

Seven Billion and Counting

A Reading A-Z Level Z1 Leveled Book
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Connections

Writing

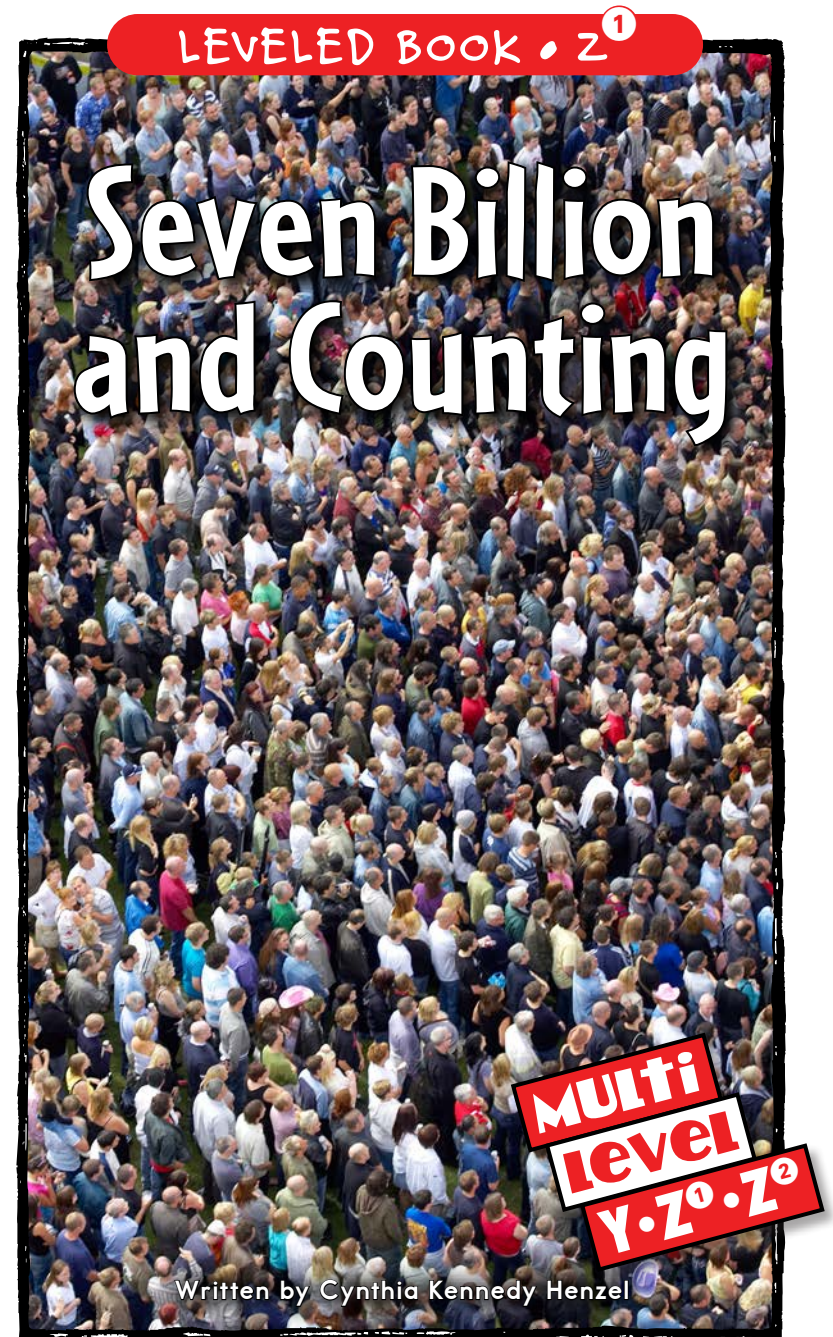
Imagine you are the President of the United States. Write a speech persuading citizens to actively commit to protect Earth's limited resources. Deliver your speech to your class.

Social Studies

Write a research report comparing how developing countries and rich countries have an impact on overpopulation. Include their populations, use of resources, and laws protecting the environment.

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Seven Billion and Counting



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Focus Question

What factors are contributing to overpopulation, and how does this affect Earth?

