
CONSERVATION IN ECUADOR & THE GALÁPAGOS

A Lesson Plan for Grades 6-8

Fulbright-Hays Seminars Abroad Program 2005
Sustainability and Development in Action: Ecuador as a Case Study

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TEACHER NOTES

GOALS

This case study was designed to introduce middle school students to the complex issues and decision-making processes that surround our environmental conservation choices. Conservation is clearly related to the impact that humans have on the environment and often addresses ways to minimize that impact. By focusing on conservation challenges and choices in Ecuador, one of the most biodiverse countries on the planet, students will understand that: (1) biodiversity is crucial to our planet's environmental well-being and is central to conservation planning; (2) many natural and social factors affect environmental damage and conservation needs; and (3) conservation is a multifaceted process with many factors that affect priorities.

ASSESSMENT EVIDENCE

Biodiversity Hotspots & Conservation: The final activity introduces students to other regions in the world that need to be protected. Student groups are assigned various hotspots and must promote protection of those hotspots by creating a visually-appealing, informative, and compelling poster. The class then outlines conservation priorities, justifying their choices according to stated priorities established by the group.

LEARNING ACTIVITIES

- As an introduction, display the map of Ecuador and the Galápagos Islands and have students read *Welcome to the Galápagos*, which introduces the islands and their significance. The questions for comprehension may be completed as a worksheet or as a class discussion.
- The *Preparing for our Cruise: What Will We See in the Galápagos?* class activity introduces the wildlife of the Galápagos to students and reinforces map reading skills.
- *Our Cruise on the M/V Santa Cruz* describes the varied species of the Galápagos and introduces students to the concept of endemism. Photos can accompany the text, if the instructor reads aloud, or can be presented following the students' reading of the text.
- The *Population in the Galápagos* graph and comprehension exercises lead students to think about how the human population affects the environment.
- The *What do you see?* photos are designed to provoke class discussion about human impact on the environment. Discussion questions and environmental impact information are provided for the instructor.
- The *What is Biodiversity?* reading introduces the concept to students and highlights biodiversity in Ecuador by comparing it to the U.S., a country 33 times its size.
- The *Biodiversity and Conservation: Ecuador's National Parks* list and accompanying map and graph activities introduce Ecuador's national park system. Students begin to think about park locations, sizes, and protected species.

KEY QUESTIONS

- What is biodiversity and why is it important?
- How do people affect the environment and what ways are there to control our impact?
- How do we prioritize conservation around the world? What plants, animals, and resources need to be protected, and why?

STANDARDS

This case study was designed to address the following standards in the Texas Essential Knowledge & Skills (TEKS):

113.22, Social Studies Grade 6

(7) Geography. The student understands the impact of interactions between people and the physical environment on the development of places and regions. The student is expected to: (a) identify and analyze ways people have adapted to the physical environment in selected places and regions; (b) identify and analyze ways people have modified the physical environment; and (c) describe ways in which technology influences human capacity to modify the physical environment.

34.34 World Geography Studies

(8) Geography. The student understands how people, places, and environments are connected and interdependent. The student is expected to: (b) compare ways that humans depend on, adapt to, and modify the physical environment using local, state, national, and international human activities in a variety of cultural and technological contexts; and (d) analyze statistical and other data to infer the effects of physical and human processes on patterns of settlement, population distribution, economic and political conditions, and resource distribution.

The case study also addresses the following **National Geography Standards**:

Grades 5-8

Geography Standard 8: The Characteristics and Spatial Distribution of Ecosystems on the Earth's Surface

The student knows and understands: (1) the local and global patterns of ecosystems; (2) how ecosystems work; (3) how physical processes produce changes in ecosystems; and (4) how human activities influence changes in ecosystems.

Geography Standard 14: How Human Actions Modify the Physical Environment

The student knows and understands: (1) the consequences of human modification on the physical environment.

Finally, it also addresses the following **Curriculum Standards for Social Studies**, outlined by the National Council for the Social Studies:

Middle Grades

III. People, Places & Environments

The learner can: (a) elaborate mental maps of locales, regions, and the world that demonstrate understanding of relative location, direction, size, and shape; (b) create, interpret, use, and distinguish various representations of the earth, such as maps, globes, and photographs; (h) examine, interpret, and analyze physical and cultural patterns and their interactions, such as land use, settlement patterns, cultural transmission of customs and ideas, and ecosystem changes; and (k) propose, compare, and evaluate alternative uses of land and resources in communities, regions, nations, and the world.

South America Map with Galápagos Islands



Welcome to the Galápagos

We are about to embark on a journey to the Galápagos Islands, a chain of islands located 600 miles off the coast of Ecuador in the Pacific Ocean.

