Getting to the Core

Grade 7 Unit of Study

STUDENT RESOURCES (Feb. 2014)

Biodiversity

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SAUSD Common Core Intermediate School – Biodiversity
Student Edition

Contents:

Big Idea: All living things exist in a balance with other living things and physical factors.

Enduring Understanding: Biodiversity benefits people through more than just its contribution to material welfare and livelihoods. Biodiversity contributes to security, resiliency, social relations, health, and freedom of choices and actions.

Essential Questions:

- What is biodiversity and who/what does it affect?
- How does human activity influence the sustainability of an ecosystem and its natural resources?
- Describe physical or biological changes in an ecosystem that could alter the organisms that live in it.
- How are organisms dependent on their interactions with other organisms and with nonliving factors?
- What is the economic value of biodiversity?
- Why is biodiversity loss a concern?

What is Biodiversity?

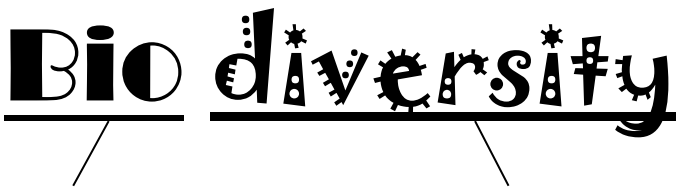
Directions: Look at the word "biodiversity." It's actually two words combined together. Make a prediction about what you think this word means.

I think biodiversity means _____

_____

_____

With the class or your partner, breakdown the meaning of the two words in biodiversity.



Biodiversity means _____

_____

_____

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Extended Anticipatory Guide

	Day 1: Opinion		Day 14 Findings		**Evidence**: Explain using your own words by using the text in this booklet and from videos you watched
	Agree	Disagree	Support	No Support	
1. Environmental changes caused by humans can always be reversed.					Video Text / Page #
2. We can learn from history so that we do not make the same mistakes again.					Video Text / Page #
3. Environments have always changed throughout time, therefore current environmental changes are part of earth's natural processes.					Video Text / Page #
4. It is very expensive and difficult to repair the environment.					Video Text / Page #
5. If humans know that an activity, such as deforestation or pollution, hurts the environment, they will stop doing that activity.					Video Text / Page #
6. One organism, or living thing, going extinct does not hurt nature because there are millions of plants and animals on earth.					Video Text / Page #

Language Supports for Agreeing

I agree with the statement that …because…
I agree with my classmate that …because…
I share a similar belief to _____. (Explanation)

Language Supports for Disagreeing

I disagree with the statement…because…
I disagree with _____. I believe that … because…
Although _____makes a valid point, I still feel that … because…

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Brainstorming Thinking Map

Draw a thinking map in the box below where you will brainstorm your ideas about the question "How does a forest and everything in it affect your life?"

Have you ever been to or hiked around in a forest? If so, describe what it looked/smelled/felt like. If not, image a forest and describe it.

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"Leaf Me Alone" I.D Lab

Purpose: To investigate the biodiversity of leaves in your community.

Procedure: Example the various leaf samples your teacher gives you. Use the Leaf identifying chart to classify the leaves into different species (groups) based on their shape, edges, and vein structure. Remember a big leaf and a small leaf may be the same kind of leaf!

Data Table/Observations: (Pick 5 different leaves to describe below)

Leaf Drawing	Shape	Edges	Vein Structure

Analysis Questions: Answer using complete sentences:

1. You only describe five leaf specimens above. How many total different types of leaves did you have?

_____

2. You determine different species of leaf by looking at them. How do you think scientist determine different species of tiny bacteria or plants and insects when they look very similar?

_____

_____

3. Answer AFTER the Bill Nye Video Clip. How does the biodiversity of leaves affect the biodiversity of things like insects, birds, and mammals?

_____

_____

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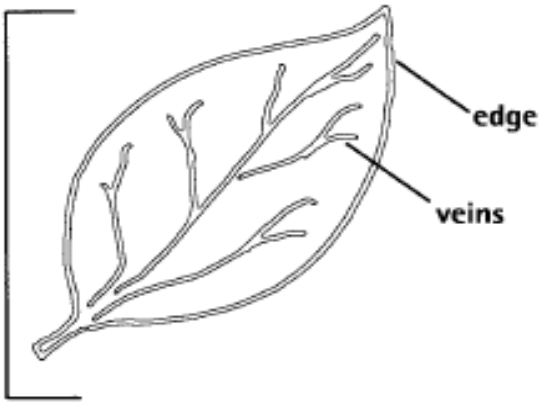
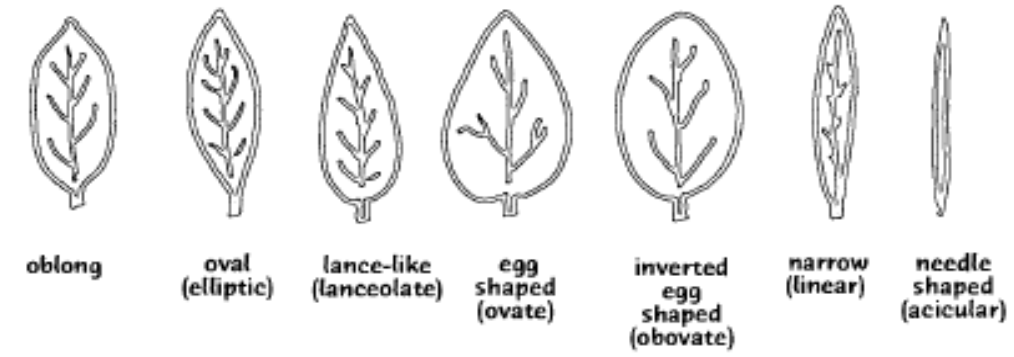
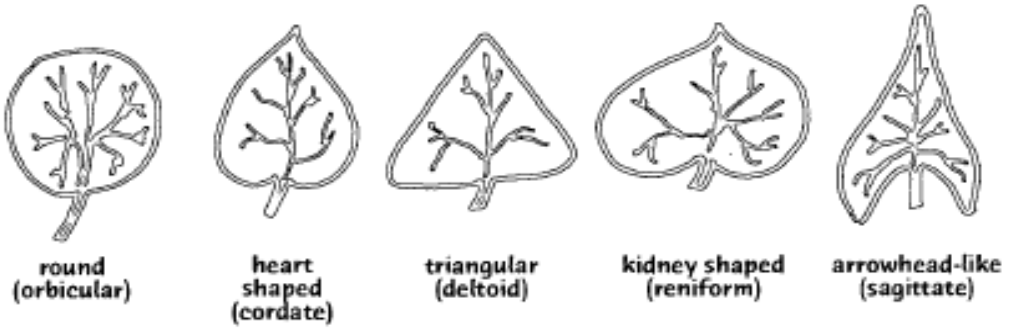
Leaf Identification Chart 1

One way to tell plants apart is by looking at their leaves.



Shapes



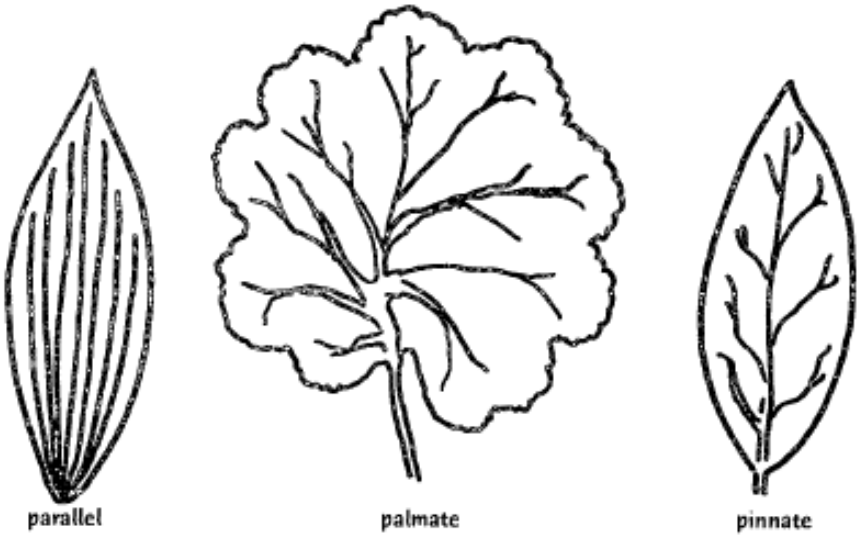


Leaf Identification Chart 2

Edges

lobed | rounded (crenate) | tooth-like (dentate) | wavy (undulate) | smooth (entire) | double saw-like (double serrate) | saw-like (serrate)

Veins (There are three main ways that veins are arranged on leaves.)



parallel | palmate | pinnate

Bill Nye & Biodiversity

Directions: As you watch the video clip, do your best to define the word or think of an image that would represent the word.

Term	Definition	Graphic/Image
Species		
Biodiversity		
Ecosystem		

Write down two key ideas you learned from the Bill Nye video using complete sentences.

1. _____

_____

_____

2. _____

_____

_____

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What Creates Biodiversity?

Directions: Think about the question below and then share your ideas or questions with your partner.

When your teacher asks you, write down your thoughts.

Prompt: In Orange County, some local organisms include hawks, eagles, mountain lions, oak trees, sea otters, rattlesnakes, and lots of types of flowers and grasses. In Antarctica, 8,070 miles to the south, you'll find very different life like penguins, elephant seals, leopard seals, mosses (a short fuzzy plant that grows on rocks), and several kinds of birds. Think of as many different things that contribute to what kind of organism can live in a specific region and explain them below. Use complete sentences.

Follow Up Quick Write: Now that you've learned about the five key biomes, biotic and abiotic factors, explain how abiotic factors affect what lives in a biome. Use the words **abiotic**, **biotic**, and **species** in your response. Underline each term every time you use it. You will share with your partner afterwards.

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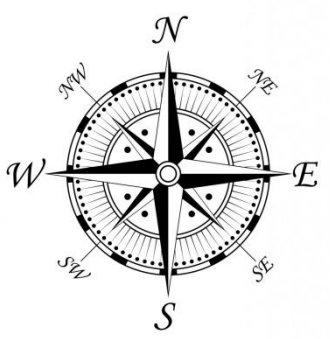
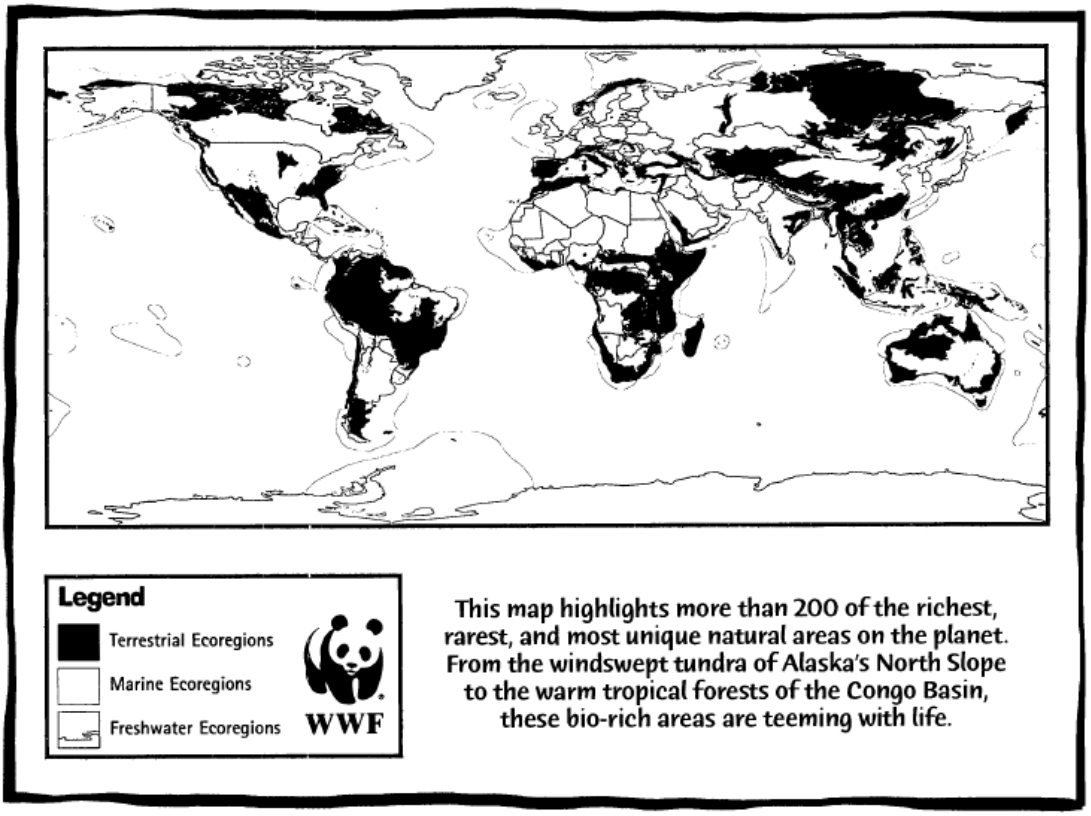
Ecoregion Species Match Up



1. Name three of the species that live in this ecoregion:
   - _____
   - _____
   - _____
2. Name of this ecoregion_____
3. Describe this ecoregion <u>using at least three facts</u> from the information on your cards (hot, cold, icy, dry, windy, etc.)
   - _____
   - _____
   - _____
4. Based on the organisms living in your ecoregion and the facts you described above, where do you think this ecoregion is located in the world? (Hint: Are your organisms designed for cold or hot weather, rainy or dry weather?)
5. If you know where your ecoregion is, mark it and label it on the map below.



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Biomes

Big Idea: All living things exist in a balance with other living things and the physical factors.

Directions: Create a thinking map in the box below to record your notes on "Biomes." Keep in mind the big idea throughout this presentation

What is your source for this information?

Which biomes have you visited?

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THE AQUATIC BIOME

Water is the common link among the five biomes and it makes up the largest part of the biosphere, covering nearly 75% of the Earth's surface. Aquatic regions are home to numerous species of plants and animals, both large and small. In fact, this is where life began billions of years ago when amino acids first started to come together. Without water, most life forms would be unable to live and the Earth would be a barren, or empty, desert-like place. Although water temperatures can vary widely, aquatic areas tend to be more humid and the air temperature on the cooler side.

The aquatic biome can be broken down into two basic regions, freshwater (i.e, ponds and rivers) and marine (i.e, oceans and estuaries).

Freshwater Regions

Freshwater is defined as having a low salt concentration—usually less than 1%. Plants and animals in freshwater regions are adjusted to the low salt content and would not be able to survive in areas of high salt concentration (i.e, ocean). There are different types of freshwater regions: ponds and lakes, streams and rivers, and wetlands. The following sections describe the characteristics of these three freshwater zones.

Ponds and Lakes These regions range in size from just a few square meters to thousands of square kilometers. Scattered throughout the earth, several are remnants from the Pleistocene glaciation.

Streams and Rivers These are bodies of flowing water moving in one direction. Streams and rivers can be found everywhere—they get their starts at headwaters, which may be springs, snowmelt or even lakes, and then travel all the way to their mouths, usually another water channel or the ocean.

Wetlands Wetlands are areas of standing water that support aquatic plants (plants that live in the water). Marshes, swamps, and bogs are all considered wetlands. Plant species adapted to the very moist and humid conditions are called hydrophytes. These include pond lilies, cattails, sedges, tamarack, and black spruce.

Marine Regions

Marine regions cover about three-fourths of the Earth's surface and include oceans, coral reefs, and estuaries. Marine algae supply much of the world's oxygen supply and take in a huge amount of atmospheric carbon dioxide. The evaporation of the seawater provides rainwater for the land.

Oceans

The largest of all the ecosystems, oceans are very large bodies of water that dominate the Earth's surface.

Coral Reefs

Coral reefs are widely distributed in warm shallow waters. They can be found as barriers along continents (e.g., the Great Barrier Reef off Australia), fringing islands, and atolls (ring shaped coral reefs).

Estuaries

Estuaries are areas where freshwater streams or rivers merge with the ocean. This mixing of waters with such different salt concentrations creates a very interesting and unique ecosystem.

THE DESERT BIOME

Deserts cover about one fifth of the Earth's surface and occur where rainfall is less than 50 cm/year. Although most deserts, such as the Sahara of North Africa and the deserts of the southwestern U.S., Mexico, and Australia, occur at low latitudes, another kind of desert, cold deserts, occur in the basin and range area of Utah and Nevada and in parts of western Asia. Most deserts have a considerable amount of specialized vegetation, as well as specialized vertebrate (has a backbone) and invertebrate (has no backbone) animals. Soils often have abundant nutrients because they need only water to become very productive and have little or no organic matter. Disturbances are common in the form of occasional fires or cold weather, and sudden, infrequent, but intense rains that cause flooding.

There are relatively few large mammals in deserts because most are not capable of storing sufficient water and withstanding the heat. Deserts often provide little shelter from the sun for large animals. The dominant animals of warm deserts are non-mammalian vertebrates, such as reptiles. Mammals are usually small, like the kangaroo mice of North American deserts.
There are four major types of deserts:

Hot and Dry
Semiarid
Coastal
Cold

Hot and Dry Desert The four major North American deserts of this type are the Chihuahuan, Sonoran, Mojave and Great Basin. Others outside the U.S. include the Southern Asian realm, Neotropical (South and Central America), Ethiopian (Africa) and Australian. The seasons are generally warm throughout the year and very hot in the summer. The winters usually bring little rainfall. Temperatures exhibit daily extremes because the atmosphere contains little humidity to block the Sun's rays.