Words to Know

birthrate	efficient
carrying capacity	fossil fuels
consumed	ingenuity
developing countries	overpopulation
distribution	standard of living
ecological footprint	sustainable

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Correlation

LEVEL Z1

Fountas & Pinnell	W-X
Reading Recovery	N/A
DRA	60



India will soon have more people than any other country on Earth. Because most of its people are poor, however, India uses far fewer resources than the United States.

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These giant statues on Easter Island were far too heavy to carry. So how were they moved?

A Giant Mystery

When Europeans first arrived on Easter Island in 1722, they were amazed to discover hundreds of colossal stone statues placed around the island. One statue was more than 32 feet (9.7 m) long and weighed 164,000 pounds (74,389 kg)! Yet the people living on the island were poor and had only ancient tools. There were no large trees to make rollers. How was it possible that these people had carved and hauled the huge stones across the island?

Centuries later, experts discovered that Easter Island was once heavily forested. When a group of people called the Rapanui settled the island, they cleared trees for homes and fields. With plenty of fish, wildlife, and crops, the population grew. The Rapanui carved the *moai*—colossal human figures of stone—and raised them along the coast. Then, about 1680, the carving stopped and the population dropped. What happened?

One popular theory is that the Rapanui used up many of their resources as their population grew too large. Resources are natural things in our environment that help us live: food, clean water, energy. At one time the island was able to provide a small population with food, water, and wood for building. During this time, the people may have used the trunks of trees like wheels to move the huge stones. Eventually, though, the population grew too large for everyone to get what they needed. The forests were all cut down. Many of the Rapanui died because they'd used up their resources.

Many people today think the seven billion humans on Earth are using up the planet's resources in much the same way as the Rapanui. Will the people of Earth suffer the same fate as the people of Easter Island?

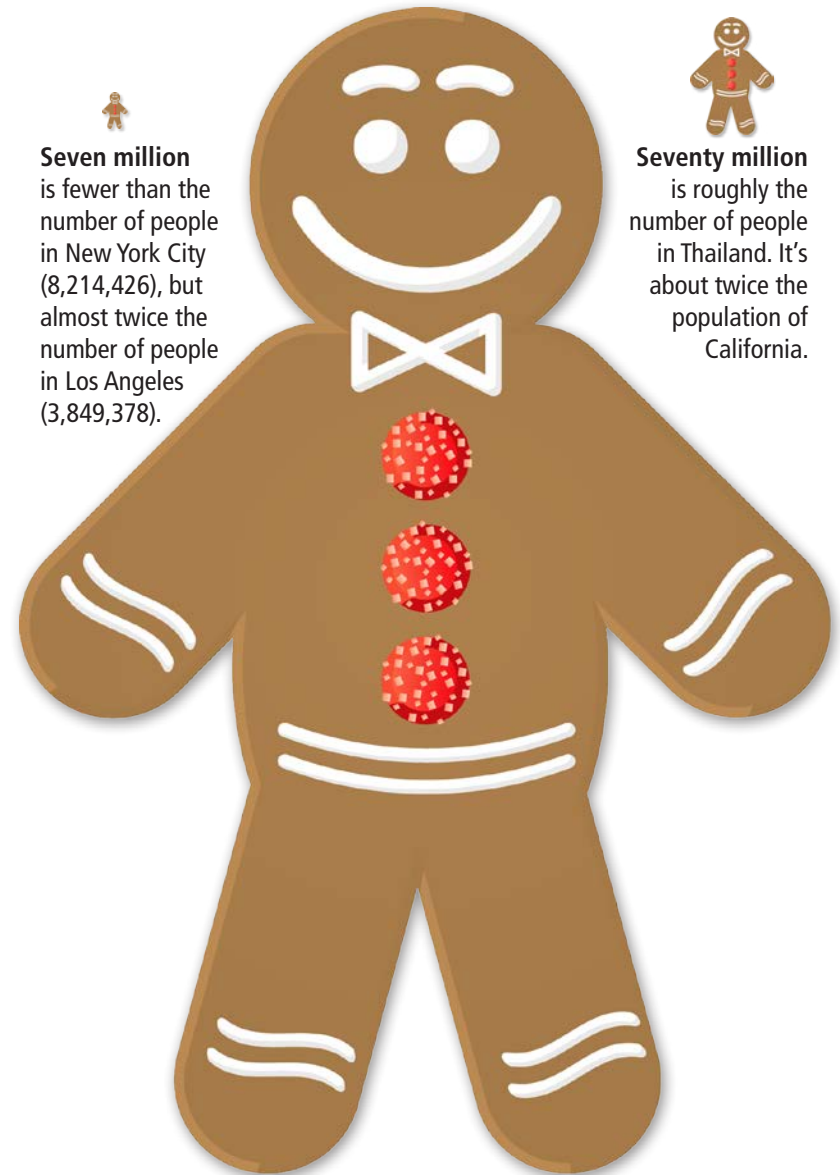
What Does 7,000,000,000 Look Like?



