

# Groundwater

A Reading A-Z Level V Leveled Book  
Word Count: 1,332

## 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.

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# Groundwater



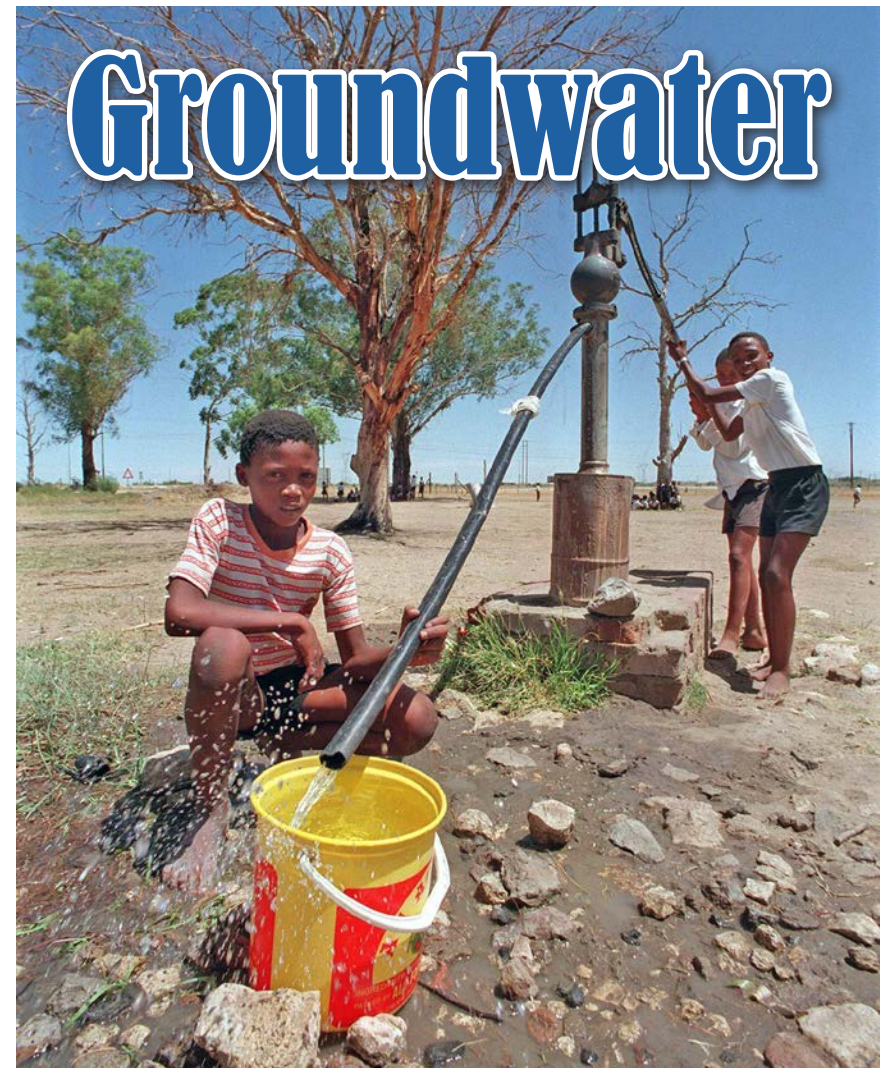
Written by Sean McCollum

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## Glossary

<b>aquifers</b> ( <i>n.</i> )	underground layers of rock, sand, and other material that can hold and absorb groundwater (p. 5)
<b>climate change</b> ( <i>n.</i> )	the long-term, lasting changes in Earth's weather patterns or the weather patterns of a region (p. 11)
<b>conservation</b> ( <i>n.</i> )	the careful use of resources to protect them from being wasted, used up, or destroyed (p. 12)
<b>crisis</b> ( <i>n.</i> )	a dangerous or unstable time or situation that demands attention (p. 4)
<b>depleted</b> ( <i>adj.</i> )	emptied or mostly used up (p. 7)
<b>drought</b> ( <i>n.</i> )	a long dry spell with little or no rainfall (p. 4)
<b>groundwater</b> ( <i>n.</i> )	water held underground in soil or rock, often feeding wells (p. 4)
<b>irrigate</b> ( <i>v.</i> )	to supply land with water, especially to help crops grow (p. 4)
<b>monitor</b> ( <i>v.</i> )	to observe the progress of something (p. 12)
<b>percolate</b> ( <i>v.</i> )	to trickle or spread slowly through something with small holes or openings (p. 5)
<b>resource</b> ( <i>n.</i> )	a supply of something valuable or very useful (p. 6)
<b>United Nations</b> ( <i>n.</i> )	an international organization that works to promote peace and economic development (p. 10)