Semiarid Desert The major deserts of this type include the sagebrush of Utah, Montana and Great Basin. They also include the Nearctic realm (North America, Newfoundland, Greenland, Russia, Europe and northern Asia)

Coastal Desert These deserts occur in moderately cool to warm areas. A good example is an area in Chile. The cool winters of coastal deserts are followed by moderately long, warm summers. The average summer temperature ranges from 13-24° C; winter temperatures are 5° C or below. The maximum annual temperature is about 35° C and the minimum is about -4° C. The average rainfall measures 8-13 cm in many areas. Some animals have specialized adaptations for dealing with the desert heat and lack of water.

Cold Desert These deserts are characterized by cold winters with snowfall and high overall rainfall throughout the winter and occasionally over the summer. They occur in the Antarctic, Greenland and the Nearctic realm. They have short, moist, and moderately warm summers with fairly long, cold winters. The mean winter temperature is between -2 to 4° C and the mean summer temperature is between 21-26° C.

THE FOREST BIOME

About 420 million years ago, ancient or very old plants and arthropods (ex. insects, spiders, millipedes) began to occupy, or live on the land. Over the millions of years that followed, these land colonizers developed and adapted to their new habitat. The first forests were dominated by giant horsetails, club mosses, and ferns that stood up to 40 feet tall.

Life on Earth continued to evolve, and in the late Paleozoic era, gymnosperms (ex.Christmas trees) appeared. By the Triassic Period, gymnosperms dominated the Earth's forests. In the Cretaceous Period, the first flowering plants (angiosperms, like roses and tulips) appeared. They evolved together with insects, birds, and mammals and quickly grew, dominating the landscape by the end of the Period. The landscape changed again during the Pleistocene Ice Ages—the surface of the planet that had been dominated by tropical forests for millions of years changed, and temperate forests spread in the Northern Hemisphere.

Today, forests occupy approximately one-third of Earth's land area, account for over two-thirds of the leaf area of land plants, and contain about 70% of carbon present in living things. They have been valued in folklore and worshipped in ancient religions. However, forests are becoming major casualties of civilization as human populations have increased over the past several thousand years, bringing deforestation, pollution, and industrial usage problems to this important biome.

Present-day forest biomes can be classified according to latitude (distance from the equator). There are three major types of forests:

- tropical
- temperate
- boreal forests (taiga)

Tropical forests Tropical forests are characterized by the greatest diversity of species. They occur near the equator, within the area bounded by latitudes 23.5 degrees N and 23.5 degrees S. One of the major characteristics of tropical forests is their distinct seasonality: winter is absent, and only two seasons are present (rainy and dry). The length of daylight is 12 hours and varies little.

Temperature is on average 20-25° C and varies little throughout the year: the average temperatures of the three warmest and three coldest months do not differ by more than 5 degrees.

Precipitation is evenly distributed throughout the year, with annual or yearly rainfall above 200 cm.

Temperate forests Temperate forests occur in eastern North America, northeastern Asia, and western and central Europe. Well-defined seasons with a distinct winter characterize this forest biome. Moderate climate and a growing season of 140-200 days during 4-6 frost-free months distinguish temperate forests.

Temperature varies from -30° C to 30° C.

Precipitation (75-150 cm) is distributed evenly throughout the year

Boreal forests Boreal forests, or taiga, represent the largest terrestrial (land) biome. Occurring between 50 and 60 degrees north latitudes, boreal forests can be found in the broad belt of Eurasia and North America: two-thirds in Siberia with the rest in Scandinavia, Alaska, and Canada. Seasons are divided into short, moist, and moderately warm summers and long, cold, and dry winters. The length of the growing season in boreal forests is 130 days.

Temperatures are very low.

Precipitation is primarily in the form of snow, 40-100 cm annually.

Current extensive logging in boreal forests may soon cause their disappearance.

THE GRASSLAND BIOME

Grasslands are characterized as lands dominated by grasses rather than large shrubs or trees. In the Miocene and Pliocene Epochs, which spanned a period of about 25 million years, mountains rose in western North America and created a continental climate favorable to grasslands. Ancient forests declined and grasslands became widespread. Following the Pleistocene Ice Ages, grasslands expanded in range as hotter and drier climates prevailed worldwide. There are two main divisions of grasslands: (1) tropical grasslands, called savannas, and (2) temperate grasslands.

Savanna

Savanna is grassland with scattered individual trees. Savannas cover almost half the surface of Africa and large areas of Australia, South America, and India. Climate is the most important factor in creating a savanna. Savannas are always found in warm or hot climates where the annual rainfall is from about 50.8 to 127 cm (20-50 inches) per year. It is crucial that the rainfall is concentrated in six or eight months of the year, followed by a long period of drought when fires can occur.

Different savannas support different grasses due to differences in rainfall and soil conditions. Savannas receive an average annual rainfall of 76.2-101.6 cm (30-40 inches). However, certain savannas can receive as little as 15.24 cm (6 inches) or as much as 25.4 cm (10 inches) of rain a year.

Savanna has both a dry and a rainy season. Seasonal fires play a vital role in the savanna's biodiversity. In October, a series of violent thunderstorms, followed by a strong drying wind, signals the beginning of the dry season. Fire is prevalent (common) around January, at the height of the dry season.

Some of the animals that live in the savanna include giraffes, zebras, buffaloes, kangaroos, mice, moles, gophers, ground squirrels, snakes, worms, termites, beetles, lions, leopards, hyenas, and elephants.

Temperate Grassland

Temperate grasslands are characterized as having grasses as the dominant vegetation. Trees and large shrubs are absent. Temperatures vary more from summer to winter, and the amount of rainfall is less in temperate grasslands than in savannas.

Precipitation in the temperate grasslands usually occurs in the late spring and early summer. The annual average is about 50.8 to 88.9 cm (20-35 inches). The temperature range is very large over the course of the year.

Some of the fauna (animals) of the temperate grasslands include gazelles, zebras, rhinoceroses, wild horses, lions, wolves, deer, mice, foxes, birds, snakes, and spiders.

Temperate grasslands can be further subdivided. **Prairies** are grasslands with tall grasses while **steppes** are grasslands with short grasses.

THE TUNDRA BIOME

Tundra is the coldest of all the biomes. Tundra comes from the Finnish word ***tunturia***, meaning treeless plain. It is noted for its frost-molded landscapes, extremely low temperatures, little precipitation, poor nutrients, and short growing seasons. Dead organic material functions as a nutrient pool. The two major nutrients are nitrogen and phosphorus. Nitrogen is created by biological fixation, and phosphorus is created by precipitation (rainfall).

Characteristics of Tundra

1. Low biotic (living) diversity
2. Extremely cold climate
3. Simple plant structure
4. Limited drainage
5. Short season of growth and reproduction
6. Energy and nutrients in the form of dead organic material
7. Large changes in population size

Tundra is separated into two types: arctic tundra and alpine tundra.

Arctic
Arctic tundra is located in the northern hemisphere, encircling the north pole and extending south to the coniferous (ex. Christmas tree) forests of the taiga. The arctic is known for its cold, desert-like conditions. The growing season ranges from 50 to 60 days. The average winter temperature is -34° C (-30° F), but the average summer temperature is 3-12° C (37-54° F) which enables this biome to sustain life. Rainfall may vary in different regions of the arctic. Yearly precipitation, including melting snow, is 15 to 25 cm (6 to 10 inches). Soil is formed slowly. A layer of permanently frozen subsoil called **permafrost** exists, consisting mostly of gravel. There are about 1,700 kinds of plants in the arctic and subarctic. They are all adapted to sweeping winds and disturbances of the soil Some of the plants of the tundra include:

- low shrubs, reindeer mosses, and grasses
- 400 varieties of flowers

The fauna (animals) in the arctic is also diverse:

- Herbivorous mammals: lemmings, voles, caribou, arctic hares and squirrels
- Carnivorous mammals: arctic foxes, wolves, and polar bears
- Migratory birds: ravens, snow buntings, falcons, loons, ravens, sandpipers, terns, snow birds, and various species of gulls
- Insects: mosquitoes, flies, moths, grasshoppers, blackflies and arctic bumble bees
- Fish: cod, flatfish, salmon, and trout

Alpine
Alpine tundra is located on mountains throughout the world at high altitude where trees cannot grow. The growing season is approximately 180 days. The nighttime temperature is usually below freezing. Unlike the arctic tundra, the soil in the alpine is well drained. The plants are very similar to those of the arctic ones and include grasses, dwarf trees, and small-leafed shrubs. The animals in the alpine tundra are also well adapted and include mammals (goats, sheep and elk), birds and many insects (beetles, grasshoppers and butterflies).

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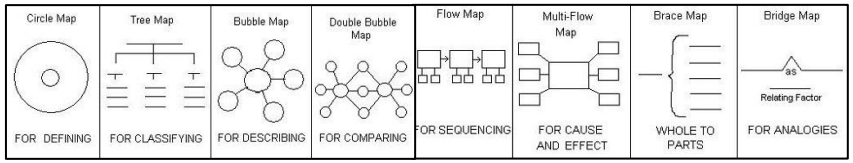
Biomes

Directions: Using what you learned reading your Biome article, select a thinking map that best organizes the information in your article. You may need to use more than one thinking map to represent all of the information. You also may find that the space below is too small. Feel free to use this as a brainstorming area. Then use a bigger piece of paper to draw your thinking map(s), complete with the frame of reference.



Last up: Create a frame of reference for your map by citing the source of your information, a 30 word description of your biome, and one fact about your biome that you find interesting.

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Five Major Biomes

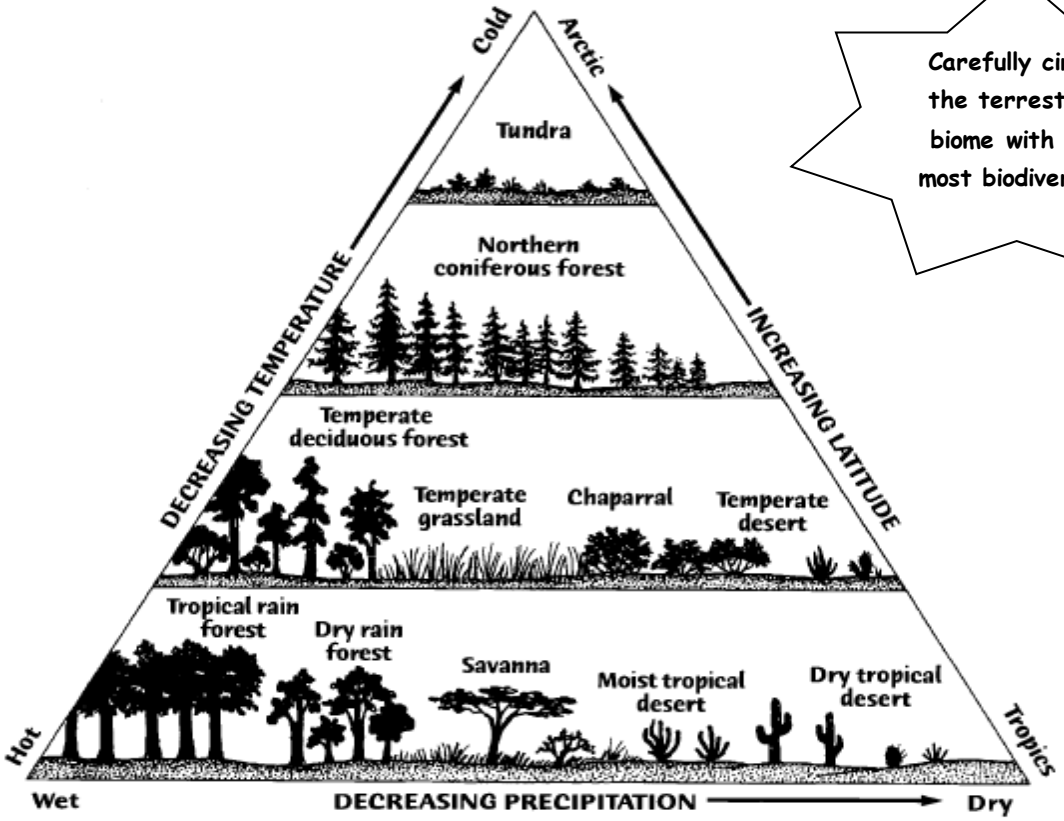
Jigsaw Matrix

	30 word description	Interesting Fact
The Aquatic Biome		
The Tundra Biome		
The Grassland Biome		

The Desert Biome		
The Forest Biome		
Use the space below to write a 2-3 sentence summary of the overarching main ideas of the information sheets:		

Where on EARTH is biodiversity found?

While almost every environment on Earth supports life, certain areas have more biodiversity than others. In general, the diversity of species tends to increase as you move from the North and South Pole towards the equator. The tropical regions, with their rain forests, coral reefs, and large tropical lakes, have an average of twice as many mammal species per square mile as temperate areas. And flowering plants are even more abundant in the tropics: A tropical forest in the Amazon basin, for example, might have over 80 species per acre, while the same amount of temperate forest in the United States would typically have less than 12. Amazingly, more than half the world's species live in tropical forests, which make up less than 7 percent of the planet's land area!



Carefully circle the terrestrial biome with the most biodiversity

Look at the pyramid of biodiversity along with the opening paragraph and describe three trends or patterns you observe. Use complete sentences. "I observe…" or "I notice that…"

- _____
- _____
- _____

Summarize your findings, describing where you would find the biome with the most biodiversity and how you knew this. Based on my observations…_____

_____

_____

_____

_____

Adapted from *Windows on the Wild*

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Parts of a Forest Ecosystem.
More than just trees!

Directions: Starting with the word Forest Ecosystem, create a thinking map to breakdown the parts of this ecosystem. Be sure to include how the forest connections to things outside the forest and to humans.
Use the following terms: **abiotic, biotic, natural resources, humans**

Forest Ecosystem

Describe the parts of an ecosystem and how it connects to humans. Explain relationships between biotic and abiotic factors. Choose a biome (such as desert, grassland, tundra, ocean, tropical rain forest) to focus on and provide examples of the parts of an ecosystem in that biome. Use and underline the terms **abiotic**, **biotic**, **natural resources**, **humans** in your answer.

_____
_____
_____
_____
_____

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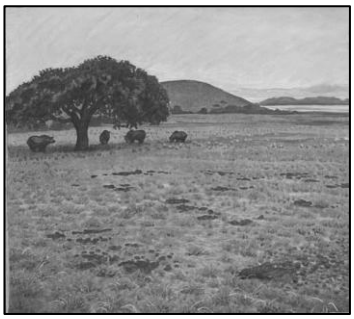
The Value of Biodiver$ity

Directions
1st Read: Read to understand. No pencil needed.
2nd Read: Use the * to mark key ideas
3rd Read: Use the ! or O to mark surprising ideas or things that you connect with.

Symbol/ Section	Comment/ Question/ Response
*	▪ Key ideas expressed ▪ Author's main points
!	▪ Surprising details/claims ▪ Emotional response
O	▪ Ideas/sections you connect with ▪ What this reminds you of

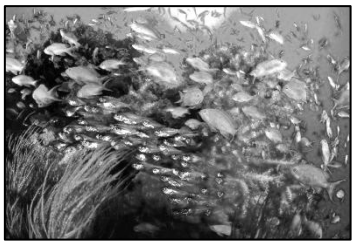
1. Biological diversity - or biodiversity - is the term given to the variety of life on Earth. The biodiversity we see today took billions of years of evolution to form, shaped by natural processes and more recently through the influence of humans. Biodiversity refers to the variety of plants, animals and microorganisms like bacteria. So far, about 1.75 million species have been identified, mostly small creatures such as insects. Scientists think that there are actually about 13 million species, though some scientist estimate there might be 100 million species on Earth!

2. Biodiversity also describes the different kinds of ecosystems and habitats that occur in deserts, forests, wetlands, mountains, lakes, rivers, and places where we grow crops of food. In each ecosystem, living creatures (biotic factors), including humans, form a community, interacting with one another and with the air, water, and soil (abiotic factors) around them. Biodiversity provides a large number of goods and services that sustain our lives, but biodiversity is rapidly decreasing due to human activity and the choices we make.



3. Habitat loss has been increasing in the last 30 years. Most of this is happening because we are bulldozing forests worldwide to plant crops of food. We do need food to survive, and growing food makes farmers money, but what is the cost of removing all of those trees? No, not the cost to actually knock down the trees, but the value of the jobs the forest was already doing, like cleaning the air and water, keeping the climate cool and regulating weather, and providing a home to thousands of organisms that could potentially help scientists discover a cure for cancer or asthma or diabetes? And guess what, all of those important crops of food we are planting? Well most of that food doesn't even go to humans; it goes to feed animals like cows and chickens and pigs!

4. Let's think locally. California didn't always look like it currently does. Temperate and Mediterranean forests (like those found right here in California) and temperate grasslands are among the fastest changing biomes in the world. Seventy-five percent of this natural habitat has already been converted into fields for growing crops. In the last 50 years, biodiversity in tropical and sub-tropical dry forests is also quickly being changed.



5. Travel south towards the equator and 20% of known coral reefs have been destroyed and another 20% seriously damaged in the last two decades. While coral reefs cover only 1.2 % of the world's shorelines, they are home to more than a million species, including more than a quarter of all ocean fish species! An estimated 30 million people

Sources Include: Ecological society of America, cdfa.ca.gov, World Health Organization, NYT.com "Putting a Value on Biodiversity", Millennium Assessment Reports, and Convention on Biological Diversity

make an income or survive off the food and resources found in a coral reef. If coral reef destruction continues, how will these 30 million people feed themselves and make enough money to support their families?

6. Nature's services have financial ($) value! Many of these services are performed seeming for "free," yet are worth many trillions of dollars. Consider the following:

   - About 78% of the top medicines used in the U.S. come from nature like plants, fungi, bacteria and vertebrates (like snakes and frogs). Plant-based drugs and medicines are worth $40 billion per year and save countless lives. How much is a life worth?

