

## Air on the Move

What is wind? What causes it? Wind is just air on the move. The sun causes it. When the sun shines on land or water, the land or water warms up. So does the air above it. As air warms up, it becomes lighter. It rises. Cooler air rushes in to fill the gap. That rush is wind.

Earth swirls with wind all the time because its surface heats unevenly. Water, for example, takes longer to heat and cool than land. So air is always rushing between water and land. Now you know why beaches are so breezy!

Different types of places, such as forests, deserts, and prairies, also soak up heat from the sun differently. They cool down at different rates, too. Don't forget about the cold places at Earth's top and bottom and the warm area around the planet's middle. Air moves constantly between all these hot and cold spots.

Some winds blow in regular patterns across thousands of miles (see the map on page 21). Other winds are local and sudden, such as gusts in a thunderstorm. Mountains, islands, and even tall buildings affect how wind moves. No wonder wind comes in so many varieties. Gales and gusts, breezes and puffs—those are just a few kinds of wind.

## Invisible Force

You can't see wind. Yet you can see its handiwork. Have you seen a tree branch swaying? Wind. Ever watch an umbrella blow inside out? Wind again.

Wind does more than just toy with umbrellas. It sculpts rocks and landscapes by tearing away tiny pieces off rocks. All those pieces add up. Piece by tiny piece, wind can erase a whole mountain. This process of wearing away is called **erosion**.

Bit by bit, over millions of years, wind carves rock into cool new shapes. What about all those loose pieces? Wind piles them into graceful sand dunes. Not bad for an invisible force.

**Sailing the Seas.** For thousands of years, people have used wind to travel the globe.

## Fast Lanes

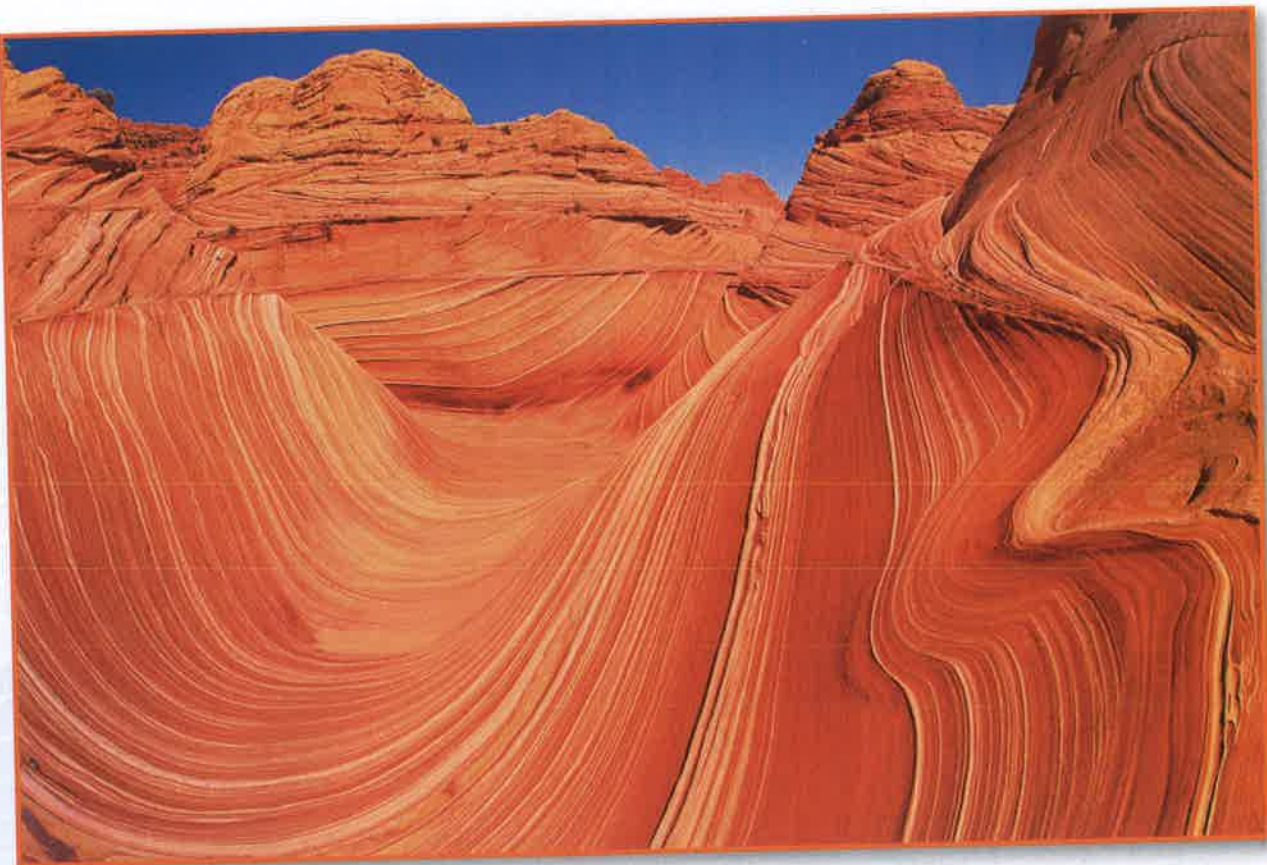
Long before people used wind to have fun at the beach, they used wind to get places. Ancient Egyptians hoisted sails to travel up and down the Nile River. The Polynesians set sail across the Pacific Ocean at least 3,000 years ago. Wind blew the Vikings on their famous raids.

