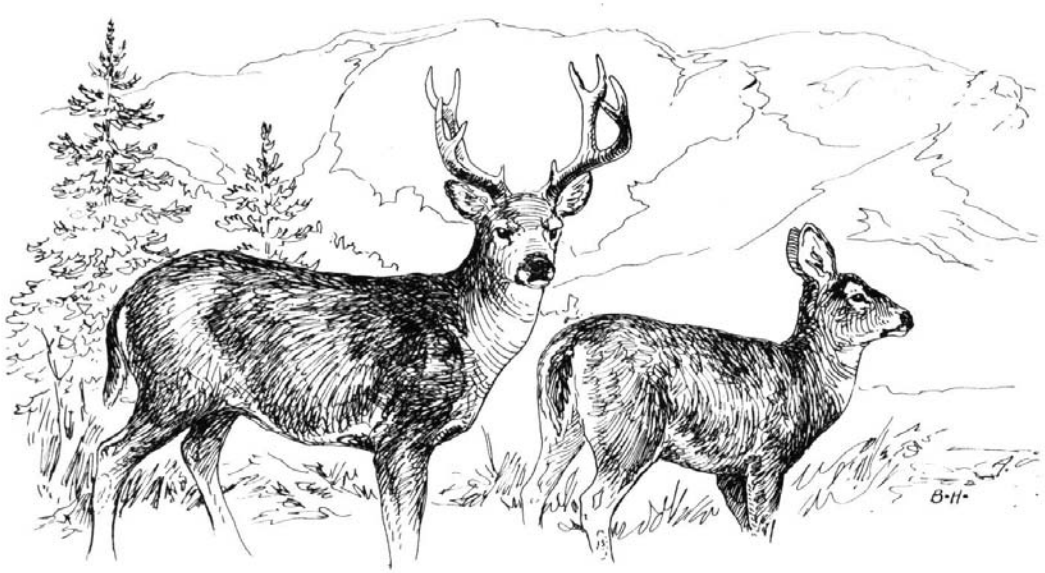
Ecology



"When we try to pick out anything by itself, we find it hitched to everything else in the universe."
—John Muir

Introduction

The word "ecology" is from the Greek, and means "the study of the home." Ecology is the study of interrelationships among plants, animals, and the environment. A program on ecology can teach children respect for their environment, appreciation for all elements of nature, and a desire to preserve and protect habitats.

We sometimes forget that we are a part of an interdependent system. What happens when something goes awry with our air, soil, water or weather? How would the world be different if we lost all the rainforests or half the animal species? The ecosystem is remarkable in the way everything works together to support life. It is important for us to realize how we often upset this delicate balance.

Poet Francis Thompson said, "Thou canst not stir a flower without the troubling of a star." Realizing how far-reaching a small change in the ecosystem can be is the first step toward becoming good stewards of our parks and our "home."

Before Teaching Kids about the Environment—Read This!

Over the course of a lifetime, an individual will build up environmental knowledge by drawing from a combination of school, the media, personal reading, family and friends, outdoor activities, and other professional and personal experiences. Yet, the National Environmental Education and Training Foundation (NEETF) found in their yearly survey on environmental awareness that Americans can correctly answer fewer than 25 percent of the basic environmental literacy questions asked.[1] Most people accumulate a diverse and often unrelated collection of factoids, but develop little real understanding about the environment.

According to NEETF "45 million Americans think the ocean is a source of fresh water; 120 million think spray cans still have chlorofluorocarbons (CFCs) in them even though CFCs were banned in 1978; another 120 million people think disposable diapers are the leading problem with landfills when they actually represent about one percent of the problem; and 130 million believe that hydropower is America's top energy source, when it accounts for just ten percent of the total."[2] Experts in the environmental education field attribute this environmental ignorance to printed materials and to educators and the media that oversimplify information, promote a political agenda, or perpetuate incorrect or outdated myths.

