

LEVELED Book • Y

Groundwater

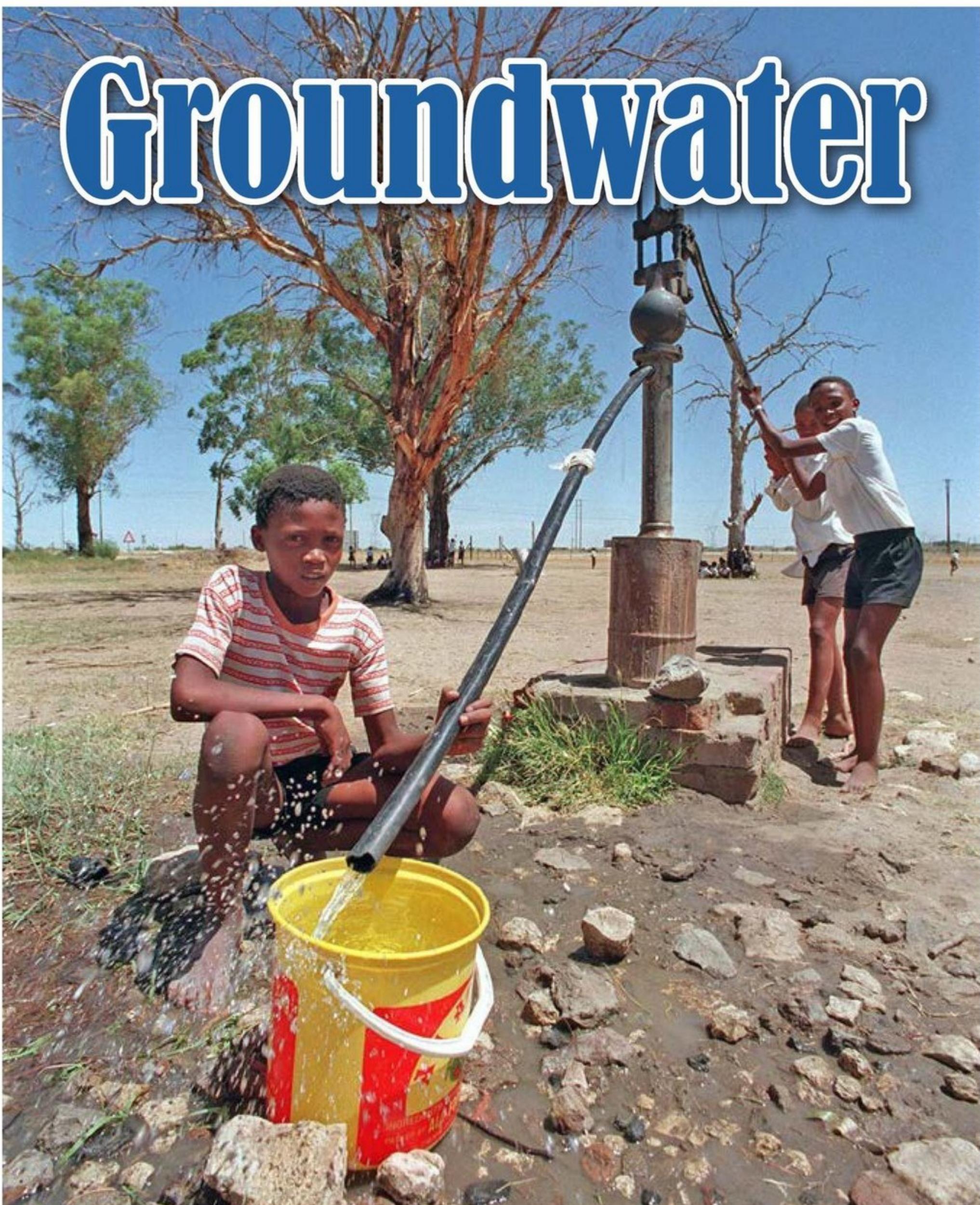


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S•V•Y

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Groundwater



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Focus Question

Why is groundwater important?

Words to Know

aquifers	groundwater
climate change	irrigate
conservation	per capita
crisis	percolate
depleted	sensors
drought	unsustainable

Page 3: Ten days after her well dried up in August 2014, a California woman receives 300 gallons (1,136 L) of drinking water.