These early sailors were smart. They noticed that Earth's major winds blew in predictable patterns. Studying these patterns helped sailors plan their voyages.

Some of Earth's most reliable winds blow west near the Equator. That's the imaginary line around the planet's middle. Trading ships hopped on them to send goods around the world. These helpful winds are called **trade winds**. You could call trade winds the original fast lanes.

People still sail boats today. Modern sailing, however, is mostly for sport. Even so, today's sailors still depend on the same wind patterns that pushed trade ships hundreds of years ago.

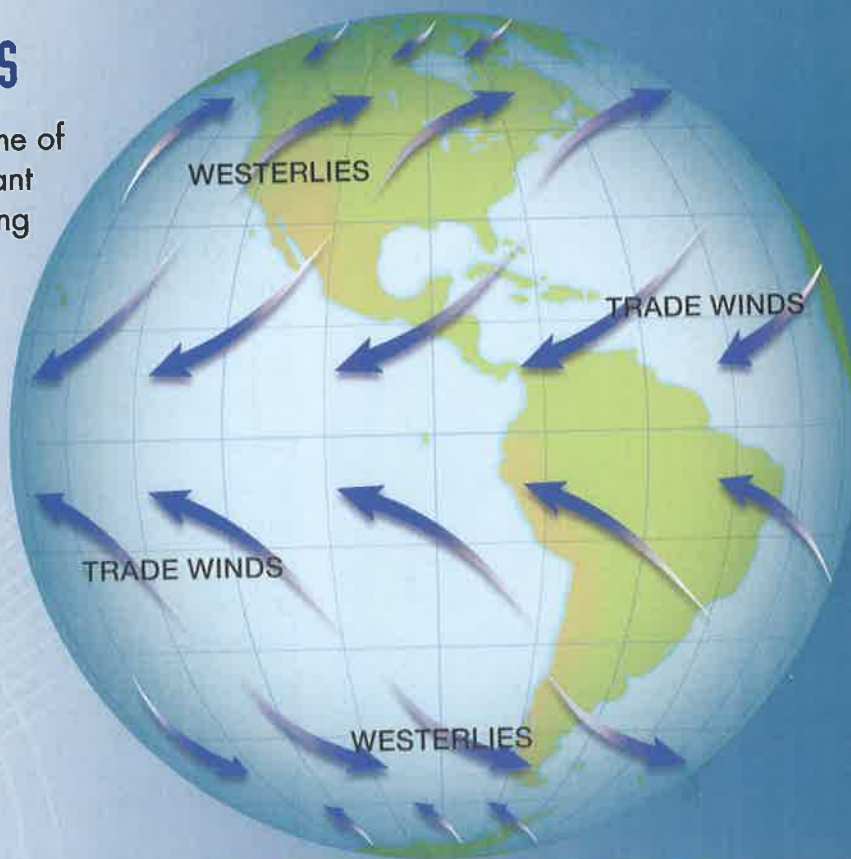




**Carved by Wind.** Over millions of years, wind has sculpted rock into beautiful landscapes such as this one in Paria Canyon, Arizona.

