

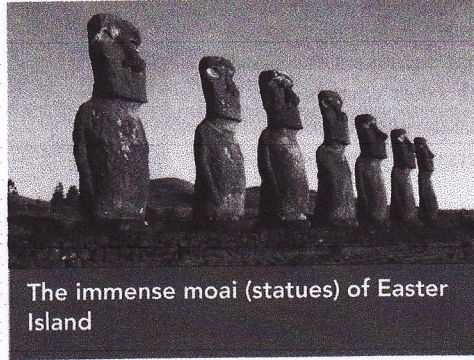
The SCIENCE behind the Story

The Lesson of Easter Island

Easter Island is one of the most remote spots on the globe, located in the Pacific Ocean 3,750 km (2,325 mi) from South America and 2,250 km (1,395 mi) from the nearest inhabited island. When the first European explorers reached the island (today called Rapa Nui) in 1722, they found a barren landscape populated by fewer than 2,000 people, who lived in caves and eked out a marginal existence from a few meager crops. However, explorers also noted that the desolate island featured hundreds of gigantic statues of carved stone, evidence that a sophisticated civilization had once inhabited the island.

Historians and anthropologists long wondered how people without wheels or ropes, on an island without trees, could have moved statues 10 m (33 ft) high weighing 90 metric tons (99 tons) as far as 10 km (6.2 mi) from the quarries where they were chiseled to the coastal sites where they were erected. The explanation, scientists discovered, was that the island did not always lack trees.

Indeed, scientific research tells us that the island had once been lushly forested and had supported a prosperous society of 6,000 to 30,000 people. Tragically, this once-flourishing civilization overused its resources and



The immense moai (statues) of Easter Island

cut down all its trees, destroying itself in a downward spiral of starvation and conflict. Today Easter Island stands as a parable and a warning for what can happen when a population consumes too much of the limited resources that support it.

To solve the mystery of Easter Island's past, scientists have used various methods. Some, such as British scientist John Flenley, have excavated sediments from the bottom of the island's lakes, drilling cores deep into the mud and examining ancient grains of pollen preserved there. Pollen grains vary from one plant species to another, so scientists can reconstruct, layer by layer, the history of vegetation in a region through time. By analyzing pollen grains under scanning electron microscopes, Flenley and other researchers found that when Polynesian people arrived (likely between A.D. 300

and 900), the island was covered with a species of palm tree related to the Chilean wine palm, a tall and thick-trunked tree.

Adding to this evidence, archaeologists located ancient palm nut casings in caves and crevices, and a geologist found carbon-lined channels in the soil that matched root channels typical of the Chilean wine palm. Scientists deciphering the island people's script on stone tablets discerned characters etched in the form of palm trees.

By studying pollen and the remains of wood from charcoal, scientists, among them French archaeologist Catherine Orliac, found that at least 21 other species of plants, many of them trees, had also been common but are now completely gone. The island had clearly supported a diverse forest. However, starting around A.D. 750, tree populations declined and ferns and grasses became more common, according to pollen analysis from one lake site. By A.D. 950, the trees were largely gone, and around A.D. 1400 overall pollen levels plummeted, indicating a dearth of vegetation.

The same sequence of events occurred two centuries later at the other two lake sites, which were higher and more remote from village areas.

people from wealthy nations such as the United States have much larger ecological footprints than do people from poorer nations. If all the world's people consumed resources at the rate of U.S. citizens, we would need the equivalent of four and one-half planet Earths.

Environmental science can help us avoid past mistakes

It remains to be seen what consequences resource consumption and population growth will have for today's



The haunting statues of Easter Island (Rapa Nui) were erected by a sophisticated civilization that collapsed after depleting its resource base and devastating its island environment.

Researchers first hypothesized that the forest loss was due to climate change, but evidence instead supported the hypothesis that the people had gradually denuded their own island.

The trees provided fuelwood, building material for houses and canoes, fruit to eat, fiber for clothing—and, presumably, logs with which to move the stone statues. By hiring groups of men to recreate the feat, anthropologists have experimentally tested hypotheses about how the islanders moved their monoliths down from the quarries. The methods that have worked involve using numerous tree trunks as rollers or sleds, along with great quantities of rope. The only likely source of rope on the island would have been

the fibrous inner bark of the hauhou tree, a species that today is near extinction.

With the trees gone, soil would have eroded away—a phenomenon confirmed by data from the lake bottoms, where large quantities of sediment accumulated. Faster runoff of rainwater would have meant less fresh water available for drinking. Runoff and erosion would have degraded the islanders' agricultural land, lowering yields of bananas, sugarcane, and sweet potatoes. Reduced agricultural production would have led to starvation and population decline.

Archaeological evidence supports a scenario of environmental degradation and civilization decline. Analysis of 6,500 bones by archaeologist

David Steadman showed that at least 31 species of birds nested on Easter Island and provided food for the islanders. Today, only one native bird species is left.

Remains from charcoal fires aged using radioisotopes of carbon (p. 26) show that besides crops and birds, early islanders feasted on the bounty of the sea, including porpoises, fish, sharks, turtles, octopus, and shellfish. But analysis of islanders' diets in the later years indicated that the people consumed little seafood. With the trees gone, the islanders could no longer build the great double canoes their proud Polynesian ancestors had used for centuries to fish and travel among islands.

As resources declined, archaeologists found, the islanders began keeping their main domesticated food animal, chickens, in stone fortresses with entrances designed to prevent theft. The once prosperous and peaceful civilization fell into clan warfare, as revealed by unearthed weapons, skeletons, and skulls with head wounds.

Is the story of Easter Island as unique and isolated as the island itself, or does it hold lessons for our world today? Like the Easter Islanders, we are all stranded together on an island with limited resources. Earth may be vastly larger and richer in resources than Easter Island, but Earth's human population is also much greater.

The Easter Islanders must have seen that they were depleting their resources, but it seems that they could not stop. Whether we can learn from the history of Easter Island and act more wisely to conserve the resources on our island, Earth, is entirely up to us. ■

global society, but we have historical evidence that civilizations can crumble when pressures from population and consumption overwhelm resource availability. Easter Island is a classic case (see **THE SCIENCE BEHIND THE STORY**, above).

Many great civilizations have fallen after degrading their environments, and each has left devastated landscapes in its wake. Historians have concluded that environmental degradation contributed in part to the fall of the Greek and Roman empires; the Angkor civilization of Southeast Asia;