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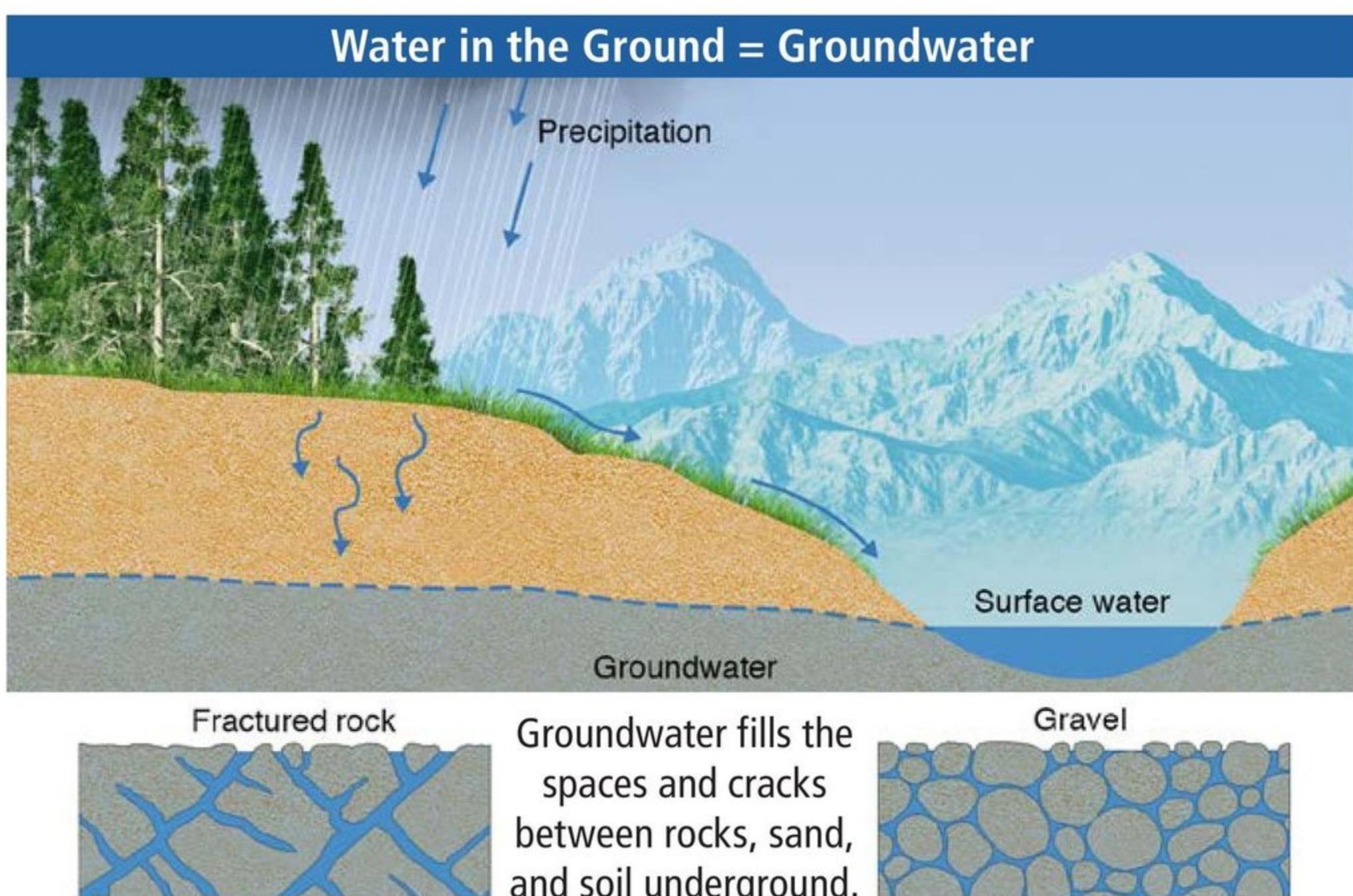
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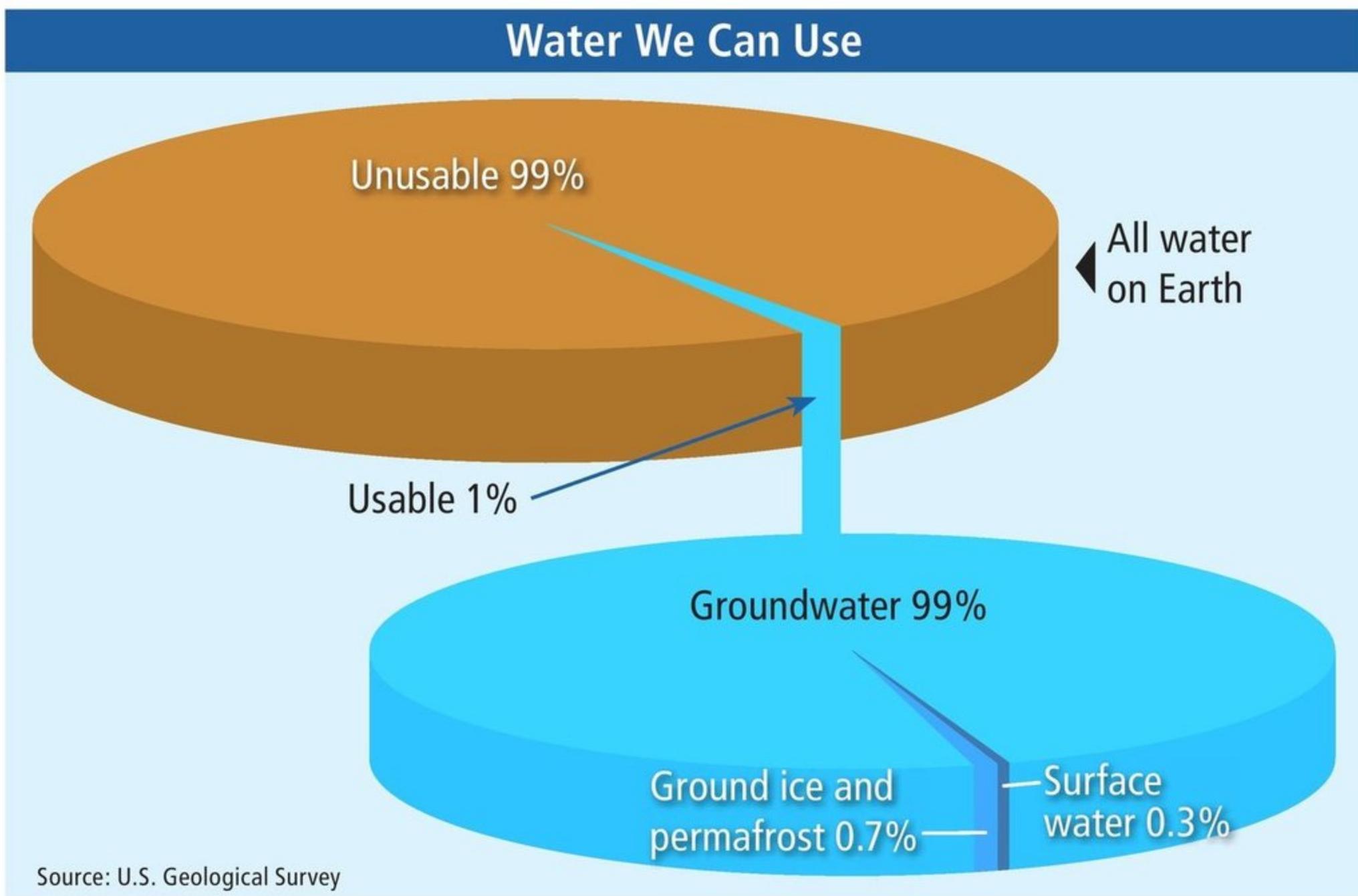
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When the Water Runs Out

