

Reflect

Think of the ocean, and you may imagine the fascinating creatures that live in its depths. The world's largest animal, the blue whale, and perhaps its fiercest predator, the great white shark, share the ocean with tiny **photosynthetic** algae. These algae, called phytoplankton, produce up to 90% of the world's oxygen. About one million ocean species are currently known. However, some scientists estimate the true number to be nearly ten times greater.

photosynthetic: describes organisms that can use carbon dioxide and energy from sunlight to produce oxygen

People rely on ecosystems

Oceans—or marine ecosystems—are indispensable resources for life on Earth. Oceans cover more than 70% of the planet's surface. Algae in the oceans consume carbon dioxide and produce oxygen.

Most cultures of the world consume a great deal of ocean life as food. Many of these food sources are harvested from ocean systems such as estuaries and kelp forests. Estuaries are coastal water bodies that receive river flow and open into the ocean. Kelp forests are open ocean ecosystems based around marine algae populations. Kelp forests contain a large diversity of ocean life such as fish, shellfish, and crustaceans.



A typical kelp forest contains a wide variety of marine plant, animal, and bacterial species.



Trash floating on the water harms marine life such as fish and turtles.

Human activities have modified Earth's ocean systems in many ways and with various consequences

In addition to relying heavily on Earth's oceans, humans also perform numerous activities that impact ocean systems. One of the most concerning impacts of human activity is water pollution. Water pollution is the addition of harmful substances and chemicals to natural water. Water pollution occurs in many different ways.

In the Gulf of Mexico in the summer, a layer of warm water floats on top of the cooler water. Fertilizer runoff from farms and lawns enters the Gulf. The nutrients in fertilizer increase growth of algae. When the algae die, they decompose, using up oxygen. This creates dead zones. Dead zones kill fish and other marine organisms, fish caught by commercial and recreational fishermen.

Reflect

A variety of practices can reduce fertilizer runoff

For example, farmers can apply fertilizer strategically, at the right time and using the right methods. Cover crops such as clover recycle nitrogen and also limit soil erosion. Buffer zones of trees and shrubs around streams absorb nutrients before they enter the water.

Career Corner: Conservation Biologist

Conservation biology is an increasingly important field of study as human impact on the environment intensifies. These scientists research living species and their environments. They learn how human activities alter those environments. Conservation biologists dedicate their careers to preserving Earth's living and nonliving resources. They typically earn a college degree that focuses on biology.

You can practice being a conservation biologist by developing possible solutions to protecting the oceans. Remember – sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.

What specifically do these scientists do?

A conservation biologist might measure the change in water quality in a particular ocean ecosystem. They can determine how quickly the ecosystem is becoming polluted and why. Another project for a conservation biologist might involve measuring the amount of mercury accumulating in a certain fish population. Information like this is critical for determining health concerns for species that eat those fish, including humans. Conservation biologists work in many sectors, including the government, non-profit organizations, and private companies. They play an invaluable role in promoting the health of our planet.



A scientist is demonstrating water quality testing to his students. Testing water quality before and after controlling runoff helps determine whether strategies are working.

What Do You Think?

Organic farming does not rely on chemical fertilizers and pesticides. How do you think the rise of organic farming will affect the amount of fertilizer runoff?

Reflect

Wetlands purify water

Wetlands perform several crucial services for people. Perhaps the most important is water purification. Runoff from rural and urban areas contains not only fertilizer, but also metals and sediments. Wetland plants act like a filter, processing and absorbing chemical contamination. Sediments can enrich wetlands.

Since the 1600s, wetlands have been disappearing around the country. People have filled in wetlands to build houses. Less water flows into wetlands when rivers are diverted for agriculture and city uses. More pollution reaches wetlands as rainwater runs off roads and buildings rather than soaking into the ground.

Wetland conservation relies on partnerships

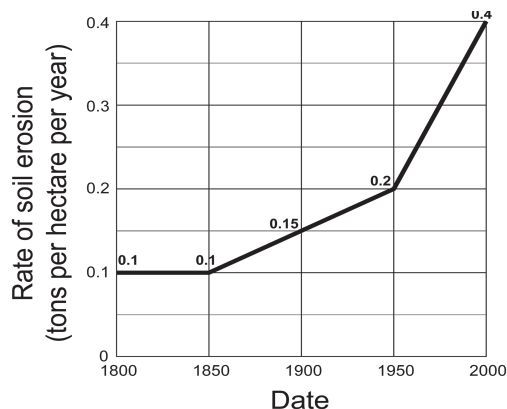
In 1989, the US Congress passed the North American Wetlands Conservation Act (NAWCA). It promotes public-private partnerships to conserve wetlands in all 50 states. While it focuses on wetlands important for migrating waterfowl, conservation of any wetland can improve water quality. Conservation efforts by other government and charitable institutions also focus on preserving and restoring wetlands.



