Class 7 - Global Biodiversity
Class Outline

FOR PART ONE: INTRODUCTION (DINOSAURS) (5 MINUTES)

Objective: To introduce the concept of extinction in a way the kids will immediately understand. (Should be careful to point out that not all dinosaurs became extinct; modern birds are thought to be their relatives. Also, it was not just dinosaurs that were affected in the mass extinction; marine mammals were hardest hit.)

1. Who has ever seen a dinosaur? Where? What do we know about dinosaurs? Why hasn't anyone ever seen one alive?

2. The kids will probably know that dinosaurs are extinct. Need to provoke ideas about why.

a) Who knows what happened to the dinosaurs? Does anyone know? It was long time ago. . . .

b) They went **extinct**. What is **extinction**? (Roughly: dying out.)

3. So, what happened to the dinosaurs?

a. Scientists don't know for sure; the dinosaurs are generally believed to have begun to live on the earth around **225 million years ago** and to have disappeared about **64 million years ago.**

i. Even this is a guess; the rocks are so old that the methods scientists rely on to date fossils are not really useful when it comes to these rocks!

ii. (By the way, guess where most **fossil** evidence about dinosaurs is found? In North America! This is because fossils are only found in certain types of rock and can only form under certain conditions. The conditions in Montana's Hell Creek happens to be a perfect spot!)

b. Many different types of scientists study the question, including astronomers, astrophysicists, geologists, paleontologists, ecologists, etc.

c. No one knows for sure, and a number of **theories** have come and gone, but scientists have developed a number of theories to explain what happened.

i. Most scientists believe it was the result of permanent **climate change**, but scientists disagree about whether that happened gradually (such as increased volcanic activity on Earth), or whether it was the result of a violent event that resulted from outside Earth! (think asteroid or meteor).

ii. Remind them of current debate about **climate change** due to greenhouse gases, which they will have probably learned about in an earlier class.

d. This was a **mass extinction**, in which more than 50% of all known species living at that time went extinct in a short period of time (less than 2 million years).

i. Not just dinosaurs were wiped out. Hardest hit were animals living in the ocean–**marine animals**. **Mammals** and **non-dinosauran reptiles** do not appear to have been affected.

ii. This was only one of many! There have been several throughout history, some even more significant than the dinosaur extinction! Some scientists think we are on the verge of another, very large mass extinction.

e. Natural Extinction–Played at least some role in the disappearance of the dinosaurs

i. How does natural extinction occur?

ii. Species naturally change through generations into new versions of themselves that are better **adapted** to their environment. Older species eventually die off as the better adapted species continue to spread and reproduce.

4. But isn't this all just ancient history???? NO.

a. Note: Kids should be told, by the way, that birds are believed to be descendants of dinosaurs. When we talk about extinct dinosaurs, then, we are talking of **non-avian dinonosaurs.**

5. [Slide show will progress to images of threatened/endangered species]. What do these animals have in common with each other? With the dinosaurs?

a. They could become extinct as well!

b. Does natural extinction explain the treats to today's tiger, whale/ etc? Some scientists have said no, that natural extinction can't account for all of it. One estimate is that the present rate of extinction is up to 1,000 times the rate of natural extinction!

c. There are new threats to today's species, because of the changes and processes that human civilization and economic activity bring to the earth.

FOR PART II: THREATS/ CAUSES

Objective: To present an overview of the three major types of threats that can potentially affect species and biodiversity.

1. Threats and Causes to Today's Endangered Species

a. Over-Exploitation (Trade/Hunting/Poaching) Trade and Poaching (3 MINUTES)–Andrea Lupanze

b. Note: particular problem for animals that live a long time and reproduce slowly (whales, sharks elephants)

i. What is poaching? Illegal killing of an animal, plant, or other species for sale of its skin, body parts, or for sport

ii. Example-African Elephant's tusks

iii. What is trade? The commercial importing or exporting of goods for sale or barter

iv. Example-African Elephant's tusk-3 African Countries allowed to trade ivory to Japan for sale, 1997.

2. How does this affect the environment and species?

a. Poaching:

i. animal populations shrink if they are hunted in large numbers and the population does not have time to reproduce.

ii. indirectly harms other animals and plants that may need that species for protection or food

iii. illegal trade hurts the indigenous people who may live in the same environment as the species - depend on the animal for its cultural, dietary, or religious needs. May assist with building their communities, African Elephant, Samburu tribe. Whales in Alaska for fuel to heat, food, skins for clothes, symbol of tribe

3. Species-Poaching threatens African Elephant is listed as a species considered in danger of becoming endangered. (listed as a threatened species and the Asian Elephant is listed as endangered under the Endangered Species Act) African Elephants are the largest of all land animals. The African Elephant is in danger of becoming extinct due to poaching. There will no longer be African Elephants in the wild if this continues.

[AL3-4]

a. What/Where: Elephants are **herbivores** or plant eaters and descended from the wooly mammoth, the word elephant comes from the Greek word **Elephas**, meaning ivory and they live in hot climates in Asia and Africa. Their large ears help them keep their blood cool by flapping. They stay near water for bathing, drinking, and cooling. Estimates: Population between 350,000 and 487,000 African Elephants. Life span of 60 years! **African elephants** found in bush habitat also forests, (Cameroon, Congo, Ivory Coast). The male stands an average 10 feet tall and weigh as much as 12,000 pounds (6 tons). Females weight approximately 8,000 pounds (4 tons).

i. Some areas use the elephants to help them build their communities [AL5]

b. Threat: Only natural predator is man. They numbered 1.5 million in 1978 in Africa. African Elephants remaining in the wild. An African Elephant is hunted for their tusks which are elongated incisor teeth. Slaughtered just for their ivory tusks to supply the ivory market, lucrative trade of jewelry - piano keys.

i. Increase in illegal guns creating a volatile situation for the elephants and people trying to protect them.

ii. Threats changed-1989 Ban on ivory trade-African Elephant population in Botswana has increased from 20,000 in 1981 to 106,000 and Zimbabwe's population has grown from 49,000 to 70,000.

iii. 1997 ivory sales to Japan was allowed for 3 African countries. An aerial survey in 1999 showed 1,370 elephant carcasses found in Zimbabwe.