Picture getting up one morning, turning on the faucet, and getting nothing but a gurgle. This happened in 2014 in a part of California famous for producing fruits and vegetables. Years of **drought** there meant little rainfall, so to **irrigate** their crops, farmers pumped massive amounts of **groundwater** from under the land.

The result? Some two thousand dry wells. In response, the county government set up centers where people could get drinking water and take showers. Even with rain, though, experts warn the shortage of groundwater there will not end soon. Unfortunately, California isn't the only place with a water **crisis**.





What and Where Is Groundwater?

Many of us glance at a globe and are fooled into thinking the planet holds plenty of water for all our needs. However, 97 percent of Earth's water is in our oceans, and its salt content makes it undrinkable and useless for watering crops. Freshwater keeps us alive by quenching our thirst and allowing us to grow food.

Less than 3 percent of Earth's water is freshwater. Of that small percentage, polar ice caps and glaciers lock up almost 70 percent. Although surface water—the freshwater in our rivers, lakes, and ponds—is often the most visible, it makes up just 0.3 percent of our freshwater supply. Scientists estimate that a whopping 99 percent of Earth's usable water is groundwater.

Groundwater is freshwater that flows slowly underground. Most of it is stored beneath land in **aquifers**, underground layers of rock, gravel, and sand that retain groundwater like colossal sponges. Rain and melting snow, called *recharge water*, **percolate** very slowly into the surface soil and rock. This water feeds the aquifers, which can reach down thousands of feet and extend for thousands of miles. Aquifers in turn feed our rivers, lakes, and wetlands. They also irrigate the best farming regions in the world.

For more than a century, people have been pumping billions of gallons of water from underground to drink, grow crops, and meet other needs. Even during droughts, communities and farms located above aquifers can draw groundwater to survive and thrive. This water source keeps much of humanity from going hungry and thirsty.