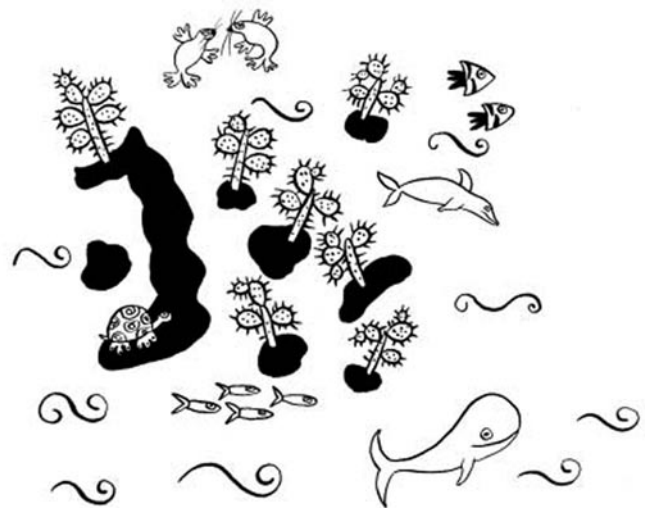
These islands are the result of a series of underwater volcanic eruptions: lava flowed up—often as far as 2,600 feet—through the ocean to create the archipelago. The earliest island was formed 4–5 million years ago, and active volcanoes in the area continue to add to the islands.

In 1535, a Spanish ship drifted off course and discovered the islands. They were inhabited by many animals, including giant tortoises (in old Spanish, *galápagos*), from which the islands got their name. The Galápagos Islands were used, for the next three centuries, as a stop-off point for sealers, whalers, pirates, and others who were navigating the eastern Pacific.

Then, in 1835, the British naturalist Charles Darwin traveled to the Galápagos to study the animals. He became interested in the finches—a type of small songbird—and realized that each island had different species of finches. Because they were on islands and isolated from each other, the finches had adapted to survive on the islands on which they lived. This made them different from each other, and different from finches on the mainland. Darwin's theory that species adapt to survive in their specific environments, based on his experience in the Galápagos, changed scientific thinking around the world.

If the islands are so isolated, how did the animals get there? No one knows for certain, but scientists believe that the plants and animals arrived on their own. Reptiles—tortoises, iguanas, lizards, geckos—probably arrived on rafts made of wood, leaves, and other vegetation that floated down rivers and got carried by the currents out to the islands. Marine birds that can fly long distances were easily able to fly there, while small birds were probably helped by strong winds. Once these animals were on the islands, they lived for centuries without natural predators because their predators did not come with them. Only when humans discovered the islands did the animals become endangered; the giant tortoises were first to suffer when passing ships began to hunt them for food.

In 1959, Ecuador declared the Galápagos Islands a national park and began to protect them and their animal inhabitants. The islands were, and continue to be, the largest and most diverse islands in the world that are mostly in pristine condition—meaning they are basically unchanged by either environmental or human influences. The government controls the number of tourists that visit the Galápagos and uses tourist fees (it costs \$100 per person to enter the park) to support conservation in the Galápagos.



Name: _____

Welcome to the Galápagos
Comprehension Exercises

- (1) Where are the Galápagos located? Are they very close to the mainland?

- (2) How did the Galápagos form? What islands in the United States were also formed this way?

- (3) Why was Darwin's visit so important? What was his theory?

- (4) How did animals arrive in the Galápagos?

- (5) Why was it important for Ecuador to create a national park in the Galápagos?

Preparing for our Cruise: What Will We See in the Galápagos?

Instructor: Hand out or display the Galápagos Islands map with wildlife chart. Tell the students that, on our cruise, we will visit:

Puerto Baquerizo Moreno on San Cristóbal Island,
Gardner Bay and Punta Suárez on Española Island,
Urbina Bay on Isabela Island, and
Punta Espinoza on Fernandina Island.

As you name each stop, ask students to: (1) locate the point on the map and (2) identify what animals we will see.

Once you are finished, ask students: (1) which animals on the wildlife chart we won't see and (2) to locate where we might travel in the future to see those animals.

Finally, ask students to identify the line that runs through the map [the Equator]. What is it? What does it tell us about the weather in the Galápagos?



Our Cruise on the M/V Santa Cruz

We are going to see the Galápagos the best way: a cruise that visits different islands. We begin our journey in Quito, Ecuador's capital. Our 1 1/2-hour flight is longer than any other flight in this small country, because we have 600 miles of ocean to cross. Finally, we land on San Cristóbal Island, where the tiny airport welcomes visitors from all over the world.

From the airport, a bus takes us to a small pier, where a *panga* (small boat) waits to take us to our cruise ship, the Santa Cruz.

Our first expedition, with our English-speaking naturalist guide, is to Isla Lobos (Sea Lion Island) and Playa Ochoa (Ochoa Beach), just to the north of Puerto Baquerizo Moreno, where we boarded the ship. Here we have our first “wet landing,” which means that there is no dock—the *panga* pulls up to the beach and we jump out into the shallow water. As you might guess, we see many sea lions on this excursion. They are very friendly and allow us to get within a few feet of where they lie on the beach, but are protective of their pups so we can't get too close nor can we touch them.