DEVELOPMENT/DESTRUCTION OF HABITAT (3 MINUTES)

1. What is development?

a. The act of making a place suitable for commercial or residential purposes.

b. Example- building shopping malls or freeways where playgrounds used to be.

2. How does this effect the environment?

a. Example- how would it affect you if the government was going to build a new freeway where Birney is?

b. Development hurts the environment and the animals that live in the area by:

i. destroying their homes, their habitat- no place to live

ii. destroying the food they eat- vegetation, or other animals- nothing to eat

ii. cause pollution- poison their homes and/or food

3. Specific example- Florida everglades

a. What/Where?

i. A fresh water swampy grassland especially in South Florida South of Lake Okeechobee, containing saw grass and at least seasonally covered by slowly moving water.

b. How threatened by development?

i. 900 people move to Florida daily; 39 million people vacation in Florida each year, 12 million people spend the winter months in Florida.

ii. Everglades National park only protects 1/5 of the actual Everglades ecosystem.

iii. Development demands on the everglades that threaten it:

– development- all those people need a place to live! (Slide of homes)

– fresh water- draining of the swamps for drinking water, and agricultural water

– farm land- perfect environment for sugar cane and rice

– recreation- people love water sports, and most visit FL to do them; hunting and fishing in the everglades

4. Animals threatened- West Indian Manatee

a. What?

– 'sea cow' are gentle giants of the water- this large aquatic mammal that averages 9 feet in length and weighs between 790- 1200 pounds!!

– they are gray to brown in color, and in the murky muddy water of the everglades they can be somewhat hidden

– they are aquatic herbivores that eat underwater grasses

– can hold their breath for up to 12 minutes!

b. How threatened

– habitat encroachment caused by flood gates to prevent floods to residential areas- get caught in them and are crushed

– entanglement in fishing nets for food- can't get up to breath

– cut by propellers from recreational boats

4. Pollution (3 MINUTES)

a. What is pollution? (Kids will have learned much about this from other presentations). Generally, **pollution** is any alteration of the natural environment producing a condition that is harmful to living organisms. Pollution may occur naturally, as when an erupting volcano emits sulfur dioxide, but the term usually refers to the negative effect of human activities; e.g., automobile exhaust emissions, oil spills, the dumping of industrial wastes in the

water supply, the overuse of pesticides and chemical fertilizers, improper disposal of solid wastes, and so on.

b. Waste and **byproducts** of human activity can end up in the air, water, or land, where it can make the animal's habitat dirty or make the animals sick.

i. Example: oil spills [show slides of oil tanker and oiled birds]

ii. Another Example: Harmful Algal Blooms.

iii. Remember the **pfiesteria** scare in the Chesapeake Bay where people were advised not to eat fish and people who worked around the water got sick? That was an example of a type of harmful algal bloom that releases toxins that harm fish and lead to sores. Pfiesteria has existed for millions of years, and normally is not harmful, but under certain conditions the numbers can go up and the organism can become toxic. **[Show slide of pfiesteria-affected fish–overview; up close; and the organism itself]**. It can also cause sores in people who work or play around the water. It's thought to be caused by the extra phosphorous and nitrogen that run off from various operations like animal farming and agricultural fertilizing. At appropriate levels, these **nutrients** are vital for life in the water, but at higher levels they can lead to rapid growth of pfiesteria.

c. Poisoning spreads all the way up a **food chain**; for example, if rodents are poisoned, then the eagles and other birds of prey that eat the rodents will also get sick.

i. Example: poisoning **[show slides of Bald Eagle and briefly tell story of DDT]**Bald Eagle has made a comeback, but a proposal to take it off the Endangered Species List in 1999 was not finalized. It is a "threatened species." **(More on that later)**
J

ii. [Show slide of deformed frog.]

d. certain pollutants, known as **greenhouse gases** can also cause global climate change, which will cause rapid changes that animals will have to either adapt to or die.

5. Ecosystems: (13 MINUTES FOR INTRO AND RAIN FORESTS)

Introduction to "Ecosystems"/ "Biodiversity": transition from species to ecosystems/biodiversity (species and their environments intertwined) ALEcoSlide

I. What is an Ecosystem?

A. A complex community of organisms and its environment functioning as an ecological unit.

B. Components of an ecosystem:

1. living: plants, insects, and animals- including people.

2. non-living components: soil, rocks, water, and air.

C. Basics of ecosystems

1. Ecosystems are like communities in that they occur in all different sizes.

2. The largest ecosystem is at the global level, and all the living and nonliving elements of the plant interact.

3. Important to remember that small ecosystems are nested within larger ecosystems, and that destruction of a small ecosystem will effect the larger ecosystem within which it is located.