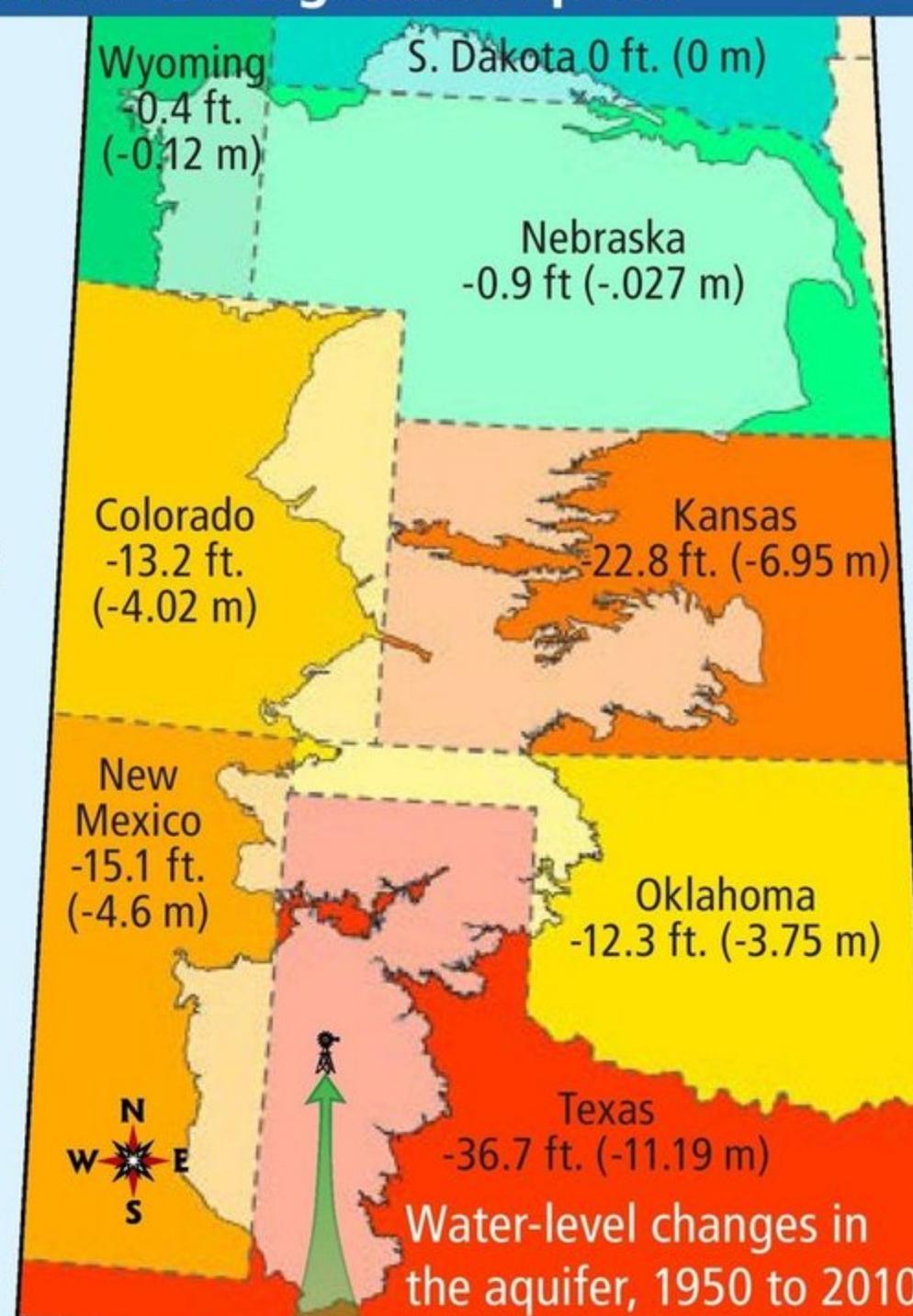
The trouble is that people are pumping water much faster than nature can replace it, and researchers are tracking an alarming trend: groundwater levels are falling fast. Water crises threaten food supplies and peace. Worldwide, experts are warning about the dangers of exhausting this life-giving resource.

Too Many Straws

Research now shows people are using up groundwater at **unsustainable** rates. According to the U.S. Geological Survey, water levels have declined in almost two-thirds of the wells across the United States since 1995. Experts predict that the Ogallala Aquifer, below the Great Plains, could be 70 percent **depleted** by the year 2060.

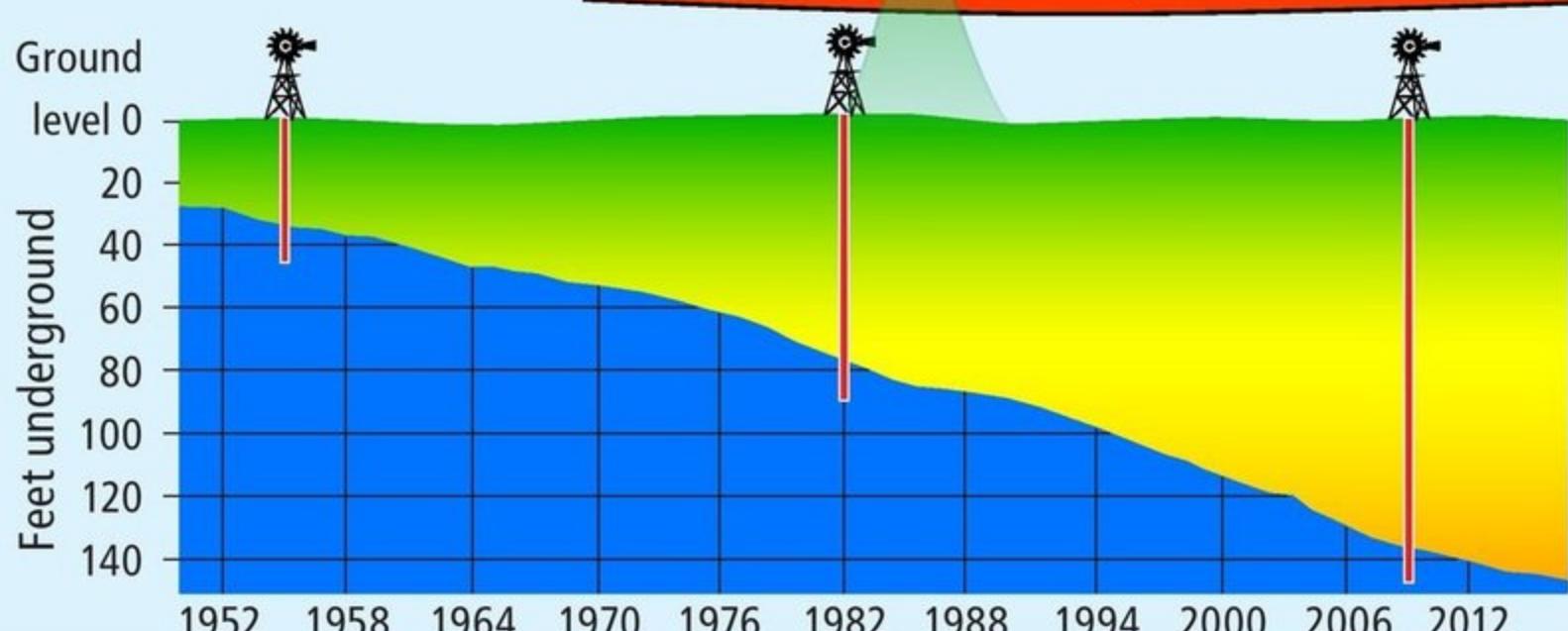
Ups and (Mostly) Downs: The Ogallala Aquifer