Patricia Poore, in her article "Enviro Education: Is it Science, Civics, or Propaganda?", suggests that many of the environmental publications geared toward children are more political than scientific and often perpetuate outdated assumptions, many of which have been questioned and updated. One of the inherent problems in writing about the environment is to explain complex ideas in a way that young children will understand. Poore finds that many of these children's publications contain oversimplification and myth, have little historical perspective, are politically oriented, and are strongly weighted toward a traditional environmentalist viewpoint, e.g. emphasizing limits to growth, conveying misinformation concerning waste management, and putting forward gloomy (if not doomsday) scenarios.[3]

Media sources play a major role in the public's understanding of environmental issues or lack thereof. Studies have found that children get more environmental information, approximately 83 percent, from the media than from any other source. While the media can be good at disseminating accurate information, they generally fail to provide the depth of information necessary for the public to become environmentally literate. Kevin Coyle, former president of NEETF, believes the media

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[1] The National Environmental Education Advisory Council, *Setting the Standard, Measuring Results, Celebrating Successes: A Report to Congress on the Status of Environmental Education in the United States,* (Washington D.C., 2005), 9.

[2] Kevin Coyle, *Environmental Literacy in America*, (Washington, D.C.: National Environmental Education and Training Foundation, 2005), v.

[3] Condensed from the article "Enviro Education: Is it Science, Civics—or Propaganda?" by Patricia Poore. *Garbage: The Practical Journal for the Environment*. Vol V, Number 2. April/May 1993. Pg. 26-31.

"provides a steady, even ubiquitous flow of awareness-building information but it seldom educates on complex matters or builds skill. The misapprehension it fosters can grow into persistent and incorrect myths."

While we tend to blame publications and the media for the public's misconceptions or lack of awareness of environmental issues and concepts, as environmental educators we must be aware of our own methods of promoting environmental stewardship. Are we actively educating the public or just disseminating information? Environmental information simply makes one aware of a topic but goes no further toward generating deeper "awareness." True education involves a sequenced series of learning steps that result in a thorough knowledge of a subject, including developing skills, and learning how to apply them in a real world setting. As conservationist Aldo Leopold wrote in 1944, "Acts of conservation without the requisite desires and skill are futile. To create these desires and skills, and the community motive, is the task of education." While the public can be informed about environmental topics, they also need to be equipped and trained in how they personally can use that information to make a difference in their world.

Environmental education begins close to home, encouraging children and adults to understand and make connections with their immediate surroundings. Individuals must grasp and understand the concept of causal connections within the environment in order to fully comprehend the need for environmental stewardship. This can only begin at the local level, where they often feel the most comfortable. It is at this level that people are more apt to develop the environmental awareness, knowledge and skills necessary for moving into broader issues and a more sophisticated comprehension of causes, connections and consequences. Traits of effective environmental education programs include hands-on activities, investigational approaches, and student-directed learning.

The North American Association of Environmental Educators (NAAEE) believes that to be effective, educators must take a balanced approach to instruction by incorporating differing perspectives and points of view evenhandedly and respectfully, and presenting information with intellectual honesty. In their *Excellence in Environmental Education: Guidelines for Learning (Pre K-12),*[4] NAAEE proposes the following suggestions to help guide environmental program instruction:

- The child or adult is an active participant.
- Instruction should be guided by the learner's interests and treated as a process of building knowledge and skills.
- The program provides opportunities for learners to enhance their capacity for independent thinking and effective, responsible action.
- The program should provide strong emphasis on developing communication skills.
- Educators must take a balanced approach to instruction.

[4] North American Association of Environmental Education, *Excellence in Environmental Education: Guidelines for Learning (Pre K-12)*, (Washington, D.C.: North American Association for Environmental Education, 2004). www.naaee.org.

- Personal commitment begins with an awareness of what immediately surrounds them.
- Instruction provides learners with early and continuing opportunities to explore their environment.

By providing accurate and balanced information, and facilitating activities that are designed to confirm and build on this information, educators are preparing children and the public to become environmental stewards.