   - Companies in the US and Canada made $271 billion in 2012 in the fossil fuel industry of coal and oil found naturally in the ground. Better protecting our forests would prevent $3.7 trillion in damages created by greenhouse gases.

   - Over 100,000 different animals species—including bats, bees, flies, moths, beetles birds, and butterflies—provide free pollination services, making our food grow. One third of human food is a direct result of this free pollination.

   - Additionally, insects naturally control pests and reduce diseases (Over $11 billion was spent on pesticides in 2001 in the US alone).

   - Nature detoxifies and breaks down waste products (like feces), but we produce more than nature can handle and need to build machines to help keep waste from piling up on the streets or in the oceans. Orange County spent $480 million to build a water purification plant that nature used to do for free. We spend $29 million a year just to keep the water plant running.

   - Biodiversity or "ecotourism" is a tourist attraction that brings in over $300 billion dollars a year. How much would you pay to go to a beautify beach or see a lion in the wild?

7. Our personal health, and the health of our economy and human society, depends on the continuous supply of various ecological services that would be extremely costly or impossible to replace. These natural services offer us endless benefits and many cannot be replaced by humans or machines created by humans. Biodiversity even helps control the weather and climate. For example, biodiversity helps:

   - Stabilize and regulate Earth's climate (Think Global Warming, continual droughts, and 80°F in January in California!)

   - Reduce flooding, droughts (lack of rain), temperature extremes and the forces of wind (Southern California got less than 3 inches of rain in 2013).

8. Protecting biodiversity is not easy and will require big changes to how we live and use Earth's resources. Biodiversity supports everything from agriculture (food), cosmetics (makeup), pharmaceuticals (medicine), paper, construction (of buildings, cars, roads), and waste treatment. The loss of biodiversity threatens our food supplies, opportunities for outdoor fun and tourism, and sources of wood, medicines and energy.

Sources Include: Ecological society of America, cdfa.ca.gov, World Health Organization, NYT.com "Putting a Value on Biodiversity", Millennium Assessment Reports, and Convention on Biological Diversity

Collaborative Annotation Chart:

Directions: The 1st time you read your article, put your pencil down and just read to understand.

- The 2nd time you read, use the ***** symbol to mark key ideas.
- The 3rd time you read, use the **!** or **O** symbol to mark surprising ideas or things you connect with.

Next, select 4 annotated sections and write them below with a quick comment about why you picked that sentence, word, or idea.

Lastly, share with your partner. Be sure to identify the quote or passage you selected. Then, share your comment using a "Sample Language Support" to get your discussion flowing. Record your partner's response before moving on to the next passage you selected.

Symbol/ Section	Comment/ Question/ Response	Sample Language Support
*	▪ Key ideas expressed ▪ Author's main points	▪ One significant idea in this text is… ▪ The author is trying to convey…
!	▪ Surprising details/claims ▪ Emotional response	▪ I was surprised to read that… ▪ How can anyone claim that…
O	▪ Ideas/sections you connect with ▪ What this reminds you of	▪ This section reminded me of… ▪ This connects with my experience in that…

Symbol/ Section	Para-graph #	Your comment/reason for marking this passage	Your partner's comment/question/ response to what you said

Essential Questions about Biodiversity

- What is biodiversity and who/what does it affect?
- How does human activity influence the sustainability of an ecosystem and its natural resources?
- Describe physical or biological changes in an ecosystem that could alter the organisms that live in it.
- How are organisms and populations of organisms dependent on their interactions with other organisms and with nonliving factors?
- What is the economic value of biodiversity?
- Why is biodiversity loss a concern?

Summarize: Select one of the Essential Questions from today's lesson as your focus and write a 30-50 word summary of the article using key facts and ideas. Paraphrase essential information and leave out unnecessary details. Use your own words!

Threats to Biodiversity

Quick Write: Every hour, three species of plants, animals, and other living things vanish forever. Describe as many things that you can think of that are contributing to these organisms extinction.

_____

_____

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Easter Island Ecosystem Downfall

Quick Write: Explain in your own words what happened to the lush ecosystem on Easter Island: Use four words from the card sort in your explanation. (fertile, abundant, pristine paradise, multiplied, vanish, barren, wasteland, ceased, disappeared, extinct)

_____

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Easter's End Close Read
Shades of Meaning: words dealing with life

"Shades of Meaning" explores subtle differences between similar or related words & phrases.
1st Sort: Sort the words related to the comic Easter's End into two categories **"life"** to **"lack of life"**.
2nd Sort: Rank all of the words from **"most life"** to **"least life"**. Illustrate words #1 and #10.

Second Sort: Rank	Illustration
Word that most strongly represent Life Most life → 1. _____ 2. _____ 3. _____ 4. _____ Some life 5. _____ 6. _____ 7. _____ 8. _____ ↓ No life 9. _____ 10. _____ **Word that most strongly represents Lack of Life or Loss of Life**	**Word #1** **Word #10**

Justify (explain why) in writing how you determined the order of words on line #1 and #2. Be specific.

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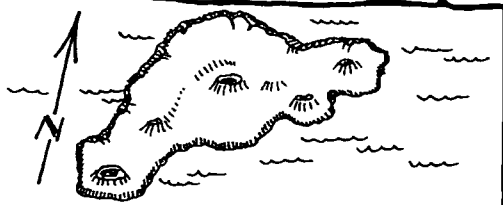
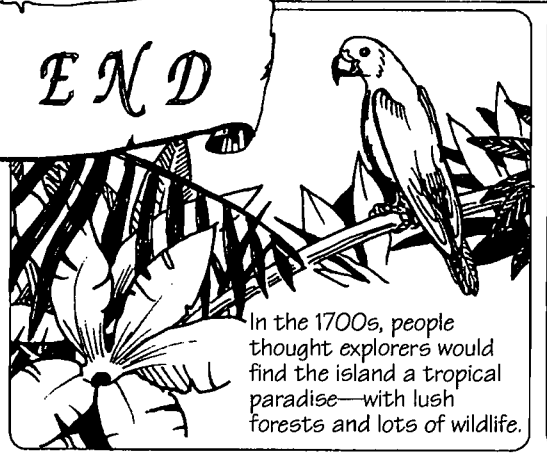
EASTER'S END

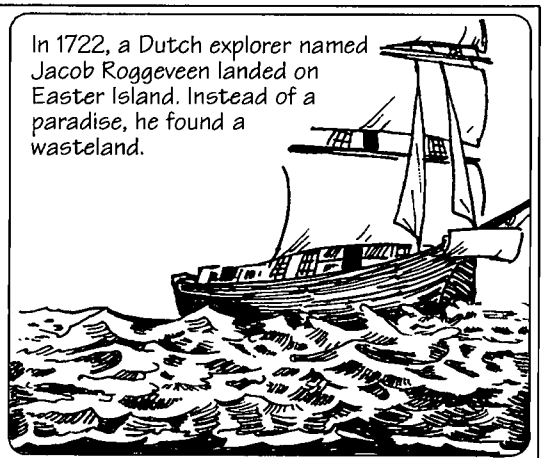


Easter Island lies far out in the Pacific Ocean. It has an area of about 64 square miles, almost three times the size of Manhattan.



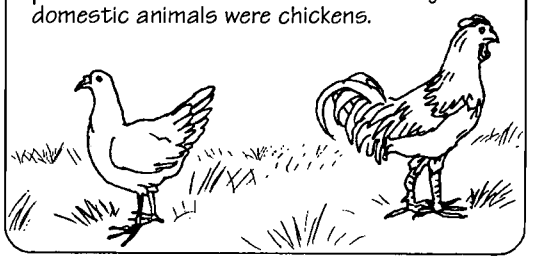
In the 1700s, people thought explorers would find the island a tropical paradise—with lush forests and lots of wildlife.

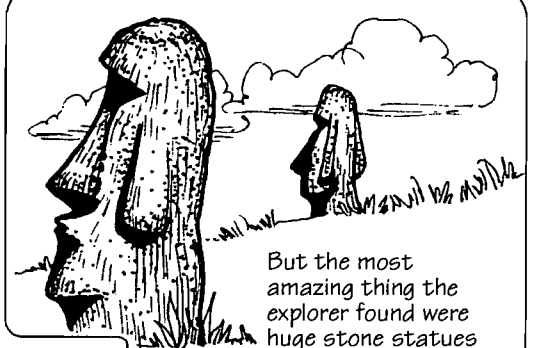
In 1722, a Dutch explorer named Jacob Roggeveen landed on Easter Island. Instead of a paradise, he found a wasteland.



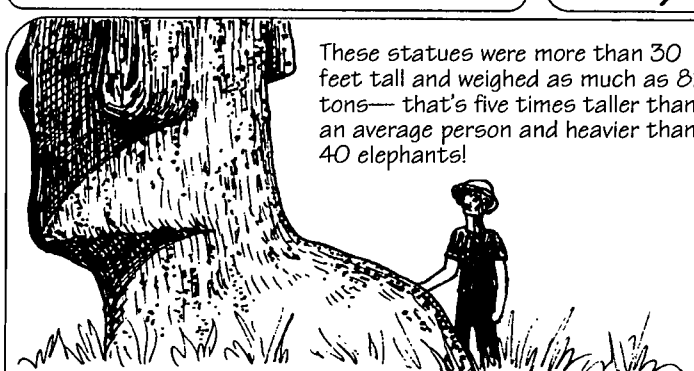
There were no tall trees. And the only native wildlife he saw were insects and other tiny creatures. There was not a single bat, snail, songbird, or lizard.

Instead of busy cities, he found only 2,000 people—not a big population for an island paradise. And he noticed that the only domestic animals were chickens.





But the most amazing thing the explorer found were huge stone statues lining the shore.



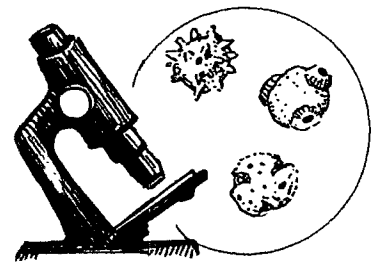
These statues were more than 30 feet tall and weighed as much as 82 tons— that's five times taller than an average person and heavier than 40 elephants!

How did these enormous statues get there with no machines or ropes or horses?

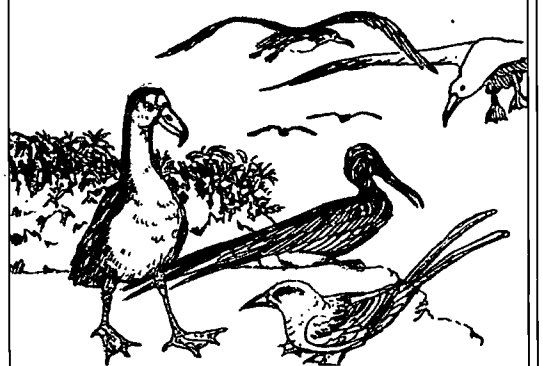
For more than 200 years, no one could solve the mystery.

EASTER'S END (Cont'd.)

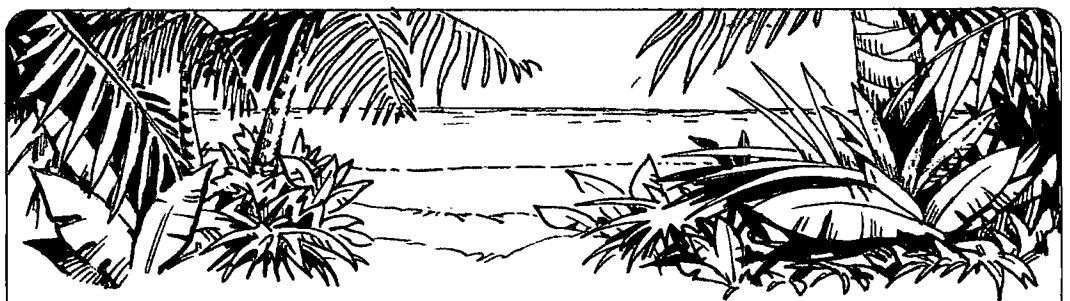
But now, scientists think they have some answers. By digging up old garbage heaps, they learned what kinds of animals the Islanders used to eat.



And by looking at ancient pollen grains buried at the bottom of lakes and swamps, they have learned what kinds of plants used to grow on the island.

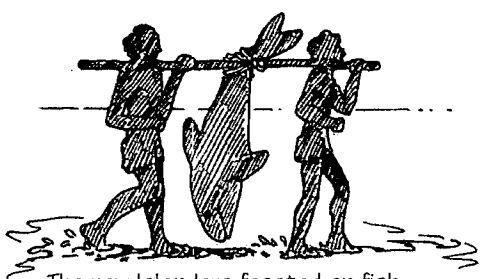


They found more than 20 types of seabirds nesting on the island, including albatross, boobies, frigate birds, storm petrels, terns, and tropical birds.



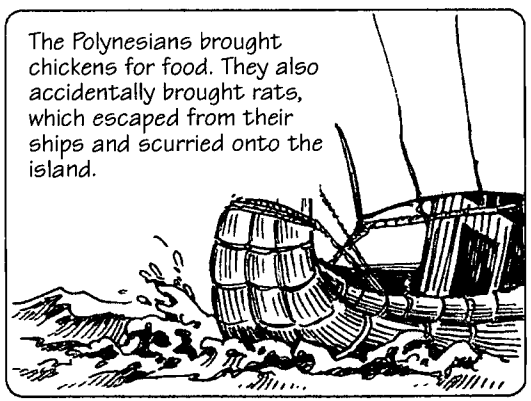
Here's what they think happened . . . The first people to live on the island came from Polynesia about 1,600 years ago. When they first stepped ashore, they found a lush tropical island. It was covered with forests of hauhau trees, toromiro trees, tree daisies, and giant palm trees called Easter Island palms.

They also found barn owls, herons, parrots, rails, and other types of land birds when they arrived on the island.



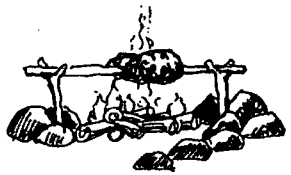
The new Islanders feasted on fish, porpoises, seals, and other animals.

The Polynesians brought chickens for food. They also accidentally brought rats, which escaped from their ships and scurried onto the island.

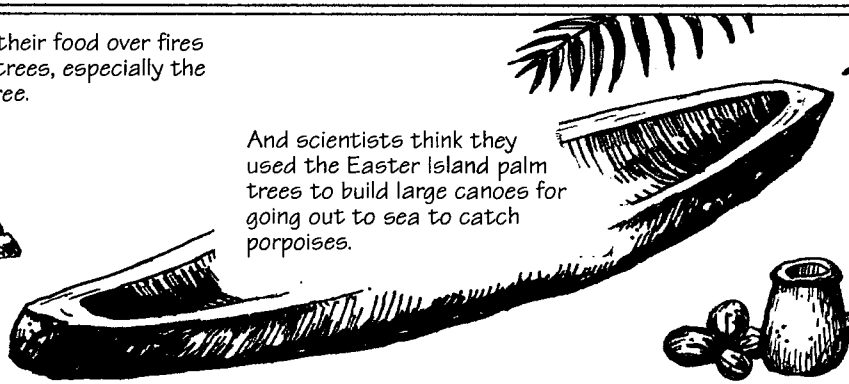


EASTER'S END (Cont'd.)

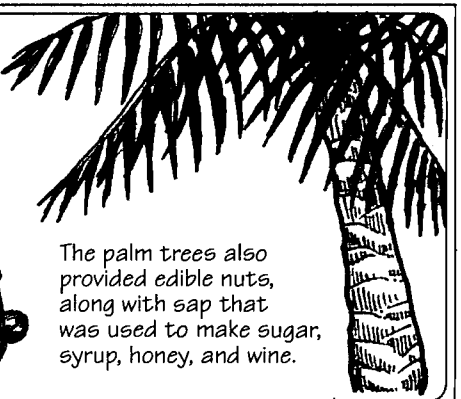
The Polynesians cooked their food over fires made from the island's trees, especially the slow-burning toromiro tree.



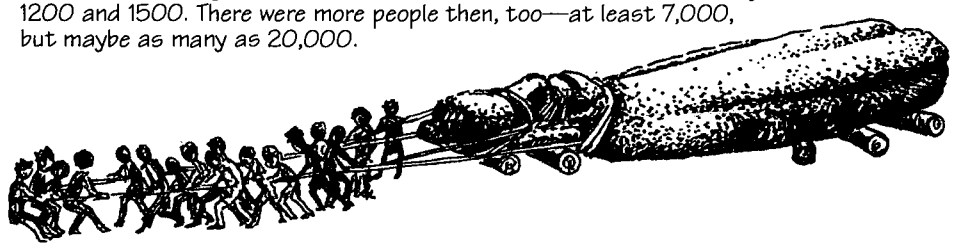
And scientists think they used the Easter Island palm trees to build large canoes for going out to sea to catch porpoises.



The palm trees also provided edible nuts, along with sap that was used to make sugar, syrup, honey, and wine.



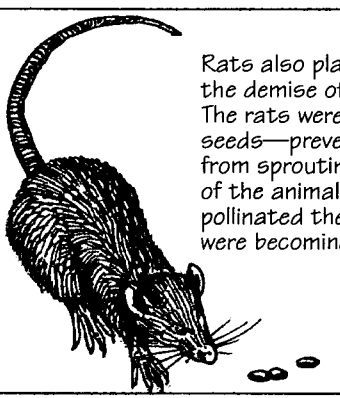
What about the statues? Using strong palm trees, the Easter Islanders could have built wooden tracks or rollers, then dragged the statues across the tracks on wooden sleds. Scientists also think the Islanders used the hauhau trees to make rope for pulling the statues. According to records, most statues were built between the years 1200 and 1500. There were more people then, too—at least 7,000, but maybe as many as 20,000.