The Ogallala (a.k.a. High Plains) Aquifer waters the wheat fields of America—but that water can't last forever. This map shows state-by-state changes in the water level of the Ogallala Aquifer over a span of about sixty years. In some places, water levels are largely unchanged today; in others, they have declined dramatically.



Source: U.S. Geological Survey

The water level in one Texas well has plunged more than 120 feet (36.6 m).





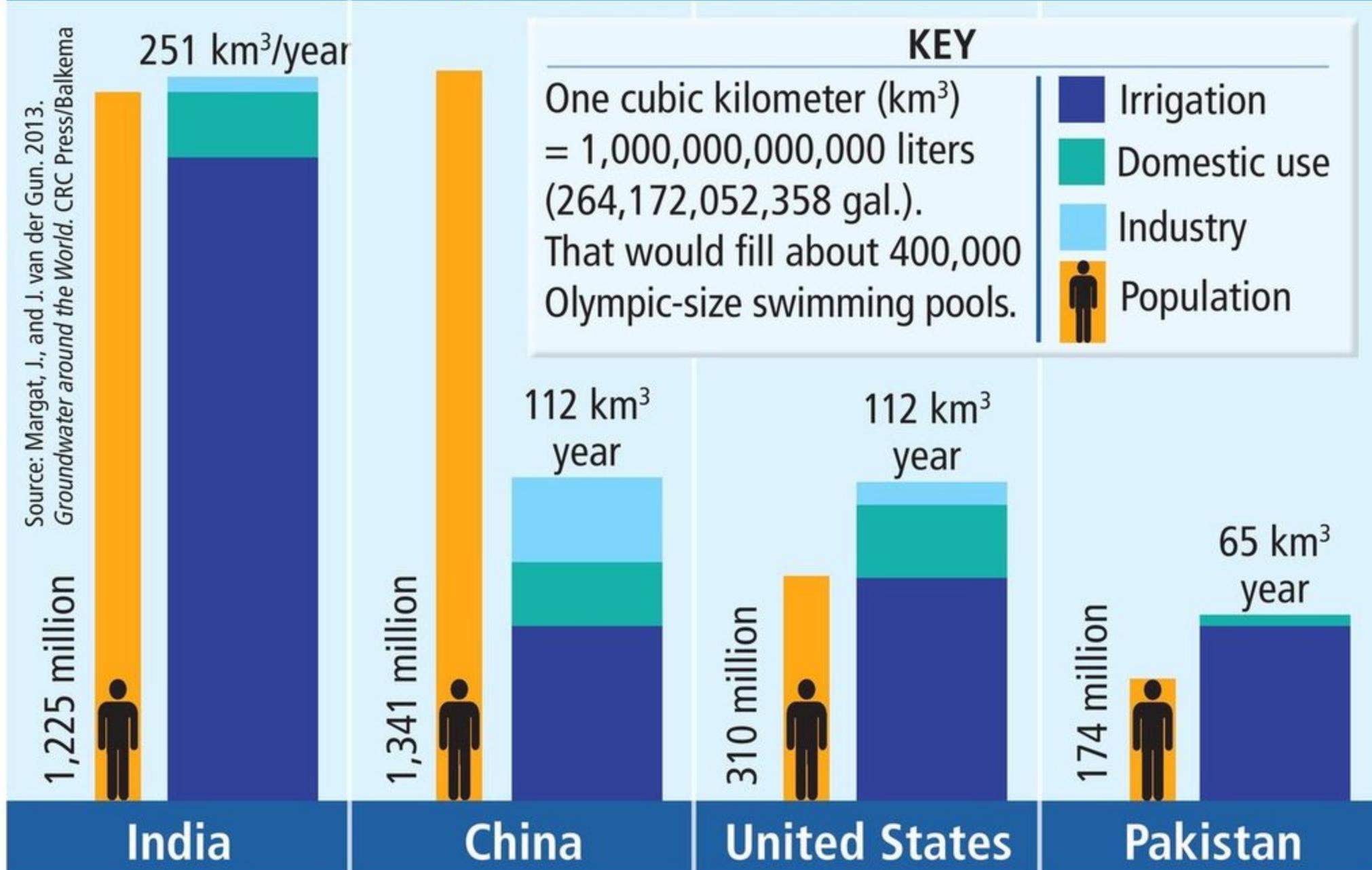
Sonoma Valley in California is famous for its vineyards.

Competition for groundwater is causing conflict in some farming areas. In Northern California, for example, winemakers grow acres of grapes. Grapes require large amounts of water to grow. Many of these growers have drilled deep wells to make sure they can get the groundwater they need. Without it, they might go out of business.