If environmental education is done right, the average person is more likely to take regular positive action on behalf of the environment. Individuals who understand environmental issues and how environmental quality is impacted by human decisions are better equipped to use this knowledge to make informed, well-reasoned choices that also take into account social and political considerations. According to Kevin Coyle, "We are moving beyond a time when we can rely on a cadre of environmental experts to fix our environmental problems…. A stronger public understanding of environmental science and related issues is a growing necessity, and comprehensive environmental education is the only answer that makes complete sense."

Interesting Ecology Facts

- It takes 100 to 500 years for an aluminum can to decompose, but we can recycle aluminum and use it again and again.
- The energy saved from recycling one glass bottle can run a 100-watt light bulb for four hours. It also causes 20 percent less air pollution and 50 percent less water pollution than when a new bottle is made from raw materials.
- The most common cause of species extinction is habitat destruction.
- In one year, a full-grown tree takes 26 pounds of carbon dioxide out of the air.
- A car gives off about a pound of carbon dioxide for every mile it is driven. In a year, all that carbon dioxide would weigh almost as much as an elephant.
- In 1963 only 500 pairs of bald eagles lived in the lower forty-eight states. Only 25 years after banning the use of certain chemicals, there are more than 5,000 pairs.

Sample Program: Ecology

I. Introduction
Introduce yourself to the group.

Introduce the Junior Ranger Program.

II. Focus
   A. Can anyone tell me what a habitat is?
      An animal's home
   B. What would an animal need to make a good home?
      Go around the group, and ask each child to name something an animal would need to have a good home (answers might include accessible food and water, shelter, and a clean, unpolluted environment).

III. Objectives
Today we're going to talk about ecology. "Ecology" means "the study of the home." When we think of a home we usually think of a house, but the earth is our home, too, and is also home to plants and animals. We are going to learn about how plants, animals, and humans need each other to survive, and how our health and survival depends on how well we take care of our environment. We'll be playing some games, and taking a hike down an "un-nature" trail, too.

IV. Inquiry/Discussion
   A. Where do the animals live?
      1. What are some habitats (some places where animals live) here at the park?
         Oak trees, tidepools, etc . . . (examples from your unit)
   B. Animals, plants and people need each other.
      1. Do animals need plants to be able to survive? Why?
         Yes—Some animals are plant eaters; some live in plants (bushes or trees); and plants produce the oxygen animals breathe.
      2. Do plants need animals? Why?
         Yes—Animals (like bees) pollinate plants, spread plant seeds, fertilize plants, and produce carbon dioxide (which plants need to produce energy).
      3. Do animals need animals? Why?
         Yes—Animals eat other animals, and animals help other animals (e.g. symbiosis: remove and clean off pests: shark/remora).
      4. Do plants need plants? Why?
         Yes—Plants need other plants for symbiosis, fertilizer (plants break down and return nutrients to the soil), succession (progression of plant communities/types).
      5. So animals need plants, plants need animals, animals need other animals, and plants need other plants. What about humans? Do humans need plants and animals?
         Yes—Humans eat both plants and animals, use plant and animal products, breathe oxygen made by plants, etc.
      6. Do plants and animals need humans?
         If you have pets or houseplants, they need you to take care of them. Pets need food, water, exercise, veterinary care, etc. Plants need water, sunlight, fertilizer, and a bigger pot when their roots get crowded. Wild

animals are capable of living without human interference, but in some cases we have altered or destroyed their environments so much that we have to step in and help them. Humans have a responsibility to try to mitigate our damage.

7. Activities: "Knots" and "Support to Survive" (see activity section below)
   Can you see how plants, animals, and people are all connected and how we need each other to survive? A state park is home to many plants and animals, and people can affect these habitats.

C. What can happen to plants and animals when humans visit the park?
   Sometimes, people who visit a park make noise, feed animals, leave trash, destroy plant life, or destroy animal's homes.
   Or, people like you can protect plants' and animals' homes from harm.