D. Water cycle- (definition) example of how water effects all ecosystems (large effecting small)

E. Food chain- (definition) if one aspect of an ecosystems food chain is affected, it can affect the entire ecosystem (small affecting large)

F. An important aspect of ecosystems is the biodiversity that occurs within each unique ecosystem.

1. Biodiversity describes the wide variety of plant and animal life that exist and interact in ecosystems.

2. to lose a unique part of any ecosystem can negatively effect the global ecosystem

3. Rain Forests–Sarah Slack

II. Amazon Rainforest

A. Where located?

1. (show series of maps, from global level to the area)

2. Mostly in Brazil, but begins in Peru in the Andes mountain range, and ends at the Atlantic ocean

B. Attributes that make it unique

1. Different types of Rainforest, and this one is Tropical (located around the equator where temperatures stay near 80 degrees year round)

2. What makes this a “rain” forest- has to get at least 100 inches of rain every year- the amazon gets anywhere from 160 to 400 inches of rain every year.

3. Centered around the amazon river, 2nd longest river in the world, this ecosystem carries nearly 20% of the worlds fresh water

– variety of fish (pink dolphins, catfish, commercial fish- tetras)

4. This River floods annually during the wet season from November to June by 25 to 45 feet- 2 to four stories in height!

5. Very diverse ecosystem, also has the rainforest aspect!!

6. Tropical rainforest have layers (image)

– emergent trees- highest layer up to 130 ft. in height (mostly birds live here)

– canopy- 65 to 100 ft. the canopy absorbs 90% of the sun's light (birds, insects and mammals (monkeys, sloths) live here)

– understory- smaller growing trees, bushes, flowers, land mammals (jaguars)

7. Species- diversity

– great biodiversity is related to the fact that this is one of the oldest ecosystems in the world- not effected by ice ages which caused great extinctions.

– rainforest covers only 2% of earth's surface, but over 50% of the earth's land based animal, insect and flora species live her.

– in a four square mile area of rainforest you can find: 750 species of trees, 1500 different kinds of flowering plants, 125 different mammals, 400 species of birds, 100 reptiles, 60 amphibians, countless insects and 150 species of butterflies!!!!

– to date, only 1% of the rainforest species have been studied

C. Threats to the Amazon Rainforest and its species- 137 species a day become extinct!

1. Development- Biggest threat in Amazon is logging

– in Latin America and Asia, 40% of the rainforests have already been lost

– you can replant certain trees, but you can't bring back extinct species

– according to the Brazilian government, up to 80% of the logging done in the Amazon is illegal

– also mining

– development- large multinationals construct operating plants because of inexpensive labor costs in South America

2. Pollution

– agricultural runoff- pesticides and fertilizers can damage these ecosystems, as well as bio-waste from ranches

– run off from logging sights (gasoline and waste products)

3. Poaching/Hunting

– many animals are illegally killed (poached) for their pelts- ie, jaguar, leopard, certain species of monkey

– also, sometimes animals are killed because people move into their habitat and are therefore endangered by them (ie rubber farmers)

4. Natural threats

– fires caused by lightening

– droughts

5. Specific example- Jaguar

– Latin American Indian language, jaguar means: "wild beast that overcomes its prey in a single bound;" only member of the panther family in the America's and the 3rd largest cat in the world

– used to range from southern US through Central America and deep into South America; now only in South America and small pockets of Central America

– jaguars are nocturnal- they hunt by night and eat deer, pigs, sloth, fish and even small alligators!

– generally, jaguars are golden with black spots, but there are some rare all back jaguars

– adult jaguars range in size from 200-250 lbs.

– excellent swimmers, most water loving of all cats- they actually 'fish' for food sometimes

– biggest threats: hunting/poaching, destruction of habitat, destruction of food source

D. Why so important to protect the Amazon ecosystem?

1. Help control world's climate

– water cycle

– carbon monoxide to O2 (40% of oxygen we breath from Amazon alone!)

– prescription medicines from plants (25% of CURRENT medicines)

– contain 50% of the worlds plants

2. Pharmaceutical products

– one in four pharmaceuticals comes from a tropical rainforest plant

– 1400 rainforest plants are believed to offer cures for cancer

– remember- less than 1% of the rainforest plants have even been tested!!

3. Part of the Global ecosystem

– much more is lost if the Rainforests are destroyed than is initially apparent

4. Eye opening facts:

– 1.5 acres of rainforest are lost every second

– some experts estimate that at the current rate of destruction, all rainforests could be destroyed in only 40 years

– a single rainforest reserve in Peru is home to more species of birds than the entire United States

E. What can be done?

1. Recycle used products

– plastics- rubber comes from a rainforest tree, so recycling plastics helps reduce the demand on this resource

2. Protect the animals and plants

– laws and organizations whose goal is to protect threatened species

3. Use sustainable development practices- Balance

– Sustainable development is a way of using land that allows humans to extract resources without destroying ecosystems

– economists estimate that tapping the resources in an acre of rainforest could yield $2,400 as compared to $400 an acre for logging

F. Coral Reefs (10 MINUTES) **AL 6-7**

Did you know? Coral reefs are one of the most ancient ecosystems on the planet. The first stages of coral reef evolution began 400 million years ago. Modern coral reefs have been in existence for over 50 million years. Some established coral reefs are between 5,000 and 10,000 years old.

III. CORAL AND CORAL REEFS

Coral

A. What is **Coral**? Coral Polyps: are tiny coral animals the size of a pinhead, thousands of these coral polyps cover one coral branch or mound. Polyps use calcium carbonate from the seawater to build a **hard skeleton**, this limestone skeleton protects the delicate soft body of the polyp. There are **two types of coral**, hard and soft. Coral Polyps are nocturnal **invertebrates** or spineless animals with a sack-like body and an opening or mouth encircled by stinging tentacles called **cnidae.**

B. What makes them unique? Polyps build off of each deceased coral and organisms to make coral reefs: Corals are used in new medicines, are the foundation of one of the most diverse ecosystems in the world. Corals only survive in warm water between 7that is sediment and pollution free. When these organisms die their skeletons serve as foundations for new corals. Corals derive their color and most of their food from photo synthetic symbiotic algae called zooanthellae, a micro organism that lives in the coral tissues

Coral Reefs

A. What are Coral Reefs? Coral reefs are limestone structures that provide shelter for nearly one quarter of all marine life. It is one of the largest and most complex ecosystems on the planet and is home to more than 4,000 different species of fish, 700 species of coral, and thousands of other plants and animals.

