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AMERICA'S GROUNDWATER: ARE WE DOING ENOUGH TO SAVE IT?

An NPG Forum Paper
by Christopher J. Daly

SUMMARY

"When the well's dry, we know the worth of water."
– Ben Franklin

This review of the current status of groundwater in the United States takes a general overall look at current groundwater levels throughout the nation. It will further examine specific aquifers (the Floridan, Ogallala/High Plains, and Central Valley) and how certain states, grappling with dwindling supplies of water, are very dependent on the health of these aquifers for their future.

How threatened are America's aquifers, which have been around for millions of years, when it comes to their long-term future? The answer to that question lies in present levels of groundwater, success of replenishment efforts, management policies set by federal, state and local governments – as well as the cooperation of individual property owners with those policies – and the pressure of increased population and a "growth at any cost" mentality on a multitude of fronts.

AMERICA'S GROUNDWATER: AN OVERVIEW

Mention the terms "groundwater" and "aquifers" to most Americans and you will get a ho-hum reaction. Decades-long supplies of groundwater are critical to the health and well-being of our nation well into the future, yet the issue of how much "old" water and "replenished" water lies beneath our states, counties, cities, and farms does not show up on the list of major topics that dominate the national conversation.

However, that may all be about to change. Alarm bells – some ringing more loudly than others – are going off throughout the United States.

Groundwater is being used up at an ever-increasing pace. And lower levels of this valuable resource in key aquifers mean less local water for the communities, farms, businesses and wildlife that depend on the water lying in the earth beneath them.

The U.S. Geological Survey (USGS) states: "An aquifer can be compared to a bank account, and groundwater occurring in an aquifer is analogous to the money in the account." It also noted: "Groundwater is the source of drinking water for about half the nation and nearly all of the rural population, and it provides over 50 billion gallons per day in support of the nation's agricultural economy."[1]

The reality is that we count on water to be there 24 hours a day, seven days a week, and 365 days a year – whenever we want it. Groundwater has been there for millions of years and must be there for millions more. The big concern is that in areas where it is not replenished fast enough it could run out – creating social, economic and environmental havoc.

As we move farther into the 21st century, we face an increasing demand for potable drinking water to serve the nourishment needs of our ever-growing population. However, that water is just a miniscule portion of the billions of gallons of water that will be needed for agriculture and industry expansion if our nation's population grows to its projected 400 million by 2051. Annual rainfall will do its best to

supply U.S. water needs, and will have some impact on replenishing groundwater supplies. Yet, it is almost inevitable: the limited groundwater in America's already threatened aquifers will be drained at an ever-increasing rate to fill the gap.

A University of Victoria study released in 2015 found that many people believe groundwater is constantly replenished by rain and melting snow. However, that water mainly goes to lakes and rivers – groundwater is actually renewed much more slowly. Tom Gleeson, who headed up the study, states: "In fact, just 6 percent of the groundwater around the world is replenished and renewed within a 'human lifetime' of 50 years."[2]

According to the Springs Stewardship Institute, "Earth holds about 332.5 million cubic miles of water and more than 96 percent is saline. Of that, about 2.5 percent remains as freshwater. 68 percent of that freshwater is locked within ice and glaciers, leaving about 30 percent of the world's freshwater supply in the ground. Sources of freshwater weigh in at about 22,300 cubic miles of water – about 1/150th of 1 percent of the world's total water."[3]

A recent headline in Popular Science *magazine screamed: "U.S. Has Depleted Two Lake Eries' Worth of Groundwater Since 1900." The accompanying story highlighted a recent U.S. Geological Survey study that found the interval between 2000 and 2008 to be the "period of fastest depletion."*[4]

THE GRANDDADDY OF AMERICA'S AQUIFERS: THE OGALLALA

To understand the status of the Ogallala/High Plains Aquifer, one has to envision a huge reservoir sitting in the heart of America – it is situated beneath parts of eight states that run from South Dakota to Texas – that supplements annual rainwater in this vast area. The Ogallala's water serves the demands of millions of people that live above it and nourishes a region that supplies at least one-fifth of the total annual U.S. harvest.[5]

The Ogallala is composed primarily of unconsolidated poorly-sorted clay, silt, sand and gravel with groundwater filling the spaces between grains below the water table. The Ogallala was established about 10 million years ago by fluvial deposition from streams that flowed eastward from the Rocky Mountains during the Pliocene epoch.