V. Guided Discovery

A. Let's see if we can spot evidence of people in the park on the "un-nature" trail.
   1. Activity: The "Un-nature" Trail

VI. Application

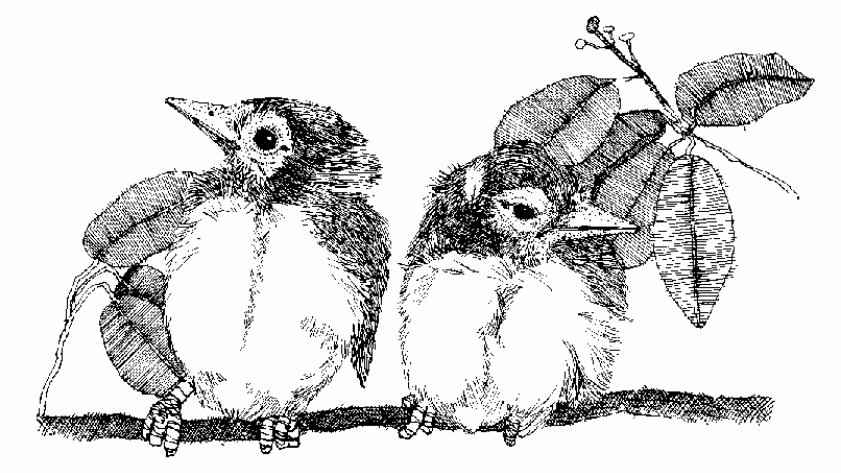
A. What was it like to see man-made objects on the trail?
B. Why is it important to protect the park environment?
   So plants and animals have a natural, unpolluted place to live
C. What can you do to protect the park environment?
   Take only pictures, leave only footprints.
   Do not feed the animals.
   Do not litter and help out by properly disposing of the litter you do see.
D. How do you think protecting the park environment will make the park a nicer place for you to visit?
E. Outside the park, what happens when people don't protect the environment?
   Our home (our habitat) gets polluted and becomes a less clean and healthy place to live. Just by looking around you can see evidence of this. Can you smell car/truck exhaust? Do you see trash? It not only looks bad, but it presents a danger for animals that might swallow it or get tangled in it. Trash, such as motor oil, animal feces, etc., can travel from your neighborhood all the way to the ocean where it causes lots of problems, including contaminating the water.
F. Can anyone name some of the environmental problems we are having worldwide?
   The greenhouse effect, pollution, ozone hole, deforestation[5]
   What are some things we are doing to solve these problems?
G. When you go back home, do you have any ideas about how you can help protect the earth, our home, from these problems?
   Recycle, save water, make less trash, don't litter, use recycled products, eat organic foods, buy California grown products, help community groups.

[5] Information about deforestation is available in the Plant Life information section.

H. What do you think would happen if we all did these things? Would our home be a nicer place to live?

VII. Conclusion

A. Announce when and where the next Junior Ranger session will be, and what the topic will be.
B. Stamp log books.



Activities

Knots (Web of Life)

Number of Children: 6 or more
Environment: Any
Equipment needed: None
Purpose of Activity: To try and untangle the complex web of the relationships between animals and plants.
Activity:

1. Explain that every animal and plant is connected in many ways to the other plants and animals around it. The soil, the amount of water, exposure to the wind, and many other factors affect all living things as well.
2. The object of the game is to try and untangle a complex web of relationships to see the cycle involved. Give each player an animal or plant name before the knot begins. Tell them to remember their names. Stand in a circle, shoulder to shoulder. Have everyone reach across to grab two other hands (not the same person's or the person next to you). Now that you are all interconnected, try to untangle the knot without letting go of any hands. Do you end up in a circle? Two circles?
3. After the knot is untangled, ask the players their animal or plant names, and talk about the relationships between their neighbors on each side of them in the circle. Would they be eaten or eat their neighbors? How is this going to affect the food web they are part of?

From The New Games Book, by Andrew Fluegelman. New Games Foundation, The Headlands Press Inc., 1976.