Seven million is fewer than the number of people in New York City (8,214,426), but almost twice the number of people in Los Angeles (3,849,378).



Seventy million is roughly the number of people in Thailand. It's about twice the population of California.



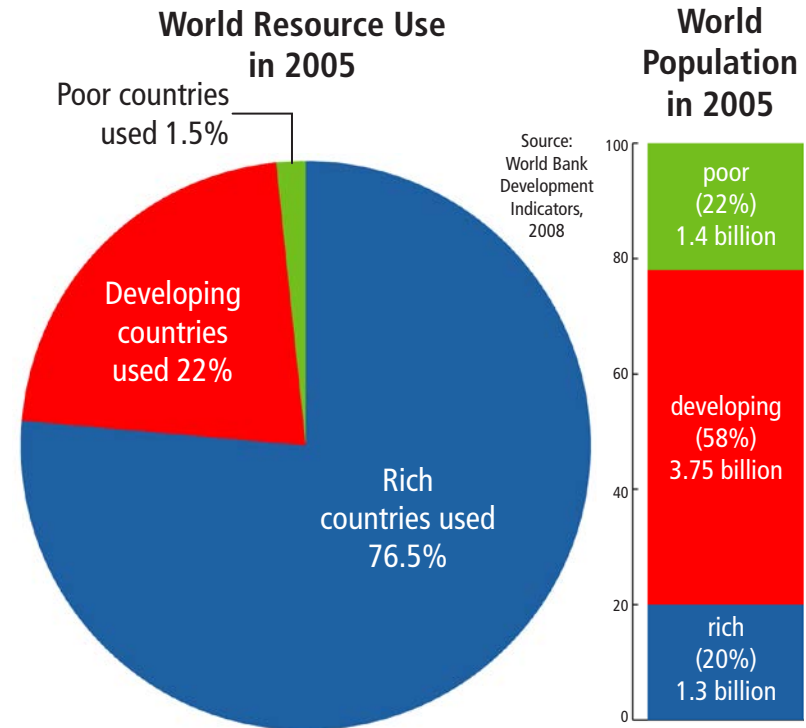
Here, the giant gingerbread man represents the seven billion people on Earth. To give a sense of just how big that number is, gingerbread men representing seventy million and seven million—still huge numbers—are placed beside seven billion. By comparison, seven billion is colossal.

How Many Are Too Many?

If you look around you, Earth may not seem crowded. There are empty houses, fields, and forests. Even New York City, with an average of 27,012 people per square mile, still has room for parks. In fact, all the people on Earth would fit in Los Angeles if you packed them shoulder to shoulder, but it wouldn't be too comfortable!

Overpopulation is not a problem of space. Rather, it is a problem of not having enough resources. Overpopulation means that people have exceeded their environment's **carrying capacity**—the largest number that can live in a place without using up the resources they need to survive. Scientists estimate Earth's carrying capacity at between two and forty billion people. Why such a wide estimate? Because the carrying capacity depends on how many resources each person uses.

If everyone on Earth lived the way most Americans live, Earth could only support two billion people. That's because rich countries like the United States and those in Western Europe use more than three-quarters of the world's resources. Those living in poverty—although they outnumber the people in rich countries—use only 1.5 percent of the world's resources.



Many people in poor countries live on less than \$1.25 a day. In rich countries, most people live on at least \$10 a day. Ten dollars a day doesn't mean you're rich—far from it. It does mean you're richer than 80 percent of the other people on the planet.

Over half the world's people live in **developing countries** where more and more resources are being used. Two developing countries are China and India, each with more than a billion people.

