Zoo and Botanical Gardens Biome Contract

Overview
Students will investigate biotic and abiotic factors of different biomes by preparing a presentation on the design of an exhibit to a fictitious zoo.

Introduction
Biomes are very large regions of the earth for which distribution depends on the amount of rainfall and the temperature in an area. Each biome is characterized by different biotic factors (living components) such as its vegetation and animal life. The earth has many biomes including freshwater, marine, and terrestrial. In the northern hemisphere, from the equator to the most northerly climes, there is a trend in terrestrial biomes: from tropical rain forest, desert, grasslands, temperate deciduous forest, taiga and finally tundra. Within any given biome there will be characteristic abiotic factors, which are non-living and include temperature, water, sunlight, wind, rocks, and soil. There will also be biotic factors. The biotic factors, such as the plants, will have specific adaptations that allow them to survive in their own biome.

Biodiversity is the total diversity and variability of living things and the systems of which they are a part. The species diversity within a biome is directly related to (1) net productivity of the area, (2) availability of moisture, and (3) ambient temperature.

Within each biome there will be a community structure and interactions between members of its population. Given animals will be predators, prey, or decomposers, creating a food web. There will be competition for food, and this competition will drive unique relationships (mutatisitic, in which both parties benefit; commensalisite, in which one party benefits and another is unaware; and parasitic, in which one party benefits and another party is harmed).

Additionally, each biome is impacted by new populations moving in. For instance, humans have a huge effect on their local environment. In each biome to which we have moved, we have changed elements of the biotic and abiotic components of the environment. Humans have even generated effects that cross biomes, such as global warming.

Motivation
Your group has been hired as a consulting firm to design a zoo and botanical garden of the Americas in South Africa. Each group will represent a different biome and make a case before the zoo panel as to why their biome should be included in the zoo.

Objectives
At the completion of this activity, students should be able to
1. Define biodiversity
2. List the 7 major terrestrial biomes of the Americas
3. List alterations in a specific habitat and discuss the origins and effect.
4. Construct a food web for a given biome and outline the role of producers, consumer levels, and decomposers.
5. Describe some of the adaptations plants and animals have to survive in their biome.

Materials
- Old magazines for making collages if you intend for these projects to be worked on in class.
- Internet access for research
- Library access for research
- Poster boards
- Glue
- Scissors
- Graph paper for figures

Associated California Biology Standards
6a. Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
6b. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of non-native species, or changes in population size.
6e. Students know a vital part of an ecosystem is the stability of its producers and decomposers.
6g. Students know how to distinguish between the accommodation of an individual organism to its environment and the gradual adaptation of a lineage of organisms through genetic change.

Procedure
1. Have students self-select work teams. Assign each team a biome. There must be at least 7 teams, one for each biome (taiga, tundra, desert, tropical rainforest, temperate forest, grassland, tropical savanna). Give each group the assignment to investigate their biome and prepare a display to present to the zoo board on why their biome should be included at the zoo.
2. Some of the information that you may have groups include are:
   (A) Abiotic factors: Students should research the average monthly precipitation and temperature for their biome over the course of a typical year. Students can then plot the information in the form of a climatogram, (temperature with a line graph, precipitation with a bar graph). Students should work in groups to draw and label the type of soil profile found in their biome. Is there much sunlight in their area? How about the wind levels?
   (B) Research about the plants and animals that are found in their biome. From this research, students can make a collage of what the biome might look like, or what their exhibit might look like. Students should include a biome food web with the appropriate components that will be critical to the success of the exhibit. Based on their food web, students should include an energy pyramid using the names of plants and animals found in their biome.
   (C) The relationships between their biome inhabitants (plants and animals). Students should find an example of mutualism, commensalism, parasitism, and an example of interspecific competition.
   (D) Various adaptations of the plant and animals to their biome and how these adaptations help them survive in their biome.
(E) A map of the Americas with the locations of their biome highlighted. Additionally, they should include any national parks and monuments found in their biome.

(F) The types of environmental damage that have occurred in their biome and the solutions that are being worked on to solve these problems.

(G) In addition to each group’s display board, each group should turn in a written description of their research on their biome to give to the zoo.

(H) Each group will present their biome to the Zoo’s president and should make the case as to why their biome design should be selected for an exhibit at the zoo.