Many smaller farmers and homeowners nearby, though, are concerned by what they consider “water grabbing.” They blame these vineyards for sucking up too much of the groundwater they all share, while their shallower wells go dry. In many cases, these smaller property owners cannot afford to drill deeper wells for themselves. It’s as if everyone has their straws in the same drink, but some farms and businesses can pay for more and longer straws.

This situation raises big questions: Who owns groundwater? How much usage is fair?

Top Four Global Water Users



Compare China's population to the United States'. Now compare their water use. Per person, which country is using more water?

Water Fights

Halfway around the world, Pakistan's available water has dropped by almost 75 percent in the last sixty years. Many in Pakistan put the blame on India, their neighbor to the south. They accuse India of building dams that block river water that would normally flow to them. This situation, Pakistani farmers argue, has forced them to pump more groundwater.

Indian officials say Pakistan itself is to blame, due to poor management of the water it has. Today, both countries—longtime rivals that have fought four wars in the past—face water shortages and increasing competition for freshwater.

The United Nations predicts such water crises will only grow worse. United Nations officials estimate that if nothing changes, the world will fall 40 percent short of its water needs by the year 2030. Nearly two billion people worldwide could face severe water shortages, leading to food shortages and famine.



A Syrian refugee girl arrives in Jordan in 2013.

Such water crises can contribute to conflict and war, experts warn. In some places, lack of water has already forced large numbers of people to leave their homes and lands. In Syria, for example, drought drove rural people into cities. Evidence suggests that this movement, in turn, helped start a civil war in 2011 in which many Syrians have died.

In many places, groundwater is that important—the difference between green farms or dusty fields, a matter of life or death. Developing safe, reliable water supplies for as many people as possible needs to be an international priority. Failing to address the water crisis leads to clashes, violence, and great suffering that threatens to spread as people continue to fight for water resources.

Staying Out of Trouble

There is an old saying: “It is easier to stay out of trouble than get out of trouble.” This is true about the world’s supply of groundwater. Dealing with this crisis now will be much easier than dealing with it after aquifers are depleted. Maintaining our groundwater supply requires us to plan ahead, however, while carefully managing how we use water today. Many experts predict the challenges will only become more difficult.

One growing threat to the world’s groundwater supply is **climate change**. Almost all scientists who study the Earth now agree that its average temperature is rising, with the ten hottest years on record all hitting since the year 2000. Climate change may also mean large-scale changes in weather patterns. For example, climatologists predict regions that rely on regular rainy seasons may see those seasons shift or the amount of precipitation they deliver change. Major disruptions in water availability would likely result.

Another huge challenge is population growth. Currently, more than seven billion people live on our planet. That figure is expected to reach eleven billion by the year 2100. All of these people will need water to drink and grow food. We must manage our groundwater now, and we can.

Farming Smarter

Conservation of water is the best hope for ensuring sustainable water supplies. This means developing and practicing ways to reduce water usage and keep more groundwater in the ground. Improving our farming practices is by far the most important action we can take to conserve groundwater. According to the U.S. Geological Survey, about 65 percent of the fresh groundwater Americans pump to the surface is used to irrigate