If everyone on Earth **consumed** only what we needed to stay alive, our planet could support forty billion people. Other species would be pushed out, however, and life would be hard.

A Recent Problem?

Jared Diamond, a well-known scientist, wrote about the decline of the Rapanui in his best-selling 2004 book, *Collapse: How Societies Choose to Fail or Succeed*. Along with some experts before him, Diamond thinks that at one time, ten thousand or more Rapanui probably lived on Easter Island. By the time the Europeans arrived, the island could barely support two thousand. The forests were gone. The best farming soil had washed away. The Rapanui had exceeded the carrying capacity of their island.



Clearing trees can cause erosion. Too much salt in the soil can kill plants. Here, clearing trees for farming actually released salt from the soil and ruined it.

Do You Know?

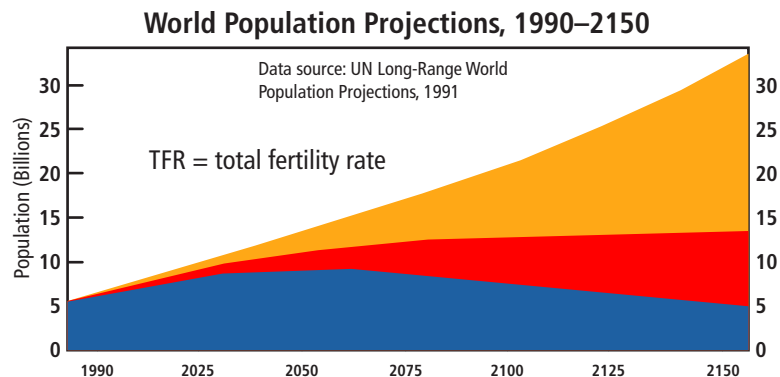
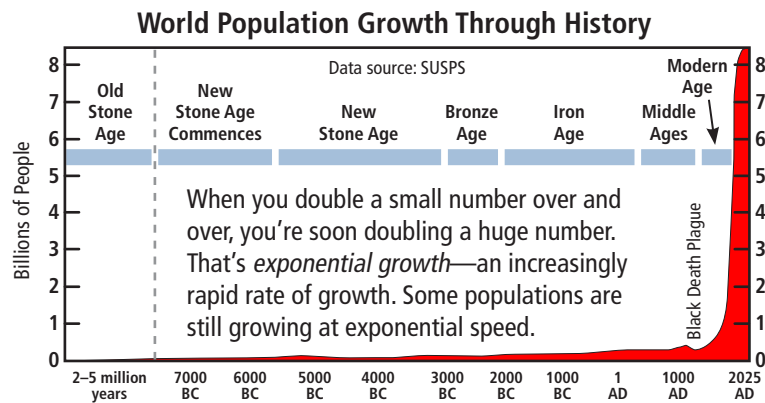
A few inches of rich farming soil take hundreds of years to develop. Yet that soil can be blown or washed away in a few years. As salts left from irrigation build in the soil, it can also become useless.

Experts suspect this kind of collapse has happened to many civilizations. In the Middle East, where farming began about ten thousand years ago, populations soared with larger food supplies from irrigating crops. However, irrigation can erode soil or leave enough salt in the soil to kill crops. This land, once known as the Fertile Crescent because it could grow so much food, wore out. Over time, the theory goes, the carrying capacity of the land decreased and the ancient civilizations disappeared.

As populations exceed their carrying capacity, the result can be starvation, the spread of disease, the destruction of the environment, and wars as people fight for scarce resources. If they can, some people leave to find new resources. The Easter Islanders could not leave because their nearest neighbors were thousands of miles across the ocean, and they had no wood left to build canoes. As the European population boomed in the 1800s, people moved to the Americas and Australia.

The Growth Spurt

In 1800, one billion people lived on Earth. It took humans 120,000 years to reach that number. By 1927, just 127 years later, we had doubled that number. Thirty-three years later, in 1960, we'd tripled it: three billion people. The year 2011 saw the seven billionth person on the planet—and a population still growing at more than 200,000 people each day.



Three estimates of future world population based on three different fertility rates. The TFR is the average number of children that each woman will have during her lifetime, worldwide.

The population explosion began with the new technology of the Industrial Revolution (1760–1850). New farming practices, manufacturing, and railroads changed the way people lived. Better food supplies and **distribution** meant that more children survived and people were healthier. More people moved from farms to cities to work in factories.

