think about every time you use water during your day. You might think about taking a shower, watering your plants, or filling a cup of ramen for dinner. Now think about what would happen if that water went away. Sure, your lawn might brown, and you might be frustrated when you go to wash the dishes or brush your teeth, but beyond these personal disruptions, hospitals are forced to ration supplies, electricity production grinds to a halt, and companies drastically cut back on production of everything from clothing to cabbage.

This might seem like a bad dream for those of us lucky enough to have a stable water supply, but projections of a warming world mean that the nightmare of water insecurity could become a reality for communities around the globe. In the face of mounting predictions for a more arid, thirsty, and populous future, the American Southwest has emerged as one of the most vulnerable regions to future water shortages alongside nations in the drought-stricken Sahara and Middle East. This confluence of risk factors raises concern for the long-term sustainability of the Colorado River, an overallocated hydrological lifeline supporting over 40 million people and 800 billion dollars of economic output.

But the historical landscape looked much different. Over 400 years ago, Native peoples and Spanish settlers in what is now the Southwest United States began constructing acequias. These gravity-fed ditch systems, many of which are still used today, incorporate community management strategies where irrigators and water users have a collective responsibility to divert and protect the shared natural resource. An enduring testament to this communal ethos is the Acequia Madre, or mother ditch, which dates back to around 1610. Today, this durable system continues to divert surface water from the Sangre de Cristo mountains to sustain the water needs of Santa Fe, one of the most vulnerable, adaptive, and resilient communities reliant on the Colorado River.

Historic photos of the Acequia Madre, circa 1890-1920

(Weideman)

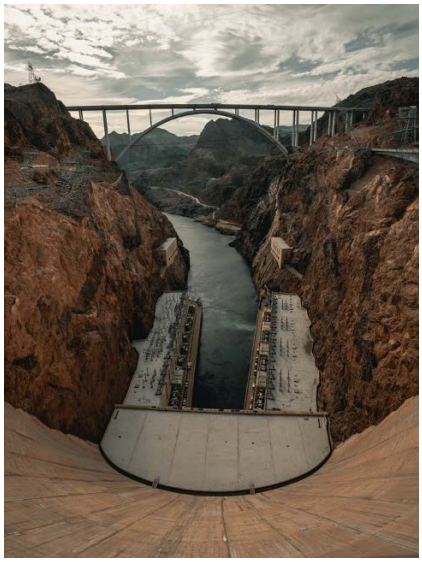
Across the West, this environmentally sensitive, community-based approach began degrading as the gold rush and Manifest Destiny pushed Americans further into the frontier, leading to the creation of the uniquely Western “first in time, first in right doctrine” during the 19th century. This

rigid precedent, commonly referred to as prior appropriation, formalized the idea that the first person to divert water for beneficial purposes, such as irrigation, industrial, or domestic use, retains the right to continue diverting water for the same use forever and gets to be the first to receive water during times of drought.

As a result, settlers began building numerous diversions, channels, and tunnels to carry untapped water downstream from the snow-capped Rocky Mountains to budding communities, farmland, and mines throughout the Western United States. These rudimentary structures afforded settlers control over the combative environmental forces that historically determined the limited development of the region. Now individuals seeking opportunity in the ore-rich mountains and fertile plains of the West could bend nature to their needs by moving, storing, and consuming as much water as they saw fit.

Grand Ditch, the first Colorado River transbasin diversion, built 1890 (Mergen)

As the 20th century began, technology improved, populations grew, and legislators in the West recognized the increasing need to allocate water rights between the states. This led to the adoption of the Colorado River Compact in 1922, following a period of historic high flow levels. This monumental agreement split up water entitlements between the states that sit in the drainage basin of the Colorado River and kicked off a development boom in the following decades as massive state and federal projects sought to develop the vast irrigation and electrification potential of the river and its tributaries. This influx of investment helped to promote economic growth and water accessibility in the underdeveloped and indelibly dry Southwest, setting the stage for rapid growth and water consumption. At this point, the ethos of the American Southwest had unmistakably transitioned from natural collaboration towards environmental domination as massive concrete dams and channels spanning states pooled, pushed, and pulled Colorado River water to quench the endless thirst of sprawling cities and arid agriculture complexes across an area larger than the United Kingdom.



