

Biogeography: A Place for Everything and Everything in its Place

Overview

Students become familiar with the concept of biogeography and with some of the factors that dictate the distribution of plants and animals on the earth.



Title

Biogeography: A Place for Everything and Everything in its Place

Investigative Question

What is biogeography and how does it relate to the invasive species issue?

Overview

Students become familiar with the concept of biogeography and with some of the factors that dictate the distribution of plants and animals on the earth.

Objective

Students learn the major biogeographic realms of the earth, become familiar with representative plants and animals from those realms, and begin to ask the question *What happens when species are accidentally transported between realms?*

Materials

Large map of the world; pictures or plastic models of various plants and animals; copies of student activity sheets.

Advance Preparation

Assemble collection of photographs of plants and animals or plastic animals (Beanie Babies™ can also be used); copy needed sheets.

Time

One class period

Introducing the Activity

Use the following analogy to acquaint students with the concept of biogeography. Imagine your family's house. Everything is likely to be relatively neatly organized: cooking and eating utensils in the kitchen, clothing for each member of the family in separate rooms, toys and games in the family room, etc. That's pretty much the way the earth has become organized over the last 3.5 billion years.

Species come and go (extinction and evolution), species occur mostly in optimum habitats, dispersal takes place, but on a relatively slow scale (hundreds, thousands, or even millions of years). Natural disturbances sometimes open up new avenues to species to colonize and move around. This is the way it has been for millions of years, except for the last 1,000 years or so. Since humans have become relatively civilized, they have caused confusion and sometimes great disruption in natural habitats, ecosystems, and even biomes, by either intentionally or accidentally moving species from one area to another.

Procedure

1. Hand out Student Page 1 and allow students to read and then discuss.
2. Provide each student or pair of students with Activity Sheet #1 on the earth's biogeographic realms. Lead a brief discussion on what these areas are and ask students to name a representative organism from each realm. Students likely will be able to do this for most of the eight.
3. There are several ways to handle the second part of the activity.
 - A. Have students take their maps home and do a search for at least 5 representative organisms from each of the 8 realms.
 - B. Assign students or groups of students a single realm and have them make and list of organisms and also describe the general characteristics of their realm.
 - C. Use a large map as a bulletin board activity and have students collect photos of representative organisms and create a classroom display.
 - D. Use a large map in a classroom activity whereby students must choose or be given a certain organism and place it in its correct realm.

3. Later, ask students to think about and write short answers to the following questions:
- Given the vast amount of time that plants and animals have had to sort things out (become adapted to living in a particular environment), what must happen if a plant or animal is to have any success dispersing and increasing its range?** There are several appropriate answers here: Some sort of disturbance opens up a habitat to dispersal and colonization, a favorable mutation may allow a species to outcompete its neighbors, or perhaps a long-range dispersal event (flood, hurricane, transport by another organism) may move another species into a favorable location.
 - How do humans fit into all this? What have we done to change the system?** Humans have become a very mobile species and we are constantly moving organisms around, either intentionally or by accident. Some of these moves are for the good (Agricultural crops); others create great ecological problems (diseases moved around to areas where humans [and other organisms] have no resistance to them); plants and animals moved that become pests in our system or that disrupt natural ecosystems by their presence.

Assessing the Activity

Have students define the term 'native organism.' Under what circumstances could species within the same biogeographic realm be non-native (exotic)? Answers: Native means a species that occurs naturally and that is part of the functioning ecosystem within an area (i.e., it's part of the food chain). Also, a species that exists in a very different type of habitat (eastern deciduous forest) could be moved into a

different types of forest (conifer) and survive and reproduce. Examples include the Colorado potato beetle (native to the western US but now found over most of North America) and osage orange (native to the southern Midwest, but now found over much of the eastern US).

Extending the Activity

Use Activity Sheet #2 to introduce the concept of biomes to students. Each large biogeographic realm contains any number of biomes. Biomes are major ecological community types. The examples given are for North America. Have students write a short paragraph about each of the six biomes and make a short list of organisms within each biome. Ask the following question. What could happen if organisms were accidentally or intentionally moved from one area of the continent to another?

There are three possibilities – Nothing would happen as it could not survive; it would either exist at a low level and cause little or no disruption; it could find the area to its liking and be without any of its natural enemies and become a problem by becoming a dominant component of the new landscape and outcompeting native species.

State Goals

11,12 (Objectives 12.4.08, 12.7.32)

Concept

Throughout the earth's history, species of plants and animals have sorted out the best places for them to live through competition, adaptation, and various other ecological factors. Human, by moving species around over great distances or around ecological barriers, have changed the system, sometimes for the good, sometimes for the bad.

Safety and Waste Disposal

No hazardous materials are used in this activity.

Student Page 1 – Biogeography

Biogeography is the study of the distributions of plants and animals over the surface of the Earth in both space and time. Biogeography may also try to explain the changing distributions of organisms over time, either in the short term or over geological time. Scientists have designated eight (if you include Antarctica and the oceans) Biogeographic realms on the earth (see enclosed map).

There are three fundamental processes in biogeography: evolution, extinction, and dispersal. While we define all three, we will concentrate most of our efforts on *dispersal*.

- evolution: any irreversible change in the genetic composition of a population.
- extinction: the process of a species becoming permanently eliminated with no more living individuals on earth.
- dispersal: the movement of organisms away from their point of origin. Dispersal is the capacity of organisms to move from their birthplace to a new site and is an ecological process that is part of the life history of every species. Without dispersal, genetic interchange is limited, and species do not have a chance to adapt to a new environment. Dispersal is an important part of the process of evolution. Animals achieve dispersal by walking, swimming, flying, etc. Plants disperse somewhat more passively by

floating, hitching rides, blowing in the wind, etc. What is important to remember, however, is that natural dispersal takes place in an evolutionary time frame. What does this mean? Read on to find out!

Barriers

There are many barriers to dispersal. Without these barriers, every species would occur everywhere. Barriers are species specific: they affect each species differently. For example, a vast body of water can be a significant barrier to a land dweller, but is likely none at all to a fish.

- Physiological barriers are those conditions that are so different from that of the original environment that a species can't survive in them for very long. Example: most freshwater fish can't survive for very long in salt water.
- Ecological barriers include predation and competition. If there's a big guy waiting to eat you next door, you will probably stay at home. Conversely, if there is nothing to eat next door because some other species has already consume it, then a species is also not likely to disperse.
- Physical barriers may make dispersal difficult. Examples are good habitats that are too far away or too difficult to get to—across a mountain range, on the other side of an ocean, etc.