The "Un-nature" Trail

Number of Children: No more than 10
Environment: Trail
Equipment Needed: 10-15 man-made objects (clothes pins, pencils, combs, mirrors, toys, soda cans, etc.)
Purpose of Activity: To sharpen observation skills
Activity:

1. Place the man-made objects just off a 20- to 30-foot long section of trail. Use some bright objects and some well-hidden ones. Keep track of them so none are left out following the activity.
2. Have people walk the trail one at a time, silently, trying to see as many objects as possible. At the end, they whisper to you how many they have seen. If not all were spotted, tell them "there's still more," and let them start over.
3. Finish up by walking the trail as a group, pointing out and then removing each object in order. Make a point about keeping unnatural objects where they belong while hiking, then practice your new observation skills on a nature hike.

Variation:

Give each person a piece of paper and a pencil and have them write down the unnatural items. The second time through have the group pick up the items. Usually, they will find more than you originally set out.

From Sharing Nature with Children by Joseph B. Cornell. Nevada City: Ananda Publications, 1979.

Support to Survive

Number of children: 12 or more
Environment: Any
Equipment needed: None
Purpose of activity: To demonstrate how survival depends on support, not just individual effort
Activity:

1. Think of the way systems support each other (animals require plants; plants need sunlight; humans need oxygen from plants; soil needs nutrients from decomposers, etc.). Here is a new way we can support each other and relax at the same time.
2. Form a close circle standing shoulder to shoulder. Turn 90 degrees to the right. At the same time, everyone should sit down on the knees of the person behind them. Now try waving your hands and walking forward in a circle.
3. This game shows how all systems working together support one another.

From The New Games Book. New Games Foundation, The Headlands Press Inc., 1976.

Background Information: Ecology

When we talk about "nature," we usually mean all of the outdoors, and all the plants, animals, and environments we find there. However, we cannot really lump all of "nature" into one big category, for every animal and plant has a particular home and a particular environment to which it has become adapted in order to live. The study of living things in relation to their environment and to each other is *ecology*.

An invisible "web of life" connects living things to their homes in many ways, including the relationships between species living in the same area and their interaction with soil, air, rain and light. In a healthy ecosystem, living organisms are in balance with nature, and do not use up their resources. When an ecosystem is thrown off balance by human interference, however, biodiversity, food chains, and even the global climate are affected. One disruption of a fragile ecology can have far-reaching repercussions.

Biodiversity

The term "biodiversity" refers to all the different plants and animals that live in the same area. Tropical rainforests have more biodiversity than anyplace else on Earth. Even small patches of rainforest have native species that are found nowhere else in the world. For every species we know about, there may be 30 more that we haven't discovered.

Retaining biodiversity in ecosystems is important for many reasons, including maintaining the balance of species, the potential of these species for providing people with food and medicine, and enabling ecosystems to withstand environmental stress and adapt to change.

One potential problem if an ecosystem is disturbed is that the food web may develop a missing link. (For more information about food webs, see the Background Information section in the Energy chapter.)

Human Impact on the Global Climate

Humans have been modifying their environment for thousands of years. The use of fire and the overgrazing of lands by domesticated animals have negatively affected the abundance and distribution of vegetation, increasing the size of deserts in some parts of the world. By altering ground cover, important climatological factors like evaporation rates and surface winds have changed and continue to change.

Global Warming[6]

Most scientists think the world is getting warmer. According to the National Academy of Sciences, the earth's surface temperature has risen by about one degree Fahrenheit in the past century, with accelerated warming during the past two decades. Special computer programs show that temperatures could keep climbing for years to come. Scientists predict by 2100 the global surface temperature could increase an average of 1.6 to 6.3 degrees Fahrenheit.