At the same time, scientists discovered the causes of many diseases and encouraged better hygiene. In 1796, Edward Jenner discovered the smallpox vaccine, the first of many vaccines that saved thousands of lives. More children survived to adulthood, which meant that more adults were around to have more children. The human population boomed.



A seven-month-old girl inhales vaporized penicillin under a Plexiglas tent in 1945. Discovered in 1928, penicillin was the first antibiotic. It saves countless lives.

Technology to the Rescue!

Thomas Malthus sounded the alarm about overpopulation in 1798 in his *Essay on the Principle of Population*. He thought that the human population was growing faster than its ability to grow food. If families did not have fewer children, he argued, the result would be starvation.

Malthus didn't know that over the next two hundred years, advances in technology would allow farmers to grow more food. But in the 1940s, the Green Revolution began. Scientists developed special seeds so farmers could produce more food. They developed chemicals to control insects and plant diseases. Places unfit for farming before could now grow food with chemical fertilizers and irrigation.



Irrigation makes possible this wheat farm in a desert in Saudi Arabia.

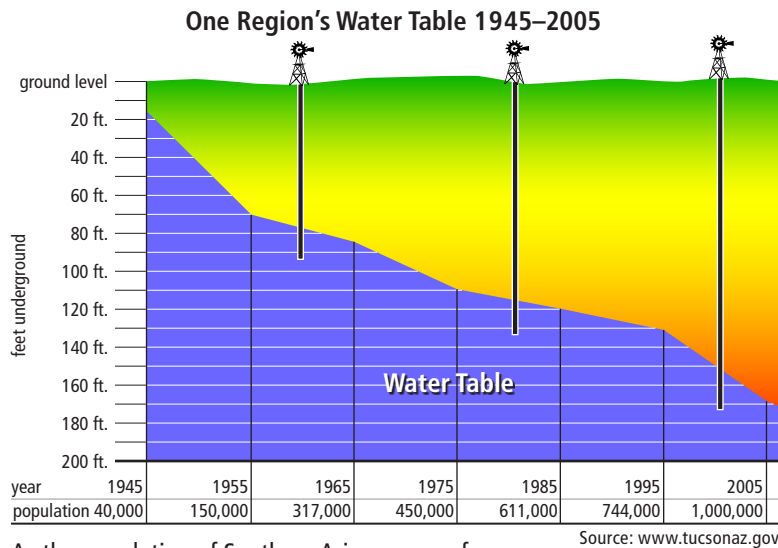
This new farming technology spread across the globe, allowing even poor countries to grow more food. It brought a threefold increase in food production. Some people believed that this kind of human **ingenuity** would allow the population to grow forever.

Yet new technology brought new problems. More water was needed for irrigation. Chemicals used to grow crops polluted food and water, and poisoned the environment. Rachel Carson's 1962 book *Silent Spring* brought attention to these problems. Some people realized that we were destroying the planet we depend on for life. But there were no New Worlds left to discover on Earth.

Of course, some resources are *renewable*. They can be replaced. New trees can be planted. The Sun and wind offer huge supplies of energy. Water is constantly renewed through the water cycle. Yet most of Earth's water is salt water—only 2.5 percent is fresh. Of that small amount, two-thirds is frozen in glaciers. The amount of available fresh water is less than 1 percent of the water on Earth.

Math Minute

Water makes up 60 percent of your body weight. Use your total weight to figure out your water weight.



As the population of Southern Arizona grew from 40,000 to 1 million, the water table plunged 170 feet. How much deeper did people have to drill to get water in 2005 than in 1985?

Fresh water is not evenly distributed over the planet, either. Twenty percent of people, mostly in Africa and parts of Asia, do not have a safe source of drinking water. Meanwhile, much fresh water is wasted.

Seventy percent of available fresh water is used for irrigation. In the United States, underground water in the West is pumped onto fields faster than it can be replaced. Mighty rivers like the Colorado either trickle to the sea or fail to reach the sea at all because so much water is taken for irrigation and cities. As water becomes scarce, much of the cropland that feeds the world will become desert.