Scientific American magazine noted the following about the Ogallala:[6]

- If spread across the U.S. the aquifer would cover all 50 states with 1.5 feet of water;
- If drained, it would take more than 6,000 years to refill naturally;
- More than 90 percent of the water pumped is used to irrigate crops;
- $20 billion a year in food and fiber depend on the aquifer

Essentially, the Ogallala is a saturated gravel bed that varies from "more than 1,000 feet thick in the North to a few feet in the Southwest…. Today, the Ogallala Aquifer is being depleted at an annual volume equivalent to 18 Colorado Rivers. Although precipitation and river systems are recharging a few parts of the northern aquifer, in most places nature cannot keep up with human demands."[7] That is particularly true in the most southern areas in the northern panhandle of Texas.

The depletion of the Colorado River and the Ogallala aquifer serve as examples of large groundwater reserves that are being depleted – despite how necessary they are to our economy and well-being. The Ogallala aquifer has been collecting groundwater for tens of thousands of years, and its water resources have to be shared among citizens, farmers and industries.

Water from the Ogallala aquifer is used for irrigation throughout the Great Plains. So much water is being taken from this aquifer so fast that there is no time for it to refill. Unfortunately, strict regulations are not in place to control how much water can be pumped from this reservoir – an oversight which could have a devastating effect on crops and the people who live in the area it serves.

FLORIDA

As technologies on how to measure current supplies and use of groundwater continue to expand, we can no longer ignore or feign ignorance of the issue of overuse.

The Floridan Aquifer is the largest in the southeastern United States. It "underlies most of the state, about half of Georgia, parts of Mississippi and Alabama and a little bit of South Carolina…."[8] Throughout this vast tract of land, the growing demand for freshwater means groundwater is being withdrawn at a faster rate than the aquifers can be replenished.

In the state of Florida, where U.S. Census figures show population growth from 2.8 million in 1950 to 20.3 million in 2015, this problem will be further exacerbated in the coming years. Concurrent population growth in both Georgia and South Carolina will only contribute to the crisis.

When the Sunshine State is not experiencing drought, the Floridan – as with all aquifers – "is replenished, or recharged, by rainfall. On average, Florida receives 51 inches of rain each year. However, not all of the rain reaches the aquifer. About 38 inches evaporates or runs off the land into surface waters, like lakes, rivers and streams, before it has a chance to soak into the ground. This leaves, on average, 13 inches annually to recharge the aquifer in limited areas."[9]

About 103 gallons of water are used daily by each Florida resident and more than 60 percent of this water is taken directly from aquifers. The biggest consumer of water in this area is landscape irrigation. Water consumption from every sector has grown from 300 million gallons of water a day in 1960, to 800 million gallons of water a day in 2010. Tentative information shows this region is at or near capacity to tap the aquifer, according to Mark Hammond, director of the Southwest Florida Water Management Division.

The good news is that Florida is actively working to address the growing water crisis that threatens the future of the Floridan Aquifer. The Florida Aquifer System Sustainability Act of 2013 hopes to "build on past efforts to address water sources on a system-wide basis, and bring permanent solutions to Florida's water sustainability needs."[10]

Due to its miles of coastline, the decline in Florida's groundwater levels are not only threatened by rapid depletion but can also lead to salt-water intrusion that can negatively impact native plants and wildlife. Another vulnerability is found in excessive pumping of groundwater, leading to lower aquifer levels in certain areas that can, in turn, foster sinkholes.

> *"Florida has so overpumped its once abundant groundwater that the hundred-thousand-square-mile sponge known as the Floridan Aquifer, one of the most productive aquifers in the world, can no longer supply the state's drinking-water needs."*[11]

TEXAS

For decades, Texas has been bedeviled by on-again, off-again droughts. The persistent recent drought in the northwestern part of the Lone Star state has led to farmers pumping more water from the Ogallala Aquifer (referred to as the High Plains Aquifer in the Texas panhandle), only accelerating the depletion of this all-important water supply. This is an area that gets very little recharge from current rainfall.