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### Focus Question

Why is groundwater important?



## Words to Know

aquifers	groundwater
climate change	irrigate
conservation	monitor
crisis	percolate
depleted	resource
drought	United Nations

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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### Correlation

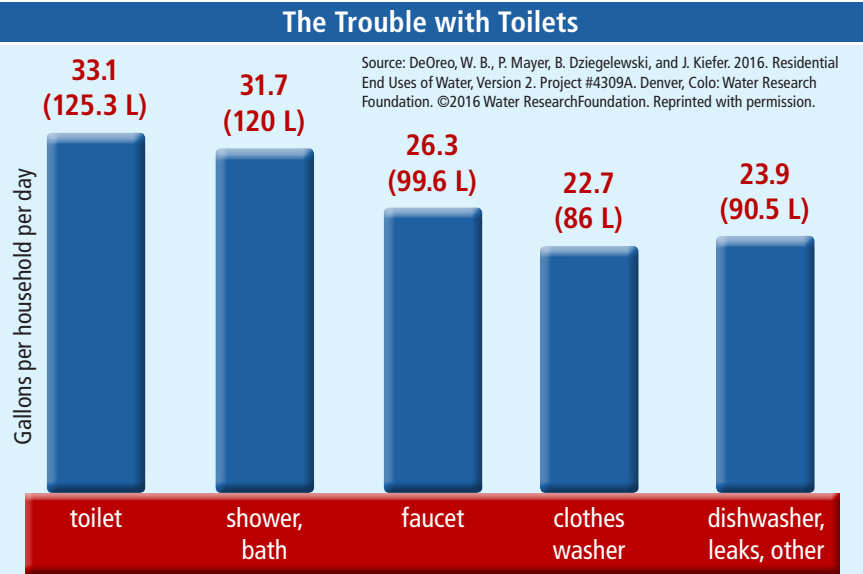
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Nationwide, 57 percent of American households rely on groundwater. In rural areas, that figure is more than 90 percent. Fortunately, small changes in plumbing and water use can save hundreds of gallons in the average American home each week. By installing low-flush toilets and taking shorter showers, we can use less groundwater. In addition, property owners can save water by replacing thirsty grass lawns with yards that need less water. The motto in California for letting lawns die is pretty catchy: “Brown is the New Green.”

Saving our groundwater isn’t easy. 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.



In the dry summer of 2014, some Los Angeles homeowners swapped grass for plants that can thrive on less water.



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.

### Future Focus

Record drought forced California to conserve water. At one point, cities there could fine people five hundred dollars a day if they failed to follow restrictions on washing cars or watering lawns. As a result, water use there dropped. In just six months, people in California went from using as much as 140 gallons (530 L) per person to just 67 gallons (254 L) a day, on average.