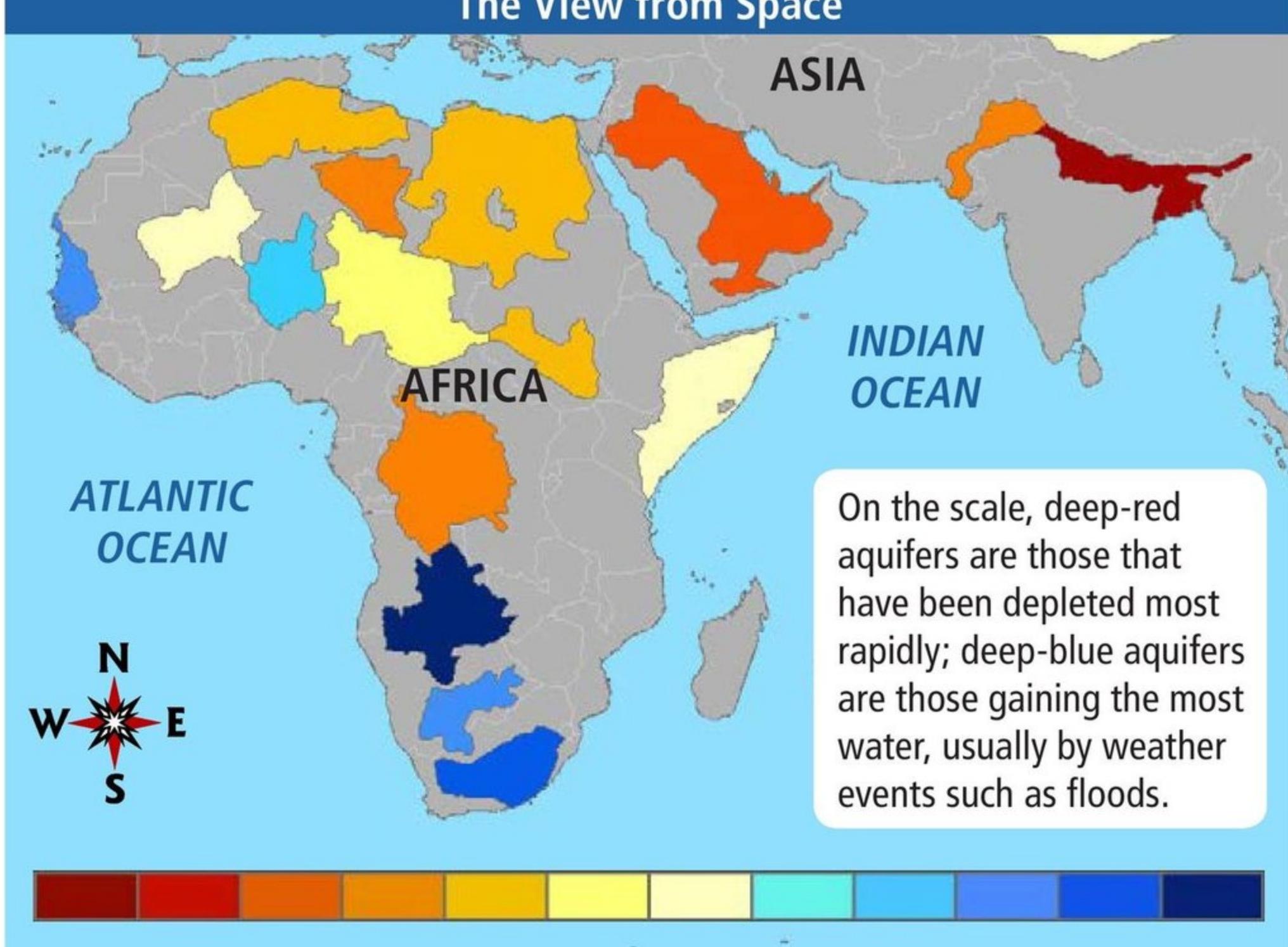
crops. Studies indicate many forms of irrigation are wasteful. They spray and sprinkle water on the surface, where much of it is lost to evaporation.

More farmers now accept that they cannot keep pumping so much groundwater. They are adopting new ideas and technologies to make sure every drop counts. For example, some farms now use *tensiometers*. These **sensors** monitor moisture in the soil and turn the irrigation on and off automatically, wasting less water. Many fruit and nut orchards are also changing their practices. They now bury irrigation pipes to deliver water closer to the tree roots, reducing water waste.



Almond trees in bloom

The View from Space



Since 2002, NASA has been monitoring changes in groundwater from space. Called the Gravity Recovery and Climate Experiment (GRACE), its two satellites respond to Earth's gravity field. They can measure shifts in water volume on and under the planet's surface. NASA data gathered over a ten-year period (2003–2013) shows trends for Earth's largest aquifers. About one-third of these aquifers are dangerously depleted.

Planting different crops is another major change that can help conserve groundwater. In states such as Kansas and Iowa, some farms are switching from corn to wheat and sorghum. Corn requires a lot more water than the other two, but corn crops earn more money, so other farmers remain reluctant to change. Still, if farms do not conserve water voluntarily, exhausted aquifers will eventually force them to.