The Hoover Dam & Colorado River (Banks)

As a result of this unprecedented hydrological and economic development, cities across the West witnessed staggering population growth throughout the 20th century. In Santa Fe, to cope with a tripling of the population between 1930 and 1960, alongside a multi-year drought, the private water utility developed the City Well Field to extract water from an aquifer underneath the city. This system helped to cope with the growth and compensate for low flow years on the Santa Fe River; however, it ended

up being a shortsighted solution as the ever-growing population required larger and larger extractions from the aquifer and failed to address a more fundamental problem, the overuse of the rapidly depleting resource.

Imagine that water is money and the earth is the bank. In this system, surface water from streams and lakes serves as a renewable checking account that providers can draw from to meet water needs. During times of drought or high consumption when surface water falls short of demand, water providers can tap into their groundwater savings account to shore up the gap between supply and demand in the short term, but these slow-filling pools can easily be overdrawn if the sustained rate of extraction is greater than the small natural inflow from precipitation. Just like taking out unsustainable loans, running an unbalanced hydrological checkbook can leave cities in a dire state of water insecurity.

To address the growing threat of water shortages amid sustained increases in population growth and water consumption during the 1970s, Santa Fe's private water supplier began to ramp up supply by developing the Buckman Well Field, another groundwater extraction system fed by the Rio Grande 15 miles away from the city. Though this helped to increase and diversify the water supply of Santa Fe, unsustainable aquifer pumping accelerated to meet demand as groundwater extraction became the dominant form of water supply in the 1990s and 2000s, peaking at a staggering 93% during the exceptionally dry 2003 water year. This unsustainable system continued to sink the city further and further into hydrological debt.

This problem wasn't unique to Santa Fe. Across communities reliant on the Colorado River, intensifying drought and declining streamflows in the 1990s and early 2000s posed a formidable threat to the ethos of environmental domination that had prioritized present water consumption over long-term sustainability. This period marked a watershed moment for many municipalities as sustained water stress forced the inaugural implementation of water conservation measures prohibiting landscape watering, vehicle washing, and pool filling. Moreover, this period forced leaders to think seriously about the long-term feasibility of continued growth in a region plagued by increasing aridity, heat, and water insecurity.

Though the systemwide reservoirs and groundwater savings account helped to reduce the impact of the drought, it became clear that the historic overallocation of water rights and the "build first, conserve later" approach taken by municipalities had become fundamentally incompatible with the reality of a hotter, drier, and more populous Southwest. In many cities, soaring demand crashed headfirst into dwindling supply as environmental domination inevitably led to consumptive submission.

In Santa Fe, this problem posed such a large threat to the water supply that the city took drastic action and purchased the water distribution system from the private owner in 1995, making it a public utility. This paradigm shift enabled the city to invest in new infrastructure, policies, and community engagement to encourage water conservation, even as other areas across the West continued to consume to the detriment of the natural systems that sustain them. Back in Santa Fe, to confront the existential threat of exhausting their groundwater savings account, the city implemented water regulation ordinances and a two-tiered pricing system that offered basic levels of water use at a low price, with additional consumption costing significantly more. This change had a substantial impact on water consumption, leading to a 20% reduction from 1995 to 1996 while setting the

stage for a return to historic community-based management strategies to confront decades of watershed mismanagement.

Following this, average water consumption remained steady until the imposition of emergency water restrictions in response to record-breaking drought conditions from fall 2000 until winter 2006. During this period, the city further increased water rates, enacted rebate programs for low-flow appliances, and distributed rain barrels to community members to curtail domestic demand. Further, Santa Fe implemented a requirement for developers to offset the increased water demand caused by their projects by paying fees or transferring new water rights to the city. This novel supply-side adjustment forced builders to incorporate sustainability into their development plans and helped the city reduce per capita consumption during the restriction period by nearly 30% from 2001 to 2006.