Some of Earth's resources, like coal, copper, and other metals, are nonrenewable. These resources take millions of years to form, so they cannot be replaced once they are used up. Oil is an important nonrenewable resource used in farming, manufacturing, and to fuel vehicles. The United States, with 5 percent of the world's people, uses 25 percent of the world's oil. As developing countries need more oil, the price of food and energy will increase.

An ecosystem is another nonrenewable resource. Ecosystems do the work that keeps our planet healthy. Swamps clean water and reduce flooding, grasslands form rich soils, and forests balance the atmosphere. Yet heavy use of wood and farmland is destroying many important ecosystems. Half of Earth's tropical rainforests, the most diverse ecosystems, are gone. Thousands of plant and animal species become extinct each year. We cannot bring them back.



China's rapid industrialization brought great pressure on the baiji, the country's freshwater river dolphin. Water pollution and lethal fishing nets killed many; noise pollution caused the nearly blind animal to collide with propellers. On Earth for more than twenty million years, the baiji is now extinct.



A woman pushes her bike on a road in Indonesia after heavy rains flooded the area. Floods and rising seas there have been linked to global warming. Indonesia could lose about two thousand islands by 2030 due to climate change.

The largest known species of palm tree lived on Easter Island. It is now extinct. Maybe the Rapanui cut the trees in order to help move the moai. Whatever happened to the trees, when the Rapanui lost them, they lost their source of fuel and materials for construction. They also lost the forest ecosystem that protected the soil and kept it healthy, provided habitat for animals, stored water, and recycled waste. Their tiny island was transformed forever.

Our planet is transforming, too. Burning **fossil fuels** such as oil and coal releases carbon dioxide into the atmosphere, trapping more heat at Earth's surface. Our planet is getting warmer, which is changing ecosystems around the world. Already we have seen melting polar ice caps, spreading deserts, and wilder weather. These are not trends that can easily be reversed.

The Good News

By 2010, the global population growth rate had slowed from a high of 2.2 percent to 1.1 percent per year. In many rich countries, population growth has actually stopped or reversed. Their **birthrate** is now below the *replacement rate* of 2.1 children per woman. The replacement rate is the average number of children born per woman that over time will create a stable population.



More people are becoming aware that Earth has limited resources. Renewable sources of energy, such as wind and solar power, are being developed. Many countries have passed laws for cleaner air and water as well as protection for ecosystems.

Since 1985, water use per person has decreased in the United States, mostly thanks to more **efficient** use of water by farming and industry. Forests have increased, although the ecosystems of old forests are often lost, even when new trees are planted.

An Uncertain Future

Despite the good news, the world's population continues to grow, mostly in poor countries. The United Nations predicts a population of about 9.6 billion by 2050. By most estimates, this is almost twice the number of people who can live on Earth in a **sustainable** way. But no matter what estimate you believe, everyone now agrees that the human population cannot keep growing forever without destroying the planet.

China's One-Child Policy

China's population, at over 1.3 billion, is the largest in the world. In 1979, the country began a one-child policy to control population growth. The policy made it against the law for many couples to have more than one child. Although the policy is estimated to have lowered China's population by 400 million, the policy is controversial. Many Chinese couples prefer to have a son, so infant girls are sometimes killed or given away. Today, there are many more young boys than girls. This will make it difficult for young men to find wives. In addition, the children born in the last few decades will find it difficult to support the huge number of aging Chinese people.



Education Is the Key

Education and equality for women matter most in reducing birthrates. In Saudi Arabia, a wealthy country with little equality for women, the birthrate remains high.

There are ways to encourage lower birthrates. The first is to make sure that children and mothers can get the health care they need. Clean water, healthy food, and good health care allow many more children to reach adulthood. Families generally have fewer children if they believe the children they have will survive.

