

Large to Little - We are all Connected

Grade/ Grade Band: 4-5	Topic: Earth Spheres	5-6 periods
Brief Lesson Description: Students will understand that the earth has interconnected systems.		
Performance Expectation(s): Students will each create an infographic with the lithosphere, hydrosphere and biosphere. Atmosphere will be covered in separate lesson. Students can optionally include atmosphere as part of their graphic.		
Specific Learning Outcomes: Students will demonstrate an introductory to medium understanding of the lithosphere, biosphere and hydrosphere.		
Narrative / Background Information		
Prior Student Knowledge: Students will have completed units in the rock cycle, water cycle, ecosystems and atmosphere.		
Standards		
5-ESS 2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.		
Science and Engineering Processes <u>Developing and Using Models</u> Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. <ul style="list-style-type: none"> Develop a model using an example to describe a scientific principle. 	Disciplinary Core Ideas <u>ESS2.A: Earth Materials and Systems</u> <ul style="list-style-type: none"> Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. 	Crosscutting Concepts: <u>Systems and System Models</u> <ul style="list-style-type: none"> A system can be described in terms of its components and their interactions.

4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.

4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Science and Engineering Processes

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4-ESS2-1)

Analyzing and Interpreting Data

Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.

- Analyze and interpret data to make sense of phenomena using logical reasoning. (4-ESS2-2)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

- Identify the evidence that supports particular points in an explanation. (4-ESS1-1)
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-ESS3-2)

Disciplinary Core Ideas

ESS1.C: The History of Planet Earth

- Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4-ESS1-1)

ESS2.A: Earth Materials and Systems

- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1)

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4-ESS2-2)

ESS2.E: Biogeology

- Living things affect the physical characteristics of their regions. (4-ESS2-1)

ESS3.B: Natural Hazards

- A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (4-ESS3-2) (Note: This Disciplinary Core Idea can also be found in 3.WC.)

ETS1.B: Designing Solutions to Engineering Problems

- Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2)

Crosscutting Concepts:

Systems and System Models Patterns

- Patterns can be used as evidence to support an explanation. (4-ESS1-1), (4-ESS2-2)

Cause and Effect

- Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS2-1), (4-ESS3-2)

Connections to Engineering, Technology, and Applications of Science

Influence of Engineering, Technology, and Science on Society and the Natural World

- Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes consistent patterns in natural systems. (4-ESS1-1)

Possible Preconceptions/Misconceptions:

Tectonic plates are done moving. Earthquakes only occur on plate boundaries. Humans cannot prepare for earthquakes.

Water availability can always be depended upon. There is nothing we can do to save water. Seasonally rainfall is always the same. If we don't have bees we can rely on another insect for pollination. Bees are bad because they sting.

LESSON PLAN - 5-E Model

ENGAGE: Opening Activity - Access Prior Learning / Stimulate Interest / Generate Questions:

Watch short video on 4 earth spheres. <https://www.youtube.com/watch?v=5FooHD0atuc>

Discuss what the 4 spheres are: The atmosphere will be in another lesson. This lesson will focus on the Lithosphere, Biosphere and Hydrosphere.

The earth's four major subsystems, or spheres, include

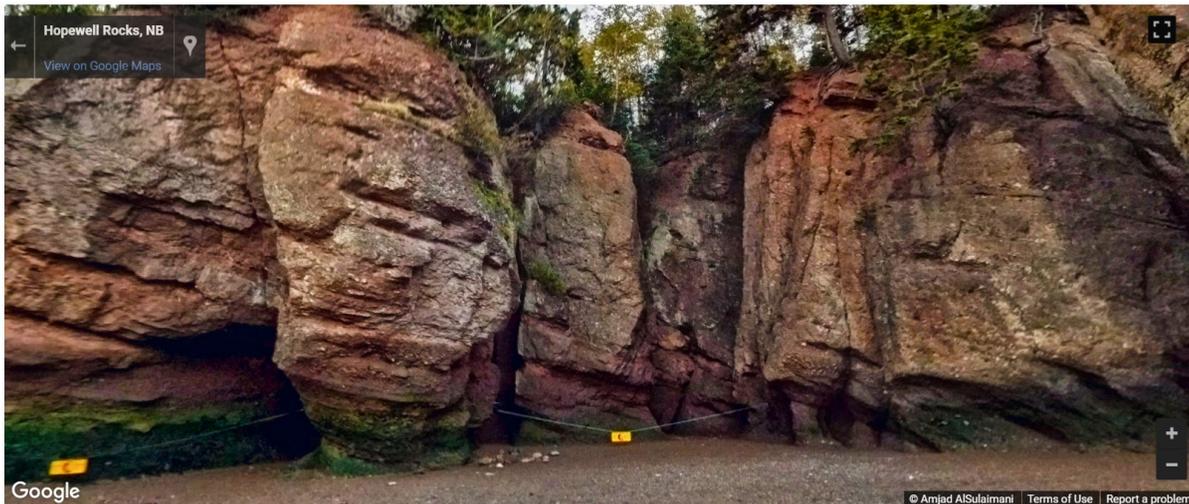
- the lithosphere, which contains all of the planet's land;
- the hydrosphere, which contains all of the planet's water and ice;
- the biosphere, which contains all of the planet's living things; and
- the atmosphere, which contains all of the planet's air and weather.

