As Groundwater Dwindles, a Global Food Shock Looms

by **Cheryl Katz \ 22 DEC 2016 \ https://tinyurl.com/d4cr3p6w**

Rising temperatures and growing demands for thirsty grains like rice and wheat could drain much of the world's groundwater in the next few decades, new research warns.

Nearly half of our food comes from the warm, dry parts of the planet, where excessive groundwater pumping to irrigate crops is rapidly shrinking the porous underground reservoirs called aquifers. Vast swaths of India, Pakistan, southern Europe, and the western United States could face depleted aquifers by mid-century, a recent study finds—taking a bite out of the food supply and leaving as many as 1.8 billion people without access to this crucial source of fresh water.

To forecast when and where specific aquifers around the globe might be drained to the point that they're unusable, Inge de Graaf, a hydrologist at the Colorado School of Mines in Golden, Colorado, developed a new model simulating regional groundwater dynamics and withdrawals from 1960 to 2100. She found that California's agricultural powerhouses—the Central Valley, Tulare Basin, and southern San Joaquin Valley, which produce a plentiful portion of the nation's food—could run out of accessible groundwater as early as the 2030s. India's Upper Ganges Basin and southern Spain and Italy could be used up between 2040 and 2060. And the southern part of the Ogallala aquifer under Kansas, Oklahoma, Texas, and New Mexico could be depleted between 2050 and 2070.

"The areas that will run into trouble the soonest are areas where we have a lot of demand and not enough surface water available," says de Graaf, who presented her results last week at the American Geophysical Union conference in San Francisco.

Farming has mushroomed across arid regions like these in the past half century. With scarce rains and few rivers and lakes, they depend on water pumped up from underground. Since 1960, excessive pumping has already used up enough groundwater worldwide to nearly fill Lake Michigan, estimates de Graaf, who projects that with climate change and population growth, future groundwater use will soar. She considers an aquifer depleted when its water level falls below a depth of around 300 feet, at which point it becomes too expensive for most users to pump up.

Shrinking groundwater supplies will dent the world's food supply, says de Graaf's co-author Marc Bierkens, a hydrologist at Utrecht University in the Netherlands. Bierkens points out that 40 percent of global food production now relies on irrigation with groundwater. If the amount of available groundwater were to be cut in half, for example, he estimates that farm output would drop by roughly 6 percent—reflecting the portion that's absolutely dependent on unsustainable groundwater use.

"It's not that the whole population will starve," says Bierkens, "but it will have an impact on the food chain and food prices."

Water Mining

Groundwater depletion affects more than food: It also damages wetlands, makes land sink, and contributes to sea-level rise.

A 2015 study based on satellite observations showed that most of the world's largest aquifers—21 out of 37—are being drained faster than they can refill. "A number of studies point to the overuse of groundwater and the tremendous risk that our water and food security are under," says water scientist Jay Famiglietti of the NASA Jet Propulsion Laboratory, who led the satellite study. "The problem is, we don't know how much groundwater is left."

De Graaf's study begins to address that problem for regional aquifers. In normal conditions, those layers of sand or porous rock are recharged by water from rain, snow, or streams seeping down through the ground. But recharge can't keep up with today's furious pace of pumping, especially in areas that receive little precipitation.

Agriculture is by far the leading groundwater user, and overexploitation is on the rise. The volume of groundwater depletion climbed 22 percent in the past decade, with nearly all of it going to watering crops, according to another study presented at the San Francisco conference.

Fully 20 percent of agricultural irrigation is now unsustainable, University College London researcher Carole Dalin reported. Nearly half goes to commercial crops of wheat and rice. And Pakistan, India, and the United States are responsible for two-thirds of that outsize groundwater use.

Studies like these show how today's unsustainable practices jeopardize the future of our planet's aquifers, says Thomas Harter, a University of California,

Davis, hydrologist who studies California's Central Valley, but was not involved in either project.

Harter, an expert on sustainable groundwater management, doubts that the Central Valley will run out of groundwater in 2030. Although the region's aquifer has been ravaged by decades of rampant pumping—made even worse by the recent statewide drought—conservation can still help save this vital resource, he says. The state recently passed a groundwater management act requiring local water agencies to devise sustainable use plans and giving them the authority to curtail runaway pumping.

"That doesn't take away from the fact that this is a real threat," says Harter. "Groundwater is sort of a black box that everybody dips into. It's seen as a local resource, but the consequences are global."