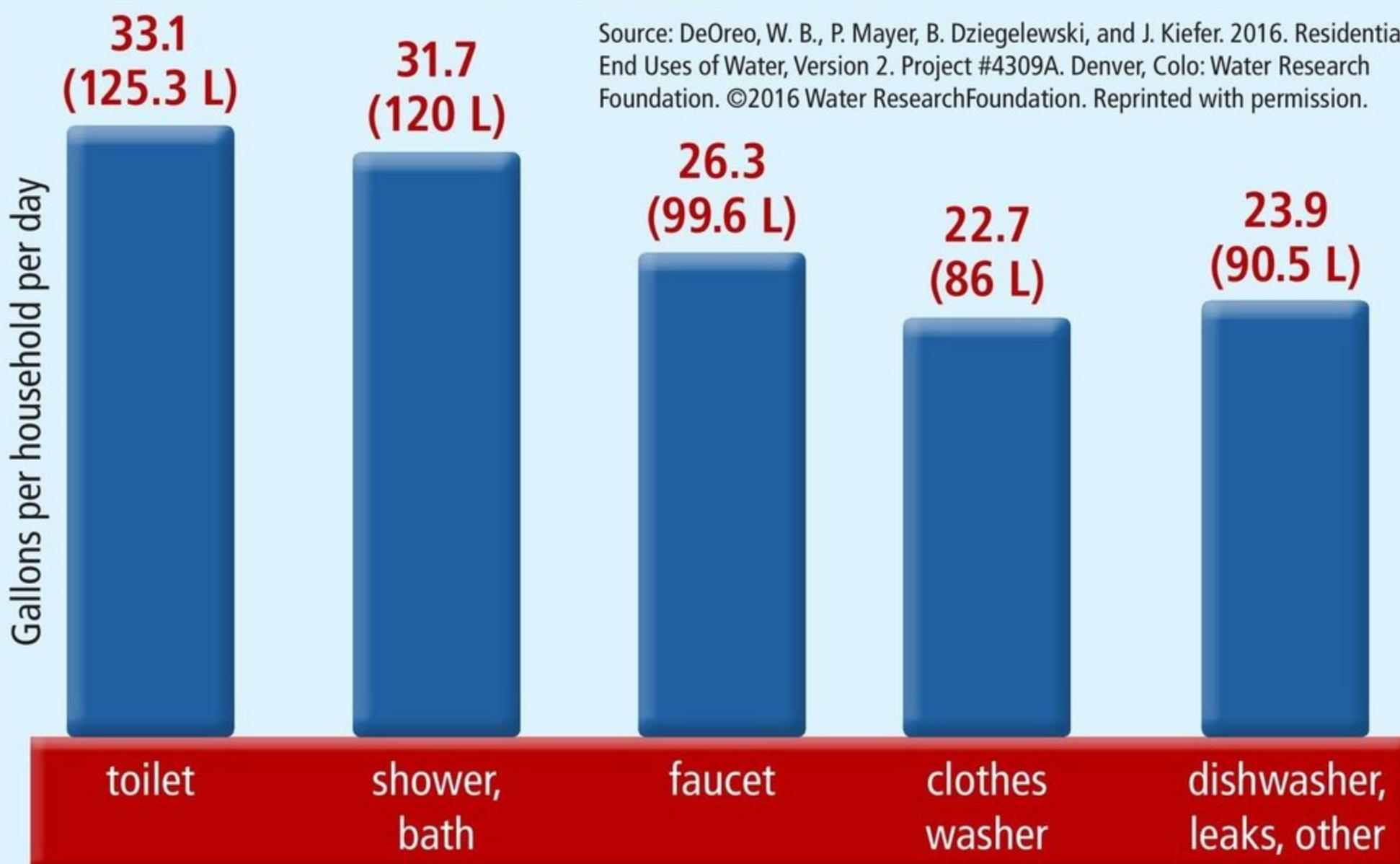
Future Focus

Record drought forced California to conserve water. Lawmakers there passed the Sustainable Groundwater Management Act in 2014, which required the monitoring of water levels in aquifers. It gave the state authority to enforce stronger water-conservation measures if communities did not come up with their own plans. For instance, cities could fine people five hundred dollars a day if they violated restrictions on washing cars and watering lawns.

Restrictions like these worked. From June 2014 until December 2014, **per capita** water use plummeted. On average, Californians went from using as much as 140 gallons (530 L) per person daily to just 67 gallons (254 L).

Nationwide, 57 percent of American households rely on groundwater. In rural areas, that figure is more than 90 percent. Fortunately, small changes in plumbing and water-use habits can save hundreds of gallons in the average American home each week. By installing low-flush toilets and taking shorter showers, we can contribute to groundwater conservation. Another small effort that can save gallons is running only full loads in washing machines and dishwashers.

The Trouble with Toilets



Did you know that toilets use more water than anything else in your house? They do, according to a 2016 study of water use inside 23,749 homes spread throughout the United States—but not as much as they did in a similar 1999 study. Newer, more efficient toilets help send less water into the sewer. Some families also practice *selective flushing*. That means they don't flush the toilet each time they use it.

In addition, property owners can save large volumes of water by replacing thirsty grass lawns with landscaping that needs less watering. The motto in California for letting lawns die is pretty catchy: “Brown is the New Green.”

There is no quick, easy fix for preserving groundwater. People need to drink. Farmers need to irrigate crops to grow our food. Still, we can be smarter about how we use this resource, both now and far into the future.

Glossary

aquifers (<i>n.</i>)	underground layers of rock, sand, and other material that can hold and absorb groundwater (p. 6)
climate change (<i>n.</i>)	the long-term, lasting changes in Earth's weather patterns or the weather patterns of a region (p. 11)
conservation (<i>n.</i>)	the careful use of resources to protect them from being wasted, completely used up, or destroyed (p. 12)
crisis (<i>n.</i>)	a dangerous or unstable time or situation that demands attention (p. 4)
depleted (<i>adj.</i>)	emptied or mostly used up (p. 7)
drought (<i>n.</i>)	a long dry spell with little or no rainfall; a water shortage caused by low rainfall (p. 4)
groundwater (<i>n.</i>)	water held underground in soil or rock, often feeding wells (p. 4)
irrigate (<i>v.</i>)	to supply land with water, especially to help crops grow (p. 4)
per capita (<i>adj.</i>)	for each person (p. 14)
percolate (<i>v.</i>)	to trickle or spread slowly through something with small holes or openings (p. 6)
sensors (<i>n.</i>)	devices that sense and react to signals or changes in conditions (p. 12)
unsustainable (<i>adj.</i>)	not able to last at the current rate of use, or involving practices that cause permanent damage to a resource (p. 7)

Groundwater

A Reading A-Z Level Y Leveled Book

Word Count: 1,553

Connections

Writing

Write an acrostic poem about groundwater.

Use the word *groundwater* as the acrostic.

Begin each line of your poem with the letters in the word.

Science and Social Studies

Write a public service announcement persuading members of your community to conserve water. Include why conserving water is important and what can be done to help.

The logo for Reading A-Z features the word "Reading" in a large, bold, red sans-serif font. The letter "A" is stylized with a small sun-like icon above it, having rays extending to the right. To the right of "Reading", the letters "A-Z" are also in a large, bold, red sans-serif font.

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