B. Where located? Pacific Ocean, Indian Ocean, the Caribbean, the Red Sea, and the Arabian Gulf. They are normally found in warm tropical seas and in clear and shallow waters since it is necessary for sunlight to filter through for the tiny algae. Fresh water can kill corals. Coral reefs are also found off of the coast of Florida and Southern Japan and cover an estimated 230,000 square miles.

1. (show series of photos from various areas, Great Barrier Reef, Red Sea, Asia, Hawaii, Florida)

2. Four types of Coral reefs: AL8

   (1) Fringing Reefs -This is the most common reef found.

   (2) Barrier Reefs also grow near coastlines but are separated by deeper and wider lagoons. (The Great Barrier Reef in Australia is the most famous and the largest barrier reef in the world.)

(3) Atolls are rings of coral that create protected lagoons and are normally located in he middle of the ocean.

(4) Patch Reefs are small isolated reefs that grow up from the bottom of the island platform or continental shelf.

B. Attributes that make it unique: A coral reef is like a major city with buildings made of coral and thousands of species living next door to each other. Reef Building corals require sunlight for photosynthesis; they need clear, shallow water usually 75 deep or less.

– fragile ecosystems that are key to the existence of many forms of marine life.

– provide habitats for a large variety of organisms for food and shelter. (Fungi, sponges, sea worms, crustaceans like lobster, shrimp, crabs, and mollusks bore into coral skeletons and reside there for shelter). Other organisms include sea urchins, jelly fish, oysters, clams, turtles, reef sharks, and sea anemones.

– most biologically rich ecosystems on earth with approximately 4,000 species of fish and 800 species of reef building coral. All but one of the world's 33 major kinds of organisms is found in marine environments.

– Structure: living city that recycles and lives in unison with other types of microorganisms, animals, and plants that contribute to the structure of the reef. (Many types of algae, seaweed, sponge, sediment and mollusks add to the architecture of the reef.)

– Coral reefs have a **symbiotic** relationship with many species living in or feeding off of the reefs, this is when_____ .

C. Threats to Coral Reefs: 58 % of Worldwide reefs found at risk. Of that worldwide reefs suffered a 10 percent loss in coral, NOAA estimated in 1998 approximately two-thirds of world's reefs may be dying with 10 percent beyond recovery and an approximate 30 percent estimated to die within 10 to 20 years. 80% coral reefs in Southeast Asia are at risk, the most species rich coral reefs on earth.

1. Pollution: Radioactive waste, chemical wastes, nutrient pollution, solid waste, and biological pollution. Cyanide poisoning fishing on the reef, ships carrying millions of larvae in their ballasts tanks can damage estuaries, salt marshes, mangroves when draining. Agricultural chemicals from farming and forestry industries contaminate the integrity of the sea.

– Bleaching-nitrogen thought to be cause (Everglades coral dying due to sewage, nutrients flowing into ocean (40% of Florida reefs have died since 1996)

– Chemical Pollution -Radioactive waste or poisoning of the ocean or reef (cyanide) imbalance causing dramatic change in ocean water

– Coastal development, sewage discharge promotes growth of algae blocking sunlight

– Inland pollution, rivers transport pollution directly to reefs - deforestation, cultivation on steep slopes, and poor agricultural practices can all smother coral

– waste, plastics account for one-half of all man-made waste found in the oceans and coastlines.

– Biological pollution with introduction of alien species intentionally or inadvertently imported by humans into environment where they are not normally found.

2. Loss of Habitat: Human expansion and development is one of the greatest threats to coral reefs. Altering the landscape with development causes the amount of freshwater runoff to increase which may carry large amounts of sediment from land-clearing areas, high levels of nutrients from agricultural areas of septic systems, as well as pollutants. The increase of sediment can directly damage the reef or decrease the amount of light reaching the corals causing bleaching. The increase in nutrients may increase the growth of other reef organisms such as sponges that may compete with the coral for space on the reefs.

– Global Warming: The coral reefs may be damaged due to the increased concentrations of greenhouse gases which may result in sea level rise and higher ocean temperatures which is potentially destructive to corals. Thought to be reason from temperatures soaring in 1998 that make coral reefs vulnerable to diseases, may be reason for some coral bleaching. AL 12 3.

3. Trade or Poaching: Coral breakage by divers and other ocean enthusiasts. Corals are popular decorations. People often take coral while on vacation or purchase a coral souvenir from a shop. The shops receive the corals from commercial collectors who select from older and well-developed colonies and will take the healthiest coral damaging the reef because it will make the most money.

– Reef Species removed -Sea horses, sea urchins have detrimental cascading effect on the entire ecosystem (US largest importer of exotic aquarium fish (½ of the worlds aquarium fish business.

– Tourists - touching, taking pieces of reef, trampling on reef, or grounding boat on reef may have anywhere from a small to a large impact by weakening the reef or destroying it.

– Fisherman-destructive practices (Fisherman bang on the reef with bags filed with rocks to drive fish out of crevices) Blast fishing (dynamite) and fishing with cyanide for “live fish trade”; Trawl Fishing

4. Natural: Severe weather may cause changes in the coral colonies. Typhoons, Hurricanes, Monsoons will damage the coral reefs by the large and powerful waves that may cause large corals to break apart and scatter about the reefs. The slow growing corals may be overgrown by quicker growing algae, which deplete the____.