## Planet Patterns

This map shows some of Earth's most important wind patterns. Sailing ships still use these winds to travel the globe.



## Wind Power

To cross the ocean, people don't need wind anymore. They have airplanes for that. Still, wind can help us in other ways. One way is by making electricity.

The Horse Hollow wind farm in Texas grows no wheat or corn. Instead, it has hundreds of steel **wind turbines**. (You can see wind turbines on the top of page 19.) Each tower is taller than a 20-story building. Hear that weird hum? That's the blades spinning in the steady wind.

Wind, after all, is energy. It's clean and **renewable energy**, too. Wind makes the turbines spin. The spinning turns a **generator**. Then the generator makes electricity.

Wind farms work best in open places where nothing gets in the wind's way. So far, the United States snags enough breeze to power about 4.5 million homes. That's only about one percent of the electricity we need. Slowly, though, the role of wind power is growing. More wind farms seem to crop up every year.



RICHARD NOWITZ/NATIONAL GEOGRAPHIC IMAGE COLLECTION



**Power Source.** People around the world have used windmills to catch wind's energy.

## Tornado Terror

Wind isn't always fun or helpful. It can also be terrifying. Just ask anyone who has seen a tornado. It is a vertical column of spinning air.

Tornadoes form in severe thunderstorms. They can start when wind above the ground moves faster than wind at ground level. The air in between rolls into a spinning tube.

Sometimes air rising inside a thunderstorm tilts the spinning tube upright. Then watch out! It's tornado time. Most tornadoes only last a few minutes. Yet their violent winds do loads of damage. Tornadoes can blast to pieces cars, houses, and anything else in their way.

On May 3, 1999, a string of deadly tornadoes ripped across Oklahoma. Weather scientists followed one of the twisters in a truck. Using radar, the scientists clocked the tornado's winds at 484 kilometers (301 miles) an hour. It was the fastest tornado ever recorded.

**Texas Twister.** Speeding across the Texas Panhandle, this tornado takes a rare shape. Scientists call it a mother ship.



## Hurricane Force

Tornadoes may be terrifying, but hurricanes are huge. These massive storms easily stretch across three states. Hurricane winds pack a major punch.

Hurricanes form over tropical oceans. Warm, moist air rises. More air moves in underneath. Then that air rises, too. Big, wet clouds start to gather.

Over a few days, Earth's rotation causes the growing mass of clouds to spin. When winds reach 119 kilometers (74 miles) an hour, the storm becomes a hurricane. Winds in the strongest hurricanes race at over 249 kilometers (155 miles) an hour.

Once hurricanes hit land, they can do some extreme damage. The winds blow away trees and buildings. Towering waves flood coasts.

In 2005, Hurricane Katrina plowed into New Orleans, Louisiana. Water flooded the city. Thousands of homes and lives were lost.

## A World of Wind

From gentle breezes to strong gusts, wind is everywhere. It can sculpt mountains and tear apart houses. Long ago, wind carried explorers to new places. Now it helps light cities and makes sports like windsurfing a thrill.

The next time you are just shooting the breeze, think about the many ways that wind changes our world.

## Wordwise

**erosion:** wearing away by wind or water

**generator:** machine that produces electricity

**renewable energy:** energy from a source, such as wind, that does not get used up

**trade wind:** constant wind that blows toward the Equator

**wind turbine:** windmill that makes electricity



TAYLOR S. KENSLEY/NATIONAL GEOGRAPHIC IMAGE COLLECTION

**Water Source.** *Water is scarce in the Southwest. People there have learned how to use it wisely.*

# The Wonder of Water

Living in a dry place, some Native Americans know what everyone needs to remember. Water is precious.