The next morning, our expedition is to Punta Suárez on Española Island, where we have a “dry landing” (on a dock) and will spend the next two hours hiking through black lava rocks. But first we have to get by the sea lion that has placed himself in our way on the dock; centuries of isolation have left these animals unafraid of humans, so he won't move for us, but we don't want to upset him so we find a path around him. Once we make our way past the sea lion roadblock, we find large families of marine iguanas resting comfortably under the morning sun. These iguanas exist only in the Galápagos; the scientific term for this is **endemic**. Endemic means that a species exists only in one place on the planet; it's very important to protect endemic species because if conditions cause them to disappear from one place, they disappear from the Earth. A little farther along, we begin to see the birds here for mating season: blue-footed boobies nesting on their eggs and waved albatrosses doing their courting dance. Like the marine iguana, the waved albatross is endemic to the Galápagos. The birds are everywhere and, once again, are unafraid of us as we get close to take pictures. The afternoon at Gardner Bay brings us more sea lions, finches, and many colorful fish that we see when we snorkel.

On our last day, we begin with a “wet landing” at Urbina Bay on Isabela Island, where we see flamingos churning up the water as they search for shrimp to eat and giant tortoises walk around slowly, observing us as we observe them. We then reembark on the *panga* to see the Galápagos penguins, another endemic species and the most northerly occurring of all penguins. And finally, we visit Fernandina Island, with no introduced mammals, meaning that none of mammals here were brought by humans. We spend our last afternoon snorkeling with the sea lions, who have provided both our welcoming committee and our going-away party for the Galápagos.



The volcanic islands rise out of the mist.





The *panga* ahead of us heads around the cliffs to get to Isla Lobos.



Photo courtesy of Zsuzsa Nemeth.

Sea lions relaxing on the beach.





Marine iguanas.





Blue-footed boobies and their babies.





Waved albatrosses.

Photo courtesy of Zsuzsa Nemeth.



Flamingo.



Tortoises.





Galápagos penguins.

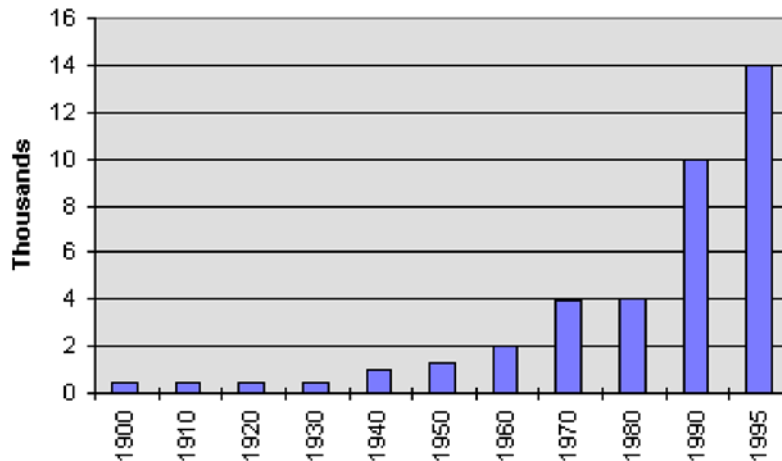


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Population in the Galápagos

Graph Comprehension Exercises

Population in the Galapagos Islands 1900-1995



- (1) Approximately how many people lived in the Galápagos Islands in 1900?
- (2) Was there much increase in the population between 1900–1930?
- (3) Between 1949 and the early 1970s, there was a series of natural disasters—earthquakes and droughts—in mainland Ecuador. Were the increases in the population of the Galápagos bigger during this period? Do you think the two are related? Why or why not?
- (4) Between which years was the population increase the greatest? What was the population in the first of those years, and what was it in the second?
- (5) What was the population of the Galápagos Islands in 1995?
- (6) The population in 2005 is 26,000. How many more people is that since 1995?
- (7) Think about what you already know about the Galápagos. Do you think that the increased population is having an effect on the environment (plants, animals, etc.) of the islands? Why or why not?

What do you see?

Instructor: Show the following slide to your students and encourage class discussion by asking the questions listed below and by discussing some of the environmental impact information.

Discussion Questions

What does the cat have in its mouth?

What do you see behind the tortoise?

Is it normal to see a cat with an iguana, or goats in a field behind a giant tortoise?

Inform students that the marine iguana and giant tortoise are native to the area, but people have brought in the cats and the goats. Does this change what you think is happening in the photos?

Do the native animals seem to be threatened by the introduced species?

Environmental Impact Information

Humans destroy the land—even when they don't mean to—by clearing it to grow food, polluting the water, and overexploiting the resources (e.g., overfishing the waters). They also bring in their own animals, both pets and farm animals, which may hunt and kill natural species.