D. Why so important to protect Coral reefs and the diversity of species?

ECOLOGICAL PARTNERSHIPS AND DIVERSITY

– Coral reefs provide an important food source. Spawning grounds for 15 percent of the fish caught in the world. Local fishing provides 10 to 25 percent of the protein available throughout Southeast Asia, in some parts of Pacific reef based fish and organisms account for 50% of the protein intake for humans .

– Coral reefs protect coastal areas from erosion. They buffer shorelines from the impact of waves during storms. Atolls (coral) provide the foundation of the island itself. 77 percent of isolated islands in the Indian Ocean are built exclusively of reef depositions

– Climate protection is provided due to the marine photosynthesizing and shell forming organisms ..up carbon dioxide that would otherwise intensify global warming..

– Reefs serve other marine environments because of the diversity of species and coral reef species depend on other affiliated ecosystems like mangroves, sea grass beds by way of serving as spawning grounds for species associated with the reefs.

– Reefs serve as breakwaters that allow coastal mangroves to develop, the calcium provides the sand and sediment which mangroves and sea grasses grow and

– The ecological partnership between mangroves, beaches, and sea grasses are important to coral reefs

– The Great Barrier Reef's ecosystem has nearly 8 percent or 1,500 of the world's fish species, more than 700 species of coral, over 4,000 species of mollusks, 252 species of birds nesting and breeding on the coral cays, five species of turtles live on the reef, and several species of whales and dolphins associated with the Barrier Reef. One southern section of the reef, accounting for only 3 percent of the area of the Great Barrier reef alone supports 859 species of fish and 72 percent of the world's complex coral species alone. This diversity of species amounts to approximately 4.5 percent of the worlds total compared to the diversity in Costa Rica which accounts for 3 percent of the worlds total plant species and 4.7 percent of the world's mammal species even though Costa Rica is four times as large as the southern portion of the Great Barrier Reef.

– Corals are used in new medicines, such as being used for bone grafts. Chemical within several species are being researched for new treatments for leukemia, skin cancer, and other tumors. One half of all new cancer research now focuses on marine organisms.

– Coral reefs offer recreational value as well as educational value

What can you do to help protect coral reefs?

1. Respect the species and plants-Recycle, do not throw or dump material or waste in the ocean.-Treating domestic sewage and reduce agricultural runoff leads to improved water quality which is beneficial to humans as well as the environment

– Do not remove coral or other organisms from the reefs or oceans that are threatened. Do not purchase coral jewelry or other marine souvenirs unless you are certain they have been farmed or produced in sustainable aqualuture operations

2. Protect the marine species and plants

– laws and organizations whose goal is to protect threatened species

3. Use sustainable development practices- Sustainable development is a way of using the earth in a way that allows humans to extract resources without destroying ecosystems - Balance

– promoting economic activities that are good for both coral reefs and people

– promote coastal zone management and planning

– educate communities on how to manage their reefs so they provide long term source of jobs and income.

PART FOUR: WHAT LAWS DO (7 Minutes)

Some Major Environmental Laws

1. What kinds of things do laws do to help? (Get kids to come up with some ideas if possible)

2. [slide]: Some examples of what laws do:

a. make it a crime to harm or kill endangered animals

b. make it illegal to destroy the habitat of endangered species through certain development projects, without getting approval first

c. make it a crime to buy and sell animals that are endangered or threatened, and parts of those animals (like the ivory tusks of elephants)

d. designate some habitat as protected areas so that the animals are guaranteed a place to live where they can't be hunted, etc.

3. The U.S. has many laws that do these things, the most important of which is The Endangered Species Act**. [Show slide with this title.]**

i. Attempts to prevent the extinction of endangered and threatened species by putting them on a list so they can get special protection.

Endangered and Threatened Species: **[Slide with definitions]**

A. Endangered Species: At risk of becoming extinct in the near future throughout much or all of its habitat range.

B. Threatened Species: Not in as much danger as "endangered species," but are likely to become endangered in near future.

C. Where are endangered species found?

1. Everywhere? There are over 1,000 endangered or threatened species in the United States. About half of all counties in the United States contain endangered species of some kind.

2. Worldwide, there are at least 1832 endangered or threatened species, according to the official list of the U.S. government. Many more are at risk.

3. Not Just Animals–includes insects and plants, too!

ii. Focuses on individual species, rather than ecosystems.

ii. How does it work? Three main goals of the statute:

– to identify species and their **critical habitat** needing protection, and to develop plans to help them recover

– to force the federal government agencies to consider the possible impact on these species of any action they propose to take, and to avoid harm to these species

– to prevent and punish **takings** of those species and harm to their habitats

D. Is it successful?

1. People have differing opinions about this. Some believe it is too focused on individual species at the expense of ecosystems. Most agree that it is like an "**emergency room",** meaning that species only get listed once it is clear that they are in danger, and by then it may be too late to achieve recovery.

2. Some animals that have been listed as threatened or endangered have been **delisted** due to their recovery, but some have gone extinct.

3. The ESA is an important law, but its not enough to have laws that work just inside one country. Why not? –> global threats. So, many countries have gotten together and agreed to do something about the threats to our species. Two of the largest and most important of these agreements are the Biodiversity Convention and the Convention on International Trade in Endangered Species. **[Show slide with these titles.]**

a. Both of these recognize that there is a strong tension between the need to **conserve** species and the need to use the fibers, foods, medicines, etc. that people get from these species. How do we resolve these tensions, satisfying the needs of both nature and people? Can we?

b. The key lies in the concept of **Sustainable Development:** "development that meets the needs of the present without compromising the ability of future generations to meet their needs." (From: World Commission on Environment and Development, *Our Common Future* (New York: Oxford University Press, 1987). **[Show slide with these two key definitions.]**

c. Another important concept is the precautionary principle, which requires us to act now to conserve biodiversity even if we are not sure that our other activities actually pose a threat to biodiversity. It means we can't just sit around and wait to see if the predictions of some scientists are right!