- But what happened?
- Why did they stop building statues?
- Where did the people go?

By studying pollen grains, scientists think the Islanders destroyed most of the forests by the year 800. And by the 1400s, Easter Island palms were extinct.

The rest of the forest was disappearing quickly. After years of cutting forests to clear land for gardens and using trees to build canoes, transport statues, and fuel fires, by the end of the 1400s only a few trees were left.



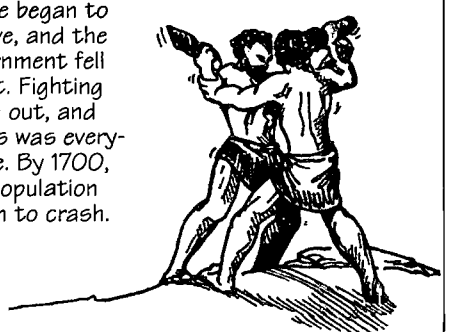
Rats also played a role in the demise of the forests. The rats were eating tree seeds—preventing them from sprouting. And some of the animals that pollinated the plants were becoming rare.

EASTER'S END (Cont'd.)

As the forests disappeared, so did other living things. Every species of native land bird became extinct. And more than half of the seabirds were wiped out, too.

People started running out of things to eat. There were fewer crops because without trees more erosion caused the soil to lose its richness. And people could no longer fish or hunt for porpoises because there were no trees left for making canoes.

People began to starve, and the government fell apart. Fighting broke out, and chaos was everywhere. By 1700, the population began to crash.



People started living in caves to protect themselves from their enemies. And during the fighting, rival clans knocked down each other's statues.

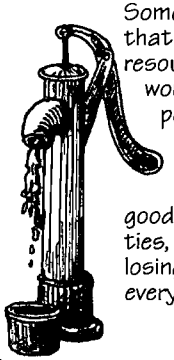
By 1864, the last statue had been knocked down and destroyed.

Why didn't the Easter Islanders realize what was happening before they destroyed the forest and their civilization?

Maybe they couldn't see that the forests and animals were disappearing until it was too late.

Or maybe the people didn't know how to change their lives and to better protect their environment.

Could something like this happen again?



Some people say it is happening . . . that people are overusing natural resources in many parts of the world and causing hardships for people and wildlife everywhere. They point out that even today millions of people don't have enough food, clean water, good soil, educational opportunities, or health care. And that we're losing species and habitats on every continent.

But many people say that what happened to the Easter Islanders won't happen to us—that although we have problems, we can learn from history and not repeat the mistakes of the past.

What do you think?

EASTER'S END

by Dr. Jared Diamond

Among the most riveting mysteries of human history are those of vanished civilizations. Everyone who has seen the abandoned buildings of the Khmer, the Maya, or the Anasazi is immediately moved to ask the same question: Why did the societies that erected those structures disappear?

Among all vanished civilizations, that of the former Polynesian society on Easter Island remains the most mysterious. The mystery stems especially from the island's gigantic stone statues and its impoverished landscape.

Easter Island, with an area of only 64 square miles, is the world's most isolated scrap of habitable land. It lies in the Pacific Ocean more than 2,000 miles west of the nearest continent (South America), and 1,400 miles from even the nearest habitable island (Pitcairn). Its subtropical location and latitude help give it a mild climate, while its volcanic origins make its soil fertile. In theory, this should have made Easter Island a miniature paradise, remote from the problems of the rest of the world.

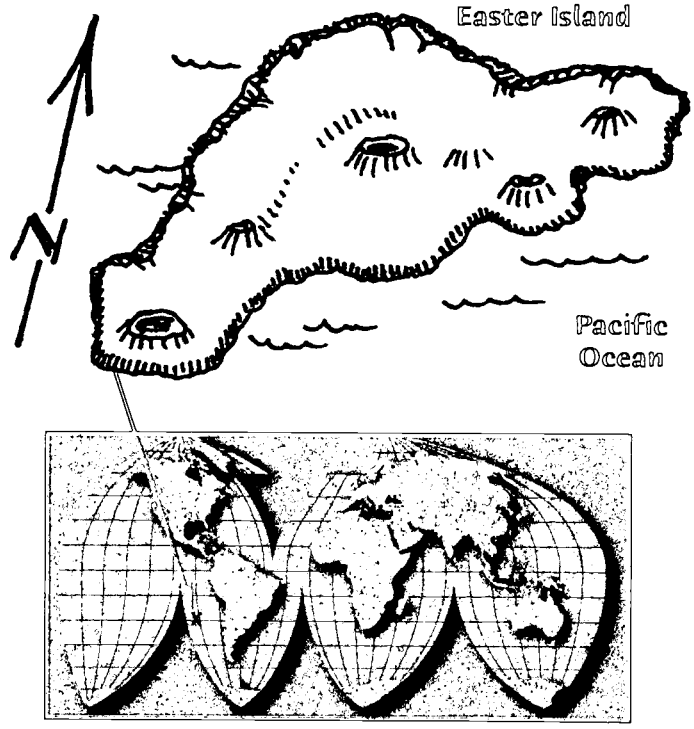
The island derives its name from its "discovery" by the Dutch explorer Jacob Roggeveen on Easter (April 5) in 1722. Roggeveen's first impression was not of a paradise but of a wasteland.

The island Roggeveen saw was a grassland without a single tree or bush over ten feet high. Modern botanists have identified only 47 species of plants native to Easter, most of them grasses, sedges, and ferns. The list includes just two species of small trees and two of woody shrubs. With such plant life, the Islanders Roggeveen encountered had no source of real firewood to warm themselves during Easter's cool, wet, windy winters. Their native animals included nothing larger than insects, not even a single species of native bat, land bird, land snail, or lizard. For domestic animals, they had only chickens.

European visitors throughout the eighteenth and early nineteenth centuries estimated Easter Island's human population at about 2,000. As Captain James Cook realized during his brief visit in 1774, the Islanders were Polynesians. Yet despite the Polynesians' well-deserved fame as a great seafaring people, the Easter Islanders who came out to Roggeveen's and Cook's ships did so by swimming or paddling canoes that Roggeveen described as "bad and frail." The canoes, only 10 feet long, held at most two people, and only three or four canoes were observed on the entire island.

With such flimsy boats, the Islanders could not travel far offshore to fish. The Islanders Roggeveen met were totally isolated, unaware that other people existed. Yet the people living on Easter claimed memories of visiting the uninhabited Sala y Gomez reef 260 miles away, far beyond the reach of the leaky canoes seen by Roggeveen. How did the Islander's ancestors reach that reef from Easter, or reach Easter from anywhere else?

Easter Island's most famous feature is its huge stone statues, more than 200 of which once stood



EASTER'S END (Cont'd.)

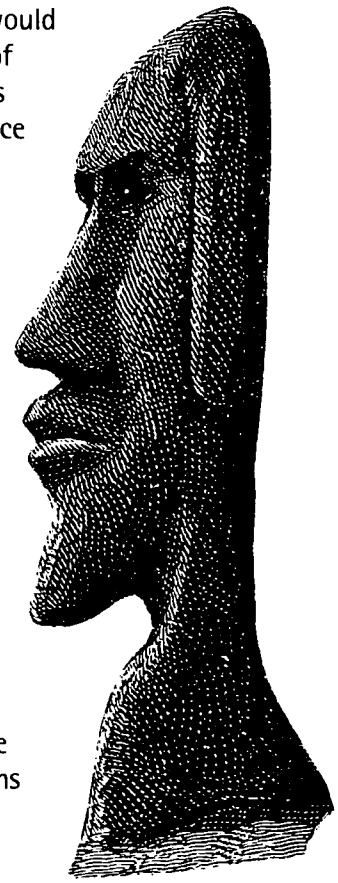
on massive stone platforms lining the coast. At least 700 more, in all stages of completion, were abandoned in quarries or on ancient roads between the quarries and the coast, as if the carvers and moving crews had thrown down their tools and walked off the job. Most of the erected statues were carved in a single quarry and then somehow transported as far as six miles—despite their being as tall as 33 feet and as heavy as 82 tons. The abandoned statues, meanwhile, were as much as 65 feet tall and weighed up to 270 tons. The stone platforms were equally gigantic: up to 500 feet long and 10 feet high, with facing slabs weighing up to 10 tons.

Roggeveen himself quickly recognized the problem the statues posed: "The stone images at first caused us to be struck with astonishment," he wrote, "because we could not comprehend how it was possible that these people, who are devoid of heavy thick timber for making any machines, as well as strong ropes, nevertheless were able to erect such images." Roggeveen might have added that the Islanders had no wheels, no draft animals, and no source of power except for their own muscles. How did they transport the giant statues for miles, even before erecting them? To deepen the mystery, the statues were still standing in 1770, but by 1864 all of them had been pulled down, by the Islanders themselves. Why then did they carve them in the first place? And why did they stop? The statues imply a society very different from the one Roggeveen saw in 1722. Their sheer number and size suggest a population much larger than 2,000 people. What became of everyone?

The fanciful theories of the past must give way to evidence gathered by hardworking scientists in three specialties: archaeology, pollen analysis, and paleontology.

Modern archaeological digs on Easter have continued since 1955. The earliest evidence of human activities are from around A.D. 400 to 700. The period of statue building peaked around 1200 to 1500, with few if any statues erected after that time. Densities of archaeological sites suggest a large population: An estimate of 7,000 people is widely quoted by archaeologists, but other estimates range up to 20,000, which does not seem impossible for an island of Easter's area and fertility.

Archaeologists have also enlisted surviving Islanders in experiments aimed at figuring out how the statues might have been carved and erected. Twenty people, using only stone chisels, could have carved even the largest completed statue within a year. Given enough timber and fiber for making ropes, teams of a few hundred people could have loaded the statues onto wooden sleds, dragged them over lubricated wooden tracks or rollers, and used logs as levers to maneuver them into a standing position. Rope could have been made from the fiber of a small native tree called the hauhau. However, that tree is now extremely scarce on Easter, and hauling one statue would have required hundreds of yards of rope. Did Easter's now barren landscape once support the necessary trees?

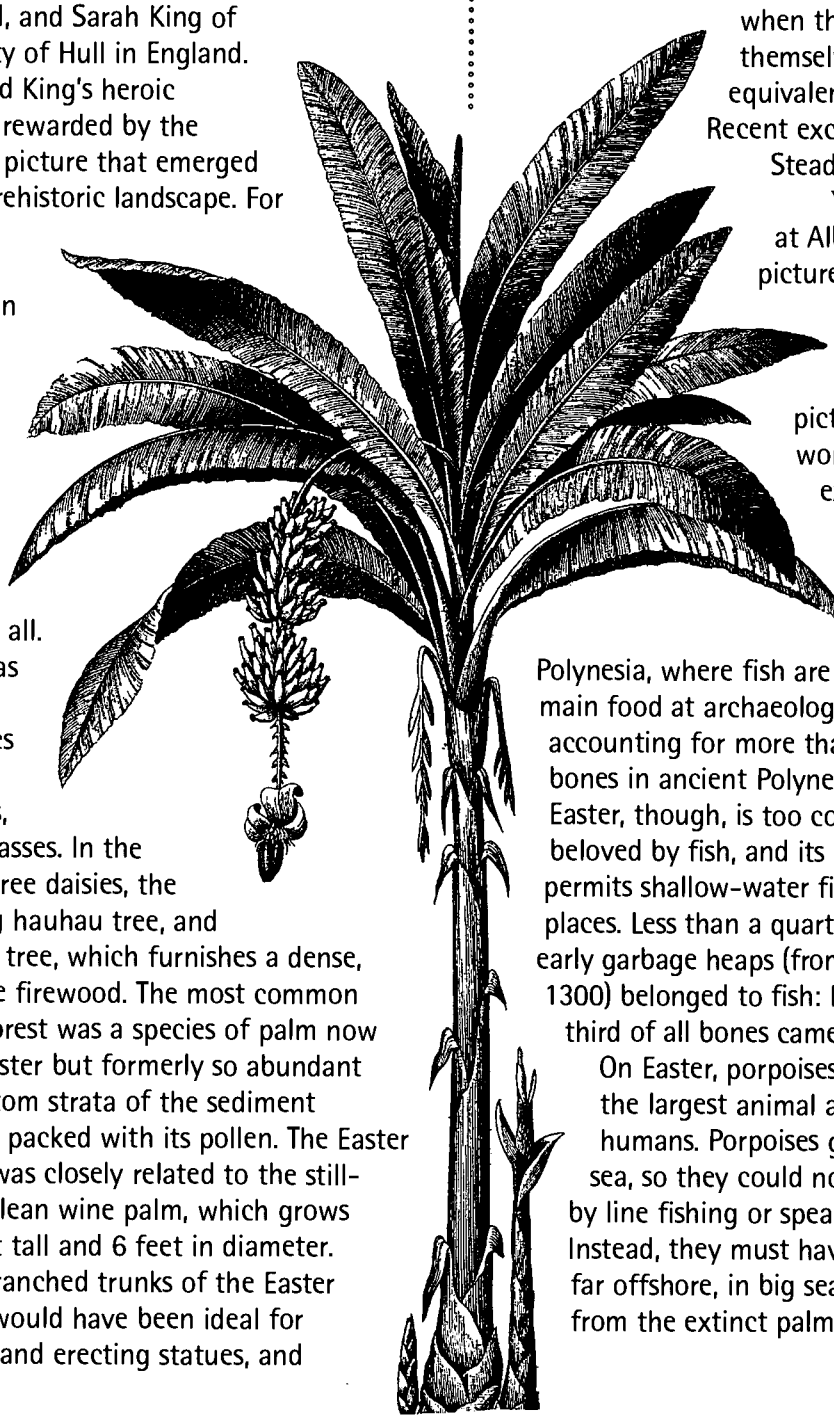


That question can be answered by the technique of pollen analysis, which involves boring out a column of sediment from a swamp or a pond, with the most recent deposits at the top and relatively more ancient deposits at the bottom. The absolute age of each layer can be dated by radiocarbon methods. Then begins the hard work: examining tens of thousands of pollen

EASTER'S END (Cont'd.)

grains under a microscope, counting them, and identifying the plant species that produced each one by comparing the grains with modern pollen from known plant species. For Easter Island, the bleary-eyed scientists who performed that task were John Flenley, now at Massey University in New Zealand, and Sarah King of the University of Hull in England.

Flenley and King's heroic efforts were rewarded by the striking new picture that emerged of Easter's prehistoric landscape. For at least 30,000 years before human arrival and during the early years of Polynesian settlement, Easter was not a wasteland at all. Instead, it was a subtropical forest of trees and woody shrubs, herbs, ferns, and grasses. In the forest grew tree daisies, the rope-yielding hauhau tree, and the toromiro tree, which furnishes a dense, mesquite-like firewood. The most common tree in the forest was a species of palm now absent on Easter but formerly so abundant that the bottom strata of the sediment column were packed with its pollen. The Easter Island palm was closely related to the still-surviving Chilean wine palm, which grows up to 82 feet tall and 6 feet in diameter. The tall, unbranched trunks of the Easter Island palm would have been ideal for transporting and erecting statues, and constructing large canoes. The palm would also have been a valuable food source, since its Chilean relative yields edible nuts as well as sap from which Chileans make sugar, syrup, honey, and wine.



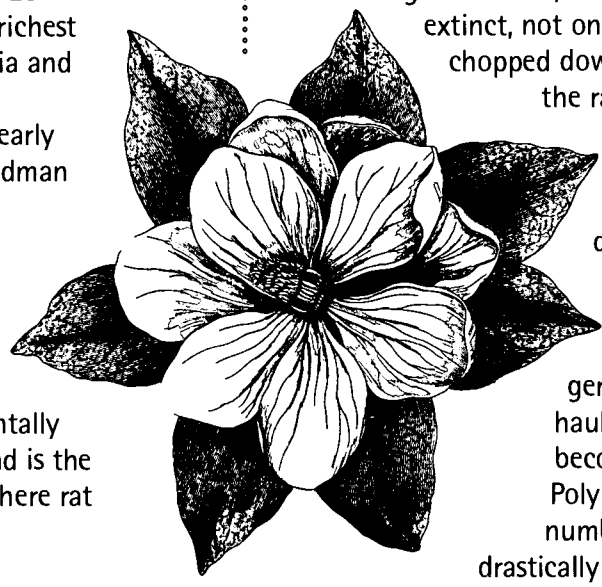
What did the first settlers of Easter Island eat when they were not glutting themselves on the local equivalent of maple syrup? Recent excavations by David Steadman, of the New York State Museum at Albany, have yielded a picture of Easter's original animal world as surprising as Flenley and King's picture of its plant world. Steadman's expectations for Easter were conditioned by his experiences elsewhere in Polynesia, where fish are overwhelmingly the main food at archaeological sites, typically accounting for more than 90 percent of the bones in ancient Polynesian garbage heaps. Easter, though, is too cool for the coral reefs beloved by fish, and its cliff-girded coastline permits shallow-water fishing in only a few places. Less than a quarter of the bones in its early garbage heaps (from the period 900 to 1300) belonged to fish: Instead, nearly one-third of all bones came from porpoises.

On Easter, porpoises would have been the largest animal available—other than humans. Porpoises generally live out at sea, so they could not have been hunted by line fishing or spear fishing from shore. Instead, they must have been harpooned far offshore, in big seaworthy canoes built from the extinct palm tree.

EASTER'S END (Cont'd.)

In addition to eating porpoise meat, Steadman found, the early Polynesian settlers were feasting on seabirds. For those birds, Easter's remoteness and lack of predators made it an ideal haven as a breeding site, at least until humans arrived. Among the large numbers of seabirds that bred on Easter were albatross, boobies, frigate birds, fulmars, petrels, prions, shearwaters, storm petrels, terns, and tropical birds. With at least 25 nesting species, Easter was the richest seabird breeding site in Polynesia and probably the whole Pacific.