Heading up the battle to adapt to drought and ensure that today's farmers leave enough water underground for future generations is the High Plains Underground Water Conservation District (HPUWCD). This 16-county authority is dedicated to finding and implementing policies that can balance water use with a constantly shrinking supply, and providing crucial information and assessments to

farmers. HPUWCD is proactive in educating citizens, incentivizing more efficient water use, and measuring and monitoring groundwater levels. Sadly, their power to place and enforce caps on groundwater pumping to slow the depletion of the aquifer have been met with resistance from farmers and threats of lawsuits.

> *"In Texas, water experts have referred to groundwater as a savings account—something you can draw on in times of need. But in many regions, the savings account is on the brink of overdraft."*[12]

Commenting on the future of water in the Texas portion of the High Plains Aquifer, Lucia Barbato, associate director at the Center for Geospatial Technology at Texas Tech University, stated: "When anybody tells me it's going to last 50 years, I just laugh." Her faith in future projections may be based on the fact that across the HPUWCD, the aquifer has already dropped below the minimal depth for large-scale regulation in six counties. Four other counties have fewer than 15 years before running out of groundwater, according to the Center's projections. Barbato noted: "You see most of the decline where the irrigated agriculture is. It's obvious that irrigated agriculture is not sustainable."[13]

Can this situation be turned around? There is hope that shifting from increasing use of sprinklers to drip irrigation systems will reduce water use by delivering more precise volumes of water directly to the roots of plants and reducing evaporation levels. A National Geographic report found that some farmers "are also using sensors to monitor the soil moisture in their fields. This enables them to more accurately determine when and how much water to deliver to their crops – and can save up to 54,300 gallons per acre."[14] But if U.S. population continues to grow, all conservation efforts will ultimately prove futile.

> *What is true for Texas is true for the U.S. as a whole: sustained population growth will inevitably, sooner or later, wipe out conservation and efficiency gains – triggering water shortages and/or a need for new environmentally damaging water projects. Water savings from efficiency and conservation should not be squandered to accommodate still more population growth.*

"For farmers in dry regions like northwest Texas, the ever-present possibility of drought creates tough choices about whether, when and what to plant.... Lacking access to surface water, many farmers in the High Plains fill that soil-moisture gap by pumping more groundwater."[15]

KANSAS

In Kansas, which sits atop the Ogallala Aquifer, access to groundwater decides a lot of things: the value of your land, what you can and can't farm, and the fate of your family as part of the farming community. Here again, the cycle of droughts and abundant rain make far-off planning quite difficult.

According to an article in *The New York Times*: "In 2011 and 2012, the Kansas Geological Survey reports, the average water level in the state's portion of the aquifer dropped 4.25 feet – nearly a third of the total decline since 1996."[16]

From the air, large areas of Kansas look like miles of side-by-side circles. That's due to the large center-pivot irrigators that are central to watering miles and miles of fields of corn, wheat or soybeans. These irrigators, which started spreading expansively in the mid-20th century, proved quite beneficial to raising farmers' harvests and incomes. However, while irrigated cropland in Kansas grew from 250,000 acres in 1950 to nearly three million today, the drain on the aquifer has been rapid and substantial – and many Kansas wells are petering out.

> *"And when the groundwater runs out, it is gone for good. Refilling the aquifer would require hundreds, if not thousands, of years of rains. This is in many ways a slow-motion crisis – decades in the making, imminent for some, years or decades away for others, hitting one farm but leaving an adjacent one untouched."*[17]

Unfortunately, while farmers have a choice of crops to grow, corn – which needs more water than others – still remains number one. That decision is often driven by the fact that the price of corn remains quite high – propelled by demand, speculation, and a government mandate to produce biofuels.