**By Jim Enote**

Director, A:shiwí A:wán Museum and Heritage Center

**W**hen I was a boy, I spent summers helping my grandparents in their cornfield. It was hot, hard work. My family belongs to the Zuni people, a Native American group. Our land lies in both Arizona and New Mexico. Summers there are hot and dry.

Early each morning, my grandfather and I walked to a **spring**. Cool, clean water flowed from the ground. We used this water for drinking and cooking. At times, we sprinkled ground corn into the spring. It was our way of saying “Thanks for keeping us alive.”

When you live in a dry place, you never forget the value of water. “Water is precious,” my grandmother would say. “Always respect it and take care of it.” Even her pottery showed her respect. On the bowls she made, she painted clouds, rain, frogs—anything to do with water.

## What’s a Watershed?

As you can tell, our spring is really important to us. Its water comes from groundwater. That is water that flows underground. Imagine if that groundwater became polluted with oil or chemicals. It could make a lot of people sick.

Scientists who study water don’t just think of a spring here or a river there. They think of entire **watersheds**. A watershed is all the land surrounding a river, lake, or other body of water. For example, the Zuni watershed surrounds the Zuni River. All the rain or snow that falls on a watershed eventually makes its way into the same body of water.

To take one example from my part of the world, melting snow often runs down the side of a mountain or cliff. Then it flows into a small stream. The stream, in turn, flows into the Zuni River.

## Everyone Wants Water

Pollution isn't the only thing that can affect a watershed. There's also the challenge of sharing water. Suppose people in one part of a watershed use too much water. When that happens, there is little left for people who live in other parts of the same watershed.

The demand for water is growing. That's because Earth has more people than ever before. And everyone needs water.

In the future, we could face serious water **shortages**. A shortage is a lack of something. By 2025, nearly half the people on Earth may have trouble getting enough fresh water.

## Using Water Wisely

For the Zuni people, the need to **conserve**, or save, water is nothing new. As a boy, I learned about saving water. I now teach that same message to young people.

One way I do this is through the museum I direct in New Mexico. It recently had a show of art done by kids about your age. They painted pictures showing what water means to them. We also take kids to springs to offer cornmeal. Then we talk about how our ancestors always used water wisely.

The kids and I don't just talk about our ancestors. I teach the young people to garden the way our ancestors did. The secret is making gardens that look like giant waffles. A waffle garden has squares. Small, dirt walls surround each square. We grow crops, or food plants, in the squares. The walls keep water from flowing away. So no water gets wasted. This allows us to grow things without too much water. The black-and-white photo on this page shows a Zuni garden from the 1930s.

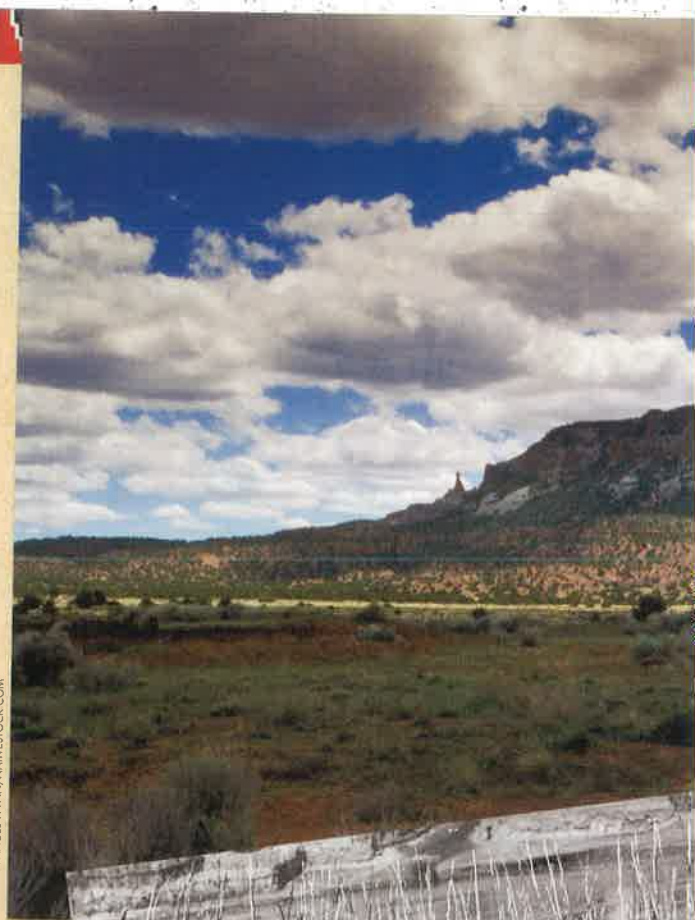
**When It Rains.** On this Zuni pot, frogs, butterflies, and water snakes represent the rain that falls in different seasons of the year.