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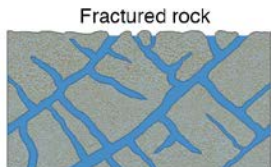
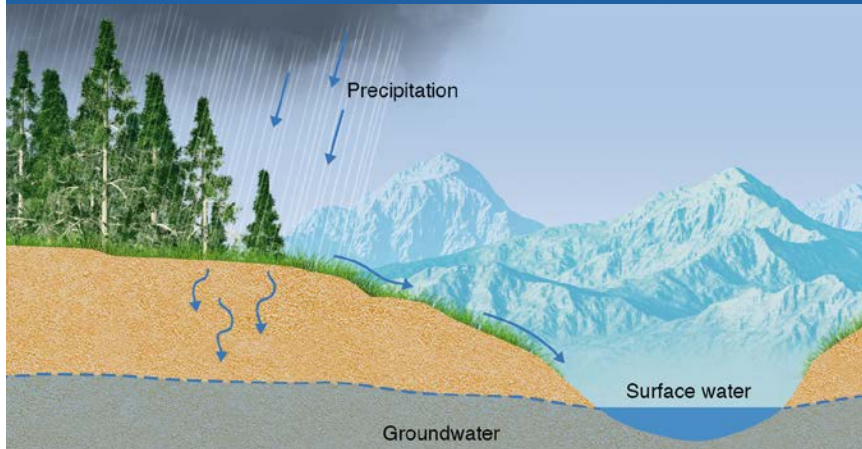
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## When the Water Runs Out

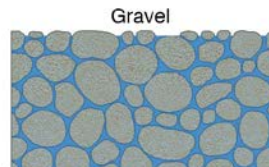
Picture getting up one morning, turning on the faucet, and getting nothing but a gurgle. This happened in 2014 in a part of California famous for its fruits and vegetables. Years of **drought** there meant little rainfall, so to **irrigate** their crops, farmers pumped huge amounts of **groundwater**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

The result? Some two thousand dry wells. Even with rain, experts warn that the shortage of groundwater there will not end soon. Unfortunately, California isn't the only place with a water **crisis**.

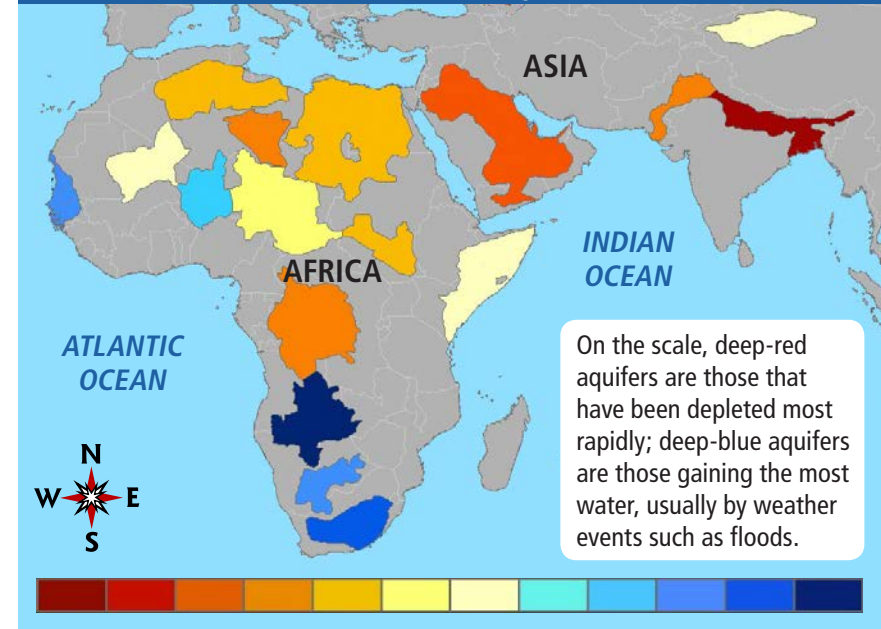
### Water in the Ground = Groundwater



Groundwater fills the spaces and cracks between rocks, sand, and soil underground.



### 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 can also help conserve groundwater. In states such as Kansas and Iowa, some farms are switching from corn to other crops because corn requires a lot of water. However, corn crops earn more money, so many farmers don't want to change.

Farmers need new ways to farm. If they do not conserve water voluntarily, empty aquifers will one day force them to.