Many scientists believe that people are causing the global warming, mostly by burning fossil fuels such as oil and coal (fossil fuels are formed underground from the remains of prehistoric animals and plants). Fossil fuels power almost everything we plug in or start up—from computers to cars. When burned, fossil fuels give off several gases, including carbon dioxide. Some of these gases also occur naturally from plant respiration and the decomposition of organic matter, but when they are combined with the emissions from human activities, the environment cannot absorb them as easily. These gases contribute to global warming because they stay around the earth and hold the sun's heat close to the surface. That's called the greenhouse effect.

Think of a car or a greenhouse. You know how hot a car gets if it is parked in the sun with the windows closed. A greenhouse works in the same way: The glass allows the sun's radiant energy in, but prevents most of the infrared radiation (heat) from escaping.

Water vapor, carbon dioxide and other gases act a little like car windows or greenhouse walls. They are part of the atmosphere, which is like a blanket of air around the earth. Sunlight passes through the atmosphere to the earth. Then the gases trap the heat so it stays close to the earth for a long time. We need some heat near the earth to keep from freezing. But we're adding a lot of extra gases to the atmosphere, and that may be making the earth a little too warm.

Some greenhouse gases that occur naturally in the atmosphere include water vapor, carbon dioxide, methane, nitrous oxide and ozone. Certain human activities, however, add to the levels of most of these naturally occurring gases:

- Carbon dioxide is released into the atmosphere when solid waste, fossil fuels, and wood and wood products are burned.
- Methane is emitted during the production and transport of the fossil fuels coal, natural gas and oil. The decomposition of organic wastes in municipal solid waste landfills and the raising of livestock also release methane gas.

[6] Information on global warming, the greenhouse effect, and the ozone problem from "Global Warming" and "Ozone Depletion." United States Environmental Protection Agency. http://yosemite.epa.gov/oar/globalwarming.nsf. Also, from "Global Warming," National Climatic Data Center, National Oceanic and Atmospheric Administration. www.ncdc.noaa.gov/oa/climate/globalwarming.html.

- Nitrous oxide is released during agricultural and industrial activities, as well as during the burning of solid waste and fossil fuels.
- A variety of industrial processes release very powerful, heat retentive, greenhouse gases that do not occur naturally. These gases include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

Plants and the ocean help to absorb some of the greenhouse gases and reduce their buildup, but deforestation by the timber industry, urban development and the burning of tropical rain forests by farmers are contributing to an increased concentration of the gases and the acceleration of climate change.

The problem with global warming is that a temperature rise of only a few degrees can bring about some big changes. For example, the weather would be affected. Some areas will have a dramatic increase in precipitation and runoff, whereas others will experience a decrease in runoff, either from reduced precipitation or higher temperatures. This change in water distribution would then change animal habitats and many aspects of human life, from agriculture to recreation.

Currently the sea level along California's coast is rising by three to eight inches per century. With global warming, scientists predict the sea will rise another 13 to 19 inches by 2100. The higher sea level could lead to flooding of low-lying property, loss of coastal wetlands, beach erosion, and saltwater contamination of drinking water.

Most scientists think global warming may hurt wild animals and plants. Many species may not be able to survive in a world that's drier, wetter, warmer, or significantly different from what they are used to. The ranges of many species of plants and animals are restricted and fragmented through both natural and human causes. This loss of habitat and the natural corridors allow migration could limit the ability of isolated species to adapt to climate change.

Humans could also be affected by global warming. Higher temperatures and increased frequency of heat waves may increase the number of heat-related illnesses and deaths. Hot weather tends to elevate air pollution by increasing the emission of natural hydrocarbons and concentration of ground-level ozone. Scientific studies have shown that ground-level ozone can aggravate existing respiratory illnesses such as asthma, reduce lung function, and induce respiratory inflammation. As people turn up their air conditioners, air pollutant emissions from power plants will also increase.