[Show slide with titles again then move through]

E. Biodiversity Convention (U.N. Doc. DPI/130/7 (1992), reprinted in 31 I.L.M. 818 (1992))

1. Signed in 1992; about 174 countries are members

2. The U.S. has signed but not become a full member.

3. Recognizes that biological diversity has value in and of itself, and that it can be useful and profitable to humankind.

4. biological diversity is the variety among and within ecosystems and species, etc.

F. Embodies concept of sustainable use of resources (tied to concept of sustainable development) and the precautionary principle.

G. Two of its main objectives:

1. conservation of biological diversity

2. sustainable use of the components of biological diversity

3. (Note: the third--fair and equitable sharing of benefits arising out of utilization of genetic resources– is not relevant here).

H. Obligates countries to take some steps to protect biodiversity inside their country, such as:

1. develop a national strategy to conserve biodiversity and make conservation consideration part of economic planning.

2. monitor those components of biological diversity that are important for conservation and the impacts of various activities on them

3. establish a system of **protected areas**

4. rehabilitate and restore degraded ecosystems and help endangered species recover

5. preserve and respect the knowledge and practices of **indigenous peoples**– people who live with the resources and have learned of their qualities–and their traditional lifestyles.

6. make principles of sustainable use part of the national decision-making process

7. Most important for the message these countries have sent; they recognize that biodiversity is precious and should be protected.

I. CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna)

1. Signed in 1973; 140 member countries

2. The United States is a member

3. Regulates **trade in endangered or threatened species** in international trade; does not attempt to regulate conservation of endangered species *within* a country's borders.

4. How does it work? There are three lists, called **appendices** to the agreement. If an animal or plant is listed in an appendix, it is subject to restrictions on trade.

J. Appendix One is a list of endangered species (threatened with extinction). More than 800 species are listed, including the African elephant, the orangutan, the Giant Panda, the tiger, and the humpback whale. **[Show photos of each.]**

(a) Note to instructor: listed at 50 C.F.R. § 23.23.)

K. Appendix Two is a list of threatened species (not yet endangered but may become so if trade is not controlled). Examples: American black bear, hippopotamus, gray wolf, flamingos, king cobra **[Show photos of each.]**

L. Appendix Three is a list of species listed at the request of countries that protect that animal under its own laws. Examples: Golden Jackal (India); Turtle Dove (Ghana); Walrus (Canada); Goliath Heron (Ghana); Himalyan Marmot (India). **[Show photos of each]**

M. If an animal is listed, you have to get permits to export the animal or any recognizable part of it from the seller's country, to import it into the buyer's country, or both.

N. How do animals get on the lists? The parties to the agreement get together every two years at Conference of the Parties. Countries can propose to list species of concern to them, and 2/3 of the member parties have to agree.

O. It is not a perfect system; sometimes not enough countries can agree on what to do about a particular animal. Sometimes a country will make a special exception for itself with regard to an animal that it wants very much to continue to import or export.

PART V -STAKEHOLDER ACTIVITY: Stakeholders in Sustainable Development Scenario (Fishing) **(15 MINUTES)**

1. Show kids map of ecological systems and quickly allow them to see where various ecosystems are found.

2. Identify a particular type of ecosystem and tell them we're going to play a role-playing game that illustrates some of the tensions that exist in those areas and that exemplify sustainable development.

3. Divide the kids into groups of stakeholders, using one of these scenarios:

A. Fishing Example (Hypothetical): (**CUT OUT SHEETS BELOW AND PASS OUT TO GROUPS OF 3. HAVE THE KIDS READ ALOUD THEIR GROUP DESCRIPTIONS, IN ORDER.)**

The fish in the Ocean are very over-harvested, and many of the species of fish are threatened with extinction. People from all over the world have come together to try to agree on what to do to prevent extinction.

All the countries in the world have come together, but they are deadlocked on what to do.

1. "Fishing Country"–a very powerful country whose economy is centered around the fishing industry-- argues that the market should be allowed to determine how much fish is caught and how much is paid for it, and that there should not be international laws to limit that. Also, their scientists believe there really isn't a serious problem. They propose to study the issue for 35 years and then decide what to do.

2. "No Fishing" Country-- argues that there should be no more fishing at all from the Ocean. Their culture celebrates fish as very special creatures, and every summer hundreds of thousands of the fish swim from the Ocean into the country's beautiful bay, drawing lots of tourists. The country's economy is dependent on this **tourism** money. The number of fish coming every summer has been dropping each year for the last 25 years. Scientists from "No Fishing" predict that if fishing is not greatly reduced or completely stopped in the Ocean, then in 40 years all the fish will be gone.

3. Compromise Country argues that there is a way for both sides to get what they need–but not necessarily everything they want--, if they change their behavior. If representatives from Compromise Country can persuade everyone to reach agreement, then everyone can come away with something. But the representatives will have to convince all the stakeholders, including the representatives from "Fishing Country" and "No Fishing Country." If they don't act quickly, there will be an all-or-nothing vote among all countries and one side or the other will lose everything. The attention of the world is focused on the issue. . . .

The rest of the countries haven't yet taken a position. In each country, however, there are a number of stakeholders trying to convince their governments to vote one way or the other:

1. Fishing companies, and their workers, that want to catch as many fish as possible so they can sell them and make a living.

2. Consumers who want as much fresh fish as possible available to eat

3. Young marine biologists who would like to be able to study the fish for the rest of their lives and to show them to their children one day.