JENNIE LAATE, ZUNI PUEBLO, I.A.H., 1983.  
FROM THE COLLECTION OF THE HEARD MUSEUM,  
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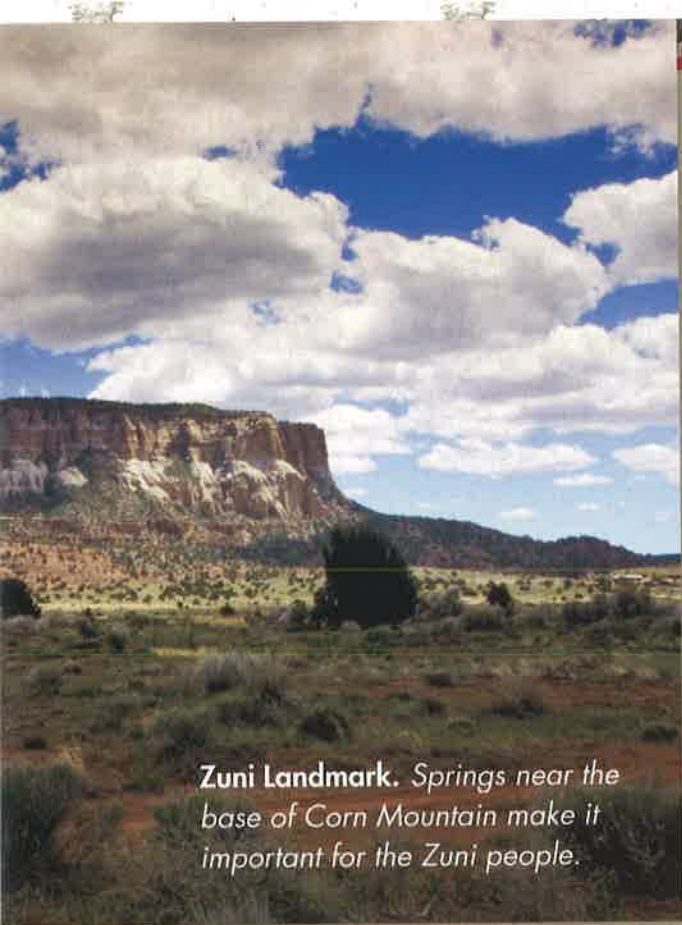
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1930s-1940s, COURTESY IMAGE OF THE COURTESY PHOTO ARCHIVE/ISTOCK, IRENA



**Saving Water.** For generations, the Zuni's waffle gardens have helped them grow food without using too much water.





*Zuni Landmark. Springs near the base of Corn Mountain make it important for the Zuni people.*

# Wordwise

**conserve:** to use without wasting

**shortage:** lack of something

**spring:** place where water flows from the ground

**watershed:** land surrounding a river, lake, sea, or other body of water



© RHONDA COSENTINO

## Rafting the River

Last spring, students at Georgia Avenue Elementary School in Memphis, Tennessee, really plunged into learning about watersheds. With the help of the Wolf River Conservancy, they rafted on the Wolf River in western Tennessee. The river flows into the Mississippi River, which makes it part of one of America's largest watersheds.

"The paddling was hard but rewarding," says fifth grader Corina Brown. Paddling along the river, students saw how living things depend on a watershed. They saw cypresses, tupelos, and other trees. They also saw many river animals.

Corina enjoyed seeing water snakes, frogs and tadpoles, and crawfish, along with "all kinds of trees." Seeing all these water wonders taught Corina that "it's important to take care of nature."