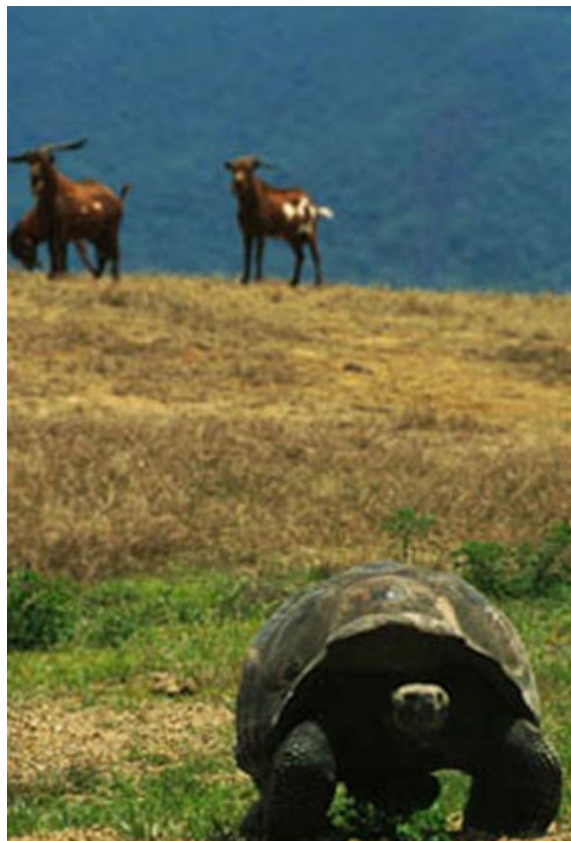
Human-introduced species and humans have caused 11 of the 13 full-species extinctions in the Galápagos.

People have farms and raise cattle on the most biodiverse land on the islands. Obviously, this has affected animal habitats. These types of activities also bring in plants and animals that are not native to the islands, causing more damage.

Habitats, communities, and ecosystems have undergone major damage, mostly on islands where people live.

Over the last decade, tourism has grown in the Galápagos and offers people a way to make money that isn't dependent on farming and other professions that destroy the environment.

Source: Craig MacFarland and Miguel Cifuentes. *Case Study: Ecuador*. Advancing Science Serving Society, <http://www.aaas.org/international/ehn/biodsum/ecuador.htm>.



Images courtesy of Charles Darwin Foundation.

What is Biodiversity?

*Biodiversity is the grand diversity of life on Earth and all the interconnections that support these many forms of life. **

There are thought to be 12.5–30 million existing species on Earth. This diversity supports human life by providing us with food, fuel, medicines, and other things we use every day. Through biodiversity, nature also keeps the world clean—forests help clean our air, wetlands clean our water and control flooding. So conservation of this biodiversity is important to the planet and to the human race.

Environmental conservation generally focuses on preventing extinction of plant and animal species, and on saving ecosystems that are in danger. For example, we often hear reports about the destruction of the Amazon rainforest, home to up to 30% of the Earth's species: what if the plant that can cure cancer is in the Amazon? We know that we must work to conserve the environment, but the question remains: what regions most need our conservation efforts? Countries have to establish priorities. Ecuador, for example, decided that the Galápagos needed protection, so they established a national park.

But Ecuador's biodiversity isn't just in the Galápagos. This small country, roughly the size of the state of Colorado, is one of the most biodiverse countries in the world. Its biodiversity is due to its varied geography and climate—Ecuador's geography ranges from the snow-capped, rising Andes Mountains, to the low, humid Amazon rain forest, to the hot and dry beaches, to the volcanic Galápagos Islands. Ecuador's biodiversity is so high that it's referred to as “megadiverse.”

A few points to compare Ecuador to the United States:

	United States	Ecuador
Size (in square kilometers)	9,631,418	283,560 (3% of U.S.)
Number of plant species	16,000	20,000
Number of insect species	90,000	> 1,000,000
Number of amphibian species	263	421
Number of mammal species	432	380

Definitions

Biodiversity: (n.) the diversity of plant and animal life in a particular habitat (or specified geographic region) or in the world as a whole; “a high level of biodiversity is desirable.”

Ecosystem: (n.) a system formed by the interaction of a community of organisms with their physical environment.

Endemic: (adj.) native to or confined to a certain region.

Habitat: (n.) The area or environment where an organism or ecological community normally lives or occurs: *a marine habitat*.

* From: Biodiversity Project, <http://www.biodiversityproject.org/biodiversity.htm>.

Biodiversity and Conservation: Ecuador's National Parks

Governments often protect biodiversity by setting up national parks and reserves, thereby limiting human use of important ecological areas. Below are brief descriptions of the nine national parks in Ecuador. Use this information to complete the attached worksheet.

Cajas National Park, 71,186 acres

Includes 232 lakes, connected by small rivers and streams. White-tailed deer, spectacled bear, puma, páramo deer, páramo rabbit, and the Andean tapir. Birds include caracara, condor, Andean toucan, and spectacled duck. Also contains archeological Inca sites.

Cotopaxi National Park, 83,829 acres

Named after the highest active snow-capped volcano in the world (19,347 ft above sea level).

Deers, pumas, condors, wild horses, and llamas. At the foot of Cotopaxi is the Inca Palace, built by Tupac Yupanqui in the fifteenth century.

Galápagos National Park, 1,713,439 acres (plus 32,851,000 acres in Galápagos Marine Reserve)

About 87% of the island territory is protected and carefully managed. Visits are allowed only to about 50 sites, in addition to the islands' few towns. UNESCO declared Galápagos a World Natural Heritage Site in 1978 and a World Biosphere Reserve in 1985.

