

**The Dynamic Balance Between Earth's Spheres 5<sup>th</sup> and 6<sup>th</sup> grade**

**Teaching Point:** Wherever you go walking or hiking, you should not only look at the small details and individual parts, but at how everything fits together. Look for clues on how the atmosphere, hydrosphere, biosphere, and geosphere act upon one another to help shape and form the land you see. Furthermore, see the effect humans (anthroposphere) make and have made.

**Cross Cutting Concepts:** Systems and Models, Patterns, Cause and Effect

**NGSS: 5-ESS2-1** Earth's major systems are the geosphere, hydrosphere, atmosphere, and biosphere.

These systems interact in ways that affect Earth's surface materials and processes.

**5-ESS3-1** Human activities in agriculture, industry, and everyday life have had major effects on land, vegetation, streams, oceans, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

**Principles of Ecology: Nested Systems, Cycles, Dynamic Balance**

**Time: 60 - 75** minutes includes hike up to Amphitheater

**Materials:** Placards for key terms with visual and definition (Geosphere, Biosphere, Hydrosphere, Atmosphere) and word cards for kids to categorize the various parts of each sphere.

**Terms: atmosphere, geosphere, hydrosphere, biosphere and anthroposphere**

Architecture	Lesson Script
<p><b>Set</b></p> <p>(1-2 mins)</p>	<p>“In the words of the famous environmentalist, John Muir: “When we try to pick out anything by itself, we find it hitched to everything else in the Universe.” In science and much of our lives we often make sense of the world by sorting, and categorizing things into separate compartments, but actually everything is interconnected and acting with each other as a whole system of systems.</p> <p>“As we hike today, we will be looking at the relationships, patterns, and processes that shape this portion of the Galindo Creek/Pine Creek Watershed. To better understand a watershed, we must look at the main Earth systems that are “hitched” together. These include the <b>atmosphere, geosphere, hydrosphere, biosphere and anthroposphere.</b>”</p>
<p><b>Teach</b></p> <p><i>This first portion of the lesson should take place at the start of the hike or in the classroom before the field trip.</i></p> <p>(15 minutes)</p>	<p>Hold up placards with images of Earth's spheres and ask participants to define, describe each sphere, elaborate/clarify further as needed.</p> <p><b><u>Atmosphere:</u></b> (Atmo- Greek for vapor) envelope of air that surrounds the solid Earth and contains gases and tiny particles of dust/ash/liquid called aerosols. The atmosphere provides space and air.</p> <p>The atmosphere is divided into layers of varying altitudes, temperatures and compositions and extends about 700 Km until it becomes outer space or the <b>exosphere</b>. The thinnest layer (about 20 Km), closest to us is known as the <b>troposphere</b> and is where the weather happens. The other layers affect us less because they are further out, but still interact with the Earth system by protecting it from harmful radiation (<b>stratosphere</b> has the ozone layer) and are visible to us at times (meteors burn up in the <b>mesosphere</b>) and Aurora Borealis is in the hot <b>thermosphere</b>.</p> <p><b><u>Geosphere:</u></b> (Geo- Greek for earth, ground or land) all the rocks, sand, minerals on Earth's surface and deep under the ground.</p>

	<p><b>Hydrosphere:</b> (Hydro- Greek for water) the mass of water found on the surface of, under, and above the Earth. This includes oceans, lakes, rivers, groundwater, as well as the water found in the clouds.</p> <p><b>Biosphere:</b> (Bio- Greek for life) The parts of Earth where life exists and includes all the living things on Earth- bacteria, plants and animals.</p> <p><b>Once each sphere is briefly defined, hand off each of the four (five if you choose to include the anthroposphere) placards to one docent/chaperone leader to hold up or to place on the ground in a big circle like a compass.</b></p> <p>As you can see, each of these spheres influences and touches some or all the other spheres, sometimes it is hard to tell which one is acting on which. To review we are going to divide you into four groups. Each group will stand by one of the placards and create a circle facing inward. Be sure to stand closely together and face inward. We will tape a word to your back and you should remain in the circle so no one in your circle can see that word-including you!</p>
<p><b>Active Engagement</b></p> <p><i>Can be done in the classroom before the field trip.</i></p> <p>(12 minutes)</p>	<p><b>Once all four groups have made their circle and have their words attached to their backs:</b></p> <p>One person in the group will turn around to show their word, then turn back to get clues from the group about what the word is. That person may not ask questions, only guess what the word might be. The group may not use the word, but can give you clues to guide you to figuring out the correct word, including the sphere(s) in which that word belongs. For example, if the word pinned to your back is “hummingbird,” the group’s first clue to you can be that your word is something that uses the atmosphere to get around, and that it is part of the biosphere. After you make a guess, they can then give you a further clue like “it nourishes itself on nectar from tubular flowers.” Once you figure out your word, the next person goes. As you talk and share, try to show how the word is connected to several of the systems.</p> <p><b>Once all groups have guessed their words, collect the words back and prepare for the hike.</b></p> <p>As we hike today, we will look at the landscape to see how the atmosphere, hydrosphere, and biosphere act on the land or geosphere and how the geosphere supports the various habitats. Be ready to explain how things are “hitched” together and working dynamically, always changing.</p>
<p><b>Hike</b></p> <p>stops to emphasize the hydrosphere and its effect on the other spheres.</p> <p>(20 mins)</p>	<p>On hike, include stops to show and discuss the power of water <b>hydrosphere</b></p> <ul style="list-style-type: none"> <li>● Habitat (riparian vs. chaparral), creek life (biosphere)</li> <li>● Nourishment to the various plants and for the animals (paths animals make to get to water, tracks...)</li> <li>● Erosion- in areas with less vegetation, discuss the benefit of perennials and deep-rooted grasses vs. annuals and shallow roots. (geosphere/biosphere)</li> </ul>