4. "Save the Fish," an international group that believes people should eat less fish

5. "Save the Dolphins" An international group that thinks the fishing companies should not be allowed to fish anymore with the equipment they have because the nets they use to scoop up lots and lots of fish hurt dolphins.

B. Questions to spur discussion:

1. Is it in everyone's best interest to do something now? What if the Scientists are wrong, so that if everyone continues to do just what they're doing the fish will still be there in 40 years? What if they're right? Won't everyone lose?

(a) Precautionary Principle

2. What happens if the "Fishing Country" gets its way, so that the market determines how many fish are caught?

(a) What happens to the price of an item as there become less and less of it? It gets more expensive. Doesn't this give fishermen more of an incentive to try to catch the last few fish, which will be worth a lot of money?

3. What if all the stakeholders agreed to make one small change: the consumers agreeing to eat less fish; the fishermen agreeing to use different nets and catch slightly less fish; the conservationists agreeing to tolerate some fishing?

(a) Sustainable Development

Recap (REMAINING TIME)

I. What we've learned

II. What we've seen from activity

III. What we'll do at the aquarium (handout on oyster testing)

Group Identity Cards:

(Cut and Distribute to Each Group)
(Have kids read aloud, in order, to set stage for discussions)

Group One: "No Fishing Country" Delegation:

Our county feels very strongly that all fishing should be banned, so that no more fish at all may be caught from the Ocean. Our "No Fishing" Proposal would therefore make it illegal to catch even a single fish from the Ocean.

Our culture celebrates fish as very special creatures, and every summer hundreds of thousands of the fish swim from the Ocean into our beautiful bay, drawing lots of tourists. Our country's economy is dependent on this tourism money.

People in our country are worried because the number of fish coming every summer has been dropping each year for the last 25 years. Scientists from our country predict that if fishing is not greatly reduced or stopped in the Ocean, then in 40 years all the fish will be gone. We believe in the **precautionary principle**, and so we think we can not afford to study the issue any more. Fishing must be stopped or greatly reduced NOW.

Group Two: "Fishing Country" Delegation:

We represent the powerful and wealthy Fishing Country. Most of the people living in our country make their living from catching, selling, or cooking fish. Therefore, we strongly believe that fishing should be allowed to continue with no restrictions such as international agreements to limit the yearly catch. Our "Fishing" Proposal would establish once and for all that there will be no limits on fishing, no matter what happens to the fish populations.

We believe that there is not a serious overfishing problem. A report recently released in our country says that fish populations are stable, and that the issue should be studied for 35 years before any decisions are made to limit the yearly catch.

Group Three: "Compromise Country" Delegation:

We come from a society that has learned to solve problems in creative ways, so that there are no total "winners" and "losers." We believe that there is a way for everyone here to get what they need, even if they can't get everything they want. We see that each side must change their behavior.

We believe we can help everyone see where they can compromise and reach agreement. If we do this before all the countries take their vote on the Fishing and No Fishing proposals, then everyone can come away with something. We say to all groups here that it is better to work together to accomplish some goals than to lose everything on an all-or-nothing vote.

(This part is not for reading aloud: Group 3's job is to get the stakeholders to see where they can compromise, and then put forward a Compromise Proposal that most groups will be able to agree

to. If the stakeholders agree to the proposal, then most of the countries will vote for it. The attention of the world is focused on the issue, so your job is very important. . .).

Group Four: Fishing companies and their workers–Interest Group

We want to be allowed to keep catching fish because we make our living using the money that comes from selling fish. However, we realize that unless the catch is regulated, the largest fishing companies could simply catch all the fish until all of them are gone, and then there would be no more fishing jobs.

We support Compromise Country's effort to bring everyone to an agreement. However, we can not agree to anything that will put us out of our jobs.

Group Five: Consumers–Interest Group

We want to be able to purchase fresh fish to feed our families. However, we want fish to be caught in a **sustainable** way, so fish will always be available.

We also support Compromise Country's efforts to get everyone to agree, but we want to be sure that the yearly catch isn't limited too much. We are afraid that if only a small number of fish are caught each year, then the fish will be more expensive at the grocery store.

Group Six: Young marine biologists–Interest Group

We study fish in the Ocean. This is our job. We want there to be plenty of fish living and breeding in the Ocean so we can study them over several generations. Also, we want to be able to teach our children decades from now about fish.

Most of our members eat fish, so we do not think fishing should be completely stopped. But, we agree with the scientists from No Fishing country that say all the fish will be gone in forty years if there no limits are placed on the yearly catch. It is very important that we all reach a compromise.

Group Seven: "Save the Fish"–Interest Group

We are an international group that believes people should eat less fish because the demand for them is placing too much strain on fish stocks in the Ocean. We think that an international tax should be imposed on fishing companies that take more than one boat full of fish from the Ocean in any year. This would make fish more expensive, and would cause people to eat less.

None of our members eat fish, but some of us live in countries where the economy is dependent on fishing. Therefore, we are reluctant to support a total ban on fishing. We are eager to reach a compromise with everyone else.

Group Eight: "Save the Dolphins"–Interest Group

We are an international group that thinks the fishing companies should not be allowed to fish anymore with the equipment they have. The nets they use to scoop up large numbers of fish at one time hurt dolphins by trapping them inside. This must be stopped.

Most of our members like to eat fish, and some are even fisherman, so we're not arguing for a total ban. We would be willing to agree to a proposal that places reasonable limits on the total annual catch and bans the most harmful nets and other equipment that hurt dolphins.