The future of Kansas agriculture will definitely be defined by the ongoing health of the aquifer that lies

below vast tracts of the state. In 2013, a Kansas State University researcher found: "If current irrigation trends continue, 69 percent of the groundwater stored in the High Plains Aquifer of Kansas will be depleted in 50 years. But immediately reducing water use could extend the aquifer's lifetime and increase net agricultural production through the year 2110."[18] And while many farmers are taking smart steps to make wiser use of the water available to them, others are not.

Sadly, as reported in the *New York Times* article, a University of California study in 2013 "concluded that Kansas farmers were using some of their water savings to expand irrigation or grow thirstier crops, not to reduce consumption."[19] As is often the case, "market forces" (i.e. population growth leading to increased need for food) will most likely dominate as each Kansas farmer decides how much water to use today and how much to drain from tomorrow.

CALIFORNIA

California has a huge water problem that has been part of its history for decades – and it only gets worse as the population grows. Recent cycles of drought are often relieved by strong, but limited, periods of rain, creating a roller-coaster crisis that impacts almost every part of California life.

"The Central Valley holds about one-sixth of the nation's irrigated land and produces 250 different crops. Farming has contributed to what the USGS calls 'one of the single largest alterations of the land surface attributed to humankind.' By 1970, 5,200 square miles of ground had sunk more than a foot – up to 28 feet in places."[20]

Terry Nagel of the Stanford Woods Institute notes that during the "good" times, most Californians treat the water crisis as an "out-of-sight, out-of-mind" matter. When the droughts come, water is often topic number one in political, business, community and personal conversations. And groundwater, which *Stanford News* reports provides "40 percent of the state's water supply during normal years and as much as 60 percent during dry times," takes center stage.[21]

The good news is that Stanford has launched a new project called "Waters of the West," designed to educate Californians about groundwater – which is long overdue. The project highlights that: "Groundwater is used by 85 percent of California's population and is the sole or primary water source for 6 million residents."[22] The program highlights how current groundwater usage is jeopardizing water resources for future generations, the depletion of the state's numerous aquifers, land subsidence (when the ground caves in after excessive amounts of water are removed), and environmental harm to wildlife and river flows.

The executive director of Water in the West, Leon Szeptycki, has high hopes for the program, noting: "The current trajectory of our groundwater use is not sustainable for the long term. We need to find better tools for managing this water so it is there for us in times of drought and in the future." Water in the West also includes: "Brand new research on groundwater recharge in California, which is a method of replenishing aquifers, storing water for times of need… [and] far less expensive than desalinization or new reservoirs."[23]

Along these lines, another project that offers to stem the overuse of groundwater is being encouraged by the University of California, Davis. In this project, large tracts of land actively supporting crops such as grapes, almonds, pistachios, and alfalfa will be purposely flooded in the winter when it can do no harm to crops, so the water can seep deeply into the ground.

An NPR Radio report on the project found that: "Over the years, California's farmers have extracted twice as much water from the state's aquifers as the total storage capacity of the state's dams and man-made lakes. In theory, farmers could replace that water."[24]

Finally, better decision-making on water-intensive crops that are prevalent in California could save countless millions of gallons of groundwater. The *Los Angeles Times* reported that: "A head of broccoli requires 5.4 gallons of water, one walnut will take 4.9 gallons, a head of lettuce requires 3.5 gallons, one tomato will need 3.3 gallons and a single almond needs 1.1 gallons."[25] The water that is saved by not growing these specific crops could then be redirected toward urban areas and municipal uses.

Note: Adding to the roller coaster effect of California's water supplies, the state received an overflow of rain in late January 2017. That gush of

water sent many Californians rejoicing, with newspapers claiming "nearly half of California is no longer in a drought, and the rest of the state saw dramatic improvement…."[26] It also produced statistics showing a major drop in the number of areas considered to be in "extreme drought" – with CNBC reporting a dip "from 24 percent statewide [at the end of December 2016] to just 2 percent [at the end of January 2017]."[27]

Commenting on the welcome rain, but noting that water restrictions will stay in place for the time being, Brad Rippey of the U.S. Department of Agriculture said the recovery in the groundwater is "still a little bit of a question mark." He added that it "depends on the local nature of the aquifers and how quickly they respond to this precipitation."[28]

CONCLUSION

Water is more than just another commodity – it is essential to life. Unlike oil, there are no substitutes for it. This paper covers only a sliver of information about America's groundwater and does not touch on other important aspects of the ongoing depletion of this natural treasure – including the growing worries related to water privatization, the future of groundwater-dependent ecosystems such as natural springs and wetlands, and concerns about groundwater pollution.