Land birds as well went into early Easter Island cooking pots. Steadman identified bones of at least six species, including barn owls, herons, parrots, and rails. Bird stew would have been seasoned with meat from large numbers of rats, which the Polynesian colonists accidentally brought with them; Easter Island is the sole known Polynesian island where rat bones outnumber fish bones at archaeological sites.



Porpoises, seabirds, land birds, and rats did not complete the list of meat formerly available on Easter. A few bones hint at the possibility of breeding seal colonies as well. All these delicacies were cooked in ovens fired by wood from the island's forest.

Such evidence lets us imagine the island onto which Easter's first Polynesian colonists stepped ashore some 1,600 years ago, after a long canoe voyage from eastern Polynesia. They found themselves in a pristine paradise. What then happened to it? The pollen grains and the bones yield a grim answer.

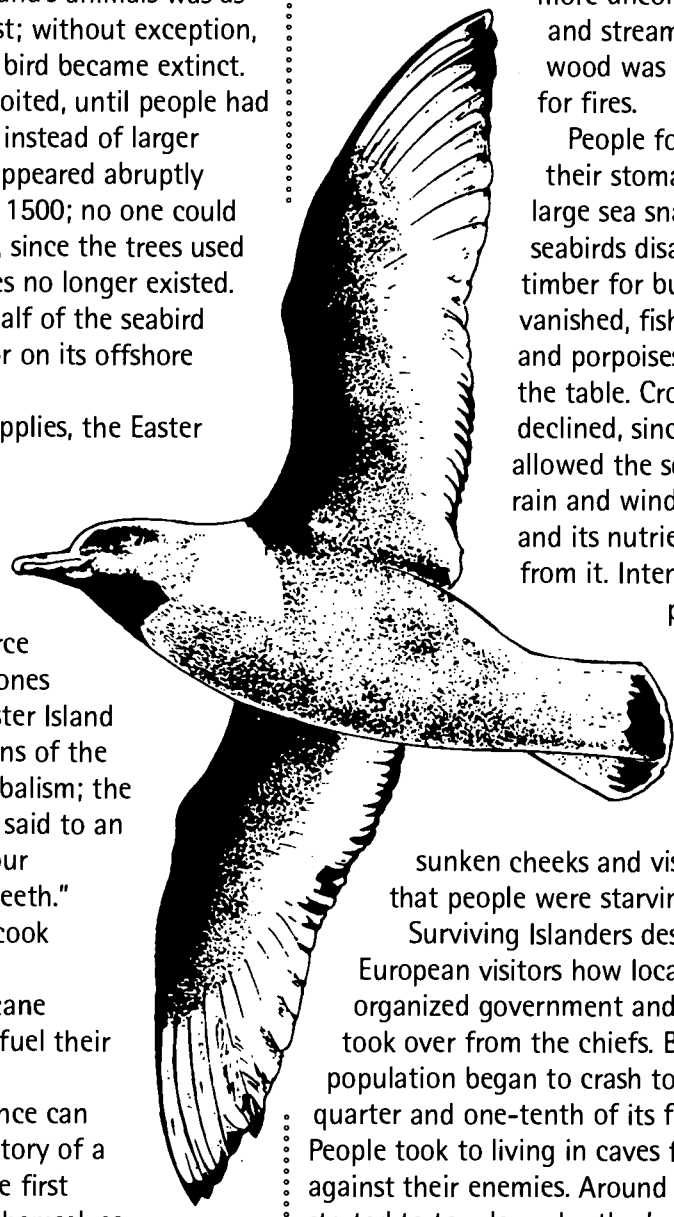
Pollen records show that destruction of Easter's forests was well underway by the year 800, just a few centuries after the start of human settlement. Then charcoal from wood fires came to fill the sediment cores, while pollen of palms and other trees and woody shrubs decreased or disappeared, and pollen of the grasses that replaced the forest became more abundant. Not long after 1400, the palm finally became extinct, not only as a result of being chopped down but also because the rats prevented its germination: Of the dozens of preserved palm nuts discovered in caves on Easter, all had been chewed by rats and could no longer germinate. While the hauhau tree did not become extinct in Polynesian times, its numbers declined drastically until there weren't enough left with which to make ropes. By 1955 only a single, nearly dead toromiro tree remained on the island, and even that lone survivor has now disappeared.

The 15th century marked the end not only for Easter's palm but for the forest itself. Its doom had been approaching as people cleared land to plant gardens; as they felled trees to build canoes, to transport and erect statues, and to burn; as rats devoured seeds; and probably as the native birds died out that had pollinated the tree's flowers and dispersed their fruit. The overall picture is among the most extreme examples of forest destruction anywhere in the world: the whole forest gone, and most of its tree species extinct.

EASTER'S END (Cont'd.)

The destruction of the island's animals was as extreme as that of the forest; without exception, every species of native land bird became extinct. Even shellfish were overexploited, until people had to settle for small sea snails instead of larger cowries. Porpoise bones disappeared abruptly from garbage heaps around 1500; no one could harpoon porpoises anymore, since the trees used for constructing large canoes no longer existed. The colonies of more than half of the seabird species breeding on Easter or on its offshore islets were wiped out.

In place of these meat supplies, the Easter Islanders intensified their production of chickens, which had been only an occasional food item. They also turned to the largest remaining meat source available: humans, whose bones became common in late Easter Island garbage heaps. Oral traditions of the Islanders are rife with cannibalism; the biggest insult that could be said to an enemy was: "The flesh of your mother sticks between my teeth." With no wood available to cook these new food sources, the Islanders resorted to sugar cane scraps, grass, and sedges to fuel their fires.



All these strands of evidence can be wound into a complete story of a society's decline and fall. The first Polynesian colonists found themselves on an island with fertile soil, abundant food, bountiful building materials, and all that they needed for comfortable living. They prospered and multiplied.

Eventually Easter's growing population was cutting the forest more rapidly than the forest was able to grow back. As the forest disappeared, the Islanders ran out of timber and rope to transport and erect their statues. Life became more uncomfortable—springs and streams dried up, and wood was no longer available for fires.

People found it harder to fill their stomachs as land birds, large sea snails, and many seabirds disappeared. Because timber for building canoes vanished, fish catches declined and porpoises disappeared from the table. Crop yield also declined, since deforestation allowed the soil to be eroded by rain and wind, dried by the sun, and its nutrients to be leached from it. Intensified chicken production and cannibalism replaced only parts of those lost foods. Preserved statuettes with sunken cheeks and visible ribs suggest that people were starving.

Surviving Islanders described to early European visitors how local chaos replaced organized government and a warrior class took over from the chiefs. By around 1700, the population began to crash toward between one-quarter and one-tenth of its former number. People took to living in caves for protection against their enemies. Around 1700 rival clans started to topple each other's statues, breaking their heads off. By 1864 the last statue had been thrown down and destroyed.

As we try to image the decline of Easter's civilization, we ask ourselves, "Why didn't they look around, realize what they were doing, and stop before it was too late? What were they thinking when they cut down the last palm tree?"

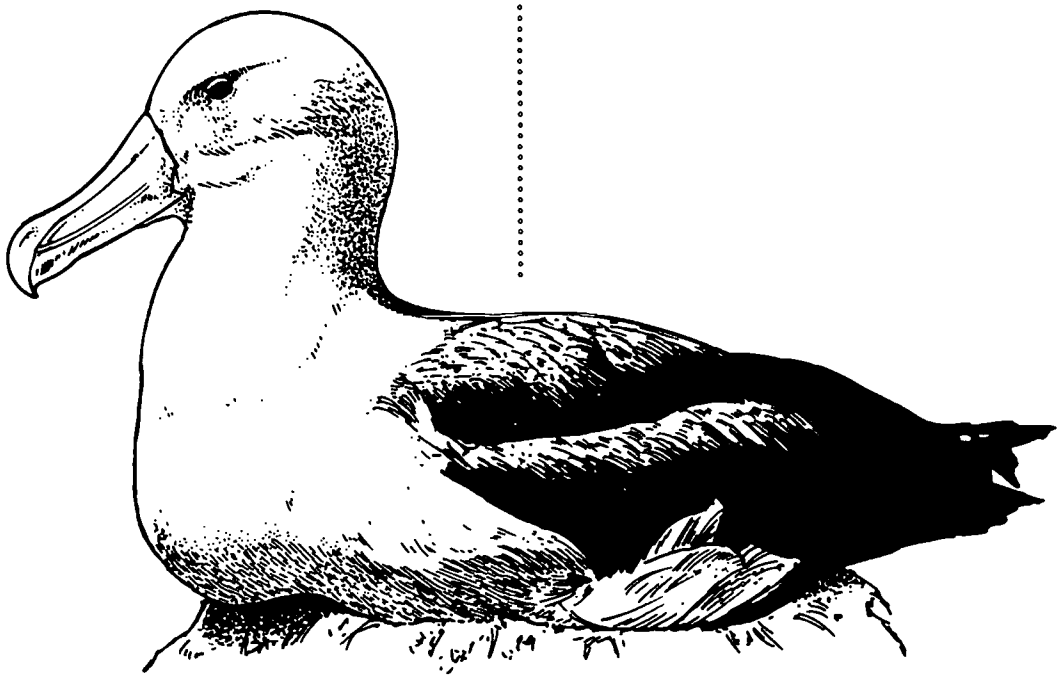
I suspect, though, that the disaster happened not with a bang but with a whimper. After all,

EASTER'S END (Cont'd.)

there are those hundreds of abandoned statues to consider. The forest the Islanders depended on for rollers and rope didn't simply disappear one day—it vanished slowly, over decades. Perhaps war interrupted the moving teams; perhaps by the time the carvers had finished their work, the last rope snapped. In the meantime, any Islander who tried to warn about the dangers of deforestation would have been overridden by carvers, bureaucrats, and chiefs, whose jobs depended on continued deforestation. The changes in forest cover from year to year would have been hard to detect: Yes, this year we cleared those woods over there, but trees started to grow back again on this abandoned garden site here. Only older people, recollecting their childhoods decades earlier, could have recognized a difference. Their children could no more have understood their parents' tales than my eight-year-old son today can understand my wife's and my tales of what Los Angeles was like 30 years ago.

Gradually trees became fewer, smaller, and less important. By the time the last fruit-bearing adult palm was cut, palms had long since ceased to be of importance. That left only smaller and smaller palm saplings to clear each year, along with other bushes and treelets. No one would have noticed the felling of the last small palm.

It would be easy to close our eyes or give up in despair. If mere thousands of Easter Islanders with only stone tools and their own muscle power managed to destroy their society, how can billions of people with metal tools and machine power do better? But there is one crucial difference. The Easter Islanders had no books and no histories of other doomed societies. Unlike the Easter Islanders, we have histories of the past—information can save us. My main hope for my son's generation is that we may now choose to learn from the fates of societies like that of Easter Island.



Easter Island Close Read

Text Dependent Questions Reread the comic to find determine the answer to these questions. Your answer must be in YOUR OWN WORDS or it is plagiarism.	Comic Box # used to support your answer
1. How did the Polynesians move the giant stone statues?	
2. Describe two different methods scientists used to figure out what Easter Island originally looked like.	
3. How did the disappearance of the trees affect the rest of the ecosystem on the island? Explain why these events were connected.	

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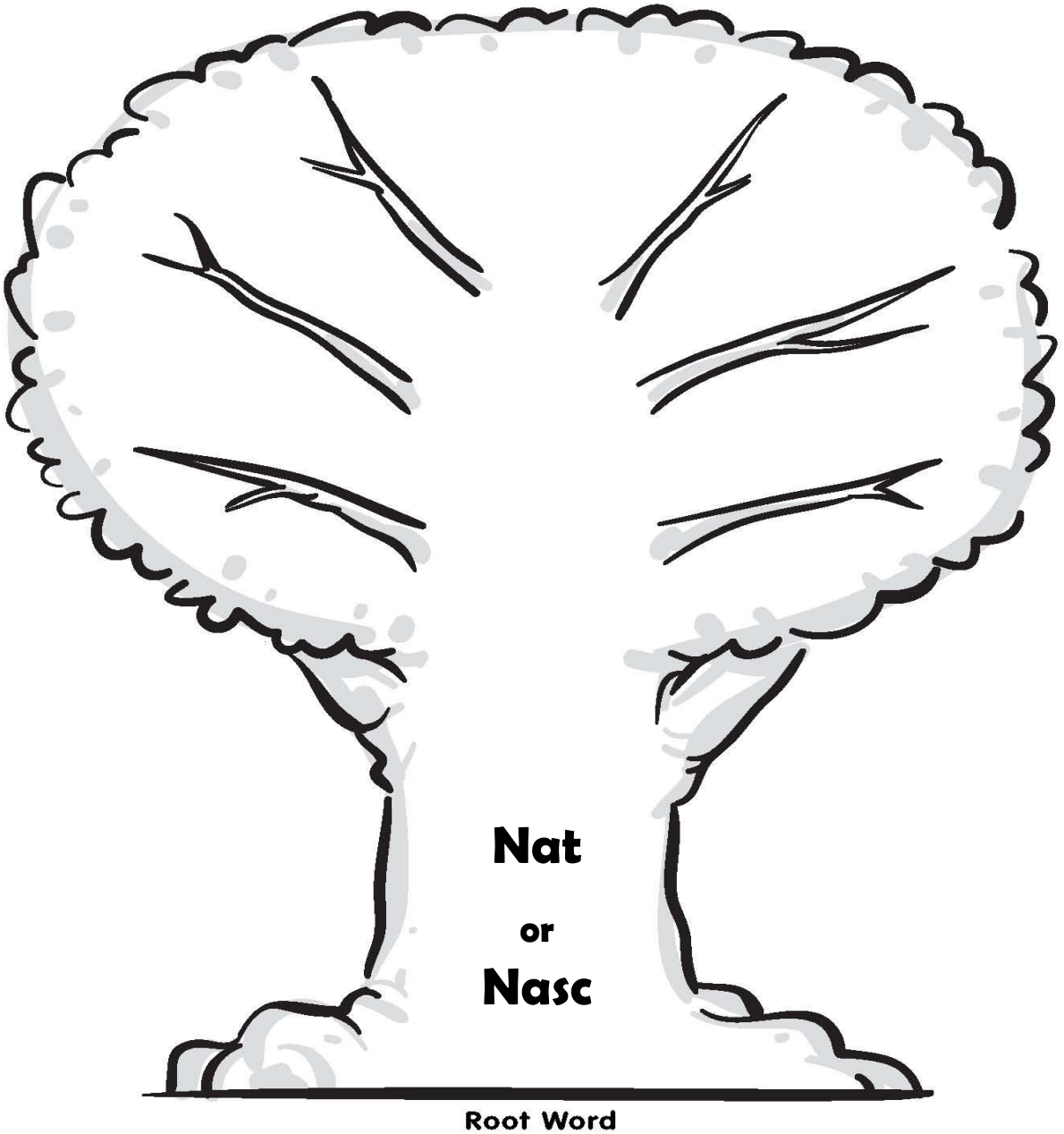
Name _____ **Date** _____

Root Word Tree

Write a root at the base of the tree. On the branches write six or more words that use that root.



Fill in the branches with words containing the root "nat" or "nasc" in English or Spanish. Roots can be found at the beginning of words, with prefixes before them or suffixes after them. Words with the root nat/nasc have to do with birth, start of life, and home. For example, "**nat**ive" means 'Belonging to something by birth." Add more branches if you can think of more words!

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Catch That Toad! Quick Write

1. Think up three ways non-native or invasive organism might get transplanted or moved from their original native home to a different spot in the world. Discuss ways that one plant/seeds and one animal besides the Cane Toad might get moved.

Animal:_____

_____

_____

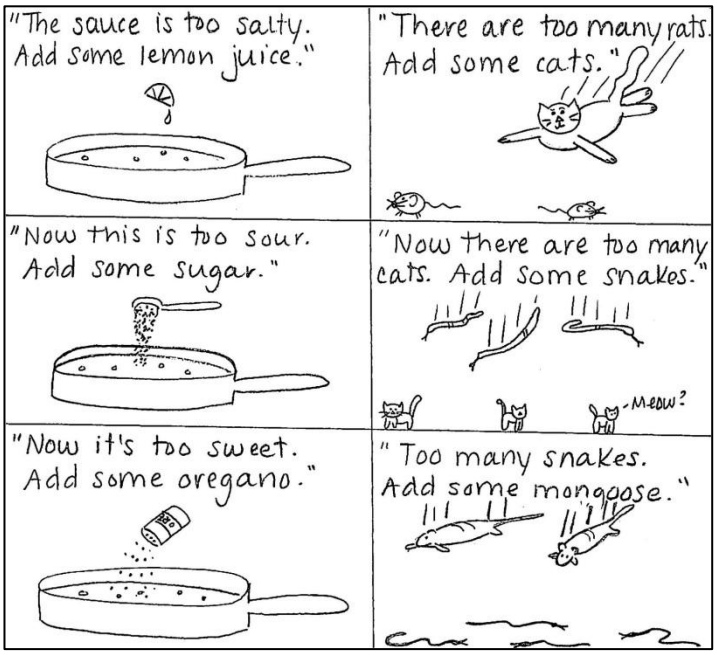
Plant/Seeds:_____

_____

_____

Part 2:

2. Look at the two comics to the right. How is the description of making a sauce similar to what happened in Australia with the Cane Toad?



