Federal Reserve Bank of Dallas

No need for Texas to come up dry in pursuit of adequate water supplies

On the record: A conversation with Sheila Olmstead

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Sheila Olmstead is a professor at the Jeb E. Brooks School of Public Policy at Cornell University, where she studies the economics of environmental policy, particularly involving water. She was previously a professor at the LBJ School of Public Affairs at the University of Texas at Austin. She discusses the competing demands for water in Texas and the challenges that growth poses.

Q. As water has become scarcer in Texas, does the state face a demand or a supply problem?

It's helpful to take a step back first and think about the different types of water resources in the state. When a lot of people think about the idea of running out of water or the concept of scarcity, they have a kind of bathtub model in mind.

There are examples of resources like that in Texas. The southern portion of the Ogallala Aquifer in the Panhandle of the state is a perfect example. It's essentially a nonrenewable resource. It's at 50 percent or less of its original reserve because of pumping activity, mostly for agriculture. Once it's no longer economically viable to pump the remaining water out of that aquifer, the resources are essentially used up.

But most water resources don't work quite like that. Some groundwater resources are highly replenished, like the Edwards Aquifer in Central Texas. The recharge rates vary from 44,000 to 2 million acre-feet per year. [An acre-foot is the amount of water needed to cover an acre of land to a depth of one foot.]

We've got a pace of use that we're worried about and also a pace of replenishment. Those two things kind of counterbalance each other. After a pretty wet period in the 1990s and 2000s, we seem to be experiencing drier periods currently. And that contributes to worries about running out of groundwater supplies. But it's better to think about those kinds of resources as having high variability than being on some kind of monotonic trend of decreasing availability over time.

That's the groundwater story. And then there's a surface water story—Texas has 15 primary river basins, many of which have networks of dams and reservoirs and other infrastructure meant to kind of mitigate against those challenges of variable supply, which have always been with us.

Parts of the west [portion of the U.S.] are experiencing longer, drier periods; but they're also experiencing more extreme rainfall. The tendency is for a hotter climate. A hotter atmosphere holds more water. So, it's not necessarily the case that climate change means it's hot and dry. The whole regime of water resource supply is changing. We tend to get a lot more of our rain in a much more condensed period.

Those are both challenges for water supply. If you're running a drinking-water treatment plant, you're just as worried about flooding events as you are about how you're going to manage peak demand in the summer.

Q. What about rising demand that comes with economic and population growth?

When we think about scarcity, we think about a gap between the demand for water and the available supply. The supply, for the most part, is coming from nature. There's some reuse. Also, building dams and reservoirs, things that we can do to affect that supply side.

But the demand side is much more of a set of policy questions that end up being relevant to how scarce the resource is going to be economically and whether we should worry about it. According to the Texas Water Development Board, if we think about agricultural demand as being things like irrigation and livestock, that's about 55 percent of the water used in Texas.

Municipal use is about one-third. The remaining water goes to manufacturing, power generation and mining. Most Texas cities are really acutely aware of scarcity and its challenges, and they use various pricing approaches and nonprice conservation policy approaches to reduce average consumption over time and accommodate growth.

If you looked at a city like Austin or San Antonio, you would see average consumption per household is actually decreasing. Sometimes it's moving around a little and sort of depends on weather and other factors. It's not necessarily decreasing total consumption. But as you have population growth, you're getting more efficient on the water demand side.

Agriculture contributes less than 10 percent of GDP for the state. Essentially, it means that there are more water conservation opportunities relatively in agriculture than there are in the cities. Households—firms connected to a city water system—are paying, in some cases, quite high prices for the water that they use. And that just traditionally has not been true in the agricultural sector.

Q. You've written about nonprice approaches to water. How do they work?

In the electricity sector, we might call this demand management, and demand management broadly includes price-based approaches as well. In the water sector, nonprice approaches are just much more common. They include things that I would call water rationing—mandated reductions in the quantity that's withdrawn from an aquifer or from a river or stream.

