



Biomes and Climate

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Abstract:

In this lesson, students are confronted with the problem of identifying three land biomes when given their average monthly temperatures and precipitation amounts in the course of a year. In order to solve this problem, students will infer and analyze the provided data table and apply the concepts they have learned about climate factors characteristic of various biomes. Students will also have access to a list of key vocabulary terms in the form of a glossary. These key terms will guide their reasoning within the context of related terms and topics, such as cycles of matter, adaptation and survival of a species.

Grade Level(s): 7th - 8th

Objectives:

Based on the data table and the comparison between the three finished graphs, students should be able to accurately identify Biome A as a coniferous forest, or taiga, Biome B as grasslands, and Biome C as desert. In the process, it is expected that students consider carefully the total yearly amount of precipitation and temperature averages for each biome.

National Standards:

Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry

Standard C: Life Science: Populations and ecosystems

Standard D: Earth and Space Science: Structure of the earth system

New Mexico Standards:

Strand 1, Standard 1, Scientific Thinking and Practice; Understand the processes of scientific investigations

Strand 2, Standard 2, Life Science; Understand the properties, structures, and processes of living things and the interdependence of living things and their environments

Materials:

- Graphing paper (3 sheets per student)
- Overhead transparency of graph setup
- Student Lab Sheet – What Biome Is This? (1 per student)
- Data tables of annual averages for three pre-selected biomes in New Mexico: desert: (Chaparral), grasslands (Ft. Sumner), and coniferous forest (Los Alamos) from Weatherbug
- Rulers
- Markers/Pencils
- World map showing biome locations (optional)



- Pictures of three selected biomes (overhead transparencies)
- Overhead projector
- Chart of annual average precipitation and temperature ranges for each biome (can write this on the board)

Background:

Biomes comprise a group of ecosystems with similar climates and adaptations in organisms. Biomes generally occupy large geographical areas; there can be aquatic and terrestrial biomes. The yearly average amount of precipitation and yearly temperature range of an area determine the climate of an area. Accordingly, these two factors influence the frequencies and types of water, carbon, and nitrogen cycles. Plants and animals living in each biome possess adaptations that enable them to better cope in their particular ecosystems. The major biomes are:

- Desert
- Grasslands
- Taiga or Coniferous Forest
- Tropical Rain Forest
- Chaparral
- Tundra
- Deciduous Forest

References:

- Weatherbug weather stations – temperature and precipitation data from
 - Chaparral Middle School, NM
 - Ft. Sumner, NM
 - Los Alamos, NM
- Lisowski, Marylin and Linda Cronin Jones. 2005. *Environmental Science*. Upper Saddle River, NJ: Pearson Prentice Hall.
- Biggs, Alton, Lucy Daniel and Ed Ortleb. 1999. *Life Science*. New York, NY: Glencoe McGraw-Hill.
- Owen, Denis F. 1980. *What is Ecology?* Oxford, UK: Oxford University Press



Procedures:

1. Review factors of climate, meaning of biome and types of biomes, meaning of adaptation with examples.
2. Write a table on the board listing the biomes and average annual precipitation and temperature ranges.

Engage

3. Present problem/question to students in contextual situation.
 - a. Ask students if their family has ever moved from one place to another because of a change in employment. Ask students to imagine that their father or mother has decided to move to another city to take a better paying job. Further, they have always lived in the desert biome and have no idea what it will be like where they are moving. Ask, "How would you be able to determine what it's like in your new city before you every get there? What type of information would be helpful to figure out what kind of biome the new city is located in?" Possible responses might include latitude, elevation, rain shadow effect, temperature, precipitation, types of plants and animals there.
 - b. Tell students that they will be "Biome Detectives" during this activity using a year's worth of monthly precipitation and temperature to determine the biome in which three "mystery" cities are located.
4. Give each student the following material:
 - a. Data table with one year of precipitation and temperature averages for Biomes A, B, and C.
 - b. Glossary
 - c. Student lab report sheet
 - d. 3 sheets of graph paper
 - e. Two different colored pencils
5. Review each handout and the directions on student activity sheet.
6. Explain that the type of graph they will be constructing is a climagraph and is used to show the relationship between climatic factors, such as temperature and precipitation. Show an example of a climagraph.
7. Using the transparency of the climagraph format, model plotting three months of precipitation and temperature for Biome A. Some students may have difficulty with place value for data less than one-tenth (1/10).
8. Clarification of assignment: Ask a couple of students to repeat the directions in their own words to ensure understanding of the assignment.