Steven Mitchell, also in fifth grade, agrees with Corina. "We need to keep animals safe," he says. He learned that a key way to do that is to "keep water clean by not littering."

## What You Can Do

Like the young people I work with, you can help save water. One way to start is by thinking of all the ways you use water in a day. Then get creative. Ask yourself how you can use less water and still do the same things.

There is one very simple change you can make. Turn off the water while you brush your teeth. That may not sound like much. Yet you can save 30 liters (8 gallons) of water a day.

You can also try taking shorter showers. In fact, you could even make it a family challenge. See who can get clean in the shortest amount of time! Encourage your family not to run the dishwasher or washing machine unless it is full.

These are simple steps, I know. Still, they can help you make a difference. Saving water any way that you can will show that you've learned a key lesson. It's the one my grandmother taught me: "Water is precious."

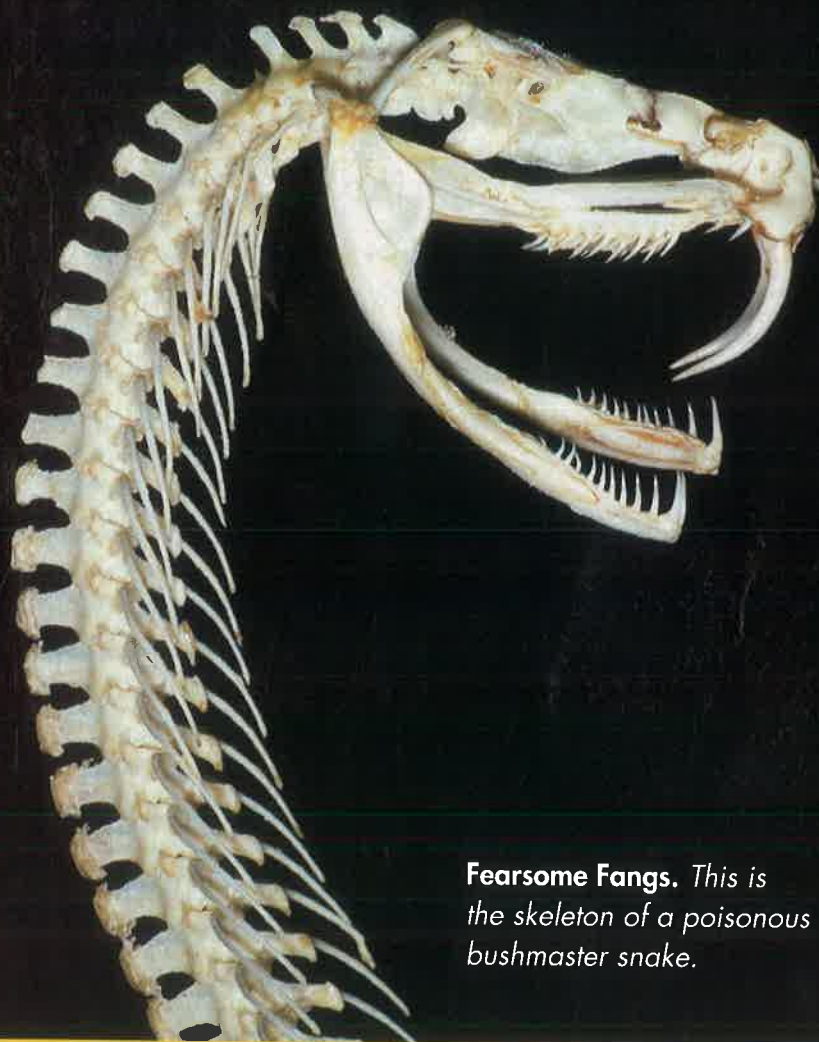
# Coming in October

**Out for Blood:** From vampire bats to stinging mosquitoes, find out what makes bloodsucking animals tick.

**Living Lights:** Enter the strange world of animals that make their own light.

**Return of the Gray Wolf:** Learn how the gray wolf is making a comeback in the United States.

**Bare Bones:** Why do many animals have a skeleton? Whether they're swimming, flying, or just thinking, their bones keep it all together.



**Fearsome Fangs.** This is the skeleton of a poisonous bushmaster snake.

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