Sometimes, rationing is implemented at the local level, such as when cities tell customers you can only water lawns on Monday and Wednesday if your house number ends in an even number.

Rice farmers who depend on the lower Colorado River in the southeastern part of the state are going to have to receive less water than their rights would entitle them to in order to provide more water during a drought to thirsty cities. Water rationing in all of those forms is one big category of nonprice approaches.

There are also mandates or subsidies for water-efficient fixtures and appliances—faucets, toilets, dishwashers, washing machines in the residential sector, and irrigation systems in the agricultural sector. If you are driving out to West Texas, you'll see some of the big center-pivot irrigation systems that spray right from the top of the hose. Instead, you can have a nozzle that's designed to point right down at the crops, which is really efficient in the delivery of water to what you're producing.

Q. What about changing the kind of the things that we grow, moving to things that use less water?

That's one of the most fascinating things about thinking of water relative to other kinds of resources, which are typically allocated in markets. What you're describing is the job of a price—to transmit information about resource scarcity and the value of its use.

That's really a hard problem. It's as hard as any economic planning problem that you can imagine. You know, it is the information that's closest to what a farmer would need or what a city planner would need to decide.

With markets, you know what the uses are and what that economic value is and where the water should go—what crops should farms produce, what kinds of livestock should be grown. Markets are great at answering those kinds of questions very efficiently, in a very decentralized manner.

And the fact that we typically don't have them [markets] for water is exactly what creates some of the kind of crazy allocation/misallocation problems that we see and that become particularly acute during periods of shortage.

Q. How should we think of energy exploration and fracking in terms of water resources?

The best work that I know on the issue of how much water fracking uses in the state and whether there are sufficient supplies to make the resource economically productive for the long run is done by scientists at the University of Texas Bureau of Economic Geology. And those folks have shown, I feel pretty convincingly, that water supply is not really a serious constraint on oil and gas production in the state.

Firms have been able to contract for enough water to run their operations and to invest in treatment to a level of quality that allows reuse. Maybe not as much as what’s happened in other parts of the country where there's much less capacity for wastewater disposal. There certainly is reuse happening in the state, and that helps as well.

But there is another water challenge for fracking operations that's going to continue to be a major issue in the Permian Basin and elsewhere in the state. And if you ask folks in the industry, they would point to what to do with the very large volumes of produced water that come out of an oil or gas well, along with the intended [oil and gas] resource.

If there is a significant concern with respect to water resources associated with fracking, it's much more about managing these huge wastewater flows than about water availability.

There are all kinds of questions firms have and that the state is currently dealing with: whether it could be reused for agriculture if it were treated to a certain standard?

Or are there places where we can put this [well water] back into rivers and streams?

Q. Given water shortages around the state, is constructing desalination plants a good solution to providing water for communities and industrial use?

In Texas, there's quite a bit of desalination already happening, but not of seawater. If you think about things like brackish groundwater, brackish surface water, there's actually quite a large number of these plants—I think the number is something like 53 different municipal desalination facilities in the state. All of them are using desalination to remove salts from brackish groundwater or brackish surface water.

The reason that we don't see a lot of seawater desalination is because it's very expensive, especially relative to other options. There are some estimates from the Texas Water Development Board that the average cost to produce an acre-foot of desalinated water from brackish sources, say groundwater, is in the $300 to $800 range.

The average cost for desalination of seawater ranges from $800 to $1,400 per acre-foot. It's really quite a bit more expensive. It's one of those things that cities tend to look at when they've run out of other good, cheaper options.

Q. What is the long-term water outlook for this region of the country?

Obviously, some of the biggest challenges that water managers are going to face are challenges related to the changing climate and increasing variability. How you deal with the current state of the world is quite different than in the past many decades.

That's true on both ends of the [weather] spectrum—longer, drier periods; more condensed, more intense wetter periods and flooding that sometimes results from that.