Explore – Independent/Dyads:

9. From the data table above, students will construct a climagraph for each biome using a bar graph for precipitation and a line graph for temperature, and using a different color for each factor.
10. When students have completed climagraphs for all three biomes, instruct them to spread the graphs out and examine the data and write their prediction/hypothesis of the identity of each biome on their lab sheet. *Encourage students to refer to the glossary or table on the board if they are uncertain. Some students may benefit from calculating the total annual precipitation for each biome before writing the hypotheses.*



Explain

11. When all students have completed graphing and writing hypotheses related to the biomes' identifications, show the pictures (transparency) of the three biomes represented in the data. Reveal the identify each of the three biomes. Students will write the identifications on their lab sheets. At the end of the activity, point out that all three mystery biomes are found in the State of New Mexico – grasslands, desert, coniferous forest (taiga), as well as others.

Elaborate:

12. Students compare their hypotheses and the actual identification of each of the mystery biomes and write a conclusion stating whether or not they have support for each of their hypotheses, referencing the graphed data.

Conclusions:

This lesson assessed students' understanding of the climate factors shaping the characteristics of different land biomes. The lesson offered an opportunity for students to provide a coherent and explicit chain of reasoning by graphing, comparing and contrasting, analyzing data, and applying concepts. The activity, then, was designed for students to justify their answers and communicate findings with their peers. Students were challenged to formulate their explanations by analyzing and drawing conclusions based on their data and graphs. We found that allowing flexible interaction among students, especially during the drawing of conclusions, was fruitful, as they were able to compare and discuss results. Students needed guidance in constructing their graphs. To that effect, a transparency of the graph paper provided to students was made, and we modeled plotting three temperature points and three precipitation points for Biome A.



Glossary

Biome - A large geographical area that has the same climate and is named based on its predominant plant life

Chaparral - This biome is also called scrub forest and is found in small areas of most continents (California). It receives 50-78 cm (20-30") of precipitation a year and its temperature ranges from 53° to 65° F in the coast range and 32° to 60° F in the mountains.

Climate - The general weather conditions that an area has over time. It is determined by the amount of precipitation and temperature, as well as by latitude, elevation, and the rain shadow effect.

Deciduous - A type of tree that sheds its leaves in the Fall each year.

Desert - The driest and hottest biome, it supports little plant life. It receives less than 25 cm (10") of precipitation a year.

Ecosystem - All communities of organisms and the abiotic factors that affect them

Elevation - The distance above sea level

Grasslands - This biome is dominated by grasses and has very few trees. It receives 25-75 cm (10-30") of precipitation a year, and its temperature ranges from well over 38° C (100°F) in summer to as low as -40° C (-40°F) in winter.

Habitat - Where an organism lives in its environment.

Humidity - Amount of moisture in the air (how "wet" the air is).

Latitude - The degrees North or South of the Equator (the Equator is located at 0° latitude, the North Pole is located at 90° N latitude, and the South Pole is located at 90° S latitude)

Niche - The role an organism has in its environment.

Permafrost - Permanently frozen layer of soil in the Tundra biome.

Precipitation - The amount of rain, snow, sleet, hail that an area receives



Taiga - This is an evergreen coniferous forest biome that receives 30-85cm (12-33") of precipitation a year, mostly in the form of snow. The temperature ranges from the 80's in the summer to -65 °F in the winter.

Temperate Deciduous Forest - This forest biome is found in both the northern and southern hemispheres below 50° latitude. It has four distinct seasons and receives 75-150 cm (30-60") of precipitation each year. Its temperatures range from -22 °F to 86 °F.

Temperature range - Low and high temperatures for an area

Tropical Rain Forest - This biome has the most biodiversity of all the biomes, and it is an example of a climax community and is located near the equator. Its temperatures are high year round, and it receives 200-225 cm (80-90") of precipitation a year.

Tundra - This is the coldest biome, found around the polar cap in the northern hemisphere, and it receives an average of 25 cm (10") of precipitation annually.



Name _____ Date _____ Per. _____

Related/Not Related

Not all words will be used, but some may be used more than once.

