

Global Precipitation Measurement Mission

Water in the Biosphere Teacher Guide

Lesson Overview:

This is an activity that was developed to give participants an understanding of the biosphere. In this one-hour long activity, participants learn about the biosphere by making observations and taking measurements. They will go outside and use a dichotomous key to investigate plants and land cover as an indication of amount of water in the biosphere. Students will use this qualitative data to understand how water is found in many places in the natural environment and how these places are connected in the water cycle. The data collection is based on protocols from the GLOBE program: www.globe.gov.

Learning Objectives:

- Describe Earth's biosphere using qualitative (words) data
- Interpret data to assess the state of moisture in the biosphere
- Explain why the biosphere is an important part of the water cycle

National Standards:

Core Idea ESS2.C: The Roles of Water in Earth's Surface Processes

- Water continuously cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation, and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS-4)

Core Idea ESS2.A: Earth Materials and Systems

- All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produces chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-b) (MS-ESS2-c)

Background Information:

Water is fundamental to life on Earth. Knowing where and how much rain or snow falls globally is vital to understanding how weather and climate impact both our environment and Earth's water and energy cycles, including effects on agriculture, fresh water availability and responses to natural disasters. The Global Precipitation Measurement (GPM) mission, launching in 2014, will help scientist to better understand how much rain and snow falls around the world.

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Water is continuously cycling through all Earth systems (the water cycle). The biosphere is all of the living things on Earth. The biosphere is an important part of the water cycle because it is where all the spheres interact and work together. Living things depend on all of the other spheres. Especially important is when plants transpire, putting water vapor into the atmosphere.

This lesson adapts protocols from the GLOBE Program (www.globe.gov) to help students get hands-on experience collecting scientific data about our biosphere so they can better understand the water cycle and why it is important to know the distribution, quantity and quality of water on Earth. For the most part, this lesson uses the MUC protocols.

http://www.globe.gov/documents/10157/334459/MUC_guide.pdf

Many background facts can be found in the notes on the PowerPoint slides. These websites and resources may prove useful to get more detailed information. There are additional resources at the end of this lesson plan.

The Land Cover/Biology Guide from The GLOBE Program

http://www.globe.gov/documents/355050/355095/land_chapintro.pdf

Materials:

Copies of "Biosphere" Student Capture Sheets, including the Land Cover Key
Pencils

Engage:

Take the students outside. Tell them you will set the timer for one minute and they need to look for as many living things as they can. Then, give students a few minutes to record their observations. After this time, share answers. How many students wrote plants? Animals? All of these living things, whether big or small, in the ground or in the air, plants or animals, are all part of the biosphere (Slide 2).

Show students the introductory slide about the biosphere (Slide 3). The biosphere is all the living things on Earth. It extends anywhere there is life. The biotic components of an ecosystem are those that are living or were living at one time. All life relies on water. Animals can move around to find their own water. Plants and trees are stationary organisms so they rely on the water that is available in their habitat. Land and habitat types are often named by the types of plants that grow in the area. Different plants require different amounts of water.

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Explore:

Present our scientific question: “How much water is present in the biosphere today?” (Slide 4) Ask the students if they can identify which components of the water cycle involve the biosphere. Let them discuss ideas or share as a class. Then show the animation of the water cycle and talk over the animation to describe the biosphere connection (Slide 5).

Prepare the students to go outside and explore the biosphere and test for water (Slide 6). Give them the land cover classification key and review how to use it and how to record the data. Also, instruct them to record other living things or signs of life they see. Finally, inform the students of how to find their biosphere study site and give them a time to return and a time-keeping device. If they finish early, they could visit another site.

Explain:

Gather the groups together (Slide 7) to share and analyze their results. Based on the data collected, have them answer the scientific question, “How much water is present in the biosphere today?” Students should discuss this question with their group and record their thoughts on the capture sheet. All plants require water to survive. So, unless the area has no vegetation or is very urban, there is water. Deciduous trees tend to live in moister environments than evergreen trees. Cultivated areas, like farms, lawns and sports fields require a lot of water to live.

Evaluate:

Discuss the following with the students: Which parts of the water cycle involve the biosphere? How is the biosphere an important part of the water cycle? (Slide 8)

Wrap up by sharing a little about NASA’s GPM Mission and satellite (Slide 9). Also share the video (Slide 10).

Elaborate/Extend:

- Take pictures of the different land covers in your area and compare them.
- Identify some species of trees and plants in your area so you know exactly what is living there.
- Go on a scavenger hunt for animals or signs of animal life.
<http://www.nwf.org/kids/family-fun/outdoor-activities/backyard-scavenger-hunt.aspx>
- Make a terrarium or tabletop biosphere to investigate how all the spheres work together and how the living things help them interact
<http://www.instructorweb.com/lesson/maketerrarium.asp>
<http://www.apartmenttherapy.com/diy-tabletop-biosphere-89370>

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Teacher Notes:

This lesson provides students with background information about the biosphere and allows students to go outside and explore the biosphere. The data collection can happen with or without the background information.

Choose locations for groups to visit where there is a variety of land cover types. Groups can all test in the same area, or you can send groups to different locations and compare land covers.

The data collection is based on GLOBE Program protocols. The GLOBE Program has many training opportunities and offers a wide variety of different opportunities for students to collect authentic data and share it with other students around the world! Go to <http://www.globe.gov> and click “join” to learn more.

Additional Resources:

- Helpful information, background, and resources about the GPM mission and Precipitation Education <http://pmm.nasa.gov/education/>
http://www.nasa.gov/mission_pages/GPM/overview/index.html
- Background information about the biosphere and water cycle
<http://www.sciencelearn.org.nz/Contexts/H2O-On-the-Go/Science-Ideas-and-Concepts/The-water-cycle>
<http://www.miamisci.org/ecolinks/biosphere.html>
http://www.geography4kids.com/files/land_intro.html