	<ul style="list-style-type: none"> <li>● Clouds/fog- provide moisture or humidity, temporary cooling, rainfall that can infiltrate into the soil and groundwater and runoff into the creeks and ultimately end up in the bay.</li> </ul> <p>Explain that we are hiking through a watershed. Watersheds are the gathering ground/basin for river systems delivering the water (including snow and ice) from the higher elevations to the lower ones and then ultimately through rivers to the oceans. Wherever you live, you are in a watershed. This is the Galindo/Pine Creek Watershed.</p>
<p><b>Active Engagement</b> (optional- 8 minutes)</p>	<p>At one good stopping point with enough room, circle the group and simulate a rainstorm.</p> <p>“Let’s stop for a moment and take note of the weather at this moment. What kind of weather are we having today? What is the driving force for the weather on Earth? Yes, the sun. Without the sun we would not have rain. Can anyone remind us why that is the case?” Hopefully students will be able to recall the major aspects of the water cycle.</p> <p>“Since it is such a dry hot day today, why don’t we make some rain on our own today.”</p> <p>Explain that you will initiate a motion and that once you have been doing this motion for a bit, you will make eye contact with the person on your right, and they are to start doing the motion and are to continue until the next time you have a new motion and make eye contact with them again. You will make eye contact with each subsequent person around the circle so that all of them are doing the first motion including you. Then you start the second motion and make eye contact with the first person to your right so that they start the new motion, while all others continue with the first motion until you make eye contact with each of them in turn.</p> <p>Motions are:</p> <ol style="list-style-type: none"> <li>1. Rub hands together gently</li> <li>2. Snap (as best as can) fingers with irregular rhythm</li> <li>3. Clap hands with irregular rhythm</li> <li>4. Stomp feet (if on pavement, do 5 before 4, if on soil do in this order)</li> <li>5. Slap hands on legs</li> <li>6. Slap hands on legs and stomp feet (height of storm)</li> <li>7. Slap hands on legs</li> <li>8. Stomp feet</li> <li>9. Clap hands</li> <li>10. Snap fingers with irregular rhythm</li> <li>11. Rub hands together gently</li> </ol> <p>This is a good time to talk about the beauty of rainstorms, but also the immense power storms have and potential dangers hiking during a rainstorm- lightning, hail, flash floods, falling limbs...</p>

	<p>“Most of the water you see today is the result of rain from this spring. Some years, like this one it rained a lot and the effects of that rain on this watershed are more obvious than in other years. As we continue hiking along the creek and up the canyon be sure to look at how water has shaped the land and influenced the biosphere.</p>
<p>Hike to amphitheater (10-15 mins)</p>	<p>Continue to ask students for evidence of the way systems are dynamic and interconnected:  For example, if you notice a track in the mud, you have evidence of the biosphere (animal’s paw mark) the geosphere (clay soils) and hydrosphere (made the soil wet for the paw print to be left behind)  What are some signs of erosion?  What are some signs of the anthroposphere?  How does evidence of decay fit into the spheres?  What are some signs of animals changing the geosphere?  How do the plants in the biosphere influence the animals and vice-versa?</p>
<p>At the amphitheater   Link  <i>Transfers back to student work and encourages accountability</i>   (3-15 minutes)</p>	<p>“Next time you go walking in nature, the suburbs, or in a busy city, take note of how everything in that area is made up of many interconnected systems. What happens in one Earth sphere influences the others.</p> <p>As humans we are not above any of these systems and when we harness them, we alter them in ways that often are more harmful than helpful. We need to walk on the Earth more gently and we need to give back to the Earth because she loves each of us.</p> <p>What will you do to love her back? Turn and talk-</p>