Evaluation
Students should be graded on both their display and the presentation of their habitat. Make a rubric for the various components you would like incorporated in each.

Extension Activities
1. This would be a great lesson in which to incorporate a field trip to a local garden or zoo that displays different types of habitats. The students could go as part of their research on the biome or as a summative event to see how they would grade a zoo or botanical garden on their habitat design.

2. This would be a good time to do the “Reading Plants” lab. In this lab you visit different habitats and look specifically at the plant adaptations that have been selected for in that habitat.

Test Preparation
1. Which of the following is not an abiotic factor?
   (A) air
   (B) water
   (C) wind
   (D) temperature
   (E) decomposers

2. The most important factors affecting the distribution of biomes are
   (A) temperature and rainfall
   (B) amount of sunlight and human population size
   (C) latitude and longitude
   (D) altitude and water supply
   (E) amount of sun and length of day

3. Which of the following lists the biomes as they appear as you move from the equator to the North Pole?
   (A) tropical rain forest-taiga-tundra-desert-temperate deciduous forest
   (B) desert-tundra-taiga-temperate deciduous forest-tropical rain forest
   (C) taiga- temperate deciduous forest- tundra-desert- tropical rain forest
   (D) tundra-taiga-temperate deciduous forest- desert- tropical rain forest
   (E) tropical rain forest- desert- temperate deciduous forest-taiga- tundra
4. Two animals live together in close association. One benefits, while the other is unaware of the first animal. The relationship is best described as
   (A) parasitism
   (B) mutualism
   (C) commensalism
   (D) predation
Student Handout: Contract Zoo and Botanical Garden

**Procedure**

Your class has been hired as a consulting firm to design a zoo and botanical garden of the Americas in South Africa.

1. Your group has been assigned a biome to research and make a presentation before the zoo president on why your biome should be included in the zoo and what it might look like.
2. In order to make your presentation, you will need to make a presentation board with your research on the biome.
3. Address the following in your display:
   a. Include abiotic factors: Your group should research the average monthly precipitation and temperature for their biome over the course of a typical year. Then plot the information in the form of a climatogram, (temperature with a line graph, precipitation with a bar graph). Draw and label the type of soil profile found in your biome. Is there much sunlight in your area? How about the wind levels?
   b. Research the plants and animals that are found in your biome. From this research you may make a collage of what you biome might look like, or what your exhibit might look like. Include a biome food web with the appropriate components that will be critical to the success of the exhibit.
   c. Based on your food web you should include an energy pyramid using the names of plants and animals found in their biome.
   d. Investigate the relationships between your biome inhabitants (plants and animals) and find an example of mutualism, commensalism, parasitism, and interspecific competition.
   e. Discuss and display various adaptations of the plant and animals to their biome and how these adaptations help them survive in their biome.
   f. Include a map of the Americas with the locations of you biome highlighted. Additionally, are their national parks or monuments found in your biome?
   g. Include the types of environmental damage that have occurred in your biome and the solutions that are being worked on to solve these problems.
4. In addition to your display board, turn in a written description of your research on your biome to give to the zoo.
5. Each group will present their biome to the Zoo’s president and should make the case as to why their biome design should be selected for an exhibit at the zoo.
Biome Clues

Taiga

Cold and wet (most of the precipitation falls in the summer)

Coniferous forests thrive

Winters are long

Elk, moose, deer, wolves, bears, lynx and wolverines thrive here

Tundra

A treeless marshy plain with grasses

Covers 1/5 of the earth’s land surface

Very low annual precipitation and most of the water present is unavailable

Caribou, foxes, lemmings and owls thrive here

Desert

Sparse vegetation often with thorns

Drought is a limiting factor

Can be warm or cold

As a biome is most represented in the interiors of the continents
Rainforest

Plenty of rain and heat

No winter

Great diversity of animals

Not very fertile soil

Savanna

Grass is the predominant vegetation

Wide temperature variation throughout year

Seasonal drought

Open landscape with widely spaced trees

Temperate Grasslands

Rich growth of prairies

Often highly productive land when converted to agriculture

Bison are most at home here

Moderate climates half-way between the equator and the poles
**Temperate Deciduous Forests**

Mild climate with plenty of rain

Deciduous trees shed their leaves in the fall

Warm summers with cool winters

Deer, bears, beavers, and raccoons thrive here