_____

_____

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_____

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_____

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Non-Native Species 3 Step Interview

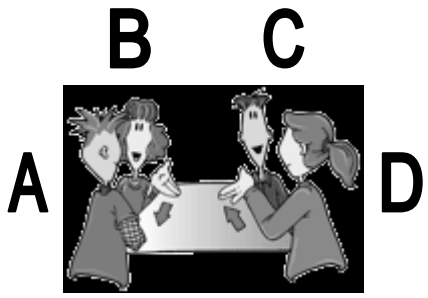
Circle one: I am Partner A B C D My name is:_____

Directions: Share your response to the quick write about how a non-native species might get transplanted from their native environment to a new location. Listen closely to your partner's response as you will need to share what they say with the rest of the team.

My partner is A B C D Their name is _____ My notes while listening to my partner that I will be sharing with others:	
My notes while listening to my 3rd partner	My notes while listening to my 4th partner

Three Step Interview:

How it Works



Step One: A interviews B by asking the quick write question

while

C interviews D

Step Two: B interviews A asking the quick write question

while

D interviews C

Step Three: 1. A reports to the whole group about B

2. B reports to the whole group about A

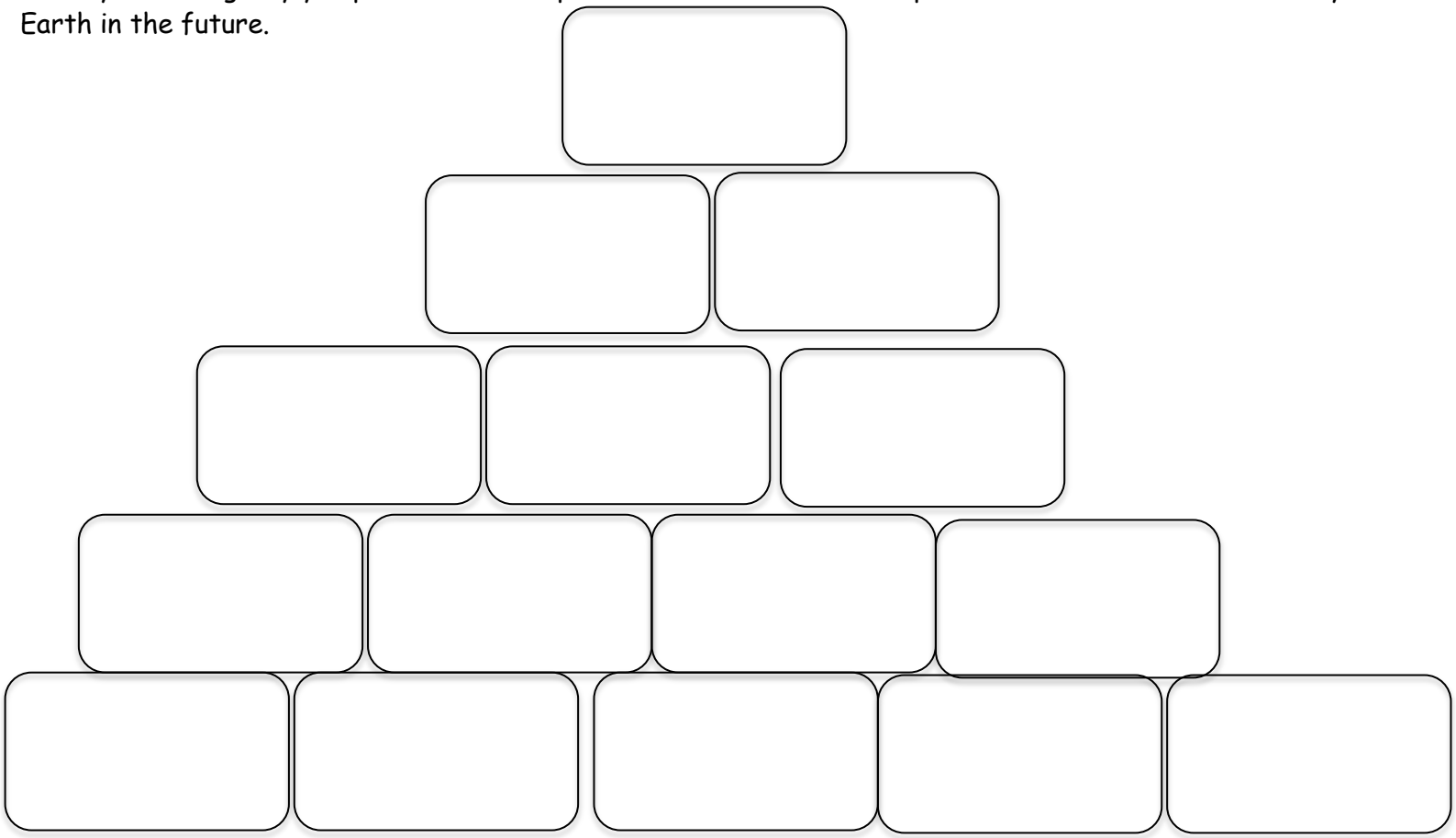
3. C reports to the whole group about D

4. D reports to the whole group about C

Priority Pyramid

How do you envision Earth and its biodiversity when you are 50 years old? What are the most important elements to make your plan a reality? Look at the priority pyramid blocks and consider how each plays a role in shaping the future.

1. Carefully consider the 15 blocks and rank them 1-15 with #1 being the MOST important to your vision and #15 being the least important.
2. Arrange them to make a pyramid with #1 at the top.
3. Justify in writing why you put #1 at the top and #15 at the bottom. Explain how it is essential or not to your vision of Earth in the future.



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Priority Pyramid

Justify your choices: "I placed _____ in spot #___ because..."

Block #1: _____

_____

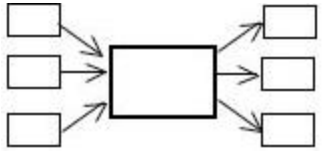
_____

Block #15: _____

_____

_____

Cause & Effect: Write all the positive changes you and your family can make RIGHT NOW to increase and protect biodiversity. Om the right side, write down all of the benefits of your actions. Your final thinking map will look like the image on the right but with many more ideas!



CAUSES/THINGS YOU CAN DO

Increase and/or Protection of Biodiversity

EFFECTS OF YOUR ACTIONS/BENEFITS

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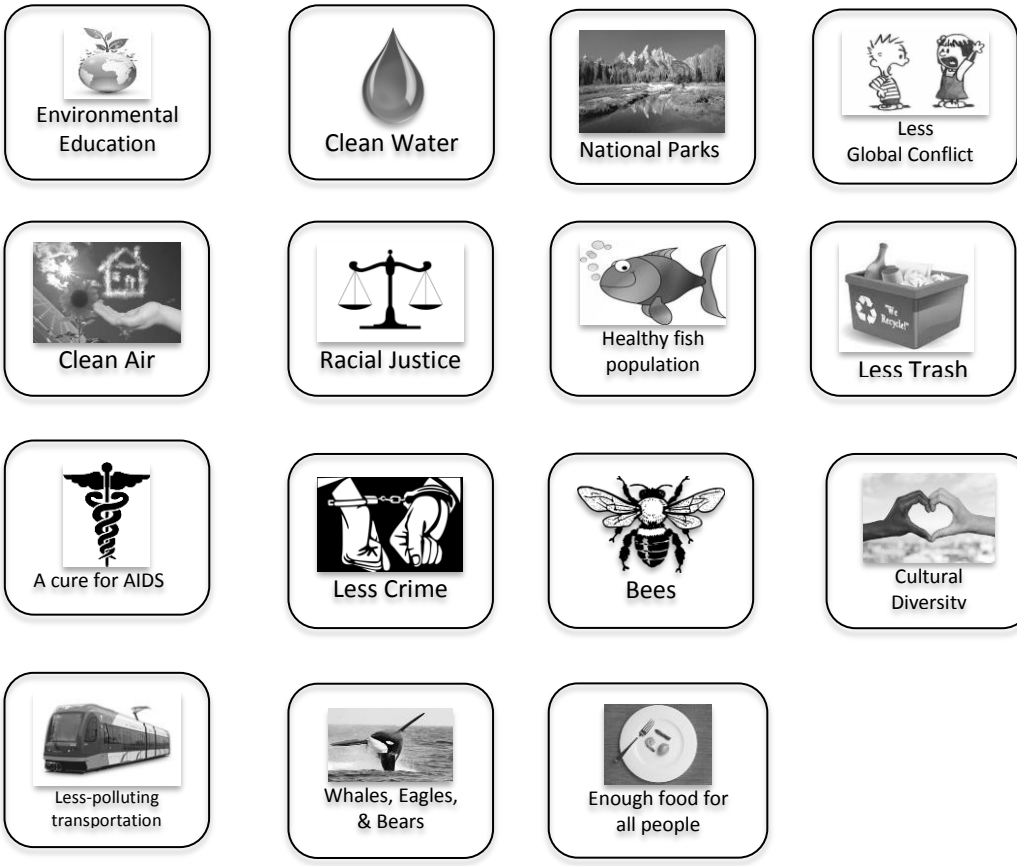
Priority Pyramid



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The Panther Problem

1. Have you ever heard of mountain lions? What about cougars? Pumas? Catamounts? Panthers? All of these names describe the same species of large cat that has the scientific name *Felis concolor*. Why does this big cat have so many different common names? The reason is that these predators are found all over North and South America, and people in different places have called these cats different names.

2. Across their vast range of native habitat, these cats live in a variety of biomes-from moist forests and cool mountains to steamy swamps. In some areas, small populations of these cats have become isolated from the general population. And over time, they have developed traits that are different enough from the general population to cause scientists to classify them as a subspecies.

3. Stalking the swamps and forests at the tip of Florida is one of these subspecies, the Florida panther, which has the scientific name *Felis concolor coryi*. Before European settlers came to North America, Florida panthers were found throughout the southeastern United States. These sleek, brown cats were once the top predator in the Florida ecosystem, feeding on deer and other large prey. In the late '80s, there were only 30 to 50 of them left in the wild. But their numbers are starting to In 2013, there numbers there are 160

http://www.youtube.com/watch?v=t-TiDWndD-4

http://www.youtube.com/watch?v=aOG6uTMgpas

What happened?

Quick Write: Describe three things/events that contributed to the significant decrease in the Florida panther population.

_____

_____

_____

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Printed with permission from *Windows on the Wild WWF*

The H.I.P.P.O. Dilemma

Environmental Threats	Examples of Threats	Possible Effects on Ecosystem
• **H = Habitat Loss** • Habitats (where plants and animals live) • Necessities for Life (food, water, sunlight, air and other essentials) • Species Adaptation (changing over time to survive in specific areas) 	• Deforestation (cutting down the trees in the forest for fuels and timber) • Wetland Conversion (wild areas converted for farming, city or water projects such as dams and irrigation) • Farming (food production, including cattle over-grazing)	• Habitat loss affects millions of species around the world, and is considered the greatest threat to survival of species. • Land Loss=species lost • Urban Growth (Human Development) • Soil Erosion
• **I = Invasive Species** • Plants or animals brought to places where they don't naturally occur. 	• Invasive Species arrive by: • ***Accidental*** (spread as human travel) • ***Intentional*** –on purpose (species • introduced to control pests)	• No natural predators to control population of invasive species • Invasive species spread diseases and parasites • Invasive species prey on native species
• **P = Pollution** • Human-caused change in the environment 	• Smog, air pollution and acid rain • Pesticides in soil or water • Oil spills • Overflowing landfills for trash • Toxins spread to oceans	• Health concerns • Water quality • Air quality
• **P =Population growth of Humans** • Total number of humans 	• Over 7 billion humans on Earth today • Expected population about 10 billion by 2050	• Not enough resources to support human necessities • Clear-cutting of forests to make way for homes and roads
• **= Over-consumption of natural resources** • Excessive use of natural resources 	• Loss of fossil fuels, forest, minerals • Loss of fresh water	• Unfair balance of resources used by developed countries • Events like the Dust Bowl occur due to over-farming and removal of topsoil

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H.I.P.P.O. "Threats to Biodiversity"

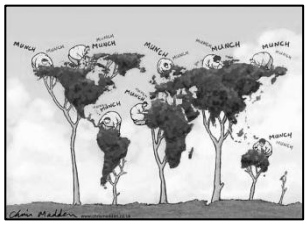
A = Habitat loss
B = Invasive species
C = Pollution
D = Population growth of humans
E = Over-consumption of natural resources

Directions: Use the H.I.P.P.O matrix to review each "threat to biodiversity" category and determine which category the following real-life scenarios belong to. Write the letter to match each threat.

1. _____ The demand for beachfront property near large cities is reducing wetlands and mangrove forests.
2. _____ Leopard skin coats were popular in the 1960s.
3. _____ When industries use water from rivers and bays, the water may go back into waterways at a higher temperature, killing organisms that can't tolerate warmer water.
4. _____ The multifora rose, an invasive species in the Unites States, destroyed many native plants in Midwestern fence rows.

5. _____ More people are moving from urban areas to the "country" where there is more "natural scenery."
6. _____ Demand for mahogany and teak woods destroys many acres of rain forests each year.
7. _____ More than 60 percent of the animal life on the Hawaiian Islands is not native.
8. _____ In the United States, the deer population in many states is larger now than in any other period of recorded history because natural predators have been destroyed by people who hunt or fear these larger predators.
9. _____The number of eagles, peregrine falcons, and ospreys dropped steeply in the late 1960s because of a pesticide called DDT that farmers sprayed on crops. DDT moved through the food chain as insects ate the pesticide covered plants and birds ate the insects. The DDT caused the birds to lay eggs with soft shells which cracked before the eggs could develop and hatch.

10. _____



11. _____

12. _____

13. _____

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H.I.P.P.O Video Notes

Use with "Invasive Species Spreading Across America"

Part 1: Directions: As you watch the video, write down examples of the H.I.P.P.O dilemma in the chart below. Be prepared to discuss the video and your responses afterwards.

Topic	Examples from the Video Clip
H Habitat Loss	
I Invasive Species	
P Pollution	
P Population growth of humans	
O Over-consumption of resources	

Part 2: Pick one of the questions below to discuss with your group: **Circle** the question you are responding to.

- Why are invasive species a problem?
- What challenges are faced by people who work to eliminate invasive species?
- How are people trying to control and remove invasive species?

Use the Sentence Starters start your discussion

GATE	Comment Frames	Question Frames
 Language of Discipline	The term _____ helped to explain _____. It was interesting when the scientist said, "____" because ___.	What does the term ____ mean? Why did the scientist say _____?
 Details	A detail that confused me was __. The part that was most interesting was ____.	Why did the scientists _____? What was important about ____?
 Patterns	I saw a repeating of _____. The scientist kept saying _____.	What did _____ have to do with __? How many times did we see ___?
 Trends	Each _____ has the same ___. As _____ increased, _____ decreased.	What affected the _____? What was the result of _____?

Response: _____

_____

_____

_____

_____

DISCUSSION RUBRIC	Excellent	Acceptable	Non-acceptable
Quality of Comments	Appropriate, thoughtful comments; responds to other student's remarks.	Mostly appropriate comments with clear thoughtfulness and reflection.	Does not participate and/or provides one-word or off topic answers.
Use of Sentence Starters	Consistently uses comment starters or question frames to begin discussion.	Frequently uses comment starters or question frames to begin discussion.	Does not use sentence starters. Provides one-word or off topic answers.
Active Listening	Sits up straight and demonstrates respect and attentiveness to others.	Listens to others most of the time, but gets distracted.	Sits passively or does not respond to group discussion.

Jigsaw Matrix – Invasive Species

	Burmese Python Article A	Fruit Fly Article B	Goldfish Article C	Kudzu Article D
Describe the organism.				
What is the problem?				
How have humans been part of the problem?				
Describe how the problem be reversed or slowed down.				
What is one interesting fact from your article?				

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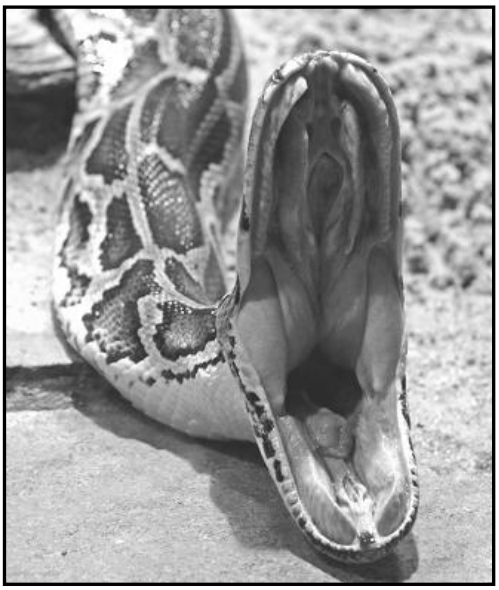
Pythons Eating Through Everglades Mammals at "Astonishing" Rate



1. From rabbits to deer to even bobcats, invasive Burmese pythons appear to be eating through the Everglades' supply of mammals, new research shows. Since the giant constrictors took hold in Florida in 2000, many previously common mammals have plummeted in number—and some, such as cottontail rabbits, may be totally gone from some areas.

2. More than a dozen years ago, Burmese pythons found their way into the wilds of Florida and started breeding. Once household pets imported from Southeast Asia, the mainland around Everglades National Park now contain tens of thousands of the snakes… which often feast on rare and endangered species. These snakes, which can grow to lengths of 20 feet and weigh up to 200 pounds, have either escaped or been dumped into the wild.

3. Burmese Pythons have no local competition and thrive in Florida's tropical climate. The pythons' rapid and widespread invasion is helped by their ability to eat everything from mice to deer, a long lifespan (15-25 years), high reproductive output, and the ability to move long distances on land and water.

4. A 2012 study is "the first to show that pythons are having impacts on prey populations—and unfortunately those impacts appear to be pretty dramatic," said study leader Michael Dorcas, a herpetologist at Davidson College in North Carolina. "We started the study after we realized, Man, we're not seeing a lot of these animals around anymore," Dorcas said. But "when we did the calculations, we were pretty astonished."

