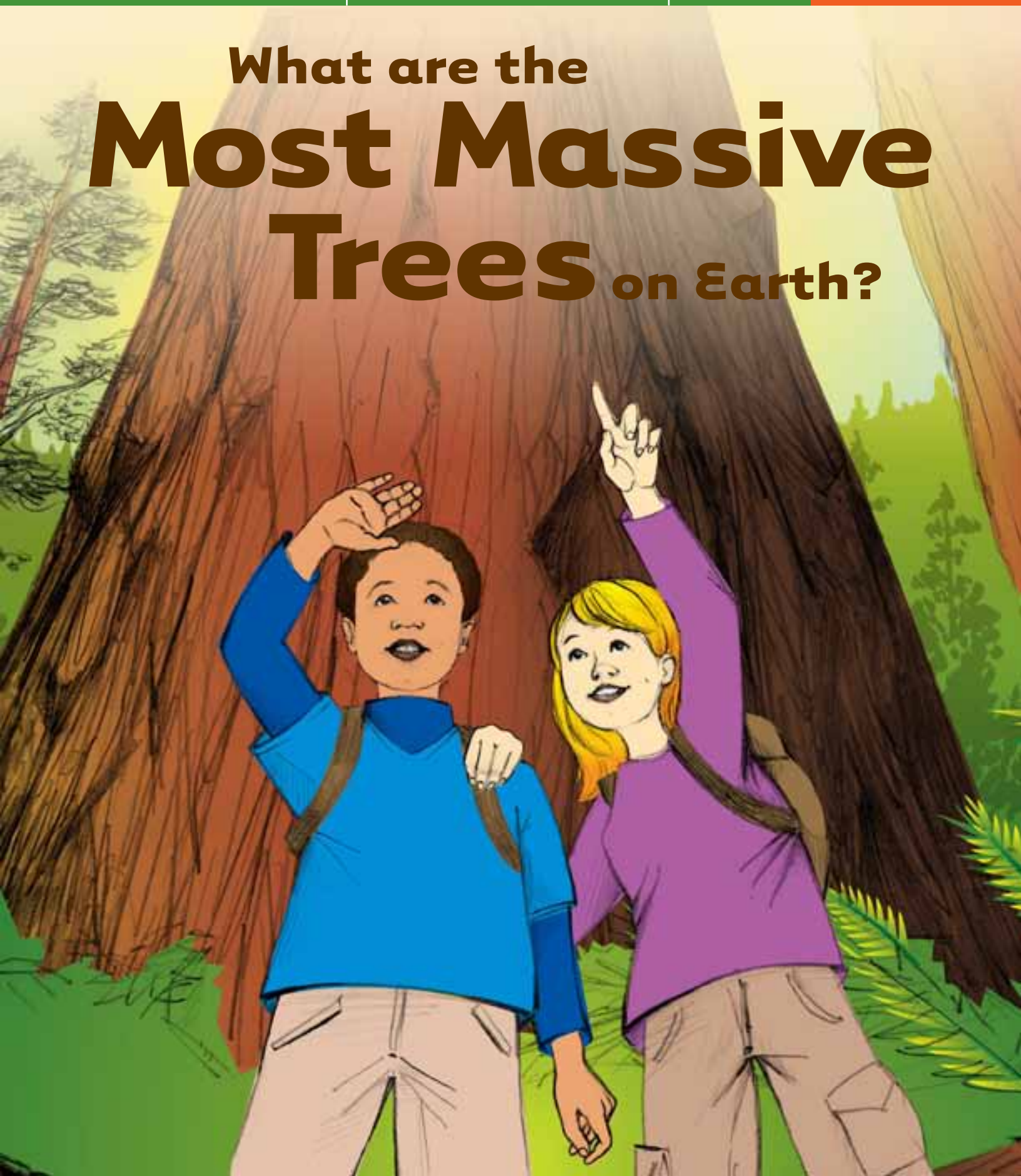
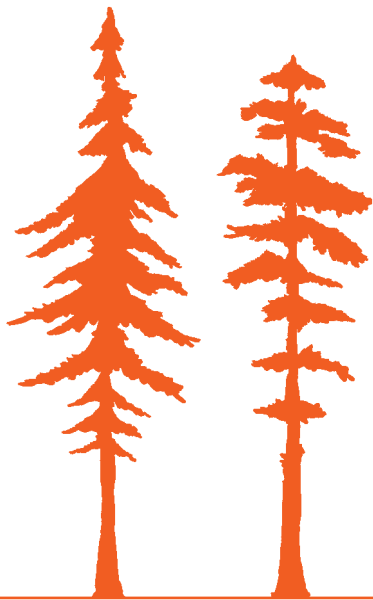




What are the
**Most Massive
Trees** on Earth?





Coast Redwood

Giant Sequoia

10-Story Building

Apple Tree

Giant sequoias are the Earth's biggest trees! These uncommon, amazing evergreen trees are among the largest and oldest beings ever to live.