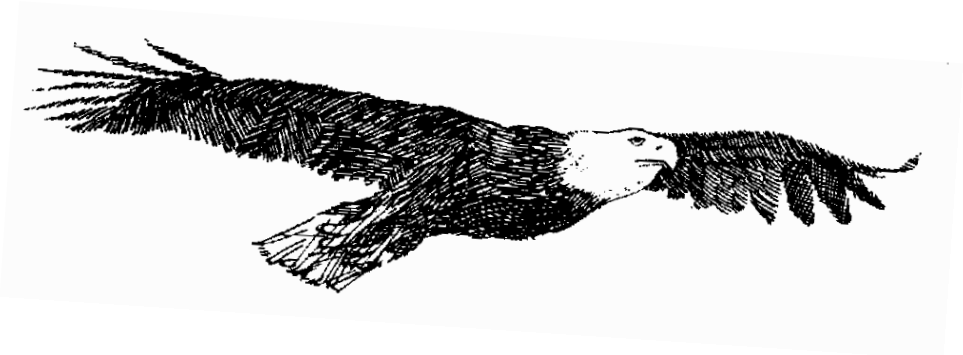
In the United States, about 6.6 tons of greenhouse gases are emitted per person every year. By reducing the amount of electricity used in homes, decreasing the production of waste, and wisely choosing modes of personal transportation, we can lower the amount of greenhouse gases being released into the atmosphere and possibly slow global warming.

The Ozone Problem

Ozone is a naturally occurring greenhouse gas in our atmosphere. The earth's ozone layer, approximately 9 to 19 miles above the earth's surface, acts like sunscreen to protect all life from the sun's harmful radiation. Factors like sunspots, changing seasons, and latitude can cause fluctuations in the naturally occurring levels of ozone in the atmosphere. However, scientists have learned that human activities have damaged this shield.

It is believed that the greatest human impact on the ozone layer has been caused by groups of chemicals known as halons and chlorofluorocarbons (CFCs). People have used these gases in air conditioners, refrigerators, aerosol sprays, fire extinguishers, and in the production of certain plastics. When CFCs get into the atmosphere, they go through several chemical reactions triggered by the sun's strong ultraviolet rays to convert ozone into oxygen. The depletion of ozone allows too many of the sun's harmful ultraviolet rays to reach the earth's surface. These kinds of rays cause many problems—including plant damage, eye disease, sunburn, and skin cancer. A lot of ozone has been destroyed, but contrary to popular opinion, there is no "hole" in the ozone layer—there's just much less ozone in some places than in others.

It's not too late to do something about global warming and the ozone problem, and a lot of people already have. Starting in the 1970s many nations banned the use and production of CFCs and halons, and many are looking at ways to cut down on the carbon dioxide they add to the air. (For example, the United States has banned the manufacture of all nonessential aerosol products that use CFCs as a propellant.) Emissions of ozone depleting substances are falling and scientists predict that the natural ozone production process will heal the ozone layer in about 50 years.



How Resources Affect Each Other

	Water	Plants	Wildlife	Humans	Soil
Soil	Affects runoff, percolation into the ground, underground storage, and purity by filtration.	Anchors plants; supplies water and minerals; affects where plants grow by topography, elevation, soil depth, acidity/alkalinity of soil.	Affects where animals live because of topography, elevation, availability of water, and types of plants that grow.	Affect productivity of soil.	[redacted]
Water	[redacted]	Affects transpiration and where plants grow (swamp, hillside, rainfall, fog, snow, etc.).	Affects aquatic animals and where animals live (by their need for water and food).	Provides scenic value and recreation; affects where people live (flood, drought, drinking water) and what people grow.	Washes away soil; affects type of soil (swamp, desert); helps break down soil by freezing, flowing and seepage.
Plants	Make open spaces in the soil for water penetration and tap roots; shade streams and keep water cool; use water in transpiration; purify water.	[redacted]	Provide food, shelter and water in succulent plants for drinking; give off oxygen for breathing.	Provide forage for cattle, shelter, necessities and luxuries of life, recreation, shade, scenic value.	Help rocks break into soil by root penetration; make organic fertilizer which enriches soil and absorbs water; hold soil in place; and protect soil from rainfall.
Wildlife	Pollute water; beavers build dams which control floods and store water.	Fertilize plants; carry seeds; give off CO_2 that plants need; destroy plants.	[redacted]	Provide scenic value, recreation, hunting, livelihood (trapping); damage crops; kill livestock.	Make organic fertilizer; cause soil compaction; beavers build dams which help percolate and hold water in soil; prevent soil erosion.
Humans	Store water in dams; pollute water; divert water; use more water than is available in some areas; manage water for their benefit.	Grow new crops; eliminate natural plants; harvest trees and grass; manage plants for their own benefit.	Harvest wildlife and natural predators; upset nature's cycle of animals; manage animals for their own benefit.	[redacted]	Increase and decrease soil productivity; cause soil erosion; put new land in production; change the face of the earth; manage soil for their own benefit.