## Farming Smarter

Our best hope is water **conservation**—finding ways to use less water and keep more groundwater in the ground. Improving the way we farm is by far the most important action we can take to conserve groundwater. Experts estimate that about 65 percent of the fresh groundwater Americans pump to the surface is used to irrigate

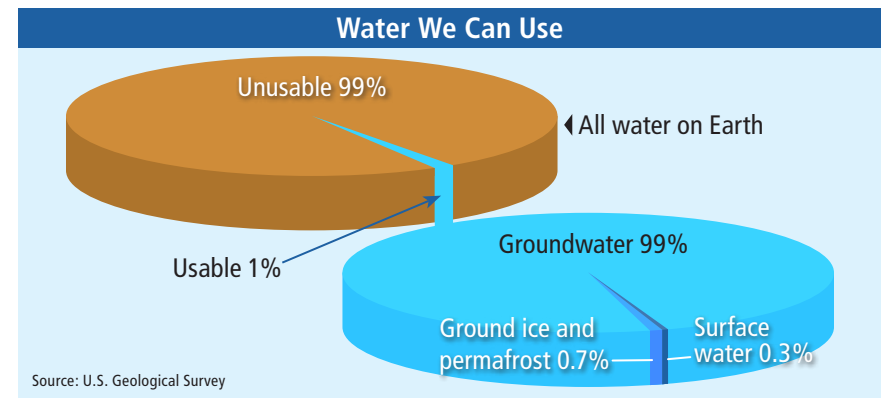


Almond trees in bloom

crops, yet many forms of irrigation waste water. 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 using new methods to make sure every drop counts. New meters **monitor** moisture in the soil

and turn the irrigation on and off automatically, wasting less water. Many fruit and nut orchards now bury irrigation pipes. Buried pipes deliver water closer to the tree roots and waste less water.



## 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. Most of Earth's water is in our oceans, however. Its salt content makes it undrinkable and useless for watering crops.

Freshwater keeps us alive, yet less than 3 percent of Earth's water is fresh. Of that small percentage, polar ice caps and glaciers lock up almost 70 percent. The surface water in our rivers, lakes, and ponds 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 huge sponges. Rain and melting snow **percolate** very slowly into the surface soil and rock to feed the aquifers.

Aquifers can reach down thousands of feet and extend for thousands of miles. They feed our rivers, lakes, and wetlands. Their freshwater also irrigates 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 groundwater levels are falling fast. Water crises threaten food supplies and peace. People near and far must conserve this life-giving **resource**.



Center-pivot irrigation makes farming possible in many dry regions.

## 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 run dry. Addressing the crisis requires us to plan ahead, however.

One growing threat to the world’s groundwater supply is **climate change**. Almost all scientists



Ongoing drought in California led to a series of wildfires in 2015.

who study the Earth now agree that it’s getting hotter. Climate change may also mean changes in weather patterns. For example, regions that rely on regular rainy seasons may see those seasons shift. They may see a change in the amount of moisture those seasons deliver. Freshwater may be harder to come by.

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



The **United Nations** predicts such battles over water will only grow worse. If nothing changes, it estimates 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.