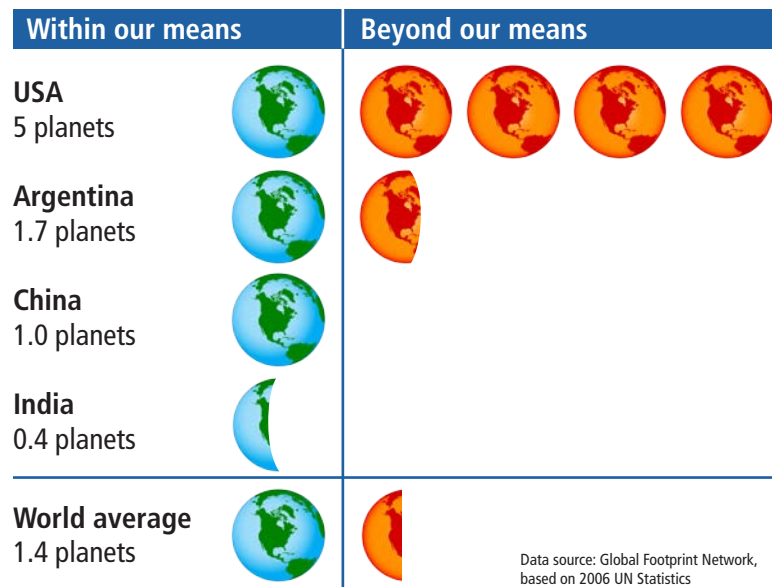
Second, governments can encourage smaller families by providing help for elderly and sick people. In some parts of the world, parents want many children to make sure someone will take care of them when they are old.

The third and most effective tool to reduce birthrate is to educate women. When women are educated, given the same opportunities as men, and given control over deciding the size of their family, they tend to have fewer children.

Enough for Everyone

The United States has an **ecological “footprint”**—that is, the amount of land required to supply the resources it uses—much greater than the amount of land it owns. It has exceeded its carrying capacity. Therefore, Americans must bring in resources from other countries to keep up their **standard of living**. With seven billion people on Earth, we’d need three or four more planets for everyone to live like most people in the United States. Rich countries can share Earth’s resources more fairly, though, in order to lower the global birthrate.

How many planets we’d need if everyone lived like a resident of the following:



Everyone in the world can have enough to eat if people in rich countries eat smarter and waste less. For example, grain is the world’s most important source of food. Yet as meat production has boomed for rich and developing countries, a third of the grain grown worldwide is used to feed livestock. It takes between 11 pounds (4.99 kg) and 16 pounds (7.25 kg) of grain to create 1 pound (0.45 kg) of meat. Eating less meat means more grain for people in poor countries and protection of valuable grasslands.

Average Americans use 3 times the food and 250 times the fresh water needed to survive. They can reduce their ecological footprint by eating smarter, recycling, and using less energy. Americans are the world’s biggest consumers. They could instead be the world’s most efficient consumers if they make intelligent choices about how to live.

An Island in Space

The Rapanui left records on carved tablets, but no one can translate the ancient language today. We can never know for sure what happened, but some experts believe that as Easter Island became overpopulated, the tribes fought for resources. The great statues they had created were toppled. Thousands died. Eventually, Europeans brought diseases that killed more. By 1877, only 111 people remained.

Today, Easter Island's population is growing again. Moai have been newly raised. But most of the native plants and animals are extinct, and the ancient culture of the Rapanui is lost. Hopefully, the tale of this little island can teach us to protect our limited resources on Earth, our own little island in space.



Glossary

birthrate (<i>n.</i>)	the number of babies born in a population within a specific period of time (p. 18)
carrying capacity (<i>n.</i>)	the greatest population that an environment can support indefinitely (p. 7)
consumed (<i>v.</i>)	ate, bought, or used (p. 8)

developing countries (<i>n.</i>)	countries moving toward higher standards of living and more advanced economies, largely through the development of industry (p. 8)
distribution (<i>n.</i>)	the sharing or delivery of goods and services to people or stores (p. 12)
ecological footprint (<i>n.</i>)	a measure of the impact that people or other living things have on the environment, especially the natural resources used to sustain them (p. 21)
efficient (<i>adj.</i>)	making good use of time and resources (p. 18)
fossil fuels (<i>n.</i>)	energy sources, such as coal, oil, and natural gas, that are taken from the ground (p. 17)
ingenuity (<i>n.</i>)	cleverness or skill in solving a problem or challenge (p. 14)
overpopulation (<i>n.</i>)	the condition of having too many people or other living things in an area (p. 7)
standard of living (<i>n.</i>)	the level of material comforts and wealth available to a person, community, or country (p. 21)
sustainable (<i>adj.</i>)	able to be used in a way that does not completely use up or cause permanent damage to a resource (p. 19)