Llanganates National Park, 542,676 acres

Rough moorlands, deep valleys, rivers, lagoons, and abundant waterfalls. Most of the park is covered by dense vegetation. Moorland rabbit, sachá (jungle) rabbit, weasel, spectacled bear, white-tailed deer, moorland deer, moorland fox, puma, deer, tapir, and the condor.

Machalilla National Park, 136,000 acres

Tropical humid and tropical dry forests. Includes Isla de la Plata, with abundance of wildlife just a two-hour boat ride from the mainland. Humpback whales from the Antarctic mate in warm waters near the park's beaches.

Podocarpus National Park, 351,436 acres

Contains jungle and highland areas, with great diversity of plant and bird life. Home to over 100 lakes. Exotic orchids, bears, pumas, humming birds, toucans, reptiles, and woodpeckers.

Sangay National Park, 671,654 acres

Extends from the Amazon Rainforest to the Andes. Mountain tapir, the spectacled bear, and the ocelot. Many of the nation's highest peaks, such as the active Sangay Volcano, El Altar, and the active Tungurahua, are in the reserve.

Sumaco-Napo-Galeras National Park, 507,181 acres

A wide diversity of ecosystems, ranging from high mountains to cloud and lowland forests. Spectacled bear, bats, marsupials, armadillos, eagles, guams, and many species of reptiles and amphibians. Plants include cedar, canelo, and rubber trees.

Yasuní National Park, 2,426,281 acres

An important biogeographical area where endemic species of plants and animals have been preserved since 20,000 BC. According to the UNESCO, more than 700 species of vegetation have been identified, there are 500 bird species and 200 different animals.

Sources: Ecuador, Ministry of Tourism, http://www.viveecuador.com/html2/eng/galapagos_nature.htm.

Exploring Ecuador, Ecuador and Galapagos Online Guide, http://exploringecuador.com/en_ar_national_park.htm.

Name: _____

Biodiversity and Conservation: Ecuador's National Parks

Map and Graph Activity

Part 1

- (1) Find the 9 national parks listed on the previous page and use a colored pencil to shade them in on the map below.
- (2) Ecuador has four geographical regions and there are national parks in each one. Using a different colored pencil or pen than the one you used to shade in the parks, follow the directions below:
 - (a) Draw a large circle around Podocarpus and Yasuní. Label this area **Amazon**.
 - (b) Draw a large circle around Cajas, Cotopaxi, Llanganates, Sangay, and Sumaco-Napo-Galeras. Label this area **Andes**.
 - (c) Draw a circle around Machalilla. Label this area **Coast**.
 - (d) Draw a circle around Galápagos. Label this area **Galápagos**.



Questions for Comprehension

- (1) Which geographical region of Ecuador has the most national parks and protected areas?
- (2) Which geographical region has the largest national park? What is its name? Why is it an important area to protect (hint: see description)?
- (3) Based on the descriptions on the previous page, which national park would you most like to visit? Why?

Biodiversity and Conservation: Ecuador's National Parks, Map and Graph Activity, p. 2

Part 2

Create a bar graph that shows the size of each national park.

1,800,000								
1,700,000								
1,600,000								
1,500,000								
1,400,000								
1,300,000								
1,200,000								
1,100,000								
1,000,000								
900,000								
800,000								
700,000								
600,000								
500,000								
400,000								
300,000								
200,000								
100,000								
	Cajas	Cotopaxi	Galápagos	Llanganates	Machalilla	Podocarpus	Sangay	Sumaco-Napo-Galeras

Questions for Comprehension

- (1) Which national park does not appear on the graph above? How big is it? How much bigger is it than the largest park on the chart?
- (2) Which park on the graph is the largest? Which is the second largest? Is there a big difference between the two?
- (3) Based on what you have read in this case study, why do you think the Galápagos National Park is one of the biggest in the country?

Biodiversity Hotspots & Conservation

The Galápagos Islands are only one place that deserve concentrated conservation efforts. In this final activity, students will research and present other important regions that need to be protected.

(1) Lead a group discussion about the concept of “biodiversity hotspots.” A hotspot is characterized by an exceptional level of species endemism and a serious level of habitat loss. Review the terms “endemism” and “habitat” and discuss why it’s especially important to protect areas that have species that don’t exist elsewhere in the world.

Ecuador, the country under discussion in this case study, is located in the Tropical Andes, the richest and most diverse region on the planet. The Tropical Andes are a biodiversity hotspot, and we’ve seen evidence of its protection in Ecuador’s national park system.

(2) Divide students into small groups and assign each group a biodiversity hotspot. Information on 6 hotspots is included in this case study (if you have more than six groups, additional information can be found at <http://www.biodiversityhotspots.org>.) You may also choose to assign additional research to the groups, to find other evidence of the importance of their regions. Each group will develop a poster board with crucial information on their hotspot as a way to promote its protection. Students should include information from the sheets that best supports the protection of their assigned hotspot. Each board should include:

- (a) Name of hotspot
- (b) Map showing where the hotspot is located
- (c) Geographical description (topography, vegetation, climate, etc.) of the hotspot¹
- (d) Size of hotspot
- (e) Information on why hotspot is special/unique
- (f) Statistics on threatened species with information on threatened species

(3) Poster boards should be either displayed for all to see or presented to the class.