Suggested Resources: Ecology

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Klots, Elsie B. *The New Field Book of Freshwater Life*. New York: G.P. Putnam's Sons, 1966. A natural history guide to the life found in ponds, streams and other freshwater habitats.

Martin, Alexander C., Herbert S. Zim, and Arnold L. Nelson. *American Wildlife and Plants: A Guide to Wildlife Food Habitats*. New York: McGraw-Hill, 1951. This reference work contains a wealth of ecological data.

Palmer, Tim, ed. *California's Threatened Environment: Restoring the Dream*. Washington D.C.: Island Press, 1993. Collection of essays about environmental issues affecting California, including population, air pollution, automobiles, recycling, water, etc.

Project Learning Tree. *Environmental Education Activity Guide: Pre K-8.* Washington, D.C.: Project Learning Tree, 1993. Project Learning Tree is an education program designed to promote awareness, appreciation, knowledge, and stewardship of forest resources. This guide is only available through training workshops. www.plt.org.

Project WET Curriculum and Activity Guide. Bozeman, MT: Project WET, 1995. Project WET ("Water Education for Teachers") is a water education program designed to promote awareness, appreciation, knowledge, and stewardship of water resources. This guide is only available through training workshops.

Project Wild K-12 Activity Guide. Bethesda, MD: Western Regional Environmental Education Council, Inc., 1992. Project Wild is an animal ecology education program. This guide is only available through training workshops. www.projectwild.org.

Roa, Michael. *A Guide to the Side of the Sea: A Teacher's Guide for Field Trips to Rocky Intertidal Areas.* Sacramento, CA: California State Parks, 2005.

Rockwell, David. *The Nature of North America: a Handbook to the Continent: Rocks, Plants, and Animals*. New York: Berkeley Books, 1998. This source is ideal for interpreters who want to consider California's natural history in a broader context.

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Van Matre, Steve. *Earth Education: A New Beginning*. Warrenville, IL: The Institute for Earth Education, 1990. This book proposes a new direction for environmental education called the "earth education path," which aims to accomplish what environmental education set out to do, but didn't: To help people improve upon their cognitive and affective relationship with the earth's natural communities and life support systems, and begin crafting lifestyles that will lessen their impact upon those places and processes on behalf of all the planet's inhabitants.

Other Sources of Information

California Coastal Commission. "Public Education Program." Offers a variety of conservation, education and community involvement programs. www.coastal.ca.gov/publiced/pendx.html.

California Environmental Protection Agency. www.calepa.ca.gov.

California Institute for Biodiversity. *CalAlive!* Produces educational materials for grades 4 through 8. www.calalive.org.

California Regional Environmental Education Community Network. An educational project whose mission is to develop a communication network that provides educators with access to high quality environmental education resources to enhance the environmental literacy of California students. www.creec.org.

Department of Conservation. "Kids & Educators." This website is full of fun facts and interesting information that students and teachers can use for school projects and learning. www.consrv.ca.gov/index/qh_kidsEducators.htm.

North American Association for Environmental Education. www.naaee.org.

The EnviroLink Network. Clearinghouse for all environmental education information, materials and ideas. www.envirolink.org.

U.S. Environmental Protection Agency. "Educational Resources." www.epa.gov/epahome/educational.htm.

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