Map of wetlands around Mobile, AL. Green – freshwater wetlands, light blue – estuarine wetlands.

Are soil erosion mitigation programs working?

Since the beginning of modern agriculture, soil erosion has been a problem. In 1935, the US government started funding soil erosion mitigation programs. Scientists designed a study to determine whether these programs make a difference. They measured the sediments in 32 lakes in Iowa. The sediments come from land erosion and are deposited in layers. Long cylinders of sediments were removed from each lake. A thicker layer means more erosion.



The graph on the left shows what scientists found. Over time, the rate of erosion increased. The scientists concluded that erosion mitigation programs have not worked. Currently, programs involve a small portion of land. These programs are voluntary. They suggest, for example, restoring buffer zones around rivers and stabilizing parcels of land that erode the fastest. Changing agricultural practices to have less impact will likely have the biggest impact on the rate of erosion.

The average soil erosion rate over time. Modified from Heathcote et al, 2013)

Reflect

Protecting coastal sand dunes protects human infrastructure

When a storm hits the Gulf coast, coastal sand dunes absorb some of the storm surge. This limits damage to the beach and flooding in inland areas.

Healthy sand dunes are covered by a variety of vegetation. Sea oats, a variety of cordgrass, as well as beach morning glory are common. Replanting vegetation is effective in places where sand dunes are mostly stable.

Swimming in the water and playing on the beach are popular along the Gulf coast. Wooden sidewalks often connect homes and parking lots to the beach. Keeping people from walking across the sand dunes protects dune vegetation.

Wind erosion is especially harmful for exposed dunes. Dune fencing is made from wooden slats. Short sections are placed so the prevailing wind piles sand up behind the fence. Trapping the sand helps dune plants take root.



Dune fencing prevents erosion caused by wind when vegetation is absent.



A variety of plants stabilize this intact sand dune.



A dune walkover protects the vegetation while allowing beach access for recreation.

What Do You Think?

On slopes, soil erosion is frequently a problem. How might the strategies used for preventing sand dune erosion be adapted to deal with soil erosion along slopes?

Try Now

What Do You Know?

Humans rely on the ocean for a wide variety of resources. However, many human activities impact ocean ecosystems. Some of these impacts have positive consequences. Many human impacts have negative consequences. Below are a list of human activities and a list of some consequences of those activities. Match each activity with the consequences it can cause. Keep in mind that human activities may have several consequences.

Human Activities	Consequences
1. Overusing fertilizers and pesticides for agriculture	A. Bacterial or algal overgrowth
2. Dumping trash into the ocean	B. Removal of oxygen from marine waters
3. Farming fish for commercial sales	C. Death of fish or other marine life
4. Emitting gases into the atmosphere that contribute to global warming	D. Accumulation and spread of toxic chemicals in ocean habitats
5. Constructing artificial reefs	E. Destruction of coastal land habitats
6. Over harvesting marine species	F. Disruption of marine food webs
7. Introducing exotic marine species into new ecosystems	G. Endangerment or extinction of entire marine populations or species
	H. Reduce the impact of overharvesting
	I. Spread of disease
	J. Rising sea levels
	K. Toxic chemical consumption by humans
	L. Acid precipitation over oceans

Connecting With Your Child

Observing Our Impact on Ocean Resources

To help your child learn more about the impact of human activities on ocean resources, visit a local beach, or possibly a river that runs to an ocean. Look for any signs of littering or pollution. Your child may also use Internet resources to investigate the water quality of that particular beach or river location. You might encourage your child to organize a “beach clean-up day” with other classmates if there is a local beach containing significant pollution.

If this type of ecosystem is difficult to access, you may also take your child to a local fish market or the seafood section of a grocery store. You may want to visit a local fish farm if one is available. Have your child observe what species of fish and other seafood at the market are caught wild. What species are sold farm-raised?

Here are some questions to discuss with your child:

- How can individuals as well as local and national governments reduce the pollution of marine ecosystems?
- What are some of the specific dangers to marine life and marine habitats posed by various forms of pollution? For example, what might be the impact of plastic 6-pack soda can rings, non- biodegradable materials, fertilizers from nearby farms, household cleaning agents, and oil spills?
- What health concerns do various farm- raised fish such as salmon, tilapia, or sea bass pose?