<https://eol.jsc.nasa.gov/Collections/> Click on Earth Observatory in Collections.

Students will examine 3-4 pictures and record what the picture is and what earth sphere is included in the picture. It can be more than one. Students can also use the street view function for a close up view. If they do the street view, that should also be recorded. This will be recorded in Google Slides.

Students should include questions that they might have about the pictures.

Example: This example shows 3 elements of the spheres. You don't see evidence of the hydrosphere but the bottom of the rocks have been eroded away by tides. The moss growing at the bottom of the rocks is under water during high tides.



Hopewell Rocks New Brunswick Canada Street View

Lithosphere with rocks

Biosphere algae and trees.

Example Questions:

Why is the moss growing on the underside of these rocks?

Why are the rocks in layers?

Were these rocks under the ocean and then lifted up by tectonic forces?

Students can use the slides they choose as part of the infographic if citation of source is included.

EXPLORE: Lesson Description - Materials Needed / Probing or Clarifying Questions:

Lithosphere - Earthquakes and Humans

Students will be introduced to the idea of Pangea. They will look at a map of the continents and discuss how the continents look like jigsaw puzzles.

<https://www.youtube.com/watch?v=ph7Eczs-nTI> Students will then view this video. Summary of video is a light recording of all the earthquakes from January 1, 2001, through December 31, 2015. The larger the earthquake the larger, the larger the light. The different colors represent the depth of the earthquake. First viewing - students will just watch. Then they will discuss what this might be illustrating. A Think, Pair Share strategy will be used and each group can come up with some ideas of what is going on.

Students will have evidence of plate boundaries marked by the earthquakes.

Using the Earth System Data Explorer - <https://mydasdata.larc.nasa.gov/> Students will use the World Population in Biosphere in the Earth System Data Explorer

Compare this global map to <https://earthquake.usgs.gov/>. Listed on this page are significant earthquakes in the last 30 days. Students will have a hard copy world map and mark significant earthquakes and compare earthquake locations to population centers.

Students can use Google Earth or Google maps to compare earthquake locations and Populations centers from Earth System Data Explorer. Students should record this information on the hard copy map for 5 of the significant earthquakes. Optional: Students can also include historically large earthquakes also from <https://earthquake.usgs.gov/>

Discussion: Possible topics: What are the problems with large populations and large earthquakes? Can this type of information help prepare those areas that are affected by volatile earthquakes? (Build earthquake resistant buildings, have well-trained first responders, drones that can alert where people need help, satellites that can transmit most damaged sections, systems for tsunamis, individuals need to have emergency food, water and supplies. In the future possibilities could include: be able to predict earthquakes, earthquake proof (not just resistant) buildings, perhaps be able to alleviate huge earthquake by triggering smaller earthquakes...)

Students will submit hard copy map with earthquake and population information.