How Big Do Giant Sequoias Get?

The largest giant sequoias are more than 250 feet tall and have trunks more than 30 feet wide at the base. That's taller than a 25-story building and wider than four school buses! Although coast redwoods can grow taller and the Mexican cypress can grow wider, giant sequoias are the most **massive** trees on Earth. One of the largest is estimated to hold over 52,000 cubic feet of wood (roughly equal to about 22,000 humans!) in its trunk and branches.



Where Do Giant Sequoias Live?

The only place giant sequoias grow naturally is on the western slopes of California's Sierra Nevada mountains, most often at elevations between 5,000 and 7,000 feet. These trees used to grow in many other places but, because of climate and landform changes, they have migrated to their current range. Today, Earth's giant sequoia forests exist in just 77 groves.

How Old Are Giant Sequoias?

It is difficult to determine the age of a living tree of such enormous size. With cut trees, people can tell the age by looking at a cross section of the trunk and counting **tree rings**, concentric circles that show the yearly growth. Because some cut giants have 2,000 to 3,000 rings, scientists think that many of the largest living sequoias are also between 2,000 and 3,000 years old.

How Do Giant Sequoias Reproduce?

Giant sequoias are *conifers*, which means that they produce seed cones. A typical sequoia cone is about 2½ inches long and contains about 200 tiny seeds the size and shape of a flake of oatmeal. A single large sequoia may produce 400,000 seeds in a year, but only a very small percentage **germinate** in nature and grow into trees.

How Long Have Giant Sequoias Existed?

The history of the giant sequoia dates back more than 144 million years to the age of the dinosaurs. Fossils suggest that forests containing sequoias once covered parts of North America, Europe and Asia. About 20 million years ago, the giant sequoia's direct ancestors lived in what is now southern Idaho and western Nevada. As the Earth's **plates** moved and the Sierra Nevada slowly rose, the climate east of the mountains gradually became much drier and hotter in summer and colder in winter. Sequoias, which prefer more moderate conditions, migrated westward to where California is now. Today, the sole survivors of this once widespread **genus** are in or near the 77 groves scattered along the western Sierra Nevada.



The Right Environment for Sequoias



Giant sequoia groves grow naturally in just a few relatively small areas in the Sierra Nevada because these places have just the right conditions for them to thrive. Certain levels of moisture, temperature and fire are vital for these trees.

A large giant sequoia tree needs thousands of gallons of water each day to grow. Since summers are dry in the Sierra Nevada, most of the water comes from melted snow that has soaked into the ground. All sequoias are sensitive to temperature and cannot live if it gets too hot in the summer or too cold in the winter. In the 260-mile-long stretch of the Sierra Nevada that lies between about 5,000 feet and 7,000 feet in **elevation**, there is generally enough snowfall to provide the moisture the giant sequoias need, without being too warm or cold.

Fire has long been common in the Sierra Nevada, and sequoia forests are adapted to live with fire. In fact, they actually need fire to thrive. Fire helps to open the sequoia cones — allowing the seeds to spread — and it also helps to prepare the soil for sprouting. In addition, fire creates space and allows in light so that young giant sequoias can grow.

The older trees have a very thick bark — sometimes more than 2 feet thick — made of fire-resistant material that helps protect them from fire damage. They also have the rather unusual ability to sprout new branches if they get burned. After losing as much as 95 percent of their foliage from fire, they can continue to live and grow for centuries.

People used to think that fire in giant sequoia forests would harm the trees, so they worked hard to prevent fires from spreading in and around the groves. In the long run, these efforts probably did more harm than good. Without fire, dense brushy trees and other plants grow too close to the sequoias, reducing the sequoias' ability to reproduce and adding more fuel that creates larger, destructive fires.

Out of Thin Air

A giant sequoia starts off as a tiny seed and over time grows into an enormous tree — with thousands of tons of wood. Where does all that material in the tree come from? Many people mistakenly think that plants and trees get their building material from the soil. But, actually it mostly comes from air!

How can a huge tree be made from air? Giant sequoias, like other plants, make their own food in their green leaves. Through **photosynthesis**, they combine carbon dioxide from the air with water that they draw up from the soil through their roots. In this process, using the energy they get from sunlight, they convert carbon dioxide and water into *carbohydrates*, or sugars. They use the carbohydrates to grow more wood, leaves, cones and roots. While water is necessary in the process, it adds just a small amount of mass to the tree compared to the carbon molecules that originally came from the air. Photosynthesis also releases oxygen back into the air, and oxygen is necessary for all animals (including humans) to breathe.

Photo: SigmaEye, Flickr Creative Commons



Sequoia Forest Communities

Giant sequoias tower over the other trees in the forest. Although they seem to stand out, they don't live alone. They depend on other living things in their ecosystem to survive. In fact, many complex relationships within a sequoia forest allow these great trees to reproduce, grow and support many microorganisms, fungi, plants and other animals — even large predators such as black bears and mountain lions.