ANOTHER ALTERNATIVE: (Keep in outline as possible idea for future)

A. Logging example: The President has proposed to open for logging a protected area in the temperate forests in Northwestern United States. The proposal is to open ALL 500 acres to logging over the next 5 years. Congress might pass it, but they might not. But, if all the stakeholders can work out something to satisfy everyone, then the Congress will vote to do that.

B. Draw a map that shows the protected area, along with the sites of most importance to the major stakeholders.

i. Stakeholders:

1. loggers/workers who want to cut the wood to make a living

2. consumers who want the wood to build houses

3. hikers who use the area for recreation, especially the marked trails

4. birdwatchers who value the area as a haven for spotted owls

5. Conservationists who think there should be no logging or development of the area for moral or ethical reasons, and that some of the park should be off-limits even to birdwatchers and hikers because it is so sensitive.

6. tourism professionals (hotel owners; tour operators) who make money from people visiting the protected forest for recreation

7. people who own houses along the edge of the forest and don't want it to be logged because they enjoy the view over the trees, and because they know their houses are worth more money with a national park right next to it

8. state governor whose interested in economic development and made supporting the President's proposal part of his reelection campaign

9. 2 senators from the state, one of whom is up for reelection. They would rather work something out to satisfy everyone than to have to vote on the President's all or nothing proposal.

(a) The one up for reelection gets most of his support from the logging companies; they are the biggest contributors to his campaign

(b) The other Senator is an environmentalist, and knows that most of the people in the state want to preserve at least a portion of the protected area.

ii. Is it in everyone's best interest to take a risk on the all-or-nothing proposal? There's a chance some of them might get everything they want, but it's for certain that there will be at least some losers.

iii. Is there a way to compromise, for example, by drawing different sections on the map, some areas that can be logged and some not? Which areas?

Glossary of Terms:

Extinction: The evolutionary termination of a species caused by the failure to reproduce and the death of all remaining members of the species; also, the natural failure to adapt to environmental change.

Adaptation

Species: A group of organisms capable of interbreeding freely with each other but not with members of other species.

Fauna: All the animals found in a given area.

Flora: All the plants found in a given area.

Fossil

Theory

Climate Change

Mass Extinction: When more than 50% of known species have become extinct in a short period of time (less than 2 million years). There have been several of these. The dinosaurs were not part of the biggest. Scientists believe we are experiencing another mass extinction, one happening very fast as a result of human activity.

Endangered Species: At risk of becoming extinct in the near future throughout much or all of its habitat range. Eligible for listing and protection under the Endangered Species Act and cites.

Threatened Species: Not yet endangered, but likely to become endangered in near future. Eligible for listing and protection under the Endangered Species Act and cites.

Habitat

Natural Extinction

Evolution: Organic evolution is any gradual, genetic change in organisms from generation to generation.

Sustainable Development: Development that meets the needs of the present generation without compromising the ability of future generations to meet their needs as well.

Stakeholders: Groups of people who each communicate their own wants and needs to each other in trying to work out environmental problems.

Precautionary Principle: the principle of taking action now to preserve biodiversity or avoiding activities that are thought to harm biodiversity, even if no one can yet prove that these actions have these effects on biodiversity.

Biodiversity: Variety among and within species, ecosystems, and all other levels of life on Earth.

Ecosystem: The organisms of a particular habitat, such as a pond or forest, together with the physical environment in which they live; a dynamic complex of plant, animal, fungal, and microorganism communities and their associated non-living environment interacting as an ecological unit. Has no fixed boundaries; determined by analytical point of reference.

Food Chain

Convention on Biological Diversity (Biodiversity Convention): International agreement among more than _____ countries (but not the United States) that expresses recognition of the value of the variety of life on Earth and obligates member countries to take steps to conserve and protect that life.

Convention on International Trade in Endangered Species (CITES): International agreement among more than _____ countries (including the United States) placing limits on buying or selling endangered or threatened species and parts of these animals.

Appendices I, II, III: List of endangered and threatened species protected under the Convention. Those on Appendix I are the most protected; those on Appendix III are the least protected.

Export: To send something out of a country, such as by selling it to a buyer in another country.

Import: To bring something into a country, such as by buying it from a seller in another country.

Permit: Piece of paper issued by a government giving permission to do something, such as export or import a listed species.

Conservation: the management of human use of the biosphere so that it may yield the greatest sustainable benefit to current generations while maintaining its potential to meet the needs and aspirations of future generations.

Endangered Species Act: United States law that provides for the listing of animals that are threatened or endangered in order to protect them from further decline and attempt to bring about their recovery.

Critical Habitat: Portions of the country designated as essential to the recovery of species listed as threatened or endangered

Takings: Any action that harms, kills, or dislocates an endangered or threatened species.

Listing: The process of putting a species on the endangered or threatened species list for protection under the ESA.

Delisting: The process of removing a species from the endangered or threatened species list because they no longer need protection or are already extinct.

Indigenous species: species that have adapted through evolution to a specific environment, in which they are found naturally.

Pollution: any alteration of the natural environment producing a condition that is harmful to living organisms. Pollution may occur naturally, as when an erupting volcano emits sulfur dioxide, but the term usually refers to the negative effect of human activities; e.g., automobile exhaust emissions, oil spills, the dumping of industrial wastes in the water supply, the overuse of pesticides and chemical fertilizers, improper disposal of solid wastes, and so on.

Byproducts: Things that are made as the result of making something else. Because they are usually not wanted, they end up as waste and can enter the environment in the form of pollution.

Non-avian dinosaurs: The large group of reptiles that used to live on the Earth, becoming extinct some 65 million years ago, that were distinct from the birds (avian creatures) that live among us today.

Greenhouse gases: chemical form of pollution that results from certain industrial and manufacturing uses, that trap warmth on the earth and can cause warming of the atmosphere