Without question, the U.S. must find more ways to stretch America's water supplies through efficiency, conservation, recycling, and better agricultural management. The constant quest to maximize any and all of these is a heartening trend when put up against today's rapid consumption rate.[29] Yet without a substantial reduction in U.S. population, none of these efforts will succeed in the long term – and we will be confronted with a massive water and food crisis.

A 2013 Stanford University report noted: "One potential solution to these challenges is *integrated regional management*, in which local entities holistically manage groundwater, surface water and land use. Pumping levels can be set to protect, not only groundwater users, but also landowners, users of connected surface streams and groundwater-dependent ecosystems. Land-use planning can account for recharge needs and water availability. Groundwater and surface water can be managed as interchangeable, with the choice between them depending on cost, relative availability and impact."

However, the bottom line is that there are no long-term "smart growth" solutions to rationing and saving America's groundwater – which is why we must act now to reduce U.S. population to a much smaller, truly sustainable size. In areas where water becomes more and more scarce – and it becomes an "every man for himself" scenario, with citizens draining any and all available water to save crops and cattle, along with land and livelihood – any logical plans may well go out the window.

With groundwater management left in the hands of states, Sandra Postel, director and founder of the Global Water Policy Project, observed in June 2014 that there had been no overreaching assessment of groundwater resources until NASA used data from its Gravity Recovery and Climate Experiment (GRACE) satellites to measure groundwater depletion.

"Now more studies are coming out of USGS, the University of California, Irvine, the University of Texas at Austin, and other institutions showing indelible connections between groundwater levels and declining surface water linked with increased development."[30]

The eminent Lester Brown, founder of the Earth Policy Institute, says to create the needed changes, "we must eliminate subsidies that create artificially low prices of water, and raise water prices to the point where they will reduce pumping to a sustainable level… The second required change, Brown says, is to stabilize population."[31]

Therein lies the key to the future of America's aquifers.

"At this moment, we as a society are like the frog that chooses to stay in a warming pot of water as the heat is gradually turned up – unable to grasp the dire consequences of incremental change. Inch by inch, the water tables drop. Mile by mile, the rivers run dry. The trends are not good. Yet we stay the course, refusing to recognize that, for safety's sake – for survival itself – a big change is necessary."

– Sandra Postel[32]