Photo: Eric in S.F., Flickr Creative Commons



In some ways, life in a giant sequoia community centers around the trees — not just because they are so big, but also because they contain so much energy. Like other trees, a giant sequoia gets energy from the sun to maintain its life functions. This energy not only sustains the tree, but it also supports many organisms in different food webs.

One sequoia food web includes animals that eat parts of the tree and the animals that eat those animals. For example, insects feed on sequoia leaves, bark and cones. These insects, in turn, are eaten by various animals such as woodpeckers, ladybugs and bats. Thus the animals get energy indirectly from the tree, and at the same time they help sequoias stay healthy by keeping the insects in check.

Photo: SparkyLeigh, Flickr Creative Commons



Photo: Frank E. (Ed) Ely © California Academy of Sciences





Explore

Compare a tree in your neighborhood to a giant sequoia by measuring its width and height. One way to find the height is to measure the length of the tree's shadow on a sunny day, and then measure the shadow of a smaller object like a friend or a post. The ratio of the tree's height to its shadow will be the same as the object's height to its shadow:

$$\frac{\text{Tree Height}}{\text{Tree Shadow}} = \frac{\text{Object Height}}{\text{Object Shadow}}$$

Calculate the height of your tree using this formula.

How does this tree's width and height compare to a giant sequoia's dimensions?

Photo: cv vick, Flickr Creative Commons



Another sequoia food web includes tiny soil organisms, called **decomposers**, which break down dead leaves, branches and logs from the trees. In the process of decomposing, these organisms get energy from the dead tissues and return nutrients to the soil for the giant sequoias and other plants.

Some animals in the community are very important in helping the giant sequoias reproduce. Both long-horned beetle larvae and a small squirrel, called the chickaree, eat the fleshy green scales of sequoia cones. Giant sequoia cones have a higher nutritional value than the tiny seeds inside. As the animals eat, they open up the cones, freeing the seeds and spreading them widely over the ground.

The giant sequoia community is found nowhere else on Earth. Because mature sequoias and other trees make so much shade, it can be hard for young sequoias to grow. Giant sequoia ecosystems depend heavily on fire to open the forest periodically and give young sequoias the space, light and nutrients to establish themselves and grow in the forest.

Photo: Mark Brunell



Get Active



Learn More

Visit the Save the Redwoods League Web site at **SaveTheRedwoods.org**. Find books about giant sequoias or ancient forests at a local library.



Inspire Others

Research different organizations that work on forest issues, and join one you like. Send your sequoia art, poetry, photos or memories to Save the Redwoods League, and we might post them on our Web site!



Visit a Park

Plan a trip with your family to a park or reserve in the giant sequoias. See the Save the Redwoods League Web site at **SaveTheRedwoods.org** for information on sequoia parks and reserves.



Reduce, Reuse, Recycle

Everything we use comes from nature. You can help trees and the environment by using fewer natural resources and recycling what you do use.



Plant a Native Tree

Learn what kinds of trees are native to your area and choose one to plant. Find a location for the tree that will allow it to grow for many years. If you can't plant a tree, find a local group that will plant one for you.

History of Sequoia Conservation



Photo: Humboldt Historical Society

Ancestors of today's giant sequoias have lived for millions of years in what is now North America.

They were here during the age of the dinosaurs and long before humans migrated to the continent.

The native peoples of California lived among these trees for more than 8,000 years and did not cut them down. After gold was discovered in California in 1849, settlers came to the area in great numbers. Some people began cutting the trees to make things like fence posts and roof shingles. Although the wood often shattered when the trees fell — making much of it unusable for lumber — logging operations continued.

Many people joined together to stop the wasteful logging and to save these extraordinary trees. Over the years, Save the Redwoods League has helped to create parks and reserves to protect the remaining giant sequoia groves, including Calaveras Big Trees State Park and parts of Sequoia National Park.

It is important to save giant sequoias not only because they are beautiful and amazing, but also because they are the most massive trees on Earth, and giant sequoia groves are rare in nature. Although some have lived thousands of years, their continued survival is threatened by human activities, including nearby logging, development and air pollution.

Save the Redwoods League knows that past **climate change** was a serious danger to giant sequoias. Many scientists are concerned that rising temperatures and changing weather patterns will reduce the annual snowpack on which sequoias depend. The changes also may cause the Sierra snowpack to melt earlier in the spring, lengthening the dry season. The League is leading an effort to study redwoods and climate change so that we can keep protecting these amazing forests.

About Save the Redwoods League

Since 1918, Save the Redwoods League has protected redwood forests so that people can be inspired by these precious natural wonders — now and in the future. The League and its partners help people of all ages experience these majestic trees through the forestlands we have helped protect and restore, the many education programs we sponsor and our Web site.



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