Burmese Pythons Causing "Severe Declines"

5. For the study, Dorcas and colleagues conducted nighttime surveys of live and dead animals on roads between 2003 and 2011. Such numbers provide estimates of how many animals of a certain species are present in a given area. Before 2000 it was common to see mammals such as rabbits, red foxes, gray foxes, Virginia opossums, raccoons, and white-tailed deer on roadways after dark, the team says. But the survey revealed "severe declines" in mammal sightings. Raccoon observations dropped by 99.3 percent, opossum by 98.9 percent, and bobcat by 87.5 percent. The scientists saw no rabbits or foxes at all during their surveys!

6. Also worrisome is what could be happening to species that were already rare—and thus more difficult to research, Dorcas noted. For instance, it's unknown whether the snakes are putting the squeeze on the Florida panther, a subspecies of cougar deemed endangered by the U.S. Fish and Wildlife Service. But "it's not unreasonable to assume that a really large python could consume a Florida panther," he said—the snakes are known to eat leopards in Southeast Asia.

7. To reduce the spread of these snakes, the U.S. Department of the Interior announced a new law in 2012 banning importation and interstate transport of four species of invasive snakes, including the Burmese python. There's no single solution to this conservation challenge, but banning the importation and interstate transport of these invasive snakes is a critical step.

8. Additionally, some snakes are captured and a tracking device is placed on them. When researchers know where Burmese pythons are located, what types of habitats they use, and how they move, capture and removal efforts become more effective. When pythons are captured, they are euthanized by US Park Rangers. All python nests found in South Florida are also destroyed.

Article by Christine Dell'Amore, National Geographic News and *Burmese Pythons in South Florida: Scientific Support for Invasive Species Management*, Rebecca G. Harvey

Invasive Fruit Fly Raising Berry Growers' Concerns Across Region

1. A new invasive insect is raising concerns among fruit growers across the US.

2. The Spotted Wing Drosophila fruit fly was first discovered in California in 2008 and by the following year it had spread to Florida. In 2011, it was detected in New England. Agriculture officials across the region expect more reports of damage caused by the insect this year. Most at risk are late season soft fruits like raspberries and blueberries, along with blackberries, elderberries, grapes, peaches and cherries. University of Vermont Extension Vegetable and Berry Specialist Vern Grubinger warns the potential for damage on those crops is extremely high.

Spotted Wing Drosophila Photo Credit Bob Koch/Minnesota Dept of Agriculture

3. While most common fruit flies are attracted to over-ripe fruit, Cornell University Berry Extension Support Specialist Cathy Heidenreich explains that's not the case with this new species. And that's why the Spotted Wing Drosophila is a concern.

4. Some Oregon growers reported losing 20 percent of their berries and up to 80 percent of late-variety peaches. Within weeks, researchers determined the fly was present in 15 counties, from Jackson County in southern Oregon, up the Willamette Valley, east through Hood River and Wasco counties and as far as Umatilla County.

5. The fly is unusual because it attacks ripe and ripening fruit, while most fruit flies are attracted to rotting produce. Its name comes from the distinctive spot at the tip of males' wings.

6. Female flies, equipped with a saw-toothed ovipositor (for reproducing), cut into the fruit skin and lay eggs just below the surface. The pinprick damage goes undetected until the larvae hatch and begin feeding, and the fruit collapses in a gooey mess. Thin skinned cherries, blueberries and raspberries are among the fruit and berries susceptible to attack.

7. Crop damage is a serious economic issue. Oregon's blueberry crop alone was valued at $117 million in 2011 and $108 million in 2012. The cherry crop value was $77 million two years ago and $74 million last year.

8. Farmers have been able to kill the fly with pesticide sprays they use for other fruit flies, but each spraying adds to costs and reduces profit, according to Eric Mortenson of the Oregonian News. Early harvest of fruit can be important in reducing exposure of fruit to the pest. Early harvests and continuing to remove fruit as soon as it ripens can help prevent the spread.

9. The invasive fruit fly has no natural predators here. Native to Asia, including northern Japan, it has adapted to colder northern climates like the U.S. Northeast.

Invasive Fruit Fly Raising Berry Growers' Concerns Across Region by Pat Bradly, New York News

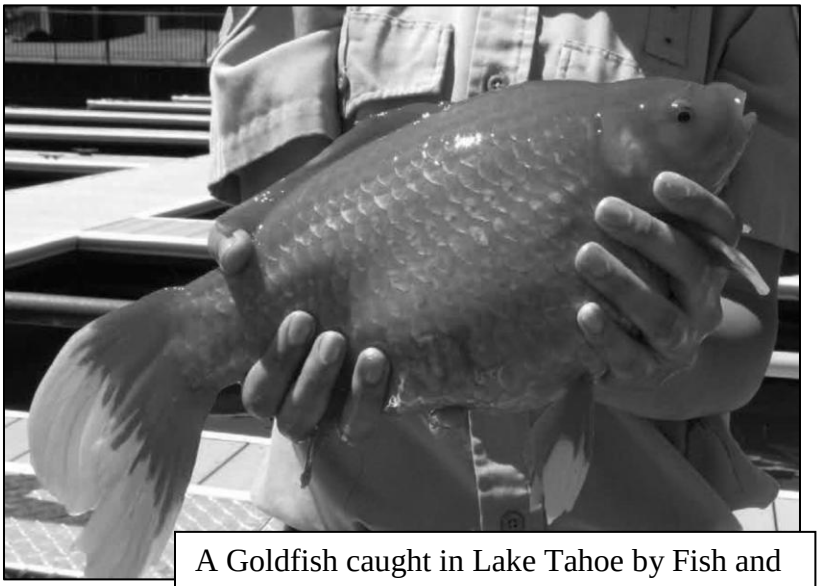
Do You Know This Is Invasive?
Goldfish—Carassius auratus

1. Goldfish are one of the most common aquarium pets. Sometimes owners find themselves unable to care for their goldfish and release them into local lakes, ponds, or streams, thinking the goldfish will be better off in the wild. What these well-intended pet owners don't realize is that when released, some of these goldfish become invasive by impacting local native fish and their habitats.

2. Aquarium goldfish are usually only a couple inches in length. However, in the wild, goldfish can grow over 16 inches and weigh over than 6 pounds. Wild goldfish can be bright orange in color, like the aquarium types, but may also be olive-green, silver, or bronze. They can be found in many habitats, including ponds, reservoirs, lakes, sloughs, and backwaters of streams and rivers. They can tolerate a wide range of environmental conditions such as high levels of turbidity (full of dirt), temperature fluctuations, low levels of dissolved oxygen, and brackish, or slightly salty, water.

3. When feeding, goldfish disturb bottom sediments, increasing turbidity and removing vegetation, which damages the habitat of native fish. Additionally, goldfish compete for food and space with naive fish species, including important sport fish populations. Goldfish originated from China, and have been selectively bred for bright colors for centuries. Goldfish became established in California in the 1860s.

4. Today, they can be found in numerous waterbodies throughout California, with large populations in southern California reservoirs and in canals, sloughs, and reservoirs of the Central Valley. Goldfish have also recently been discovered in Lake Tahoe.



A Goldfish caught in Lake Tahoe by Fish and Wildlife services.

5. The California Department of Fish and Wildlife and University of Nevada Reno, cooperation with other entries, remove goldfish and other non-native fish from Lake Tahoe as a part of the Lake Tahoe Warm Water Fish Control program. Additionally, entities throughout the state may conduct goldfish removal at other waterbodies.

6. Fish removal programs are costly and may take multiple efforts to be effective. The best way to manage invasive species such as goldfish is to prevent their introduction in the first place. Don't release your goldfish or other pets into the wild. For information regarding options other than release, visit the Habitattitude Program.

KUDZO and Invasive plant

1. An estimated 2 million acres of forest land in the southern United States is covered with kudzu. Kudzu was promoted as a forage crop (food for horses or cattle) and an ornamental plant (used for decoration) when it was introduced to the U.S. at the Philadelphia Centennial Exposition in 1876. Many southern farmers were encouraged to plant kudzu for erosion control from the mid 1930's to the mid 1950's. In 1953, kudzu was removed from the US Department of Agriculture's list of permissible cover plants due to its recognition as a pest species. Currently in Florida, kudzu has been documented in 14 counties and is listed as a Category I invasive species.

2. Kudzu is a climbing, semi-woody, perennial vine in the legume family that has the potential to reach up to 100 feet in length. Stems can reach the diameter of ½ to 4 inches, but there are reports of old 'stumps' nearly 12 inches across in Georgia. Alternately arranged leaves have three broad leaflets up to 4 inches across. Leaflets may be entire or deeply 2-3 lobed with hairy margins. Flowers are ½ inch long, purple, highly fragrant and borne in long hanging clusters. Flowering occurs in late summer, followed by the production of brown, hairy, flattened, seed pods that contain three to ten seeds.

3. The spread of kudzu in the U.S. is thought to be primarily runners and vines that root at the nodes. Kudzu may also spread by seeds. Kudzu has a massive tap root: 7 inches or more in diameter, 6 feet or more in length, weighing as much as 400 pounds! There can be as many as thirty vines growing from a single root crown.

4. Kudzu will grow over anything in its path (other plants, buildings, road signs) and eventually kills other plants it covers because it blocks out sunlight. Kudzu will also girdle (surround and squeeze) stems and tree trunks, break branches, and uproot trees and shrubs through the masses of vegetation produced. Kudzu has been reported to grow roughly one foot per day once established.

5. Total eradication of kudzu is necessary to prevent re-growth. Kudzu is a really tricky plant to get rid of. Unless you remove all of the Kudzu, a single plant will spread out and keep growing because it has no plant competition.

6. Young colonies can be eradicated (removed) in three to four years if plants are overgrazed or repeatedly cut back during the hottest temperatures of summer. Close grazing for three to four years can totally eliminate kudzu when at least 80% of the vegetative growth is continuously eaten by livestock.

***Identification and Biology of Nonnative Plants in Florida's Natural Areas* – Second Edition, K.A. Langeland, H.M. Cherry, et al. University of Florida-IFAS Pub SP 257. 2008.**

Why is Water So Important?

Did you know that you are mostly water? Two-thirds of your body is made up of water. You probably drink six to eight cups of water, milk, fruit juice, or soda each day. Animals and plants are almost all water too. So we don't just use water, we *are* water.

Three quarters of the earth is covered with water, and although most of it can't be used by people, plants or animals, water makes life on earth possible. You depend on water for drinking, cleaning, growing and processing food, growing cotton for cloth, swimming, fishing, boating, cooking, and putting out fires and generating electricity through hydropower dams. Try to think of one item or action that doesn't involve water in some way!

Water also connects us to the rest of the natural world. Plant and animals communities depend on water in many of the same ways; for food, water and shelter. Since every drop is used again and again, water is the ultimate in recycling itself. Water is naturally filtered through layers of dirt, gravel, and sand. When the water travels through the layers it is cleaned. When rainfall lands on natural areas like forests, desserts, and wetlands, the water soaks into the ground. When it soaks into the ground it is cleaned through the layers of the soil. However, in a city or town, much of the water lands on roofs or roads so it does not soak into the ground. From there the water flows into a gutter or drain and then into the local waterway. When it rains in the city, the rain water picks up pollutants from the ground such as

- Fertilizers and pesticides from crops
- Detergent from cleaning products
- Motor Oil from vehicles
- Pet waste not properly cleaned up

These pollutants then get washed into the nearby streams (or washes), where they pollute the watershed like lakes, rivers, and the ocean. It's important to protect this precious resource because we share it with all other living things, past, present and future.

Unfortunately, people have not always used water wisely. We've over used it to carry away our waste. We've put hazardous material in or on the ground where they seep into groundwater. We've often used more water than we need. Yet we can improve our water resource by conserving water at home, cleaning waste from industries and cities before it returns to rivers or lakes, and preventing pollutants from homes and farms from washing into waterways with the rain. Some communities have already begun to help!

One of the ways we can have a big effect on improving our water quality now and protecting it from future pollution is changing the small ways that people affect water. What you do in your community, or in your house, yard, road, park, business, school or farm can conserve water and improve its quality. You've already started to make a difference by learning about water!

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Ecosystem Services – Water Filtration Lab

Background:

Ecosystem services include water purification, nutrient recycling and prevention of soil erosion.

Soil is a mixture of mineral particles, air, water, microorganisms and other organic matter (material coming from living things). The materials that make up soil form layers. Hundreds of years may be required to form just a few inches of soil. Soil helps purify water by filtering out some of the suspended solids (floating "dirt" particles) as they flow through the different soil layers. The makeup of the soil determines how well it will act as a filter. Soil also helps to remove chemical contaminants such as fertilizers and pesticides. Many minerals in the soil can chemically bond with contaminants, which are then stored in the soil and prevented from flowing into nearby waterways. As a result of chemical reactions, the soil can also help "detoxify" certain chemicals, making them less harmful to living things.

Purpose:

In this lab you will purify water by removing contaminants from dirty water.

Question: How do the materials used in a filtration affect the quality of the water recovered?
Filtration materials may be:
Stratification: layered, multilayered, less layered
Composition: pure, single type or mixed, made of a variety of materials

Hypothesis: I believe materials that are __*(more layered/less layered)* *(pure or made of only one type/ composed of a variety of materials)*_ will be _*(more effective/less effective)* at producing higher quality water than other materials.

Materials:

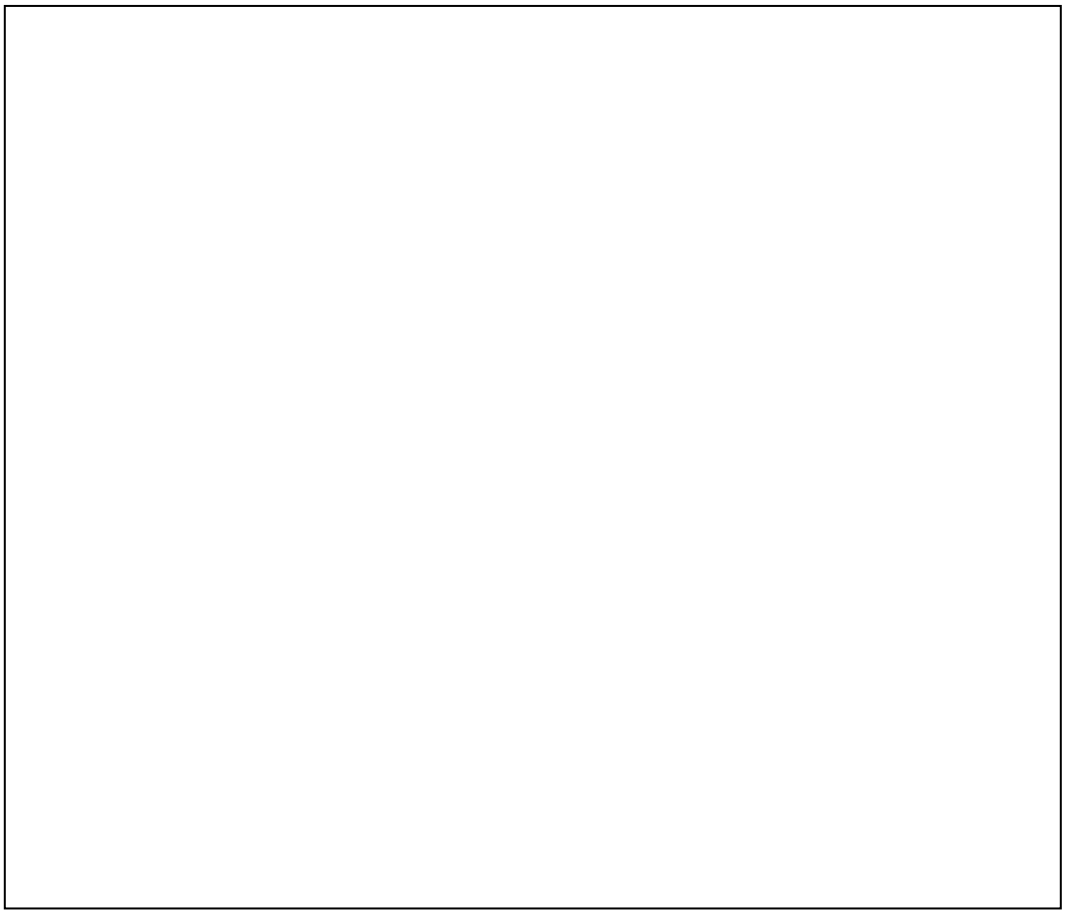
Clear funnel or clear plastic soda bottle with the bottom cut off and label removed
Clear plastic cup
Tall jar or flask
Cotton balls or toilet paper
Activated charcoal
Sand
Potting soil
Water

Procedure:

1. Pack the funnel approximately one-third full with cotton balls.
2. Place a layer of charcoal on top of the cotton balls. Then place a layer of sand on top of the charcoal.
3. Place the funnel into the jar or flask. The mouth of the jar should be small enough to keep the funnel off the bottom of the jar.
4. Mix one-fourth cup of potting soil with one-half cup of water in the plastic cup. Then slowly pour the water into the funnel.

Data:

Draw the set up for your water filtration lab below. Label the following parts: clear funnel or plastic soda bottle, dirty water, sand, activated charcoal, cotton or toilet paper, clear jar or flask, filtered water.



Analysis:

Describe the appearance of the water after filtering and any changes that you can see.

Look at the different layers in your funnel. Where did most of the large soil particles get trapped? Where did the fine particles get trapped?

What do you observe about the samples?

Conclusion: (Write a paragraph responding to the following)
How do you explain the results of the experiment?
Why do you think some materials are more effective filters than others?
How would you describe the "services" that soils provide?