(4) The class should discuss priorities: of all the hotspots represented around the room, which one would they rank 1, 2, and 3 in terms of most important to protect? Why? Guide students to think about the different considerations we must make in terms of environmental conservation: Is number of species most important? Size of territory? Endemism? What factors should governments take into consideration when they don’t have the resources to protect all endangered areas?

Alternate Activity:

Instead of poster boards, you may choose to provide each group with 2 information sheets. Groups are then responsible for prioritizing which region should be protected, and should write a short essay or complete a Tchart to defend their choice.

¹ Before handing out readings, you may wish to review geographic vocabulary used in the hand-outs (e.g. montane forest, deciduous forest, savanna, monsoon, mangrove, etc.). Please review the attached information sheets to assess which terms may require review with your students.

Mountains of Central Asia



Hotspot Original Extent (km ²)	863,362
Hotspot Vegetation Remaining (km ²)	172,672
Endemic Plant Species	1,500
Endemic Threatened Birds	0
Endemic Threatened Mammals	3
Endemic Threatened Amphibians	1
Extinct Species	0

The Mountains of Central Asia hotspot consists of two of Asia's major mountain ranges, the Pamir and the Tien Shan.

The Pamir mountain range was known to early Persians as the "roof of the world." The Eastern Pamir are plateau-like, while the Western Pamir are characterized by sharp ridges, steep slopes and deep valleys and gorges. The hotspot's highest peak is Kongur, which rises to 7,719 meters in the Chinese Pamir; four other peaks are above 7,000 meters. The 300-km-long, 150-km-wide Fergana valley separates the Pamir from the Tien Shan Mountains. The hotspot also holds more than 20,000 glaciers, covering around 18,000 square kilometers.

The climate in the Mountains of Central Asia is generally arid. Precipitation falls mainly in winter and spring and varies from more than 1,500 millimeters in the Gissar Range in the west of the hotspot to less than 100 millimeters in the Eastern Pamir.

The predominant vegetation types in the hotspot are desert, semi-desert and steppe on all the lower slopes and foothills and in some of the outlying ranges and major basins. Spruce forests occur on the moist northern slopes of the Tien Shan, while open juniper or *archa* forest occurs widely between 900 and 2,800 meters.

Unique and Threatened Biodiversity

Plants

Tulips: More than 16 endemic species grow in the steppe and meadow zones of the Mountains of Central Asia. The largest of these is the rare, brilliant orange-red Greig's tulip, often known as the king of the tulips, which is only found in western Tien Shan. Collecting for horticulture and decoration has led to the decline of many of the hotspot's tulip species.

Taxonomic Group	Species	Endemic Species
Plants	5,500	1,500
Mammals	143	6
Birds	489	0
Reptiles	59	1
Amphibians	7	4
Freshwater Fishes	27	5

Mammals

Marco Polo sheep: Magnificent curling horns have made it a favored target of trophy hunters.

Saiga antelope: Has experienced a dramatic decline since the 1970s due to habitat destruction and hunting.

Snow leopard: Has declined here, as elsewhere, as a result of poaching for its valued fur and a depletion of its prey base through illegal hunting.

Invertebrates

Butterflies: 11 of 26 species of apollo butterflies known to occur in this hotspot are endemic.

Irano-Anatolian



Hotspot Original Extent (km ²)	899,773
Hotspot Vegetation Remaining (km ²)	134,966
Endemic Plant Species	2,500
Endemic Threatened Birds	0
Endemic Threatened Mammals	3
Endemic Threatened Amphibians	2
Extinct Species	0

The topographically complex and extensive system of mountains and closed basins that make up the Irano-Anatolian Hotspot form a natural barrier between the ecosystems of the Mediterranean Basin and the dry plateaus of Western Asia. For many centuries, the Silk Road crossed east to west through this hotspot, connecting the two regions.

Elevations range from as low as 300 meters to more than 5,000 meters, including the dormant volcanoes of Mt. Ararat in Turkey (5,165 meters) and Mt. Damavand in Iran (5,671 meters). Historically, the mountains have served as both a refuge and a corridor between the eastern Mediterranean and western Asia, resulting in many patches of local endemism throughout the region.

The climate is continental, with hot summers and very cold winters. Annual rainfall varies from 100 to over 1,000 millimeters, most of it falling in winter and spring. The principal habitat in the hotspot is mountainous forest steppe, supporting oak-dominant deciduous forests in the west and south and juniper forests in the east. There are permanent glaciers in the alpine zone of Turkey's Cilo and Hakkâri mountains.

Unique and Threatened Biodiversity

Plants

Orchids: Endemic varieties occur in Turkey, and are illegally collected in large quantities for the production of a popular traditional drink called sahlepe. Because of the rapid decline of orchid species in Turkey, orchid collection has expanded to Iran.