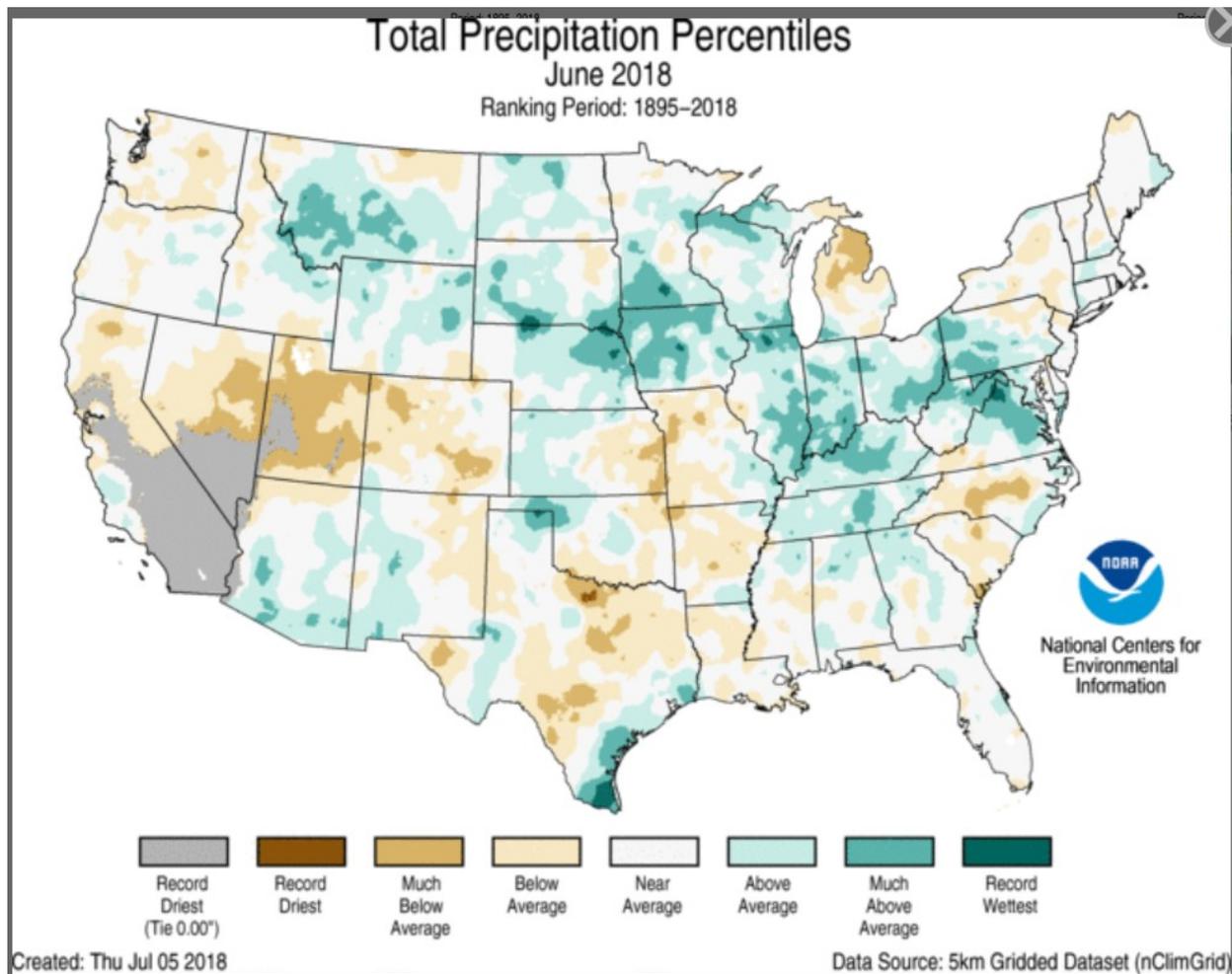
Biosphere and Hydrosphere

Humans are part of the biosphere but unlike other life on earth, we can cause great changes in the biosphere and hydrosphere. Humans with fracking are also causing changes to the lithosphere but for now at a lesser extent than the damage we can do to water or other living organisms with pollution or loss of habitat.

We looked at the lithosphere and population globally. Now we are going to examine the biosphere and hydrosphere closer to home.

Students can compare the information with the maps from year to year and month to month. General ideas and questions will be recorded on a discussion forum on Padlet. (<https://padlet.com/>.

[https://www.ncdc.noaa.gov/temp-and-precip/us-maps/1/201806?products\[\]=nationalpcpnrank&products\[\]=regionalpcpnrank&products\[\]=statewidepcpnrank&products\[\]=divisionalpcpnrank&products\[\]=grid-ranks-prcp#us-maps-select](https://www.ncdc.noaa.gov/temp-and-precip/us-maps/1/201806?products[]=nationalpcpnrank&products[]=regionalpcpnrank&products[]=statewidepcpnrank&products[]=divisionalpcpnrank&products[]=grid-ranks-prcp#us-maps-select) which show normal averages and where states are abnormally dry or wet.