Following the most acute period of drought in 2006, the focus of the public utility returned to recharging the critically strained groundwater aquifers and acquiring alternative surface water sources to supply the still-growing service population. Relief came in the form of the Buckman Direct Diversion, which pumps water diverted from the Rocky Mountains under the Continental Divide for use in Santa Fe. This diversion amounted to a second income stream for the Santa Fe water system, providing a new source to bolster the surface water checking account, with the unused excess able to refill the critically overdrafted groundwater savings account.

During the ten years since the activation of the Buckman Direct Diversion in 2010, Santa Fe has been able to replenish 40% of the historic decline of the City Well field and 80% of the Buckman Well field as a result of the shift towards a more sustainable surface water-dominated system. In tandem, the city expanded rebate programs to help residents purchase more efficient irrigation systems, appliances, and lawns while continually reassessing pricing tiers. These measures helped save water in the absence of drought conditions while promoting equity and engagement in the communal conservation effort. Due to these extensive conservation measures and community engagement, the city has reduced annual water consumption by 33% since nationalizing the water utility in 1995, despite accommodating a 25% larger service population. This is a massive improvement for a system that, just two decades before, came dangerously close to exhausting its groundwater reserves and facing a reality where taps ran dry.

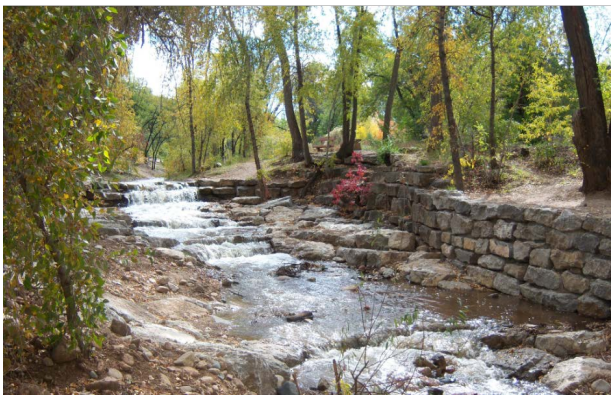
Both future projections and historic examples make clear that the long-term sustainability of the American Southwest hinges on a substantial shift towards a more water-conscious development strategy. In recent years, nearly every city supplied by the Colorado River has engaged in wide-reaching sustainability efforts from summer watering restrictions and overconsumption surcharges to outright banning grass lawns and preventing new housing development. Though these restrictions have proved successful at conserving water and preventing unsustainable growth, no other city has been as effective at reducing and sustaining low average water consumption as Santa Fe's context-sensitive, community-centric approach.

Though Santa Fe's conservation efforts have been successful, concerns about shortages remain due to projected population growth coupled with decreases in water availability attributed to climate change. These concerns become more pressing when considering that limited opportunities exist to purchase new water rights, functionally constraining any expansion of the city's supply. As a result, the public utility drafted plans for the San Juan Chama Return

Flow Project, which aims to recycle cleaned water used for handwashing, laundry, and bathing back into the Rio Grande, where it can fulfill the water rights of downstream irrigators. This system, a rarity in water supply networks, effectively allows the city to squeeze more water out of the same rights by treating and returning otherwise wasted greywater back to the source.

Following the completion of the project, the long-term sustainable supply of the city should increase from 12,000 to 20,000 acre-feet per year (af/yr), well above the 1995 production peak of 13,000af/yr, all without the purchase of additional water rights or groundwater overuse. This efficient recycling of renewable surface water will help to support Santa Fe long into the future, even as a growing population and worsening climate demand more from a reduced supply.

Despite the proven resiliency of Santa Fe resulting from its aggressive pursuit of community-based water conservation strategies, big questions remain surrounding the long-term feasibility of conservation measures to cope with a more arid and populous future. But if we've learned anything from the past, it's that we must act to bend the narrative arc of traditional development and consumption paradigms for the Southwest to confront the ever-looming threat of water insecurity. Only by prioritizing community over individualism, sustainability over consumption, and hydrological harmony over environmental domination are we able to create a truly resilient acequia system capable of sustaining the West for the next 400 years.



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