Habitat	Biome	Water cycle
Precipitation (<i>used twice</i>)	Abiotic factors	Nitrogen cycle
Food chains	Condensation	Food web
Climate factors	Temperature	Niche
Evaporation	,Nitrogen fixation	Biotic factors

1. A _____ covers a large geographical area and is determined by its climate.
2. _____, such as _____ and _____, determine what plants and animals can live in a place.
3. A _____ is made up of many interconnected _____ and is representative of the flow of energy through an ecosystem.
4. In the _____, an element essential to life is converted into a usable form by bacteria and lightning in a process called _____.
5. Every organism has a certain role, known as its _____, because of some special adaptation that it has developed through evolution.
6. The _____ is a continuous process in which water changes from a liquid into a gas and then back into either a solid or liquid through the stages of _____, _____, and _____.
7. In an ecosystem, _____, which are the living parts of the ecosystem, and _____, which are the nonliving parts of the ecosystem, interact with and are dependent on each other in many ways.
8. The place where an organism lives in its environment is called its _____.



9. Select the phrase that best completes the following statement. Then write why the phrase you chose is the best one.

The State of New Mexico can best be described as:

- a) consisting of only one biome, which is the desert.
- b) consisting of desert and forest biomes.
- c) having only one type of climate over the whole state, which is determined by the amount of precipitation received, as well as the temperature range throughout the year.
- d) having several different climates depending on the elevation, temperature range and the amount of precipitation received.

Explain: _____



Name _____ Date: _____ Per. _____

What Biome Is This?

Objective/Purpose:

In this activity, you will be analyzing one year of data for three mystery locations. Your task is to identify the biome where each mystery location is found.

Directions:

- Carefully examine the data table containing temperature and precipitation averages for Biomes "A," "B," and "C."
- Using the graph paper provided, you will create a graph that shows both temperature and precipitation amounts for each month, using the data table. You will use one color for temperature and one color for precipitation. For each graph, be sure to do the following:
 - Label the axes to reflect temperature and precipitation amounts for each month.
 - Write a title for the graph that accurately reflects the information shown on it.
 - Construct a bar graph for precipitation.
 - Construct a line graph for temperature.
- Hypothesis:** Based on the data that you graphed for each mystery location and using what you have learned about biomes, write a hypothesis that predicts the identity of each biome.

Mystery Biome "A" is _____, because _____

Mystery Biome "B" is _____, because _____

Mystery Biome "C" is _____, because _____



4. What are the identities of the mystery biomes? Your teacher will show you pictures of the places where the data was obtained and reveal the names of the biomes where those places are located.

Biome "A" - _____

Biome "B" - _____

Biome "C" - _____

5. **Conclusion:** Based on the identification of the biomes, do you have support for each of your hypotheses? Why or why not? Make reference to the data in your discussion, and be sure to use the appropriate vocabulary words that you have learned. Why would it be important to be able to identify a location's biome?



Student's Guide

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		Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Biome A	P	.02	.01	.1	1.3	1.0	.13	.3	4.0	2.5	.6	0	.01
	T	43°	45°	47°	59°	70°	80°	85°	80°	75°	61°	51°	42°
Biome B	P	.02	.01	.5	.4	3.5	1.0	1.7	2.5	1.7	1.0	0	.01
	T	61°	61°	62°	74°	81°	94°	95°	89°	88°	72°	68°	57°
Biome C	P	.002	.03	0	.01	.03	0	.02	.16	.04	.07	0	0
	T	62°	46°	65°	78°	84°	97°	102°	90°	89°	77°	70°	62°

Identifying Biomes/Ecosystems

All temperatures are given in degrees Fahrenheit.

All precipitation amounts are given in inches.

P: Precipitation (inches)

T: Temperature (°F)

A = Los Alamos (Evergreen coniferous forest, aka taiga)

B = Ft. Sumner (grasslands)

C = Chaparral (desert)



Coniferous Forest (Taiga) - Lincoln National Forest, New Mexico
(photograph by Bill Stark)



Desert - White Sands National Monument, New Mexico
(photograph by Mark Eberle)



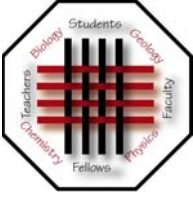
Grassland – Black Prairie, Illinois



Student's Guide

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The Black Prairie was a grassland for at least the last 15,000 years and still would be today if the grazing, fire control, agriculture, and concrete had not all but spelled its doom. Landowners Bob and Micky Bureson (on right) have restored native grasses on their property. Researcher Marilyn Shoberg gathers Little Bluestem for experimental work. Dense grasslands provided Clovis peoples with a ready source of building materials—thatched huts can be constructed in a matter of hours.



GK12 Module Student's Guide

Large grid of graph paper for student work.

Period: _____

Date: _____

Name: _____

Ecosystem/Biome _____