(For this year - we are heading into an abnormally dry weather pattern in NH).

Discussion:

What happens to our local biosphere when we don't get enough rain? (Possible discussions - plants and crops wither, streams and rivers dry up, drinking wells dry up, tourism is affected (winter - no snow - no skiing or other winter sports, summer causes problems at the lakes,

lakes have increased cyanobacteria, less insects that breed in water, less amphibians, larger wildlife wander into areas that might have more water)

Can we do anything to conserve water?

(Not watering gardens or lawns, use appliances that use less water, recycle water that is used industry if possible...)

What can we do to keep water clean? (Possible discussions: use environmentally friendly products, pesticides, clean areas where toxic chemicals have been dumped or used, develop environmentally friendly chemicals - find energy solutions that work with the environment - solar, water, wind...)

Discussion will be conducted using Padlet. <https://padlet.com/>

EXPLAIN: Concepts Explained and Vocabulary Defined:

Students will view this video on the earth systems and how they are interconnected.

<https://www.youtube.com/watch?v=o8K0RTYM6Mc> NASA E-clip

Knowing that we can affect our biosphere and hydrosphere, we are going to look at the changes to local cities. Record the changes to growth or reduction in vegetation, preserving wetlands or building over them. (Wetlands are protected in our area).

Go to <http://changematters.esri.com/compare>

Choose a place in New Hampshire and record what you are seeing. Write 1 paragraph that answers the following questions.

Can you see if the location has grown in urban development? Can you see changes in growth or decrease in vegetation?

What changes to the local biosphere and hydrosphere might be taking place? What do you think we could do better to improve the human interaction with local biosphere and hydrosphere.

This will be recorded in Google Slides and can be added to the slides that were completed in the first lesson. Students can annotate their slides and point out their observations.

Google Earth and look at the same area?

What do you see that is part of the biosphere and hydrosphere?

ELABORATE: Applications and Extensions:

The final part of this unit will be examining bees. Bees depend on a healthy biosphere and hydrosphere. But they are failing. Although scientists haven't figured out exactly what is happening to them, we can still help. Problems might be from pesticides, a disease, less areas to find pollen, or perhaps even climate change. These are all huge problems. But each person can help.

I would like to introduce the Chimpanzee article that we read as a class. I want the students to understand that what happens in Africa can also happen here. We can learn how to protect our own local environment by making informed choices

Bees are essential to humans. Students will write as a class on Padlet to write why they think that bees are so important.

Then we will view this NASA clip on bees.

<https://nasaclips.arc.nasa.gov/video/ourworld/our-world-honeybees>

We will use this site as a resource:

<https://climatekids.nasa.gov/bees/> We are not going to make the polymer bee although that could be an extension. The students will do a mini research project on why bees are important and then compare their findings to the padlet that they started with.

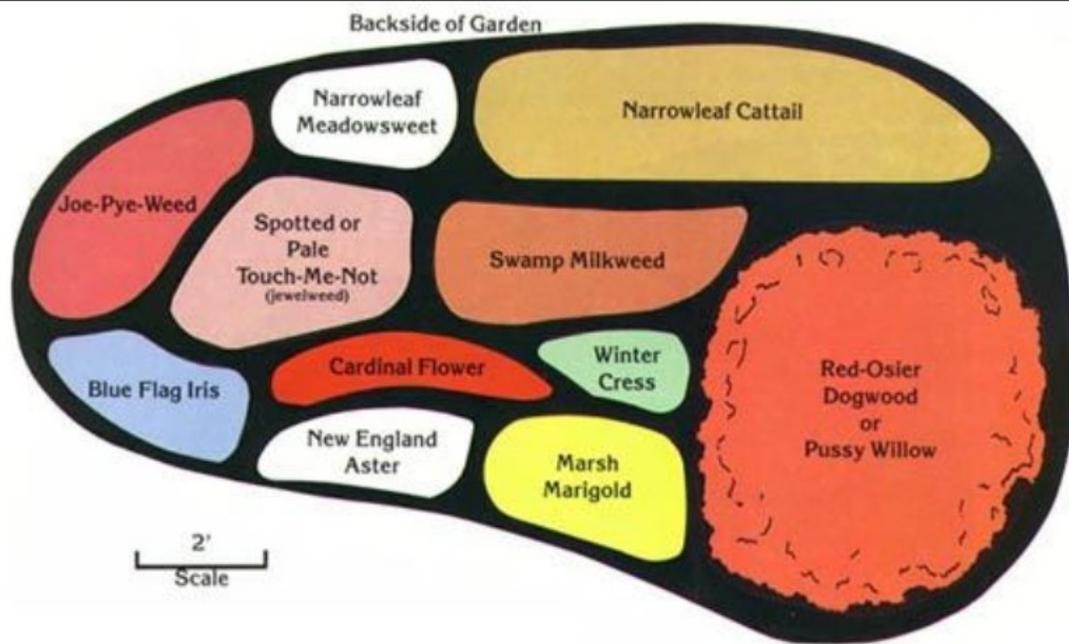
Additional Resources:

<https://www.nasa.gov/topics/earth/features/beekeepers.html>

<https://honeybeenet.gsfc.nasa.gov/Sites/ScaleHiveSite.php?SiteID=NH001>

So we know bees are having a difficult time thriving. Some because of climate change as seen in the Honeybee Net from NASA. They are also having trouble with the loss of habitat, pesticides and may also be a diseases that is responsible for the loss of wild bees.

Your job is to plan an area on the school grounds that we can use to plant bee friendly flowers. Your design can be a 3X3 square foot area that you will map out on a google spreadsheet. You will research and choose some bee friendly flowers or bushes that can be grown in our climate.



Better Homes & Gardens. (2016, November 16). Garden Plans for Birds & Butterflies. Retrieved July 21, 2018, from <https://www.bhg.com/gardening/plans/dramatic/gardens-plans-that-attract-birds-and-butterflies/>

EVALUATE:

Formative Monitoring (Questioning / Discussion): Formative and check for understanding will be conducted during each segment of this unit. Students will be evaluated on participation and completion of each task.

1. Google Slide show with 4 pictures from NASA
2. Earthquake/Population map - Discussion on video.
3. Hydrosphere discussion and /or Padlet entries
4. Change Matters - Add Google slide observations
5. Bee Discussion, Padlet and garden design.

An Infographic will be completed by each student that may include all or some of the information from this unit. It could be made as a digital poster showing the 3 spheres covered in this unit. The poster could be made in Google Docs.

Summative Assessment (Quiz / Project / Report): Infographic - can contain pictures, data, and information from the Padlets in

their infographic. They can include their bee garden design. A rubric will be followed to include the 4 different sections of this unit including a section on the lithosphere, hydrosphere and biosphere.

Elaborate Further / Reflect: Enrichment: Optional to include possible future technology protect the biosphere from earthquakes, to improve our cohabitation with other life and to protect the hydrosphere.

Resources:

CEO logo Gateway to Astronaut Photography of Earth. (2018, July 8). Retrieved July 21, 2018, from <https://eol.jsc.nasa.gov/Collections/>

National Temperature and Precipitation Maps. (2018, June). Retrieved from July 21, 2018, from [https://www.ncdc.noaa.gov/temp-and-precip/us-maps/1/201806?products\[\]=grid-ranks-prcp#us-maps-select](https://www.ncdc.noaa.gov/temp-and-precip/us-maps/1/201806?products[]=grid-ranks-prcp#us-maps-select)

Resources for Students:

Websites: 4 Earth Spheres Video

<https://www.youtube.com/watch?v=5FooHD0atuc> 4 Earth Spheres Video
<https://eol.jsc.nasa.gov/Collections/> Earth Observatory in Collections.

<https://www.youtube.com/watch?v=ph7Eczs-nTI>

Video - Earthquakes of the First 15 Years of the 21st Century

<https://mynasadata.larc.nasa.gov/> Population Data

<https://earthquake.usgs.gov/> Earthquake Information

<https://www.youtube.com/watch?v=o8K0RTYM6Mc> Video Real World: Earth Systems

<http://changematters.esri.com/compare> -

<https://nasaclips.arc.nasa.gov/video/ourworld/our-world-honeybees>

<https://climatekids.nasa.gov/bees/>

<https://www.nasa.gov/topics/earth/features/beekeepers.html>

<https://honeybeenet.gsfc.nasa.gov/Sites/ScaleHiveSite.php?SiteID=NH001>

Padlet - <https://padlet.com/>