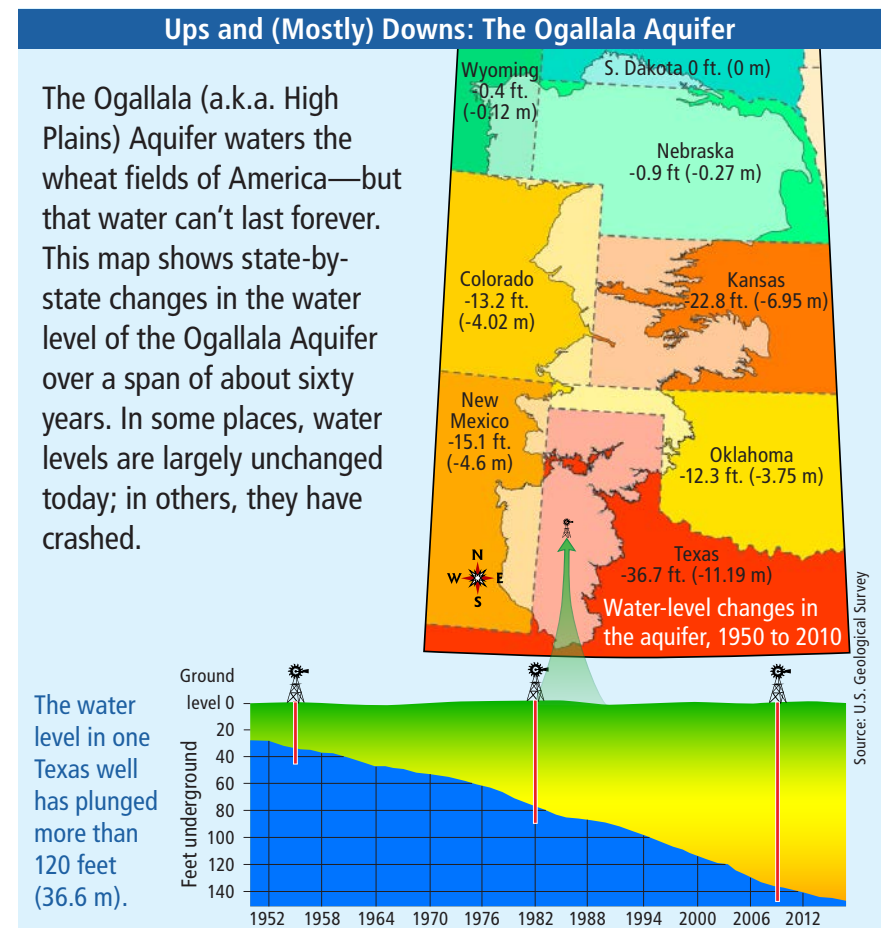
A Syrian refugee girl arrives in Jordan in 2013.

In time, shortages like these can even lead to war, experts warn. In some places, lack of water has already forced large numbers of people to leave their homes. In Syria, for example, drought drove rural people into cities. Evidence suggests that this movement, in turn, helped start a civil war in 2011. As a result, 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. Without water supplies that people can rely on, violence and great suffering threaten to spread as people fight for water resources.

## Too Many Straws

Research now shows people are pumping groundwater faster than nature can replace it. According to experts, 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.



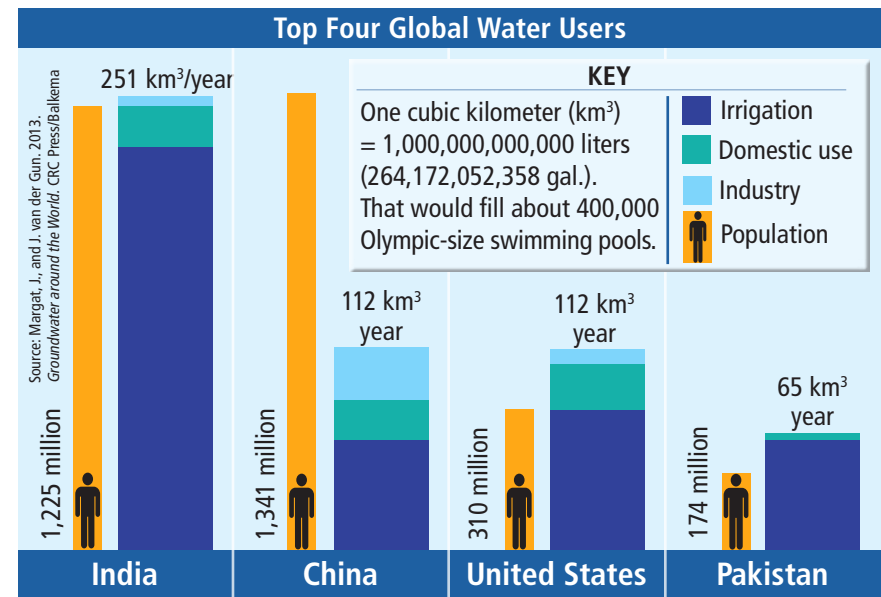


Sonoma Valley in California is famous for its vineyards.

Competition for groundwater is causing conflict in some farming areas. In Northern California, for example, winemakers grow acres of grapes, which require large amounts of water. 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, 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?



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. They say this has forced farmers in Pakistan to pump more groundwater.

Indian officials say Pakistan has only itself to blame. They say Pakistan has managed its water poorly. These two countries have fought four wars in the past. Today, both face water shortages and increasing competition for freshwater.