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A Desert City Tries to Save Itself With Rain

Tucson, Arizona, is giving residents financial incentives to harvest their rainwater as the desert city works to become carbon neutral by 2030.



Brad Lancaster, a water harvesting activist, fills a cup with filtered rainwater collected from his roof. *Photographer: Chris Malloy/Bloomberg*

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In an average year, Brad Lancaster can harvest enough rain to meet 95% of his water needs. Roof runoff collected in tanks on his modest lot in Tucson, Arizona – where 100 degree days are common in the summer months – provides what he needs to bathe, cook and drink.

When Lancaster gets thirsty, he sips filtered rain “known as sweet water,” he says, having never picked up salt from soil. When he wants a hot shower, he places his outdoor shower’s water tank in the sun. To irrigate his fruit trees beyond the Sonoran Desert’s two rainy seasons, which bring the vast majority of Tucson’s precipitation, he uses fresh rainwater or greywater – the latter being, in his case, used rainwater leftover from the shower, sink, or washing machine.

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“More rain falls on the surface of Tucson in a typical year than the entire population of Tucson consumes of municipal water in a year,” says Lancaster, author of *Rainwater Harvesting for Drylands and Beyond*. “So we have more water than we need most years – if we harvest it and reinvest it as opposed to draining it away.”

Lancaster’s methods aren’t exactly new – the history of water harvesting begins around the dawn of agriculture – but Tucson and other cities are starting to take note as climate change threatens to deplete other sources. In September, Tucson declared a climate emergency, setting the ambitious goal of going carbon neutral by 2030. The desert city has gradually implemented policies over the past decade to further water harvesting with the aim of

bolstering conservation, lowering water bills and creating more green spaces.

In many ways, the modern history of water harvesting in Arizona begins with Lancaster. Nearly two decades ago, he illegally cut his sidewalk curbs to route storm runoff into roadside soil beds home to native trees, like mesquite and ironwood. Today, these grown trees provide shade, cooling and food. Lancaster and volunteers have planted some 1,600 trees and cut dozens of curbs (now legal) across his neighborhood, Dunbar-Spring.



A curb cut in Dunbar-Spring that, come rain, directs stormwater to a planting. *Photographer: Chris Malloy/Bloomberg*

Lancaster says that even in Tucson, which averages just about 12 inches of annual rain, stormwater runoff alone can support two native trees for every 25 feet of neighborhood road, providing potential for Tucson's new million-trees program.

“Is it just the water savings thing? Not necessarily,” says Katie Bolger, chief of staff for city councilman Paul Cunningham. “Tucson is one of the fastest-warming cities in the U.S. with climate change. We have a tree canopy that’s below normal, so we want people to plant stuff. We want trees. We want greenery. What we don’t want you [doing] is to use the potable drinking water [for irrigation] you get from 300 miles away.”

Like many Western cities, Tucson’s municipal water supply is drawn from two main sources: surface water (pumped more than 300 miles from the Colorado River) and groundwater (water occurring underground). But pumping from the Colorado expends staggering energy, and climate change and overuse are diminishing the river. Local groundwater sources, too, are overdrawn; over-pumping them has many negative ripple effects, such as altering surface water flows. In addition to these precarious primary sources, Tucson has started to use a minor third water source: treated wastewater. Still, other solutions will be needed to create green spaces, bountiful shade, and keep water flowing long-term.

Water harvesting has shown early potential to be one answer and would follow similar practices in other parts of the world, chiefly in China, South Asia, Australia, and parts of Africa, but also on skyscrapers and islands without freshwater. Thanks in part to Lancaster’s example, Tucson now considers “water harvesting” its fourth water source. The term refers to both rainwater and stormwater harvesting. Rainwater is gathered from building surfaces and can be potable when filtered; stormwater harvesting collects unpotable storm runoff from streets and earth, commonly used in irrigation.

The need for irrigated farmland was what first led Indigenous tribes in Arizona to capture summer monsoon rains. The area’s more recent history of water conservation picks up around 2010, when Tucson started requiring developers of new commercial properties to irrigate 50% of landscaping using water harvesting. In 2012, the city began a program that rebates residents as much as \$2,000 for purchase of water harvesting systems. In 2017, Tucson launched a grant for funding stormwater harvesting projects.

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And on May 1, 2020, Tucson began charging residents and businesses within city limits a monthly Green Stormwater Infrastructure fee (13 cents per 748 gallons of city water used), projected to raise some \$3 million a year for public stormwater capture installations and related projects.

The new stormwater harvesting fee will fund curb cuts and infrastructure that feed sidewalk plantings, utilizing runoff while reducing urban flooding.

“We have a green streets policy,” says Candice Rupprecht, water conservation manager for Tucson. “So that’s really looking at new roadway development and how we’re utilizing those medians and right-of-way spaces.” Already, a few downtown roads show progress: rocky basins planted with mesquite trees, curb gaps ready to deliver them storm runoff.

The city’s rebate program is its boldest water-harvesting effort. This, too, is financed by a water bill fee (10 cents per 748 gallons of city water used). The program offers its full rebate for active harvesting, meaning systems that store rain in tanks rather than the ground. Approximately 250 people obtain active rebates each year, according to Rupprecht. More recently, the city introduced a loan program to bring rebates within reach of lower-income residents.

The first few years, rainwater systems installed under the rebate program weren’t conserving water, but with some learning and time for new plantings to grow, the story has changed. According to Tucson’s Water Conservation Report for its 2018 to 2019 fiscal year, the rebate program saved 52.1 million gallons of water over this period. That’s enough water to meet the annual usage of 160 households. These numbers hint at the possibilities to be unlocked with even greater adoption and education.

Some grassroots groups have big plans for water harvesting. Catlow Shipek, co-founder of the Watershed Management Group, which teaches water

harvesting from an office with a 10,000-gallon rainwater tank and passive systems that feed rain to fruit trees, vegetables, and chickens, believes the technology might help restore the area's dead and dying rivers. He says this might be possible with mainstream adoption, with "using water harvesting for everything from improving community livability, to increased tree canopy, to increasing infiltration, where we can then support shallow groundwater recharge along our tributaries, enhancing flows."

Though city government has started to embrace water harvesting, residents are still coming around. It is, as Lancaster says, "a difficult mental shift, because everything is 180 degrees opposite the conventional way of doing things." Still, there are now ambitious water-harvesting systems at the city's botanical gardens, elementary schools, and even at University of Arizona, which has offered a water harvesting class.

All signs are that Tucson and its environmentally minded mayor, Regina Romero, aren't done. Bolger, the chief of staff for city councilman Cunningham, envisions water-harvesting mandates for new houses and subdivisions. "We're looking at a real crisis in Tucson with the heat," she says. "Rainwater is the cheapest, most accessible, highest-quality water you can get. We have this huge amount of water coming and nothing to do with it. So yes, it behooves us for our future to invest in this."



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