Taxonomic Group	Species	Endemic Species
Plants	6,000	2,500
Mammals	142	10
Birds	362	0
Reptiles	116	12
Amphibians	18	2
Freshwater Fishes	90	30

Mammals

Asiatic cheetah: Only about 60 Asiatic cheetahs survive, all of them to the south of the Kopet Dag in Iran's Great Salt Desert, the Dasht-e-Kavir.

Invertebrates

Butterflies: At least 350 species. At least 240 of these are found in Turkey, nearly 20 of them endemic. Several globally threatened species occur in this hotspot, including the single-site endemic *Polyommatus dama*.

Indo-Burma



Hotspot Original Extent (km ²)	2,373,057
Hotspot Vegetation Remaining (km ²)	118,653
Endemic Plant Species	7,000
Endemic Threatened Birds	18
Endemic Threatened Mammals	25
Endemic Threatened Amphibians	35
Extinct Species	1

The Indo-Burma begins in eastern Bangladesh and then extends across north-eastern India to encompass nearly all of Myanmar, part of southern and western Yunnan Province in China, all of the Lao People's Democratic Republic, Cambodia and Vietnam, the vast majority of Thailand and a small part of Peninsular Malaysia. In addition, the hotspot covers the coastal lowlands of southern China, as well as several offshore islands.

Much of Indo-Burma is characterized by distinct seasonal weather patterns. During the northern winter months, dry, cool winds blow from the stable continental Asian high-pressure system, resulting in a dry period across much of the south, center, and west of the hotspot (the dry, northeast monsoon). As the continental system weakens in spring, the wind direction reverses and air masses forming the southwest monsoon pick up moisture from the seas to the southwest and bring abundant rains as they rise over the hills and mountains.

A wide diversity of ecosystems is represented in this hotspot, including mixed wet evergreen, dry evergreen, deciduous, and montane forests. In addition, a wide variety of distinctive, localized vegetation formations occur in Indo-Burma, including lowland floodplain swamps, mangroves, and seasonally inundated grasslands.

Unique and Threatened Biodiversity

Birds

Green peafowl: Not endemic, but a majority of the world population is found within the hotspot. This species has undergone a serious decline over the last century as a result of hunting and expansion of human populations into natural landscapes, particularly the spread of human settlements along water sources.

Taxonomic Group	Species	Endemic Species
Plants	13,500	7,000
Mammals	433	73
Birds	1,266	64
Reptiles	522	204
Amphibians	286	154
Freshwater Fishes	1,262	553

Mammals

Kitti's hog-nosed bat: One of the world's smallest mammals, no larger than a bumblebee.

Reptiles

Turtles: The highest diversity of freshwater turtles in the world. 53 species, representing one-fifth of the world's species. The striped narrow-headed softshell turtle can grow to more than 120 centimeters in length and is the largest freshwater turtle species in the world. Populations of freshwater turtles and tortoises have declined dramatically worldwide. Approximately 200 of the 300 known species are globally threatened, constituting a global crisis. The situation is particularly severe in the Indo-Burma hotspot, where overexploitation for the wildlife trade is the most significant threat.

Cerrado



Hotspot Original Extent (km ²)	2,031,990
Hotspot Vegetation Remaining (km ²)	438,910
Endemic Plant Species	4,400
Endemic Threatened Birds	10
Endemic Threatened Mammals	4
Endemic Threatened Amphibians	2
Extinct Species	0

The Cerrado spreads across the central Brazilian Plateau. The second largest of Brazil's major biomes, after Amazonia, the hotspot accounts for a full 21 percent of the country's land area. The most extensive woodland/savanna region in South America, the Cerrado is also the only hotspot that consists largely of savanna, woodland/savanna and dry forest ecosystems. Within the region, there is a mosaic of different vegetation types, including tree and scrub savanna, grassland with scattered trees, and occasional patches of a dry, closed canopy forest called the *cerradão*.

The hotspot actually receives abundant rainfall (between 1,100 and 1,600 millimeters per year), although this rainfall is concentrated in a six to seven month period between October and April. The rest of the year is characterized by a pronounced dry season, and many plant species in the hotspot are well adapted to drought conditions as a result. Much of the vegetation is also adapted to fire, which is an important part of the ecology of the Cerrado. The flora displays a number of adaptations to fire, including thick bark, leathery leaves, a rapid regeneration capacity and deep root systems. Adaptation to fire maintains a balance between grasses and woody vegetation and assists in nutrient recycling and germination.

Unique and Threatened Biodiversity

Mammals

Until twenty thousand years ago, giant mammals, the so-called megafauna, were found in the Cerrado. Magnificent species, such as a giant armadillo, a giant sloth and a rhino-type animal lived together with primitive humans.

Maned wolf: A giant, large-eared, long-legged fox-like animal that can grow to 80 centimeters in height and weigh 23 kilograms. The wolf has golden-red fur, with a black stripe running from the top of its head to the middle of its back.