ENDNOTES

1. USGS, Fact Sheet 101-03, November 2003.
2. CBC News, *Most groundwater is effectively a non-renewable resource, study finds*, Emily Chung, November 18, 2015.
3. "Why Springs?" *Springs Stewardship Institute*. Web. 10 Feb. 2017. http://springstewardshipinstitute.org/why-springs/.
4. Popular Science, *U.S. Has Depleted Two Lake Eries' Worth of Groundwater Since 1900*. Francie Diep, May 21, 2013.
5. Scientific American, *The Ogallala Aquifer: Saving a Vital U.S. Water Source*, Jane Braxton Little, March 1, 2009.
6. Ibid.
7. Ibid.
8. Bloomberg BNA, *Groundwater Declines Seen, Even in Wet Climates: Studies*, Amena H. Saiyid, August 23, 2016.
9. *St. Johns River Water Management District.* Web. 13 Feb. 2017. http://www.sjrwmd.com/aquifer.
10. Allaben, Kathryn. "Is There A Way To Stop Floridan Aquifer Depletion?" *WUFT News*, 6 Nov. 2013. Web. 13 Feb. 2017. https://www.wuft.org/news/2013/11/06/is-there-a-way-to-stop-floridan-aquifer-depletion/.
11. Barnett, Cynthia. B*lue Revolution: Unmaking America's Water Crisis*. Boston, MA: Beacon Press, 2011.
12. Fox, Samantha. "Groundwater Depletion: Is Texas Draining Its Savings Account?" *Water Sage.* Oct. 2015. Web. 13 Feb. 2017. http://www.watersage.com/blog/list-blog/october-2015/groundwater-depletion-is-texas-draining-its-saving/.
13. Brambila, Nicole C. "Drying Times: Could the Rapidly Depleting Ogallala Aquifer Run Dry?" *Lubbock Avalanche-Journal*. 9 Aug. 2014. Web. 13 Feb. 2017. http://lubbockonline.com/local-news/2014-08-09/drying-times-could-rapidly-depleting-ogallala-aquifer-run-dry.
14. Postel, Sandra. "Drought Hastens Groundwater Depletion in the Texas Panhandle." *National Geographic Society: Water Currents*. 24 July 2014. Web. 10 Feb. 2017. http://voices.nationalgeographic.com/2014/07/24/drought-hastens-groundwater-depletion-in-the-texas-panhandle/.
15. Ibid.
16. Wines, Michael. "Wells Dry, Fertile Plains Turn to Dust." *The New York Times*. 19 May 2013. Web. 8 Feb. 2017. http://www.nytimes.com/2013/05/20/us/high-plains-aquifer-dwindles-hurting-farmers.html.
17. Ibid.
18. Steward, David. "Study Forecasts Future Water Levels of Crucial Agricultural Aquifer." *Kansas State University: News and Communications Services*. 26 Aug. 2013. Web. 9 Feb. 2017. http://www.k-state.edu/media/newsreleases/aug13/groundwater82613.html.
19. *The New York Times*, Ibid.
20. Keller, Sarah Jane. "A New Report Says We're Draining Our Aquifers Faster than Ever." *High Country News*. 31 July 2013. Web. 11 Feb. 2017. http://www.hcn.org/issues/45.12/a-new-report-says-were-draining-our-aquifers-faster-than-ever.
21. Nagel, Terry. "Stanford's Water in the West Program Offers New Way to View Groundwater Resources." *Stanford News*. Stanford University, 31 July 2014. Web. 13 Feb. 2017. http://news.stanford.edu/news/2014/july/groundwater-lane-woods-073114.html.
22. Ibid.
23. Ibid.
24. Charles, Dan. "As Rains Soak California, Farmers Test How To Store Water Underground." *NPR: The Salt*. NPR, 12 Jan. 2017. Web. 13 Feb. 2017. http://www.npr.org/sections/thesalt/2017/01/12/509179190/as-rains-soak-california-farmers-test-how-to-store-water-underground.

25. Harris, Jenn. "How California's Drought Affects the Country's Supply of Fruits and Vegetables." *Los Angeles Times*. 11 Mar. 2014. Web. 13 Feb. 2017. http://www.latimes.com/food/dailydish/la-dd-california-drought-affecting-food-20140311-story.html.

26. Rogers, Paul. "News Report: California Drought is Over in Roughly Half the State, Feds Say." *The Mercury News*. 26 Jan. 2017. Web. 12 Feb. 2017. http://www.mercurynews.com/2017/01/26/new-report-california-drought-is-over-in-roughly-half-the-state-feds-say/.

27. Daniels, Jeff. "The Worst of the Drought is Over for California, But Water Restrictions Continue." *CNBC*. 26 Jan. 2017. Web. 13 Feb. 2017. http://www.cnbc.com/2017/01/26/the-worst-of-the-drought-is-over-for-california.html.

28. Ibid.

29. Thompson, Barton and Rebecca Nelson. "Integrated Regional Management: Solving the Groundwater Challenge." *Stanford University: Woods Institute for the Environment*. October 2010. Web. 12 Feb. 2017. https://woods.stanford.edu/sites/default/files/files/Water-Salon-II-Thompson-Nelson-Solution-Brief.pdf.

30. "Solutions – Water." *Web of Creation*. Web. 13 Feb. 2017. http://www.webofcreation.org/Earth%20Solutions/Water.htm.

31. Ibid.

32. Postel, Sandra. *Water Policy Project*. Web. 13 Feb. 2017. http://www.globalwaterpolicy.org/?page_id=15.

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NOTE: The views expressed in this article are those of the author and do not necessarily represent the views of NPG, Inc.

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