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Humans extract billions of gallons of oil from the ground every year. As this oil is transported and harvested around the world, accidents occur and oil may spill onto land or into the ocean where it is far more difficult to clean up. Contamination of water is not only a problem for humans, but a problem for all the animals and organism that live in the aquatic biome.

Water Pollution- Oily Feathers: Oil Spill Quick Lab

Students should complete the following procedure:

1. Submerge a feather in a cup of water.
2. Pull the feather out of the water, and dry it with a paper towel.
3. Now, place a drop or two of oil into the cup of water.
4. Submerge the feather again.
5. Pull the feather out of the water, and try to dry it with the paper towel.
6. Record any noticeable observations: _____
7. How difficult was drying the feather with oil compared with drying the feather without oil? _____
8. Explain how you think oil in the ocean (one form of water pollution) affects wildlife that depends on the ocean.

_____

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From the Ecological Society of America (ESA)

Human civilization depends on healthy ecosystems.

Have you ever considered that the cereal you eat is brought to you each morning by the wind, or that the glass of clear, cold, clean water drawn from your faucet may have been purified for you by a wetland or perhaps the root system of an entire forest? Trees in your front yard work to trap dust, dirt, and harmful gases from the air you breathe. The bright fire of oak logs you light to keep warm on cold nights and the medicine you take to ease the pain of an ailment come to you from Nature's warehouse of services. Natural ecosystems perform fundamental life-support services upon which human civilization depends. Unless human activities are carefully planned and managed, valuable ecosystems will continue to be impaired or destroyed.

What are ecosystem services?

Ecosystem Services: processes by which the environment produces resources.

Ecosystem Services are the processes by which the environment produces resources that we often take for granted such as clean water, timber, and habitat for fisheries, and pollination of native and agricultural plants. Whether we find ourselves in the city or a rural area, the ecosystems in which humans live provide goods and services that are very familiar to us.

These services are extensive and diverse … affecting the quality of our land, water, food, and health.

Ecosystems provide "services" that:

- moderate weather extremes and their impacts
- disperse seeds
- mitigate, or lessen the effects of drought and floods
- protect people from the sun's harmful ultraviolet rays
- cycle and move nutrients
- protect stream and river channels and coastal shores from erosion
- detoxify and decompose wastes
- control agricultural pests
- maintain biodiversity
- generate and preserve soils and renew their fertility
- contribute to climate stability
- purify the air and water
- regulate disease carrying organisms
- pollinate crops and natural vegetation

What is an ecosystem?

Ecosystems are nature's support systems for life.

An ecosystem is a community of animals and plants interacting with one another and with their physical environment. Ecosystems include physical and chemical components, such as soils, water, and nutrients that support the organisms living within them. These organisms may range from large animals and plants to microscopic bacteria. Ecosystems include the interactions among all organisms in a given habitat. People are part of ecosystems. The health and wellbeing of human populations depends upon the services provided by ecosystems and their components — organisms, soil, water, and nutrients.

What are ecosystem services worth?

Nature's services have financial value.

Natural ecosystems and the plants and animals within them provide humans with services that would be very difficult to duplicate. While it is often impossible to place an accurate monetary amount on ecosystem services, we can calculate some of the financial values. Many of these services are performed seemingly for "free," yet are worth many trillions of dollars, for example:

About 78% of the top medicines used in the U.S. come from nature.

Much of the Mississippi River Valley's natural flood protection services were destroyed when adjacent wetlands were drained and channels altered. As a result, the 1993 floods resulted in property damages estimated at twelve billion dollars partially from the inability of the Valley to lessen the impacts of the high volumes of water.

80% of the world's population relies upon natural medicinal products. Of the top 150 prescription drugs used in the U.S., 118 originate from natural sources: 74% from plants, 18% from fungi, 5% from bacteria, and 3% from one vertebrate (snake species). Nine of the top 10 drugs originate from natural plant products.

Over 100,000 different animal species — including bats, bees, flies, moths, beetles, birds, and butterflies — provide free pollination services. One third of human food comes from plants pollinated by wild pollinators. The value of pollination services from wild pollinators in the U.S. alone is estimated at four to six billion dollars per year.

It would cost Orange County billions to duplicate nature's water filtration system.

New York City is a case in point. Before it became overwhelmed by agricultural and sewage runoff, the watershed of the Catskill Mountains provided New York City with water ranked among the best in the Nation by Consumer Reports. When the water fell below quality standards, the City investigated what it would cost to install an artificial filtration plant. The estimated price tag for this new facility was six to eight billion dollars, plus annual operating costs of 300 million dollars — a high price to pay for what once was free. New York City decided instead to invest a fraction of that cost ($660 million) in restoring the natural capital it had in the Catskills watershed. In 1997, the City raised an Environmental Bond Issue and is currently using the funds to purchase land and halt development in the watershed, to compensate property owners for development restrictions on their land, and to subsidize the improvement of septic systems. Orange County has faced similar obstacles and has met the challenges in the same manner by

preserving the natural supply of fresh water below Fountain Valley and Anaheim through the conversion of sewage water into clean drinking water. Factor in Southern California's near chronic drought, the county's projected growth (another 300,000 to 500,000 thirsty people by 2020) and the rising cost of importing water from the Colorado River and from Northern California, and rebranding sewage as a valuable resource became a no-brainer. (For more on this, read http://www.nytimes.com/2008/08/10/magazine/10wastewater-t.html?pagewanted=all)

How are ecosystem services "cut off"?

Overpopulation and over-consumption threaten ecosystems.

Ecosystem services are so fundamental to life that they are easy to take for granted and so large in scale that it is hard to imagine that human activities could destroy them. Nevertheless, ecosystem services are severely threatened through

- growth in the scale of human enterprise (population size, per-capita consumption, and effects of technologies to produce goods for consumption)
- a mismatch between short-term needs and long-term societal well-being

Many human activities disrupt, impair, or reengineer ecosystems every day including:

- runoff of pesticides, fertilizers, and animal wastes
- pollution of land, water, and air resources
- introduction of non-native species
- overharvesting of fisheries
- destruction of wetlands
- erosion of soils
- deforestation
- urban sprawl

Ecology and ecosystem services

Many questions remain unanswered about the workings of ecosystem services.

Ecologists work to help us understand the interconnection and interdependence of the many plant and animal communities within ecosystems. Although substantial understanding of many ecosystem services and the scientific principles underlying them already exists, there is still much to learn. The tradeoffs among different services within an ecosystem, the role of biodiversity in maintaining services, and the effects of long and short-term perturbations are just some of the questions that need to be further explored. The answers to such questions will provide information critical to the development of management strategies that will protect ecosystems and help maintain the provisions of the services upon which we depend.

Conclusion: The future depends on wise eco choices today.

Conclusion

The choices we make today in how we use land and water resources will have enormous consequences on the future sustainability of earth's ecosystems and the services they provide.

How much is Ecosystem Worth? Text-Dependent Questions

Article Content Questions

1. What is an ecosystem?

2. List three services provided by ecosystems.

3. Give some statistics on the value of services provided by ecosystems.

4. Name some threats to ecosystems.

5. Are ecosystems well understood by scientists? Explain.

Extension Questions

1. Select one ecosystem service and predict the likely effect if this service is lost.

2. How does a natural ecosystem control agricultural pests?

3. Why is climate stability important?

4. What makes humans different from the rest of the ecosystem?

5. How is it possible for pollination services to be so valuable? How would we replace this service if the pollinators were lost?

6. Construction companies are often required to create new wetlands or plant trees when they have destroyed natural habitats during a project. What is the reasoning behind this requirement?

Personal Viewpoint Questions

1. Whose responsibility should it be to preserve and protect ecosystem services? Who should pay for preservation?

2. Does it make a difference if we can replicate an ecosystem service artificially for the same or lesser cost?

Collaborative Annotation Chart

Directions: As you read the article, stop when you encounter an idea that is confusing or surprising, or when you find a key idea in the passage. Use the specific symbol to indicate why you picked this passage. When you finish reading and annotating, go back and select 6 marked passages and fill in the chart below. Write down your comment/question/or response to the passage to use in discussion.

Now share with your partner. First identify the quote or passage. Then, share your remark using a "Sample Language Support" to get your discussion flowing. Record your partner's response before moving on to the next passage.

Symbol/ Section	Comment/ Question/ Response	Sample Language Support
?	▪ Questions I have ▪ Wonderings I have ▪ Confusing parts for me	▪ The statement, "…" is confusing to me because… ▪ I am unclear about the following sentence(s) ▪ I don't understand what s/he means when s/he states…
*****	▪ Key ideas expressed ▪ Author's main points	▪ One significant idea in this text is… ▪ The author is trying to convey…
!	▪ Surprising details/claims ▪ Emotional response	▪ I was surprised to read that… ▪ How can anyone claim that…

Symbol/ Section	Page/ line #	Your Comment/ Question/ Response to marked passage	Partner's Comment/ Question/ Response

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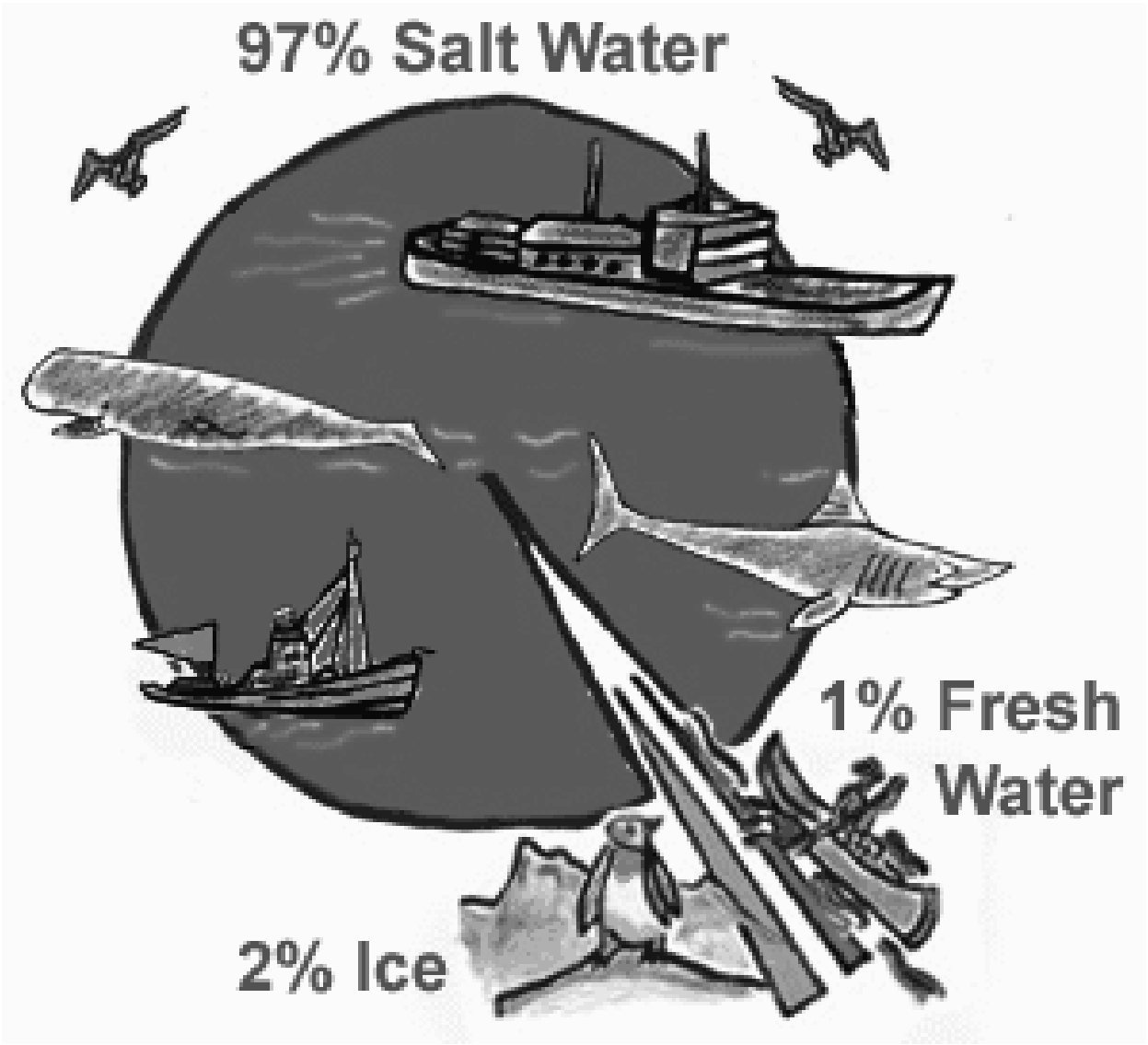
How Much of the Earth's Water Can We Use?



Personal Water Audit

Answer the following questions about your water usage today. If you do not know the exact numbers, please estimate as well as you can.

Pre-Question: Before completing the chart below, take a guess at how many gallons of water you use in 1 day_____. Compare your guess with totals below when you finish your water audit and calculations.

Question	Answer	Calculation. Try not to use a calculator!	Answer
1. How many times today have you flushed your toilet?		**Multiply this number by 3.** The average toilet uses 3 gal. of water per flush.	Gal
2. Did you take a shower or a bath?		**Write down 40 gal. if you took a bath. Write down 7 gal for every minute you were in the shower**. You may adjust your number if you did not fill the tub all the way or if you have a low flow showerhead.	Gal
3. How many times did your family run the dishwasher today?		**Account for about 10 gal. per load.**	Gal
4. How many loads of laundry did your family do today?		**Multiply this number by 40.** (If you have a front loading washer, multiply by 25 per load.)	Gal
5. How many minutes today did you run your sink faucet? Think about brushing teeth, washing hands and face, washing dishes, shaving etc.		**Factor 4 gallons per minute.**	Gal
6. Check the faucets in your house to see if any are leaky. Count the number of drops per minute.		**For every 10 drips in a minute, multiply by 1.4.** This should be done for each leaky faucet.	Gal
7. How many glasses of water did you drink today?		**Multiply each glass by 0.0625.** There are about 8 oz. in an average glass. 128 oz.= 1 gal. (or about 16 glasses of water).	Gal
8. Did you use a hose today? Think about watering a garden, washing a car, or bathing a pet.		**Factor 10 gallons per minute.**	Gal
Daily Total		**Add up the numbers in the right hand column.** This is how many gallons of water you used today domestically.	Gal

Figures for calculations estimated from "Conducting a Household Water Audit" Maryland Department of the Environment

This is your **personal daily domestic water usage**. Remember that this does not include the general water used to run your household, school, car, or other shared space. In addition, water is used to produce almost everything you buy, eat or drink. To find your **approximate total water footprint per yea**r, visit www.waterfootprint.org. Find "Your Footprint Calculator" on the left and choose the Extended Calculator. Fill this in and find your total. (Note: 1 kilogram = 2.20462262 pounds)

My total water footprint in cubic meters per year is_____.
Multiply this by 1000 to find your usage in liters:_____.
Divide this by 3.785411784 to find your **average yearly water usage** in gallons:_____.
Divide this number by 365 t find your **average daily total water usage** in gallons_____.
Compare this to your original guess at the top. Are you surprised? In addition to your **personal daily domestic water** usage total, how much water do you use each day without turning on a faucet?_____

Biodiversity Review Vocabulary Jigsaw Answer Sheet

- Work with your teammates to identify the correct vocabulary word.
- You can look back through the articles, labs, and notes you took during the unit.
- Remember to shift the cards one person to the right after figuring out each word.

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Bust the Myth: Biodiversity is Not Important!

Meet Fred and Jenny. They are in fourth grade at Madison Elementary School. They think that all the fuss about "taking care of the earth" and being conscious of water usage is silly. They think that the earth is here to be used and it really does not matter what we do, the earth will be just fine! You know this is NOT true and you want to teach them how living things exist in a balance with other living things and physical, abiotic factors. You also want them to know that biodiversity benefits us in many ways. You want Fred and Jenny to understand that it is in our best interest to understand and protect biodiversity.

Your task is to create an informational piece to dispel the myth that "biodiversity is not important!" It needs to be interesting, engaging, and factually accurate. Include diagrams and color. Get creative!

When everyone is done, you will share or perform your presentation so get ready.

Timeline: _____ class periods

Due Date: _____

1. Choose ____ essential question(s) below to answer in your informational piece.

Essential Questions:

- What is biodiversity and who/what does it affect?
- How does human activity influence the sustainability of an ecosystem and its natural resources?
- Describe physical or biological changes in an ecosystem that could alter the organisms that live in it.
- How are organisms dependent on their interactions with other organisms and with nonliving factors?
- What is the economic value of biodiversity?
- Why is biodiversity loss a concern?

2. Ideas:

- Write a skit (be prepared to act it out)
- Make a stop motion video with a phone or ipad (ask your teacher if this one is okay)
- Write a story or puppet show and present it
- Write a song and record it
- Make a poster or brochure
- Newscast presentation
- Write a talkshow interview
- Create a board game

3. An Excellent Project.

- Clearly and logically explains how the Earth is tilted and connects to seasons
- Uses pictures, diagrams or models to help clarify the concept
- Busts the misconception and makes sure it is clearly understood why distance to sun cannot explain the cause of the seasons
- Is colorful, neat, and well thought out
- _____
- _____
- _____

Team Members' Names: _____; _____
_____; _____

Brainstorm your ideas below:

What did you find interesting in the Biodiversity unit?

What Essential Questions did you choose to answer?

What materials in your student resource book will help you answer these questions?

How will you explain these things to Fred and Jenny?

Final Assessment Peer Presentation Notes

Directions: During the transitions between groups you will need to paraphrase each group's presentation. Your paraphrase must touch on the main ideas that the group presented and be written in complete sentences.

Title of Presentation: _____
Type of Presentation: _____
Paraphrase of main ideas:

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