**(HEEC) Environmental Science 1 Activity**

**Objectives**

* Surveyan area of land and determine the land’s physical features and the number of different organisms that live there.
* Identifypossible relationships between the organisms that live in an area of land.
* Compare the similarities and differences between various ecosystems.
* Determine possible impacts of a proposed human activity on an ecosystem and defend whether or not the action should occur.

**Materials**

* hand lens
* markers or felt-tip pens of several different colors
* notebook
* pen or pencil
* poster board
* stakes or survey flags, (4)
* string, about 50 m
* tape measure or metric ruler
* plastic bags
* digging tool
* *optional materials:* field guides to insects or plants, waders, digital cameras/recorders, graph paper

Part I: Site Assessment

**Directions**: Go to the site assigned to you by your teacher to complete the survey. Return to the nature hall once you are finished. **Each** student must submit complete, detailed written observations and responses to all Analysis and Conclusion questions.

**Procedure**

1. Use a tape measure or meter stick to measure a 10 m x 10 m site to study.
2. Place one stake or survey flag at each corner of the site. Loop the string around each stake, and run the string from one stake to the next to form boundaries for the site.
3. Survey the site, and then prepare a site map of the physical features of the area on the poster board. For example, show the location of streams, sidewalks, trails, or large rocks, and indicate the direction of any noticeable slope.
4. Create a set of symbols to represent the organisms at your site. For example, you might use green triangles to represent trees, blue circles to represent insects, or brown squares to represent animal burrows or nests. At the bottom or side of the poster board, make a key for your symbols.
5. Draw your symbols on the map to show the location and relative abundance of each type of organism. Make notes to clarify any observations that may be unclear or not shown by the map.
6. In your notebook, record any observations of organisms in their environment. For example, note insects feeding on plants or seeking shelter under rocks.
7. Also describe the physical characteristics of your study area. Consider the following characteristics:
   1. **Sunlight Exposure** Approximately what percentage of the area is exposed to sunlight?
   2. **Soil** Is the soil mostly sand, silt, clay, or organic matter?
   3. **Rain** Is there evidence of a recent precipitation event? How did you determine this?
   4. **Maintenance** Is the area maintained? If so, interview the person who maintains it and find out how often the site is watered, fertilized, treated with pesticides, and mowed.
   5. **Water Drainage** Is the area well drained, or does it have pools of water?
   6. **Vegetation Cover** How much of the soil is covered with vegetation? How much of the soil is exposed?
8. After completing these observations, identify a 2 m x 2 m area that you would like to study in more detail. Stake out this area, and wrap the string around the stakes.
9. Use your hand lens to inspect the area, and record the insects you see. Be careful not to disturb the soil or the organisms. Then record the types and numbers of insects you see.
10. Collect a small sample of soil, and observe it with your hand lens. Record a description of the soil and the organisms that live in it. Place the soil sample in a plastic bag to bring back with you.
11. Make a list of all the species in the area. For organisms that you cannot identify by name, make a sketch or provide a written description. Record the number of organisms of **each** species in your list.

**Analysis**

1. **Organizing Data** Return to the classroom, and display your site map. Use your site map, your classmates’ site maps, and your notes, to answer the following questions.
2. **Analyzing Data** Write one paragraph that describes the 10 m x 10 m site you studied.
3. **Analyzing Data** Describe the 2 m x 2 m site you studied. Is this site characteristic of the larger site?

**Conclusion**

1. Which species of plant was must abundant in the 10 m x 10 m area? Name abiotic factors that affect the distribution of vegetation in your area. Explain why the species is supported by these factors.
2. How does the vegetation of your test site (10 m x 10 m) impact which animals inhabit/visit the area?
3. Observe the soil sample under a digital microscope. Describe the characteristics of the soil from your area (i.e. color, texture, moisture, etc.). Include a picture of the microscope image.
4. Describe 3 specific ecological benefits of your test site.
5. Describe 2 human economic benefits of your test site.