Giant anteater: As the largest anteater in the world can grow up to 1.9 meters in length from nose to base of tail, with a huge flag-like tail that can be up to a meter long.

Invertebrates

A quarter of the 40,000 species of Neotropical butterflies and moths, nearly a third of the more than 440 species of Neotropical termites and a quarter of the nearly 550 Neotropical social wasps are found here.

Taxonomic Group	Species	Endemic Species
Plants	10,000	4,400
Mammals	195	14
Birds	607	17
Reptiles	225	33
Amphibians	186	28
Freshwater Fishes	800	200

Himalaya



Hotspot Original Extent (km ²)	741,706
Hotspot Vegetation Remaining (km ²)	185,427
Endemic Plant Species	3,160
Endemic Threatened Birds	8
Endemic Threatened Mammals	4
Endemic Threatened Amphibians	4
Extinct Species	0

The Himalaya Hotspot is home to the world's highest mountains, including Mt. Everest. The mountains rise abruptly, resulting in a diversity of ecosystems. Vascular plants have even been recorded at more than 6,000 meters. The hotspot is home to important populations of numerous large birds and mammals, including vultures, tigers, elephants, rhinos and wild water buffalo.

Stretching in an arc over 3,000 kilometers of northern Pakistan, Nepal, Bhutan and the northwestern and northeastern states of India, the Himalaya hotspot includes all of the world's mountain peaks higher than 8,000 meters. This includes the world's highest mountain, Sagarmatha (Mt. Everest) as well as several of the world's deepest river gorges.

The abrupt rise of the Himalayan Mountains from less than 500 meters to more than 8,000 meters results in a diversity of ecosystems that range, in only a couple of hundred kilometers, from alluvial grasslands (among the tallest in the world) and subtropical broadleaf forests along the foothills to temperate broadleaf forests in the mid hills, mixed conifer and conifer forests in the higher hills, and alpine meadows above the treeline.

Unique and Threatened Biodiversity

Plants

Orchids: A large number of orchids, many representing rather young endemic species, have recently been reported from the hotspot, indicating that further exploration will probably reveal a much higher degree of plant endemism.

Taxonomic Group	Species	Endemic Species
Plants	10,000	3,160
Mammals	300	12
Birds	977	15
Reptiles	176	48
Amphibians	105	42
Freshwater Fishes	269	33

Birds

Vultures: Some have undergone dramatic declines after feeding on the carcasses of cattle that have been treated with the anti-inflammatory drug *diclofenac*.

Mammals

Gangetic dolphin: Freshwater dolphins, the Brahmaputra and Ganges rivers that flow along the foothills support globally important populations.

Tigers: The alluvial grasslands support some of the highest densities of tigers in the world.

Some of the world's last remaining populations of wild water buffalo and swamp deer are restricted to protected areas in southern Nepal and northeastern India.

Mesoamerica



Hotspot Original Extent (km ²)	1,130,019
Hotspot Vegetation Remaining (km ²)	226,004
Endemic Plant Species	2,941
Endemic Threatened Birds	31
Endemic Threatened Mammals	29
Endemic Threatened Amphibians	232
Extinct Species	7

The Mesoamerican forests are the third largest among the world's hotspots. Their spectacular endemic species include quetzals, howler monkeys, and 17,000 plant species. The montane forests are important for amphibians, many endemic species of which are in dramatic decline due to an interaction

between habitat loss, fungal disease and climate change.

Spanning most of Central America, the Mesoamerica Hotspot encompasses all subtropical and tropical ecosystems from central Mexico to the Panama Canal.

The hotspot's major ecosystems are a complex mosaic of dry forests, lowland moist forest, and montane forests. Intermittent coastal swamps and mangrove forests along the Pacific coast from Mexico to Panama give way to broad-leaved and coniferous forests at higher altitudes. East of the mountains, the Caribbean lowlands are home to moist, subtropical wet forests and rain forests. In the southern part of the hotspot, broad-leaved premontane and montane hardwood forests occupy steep and cloud-shrouded slopes.

Unique and Threatened Biodiversity

Plants

Mahogany: Commercially valuable timber species are found within the hotspot and have historically driven the exploitation of the region's forest resources.

Taxonomic Group	Species	Endemic Species
Plants	17,000	2,941
Mammals	440	66
Birds	1,113	208
Reptiles	692	240
Amphibians	555	358
Freshwater Fishes	509	340

Birds

Quetzal: The best-known species from this region and conservation symbol for its cloud forest habitat. The resplendent quetzal's brilliant green and crimson plumage is the national emblem of Guatemala. An endemic species threatened by habitat destruction.

Mammals

Monkeys: Some of the most visible symbols of mammal diversity in Mesoamerica are its monkeys, including the Central American spider monkey and Mexican black howler monkey, which produce impressive roars that can be heard for miles.

Amphibians

Golden toad: One of the most poignant symbols of conservation in Mesoamerica and worldwide. A beautiful, bright orange toad found only in Costa Rica's Monteverde Cloud Forest, the golden toad hasn't been seen since 1989, when it disappeared virtually overnight.