Part II: Data Comparison

1. Join the group(s) that completed a site assessment in the same ecosystem as your group. Compare all data collected and observations, including the map and written information. Compile a list of the ten most important characteristics of the entire ecosystem.
2. Join a group comprised of at least one person from each of the other ecosystems. List similarities and differences among the various ecosystems. For example: *The soil moisture was similar in the hardwood and pine forests but much drier in the meadow.* Decide as a group the best way to share this information with the entire group.

Part III: Environmental Impact Scenarios

1. Return to your original ecosystem groups. Each group will be given an impact scenario.
2. Determine how your ecosystem could be impacted if the proposed action took place. List **ALL** possible positive and negative effects. Be specific. Consider ecological, economic, and societal effects.
3. Is it possible to carry out the proposed scenario in a way that maximizes the positive effects and minimizes the negative effects? Explain why or why not.
4. As a group, develop a proposal describing which aspects of the scenario (if any) you would like to occur. You may slightly modify the proposed actions to lessen negative impacts, but cannot completely change the proposed action. Provide justification for all proposed actions. Be prepared to present your proposal to the entire group and answer questions.

**Teacher Notes**

1. At least one group of students should visit the following ecosystems: hardwood forest, pine forest, stream, mountainside, meadow and wetland.
2. Refer to a labeled HEEC site map for the location of each ecosystem:
3. Stream: Site 3
4. Pine Forest: Site 10
5. Hardwood Forest: Site 24
6. Mountainside: Site 27
7. Wetland: Site 36
8. Meadow: Site 37
9. Scenarios:
10. Stream: Farm Inc., a large farming corporation from the Midwest has purchased the small family farms in the Cove area, upstream of the Cove Run site at Hickory (HEEC). Their intent is to mass produce corn, pigs and cattle. In order to maximize their production and profit, they plan to remove any manure treatment facilities located on the farms. Farm Inc.’s philosophy does not include any organic or sustainable farming practices. They will be in operation year-round.
11. Pine Forest: Garrett Logging Corporation has received a contract to clearcut the pine forest at Hickory (HEEC). The corporation’s policy is to take only logs, leaving behind all brush. Reclamation costs are the responsibility of Hickory, and budget cuts have resulted in a lack of funding for replanting the area. Additionally, the heavy logging equipment may damage the roads and cause soil compaction.
12. Hardwood Forest: The Nature Center at Hickory (HEEC) has become too small to accommodate larger groups of students. Construction R Us has been contracted to build a larger facility in the hardwood forest area. Plans are to make it twice as large as the current Nature Center. Paved walkways will lead to and encompass the building, and a new paved parking lot will be placed adjacent to the building. Large machinery, such as bulldozers, will be needed to dig the foundation and put in utilities. Landscaping is **not** included in the contract.
13. Mountainside: In order to increase the use of Hickory (HEEC) during the winter months and raise funds for improvements to the facility, Recreation Extraordinaire, LLC has been contracted to develop a tubing park on the hillside adjacent to the Black Gum trail. All paths the trails will follow must be completed cleared of rocks and vegetation. A mechanical rope tow will be installed to transport riders and their tubes back to the top of the mountain. An access road and additional parking must also be provided. In order for the park to be operational at night, lights will be installed along the length of the trails and parking area.
14. Wetland: Due to an increased need for event and student parking at Northern High School, More Asphalt 4 U will be installing additional paved parking at the back of the school. The constructed wetland at the school is fed with runoff from the school’s back parking lots. Therefore, increasing the amount of paved parking will also increase the amount of runoff entering the wetland.
15. Meadow: Northern High School plans to create a new practice field to meet the needs of the expanding sports teams. The field will be located in the meadow between NHS and Hickory (HEEC). A portion of the meadow has already been designated as cropland for the agriculture program. Restrooms and seating will be installed for the teams to utilize. Lighting will be put in to allow for practices after dark.

**Post-Activity Discussion Questions**

1. Identify local and global commons and relate them to the Tragedy of the Commons.
2. Review the definition of the term sustainability. Have students revisit their action plans to determine if sustainable land use has been achieved. Students should justify their responses and, if necessary, alter the plan to obtain sustainability.
3. Describe the difference between a local and global problem, how the problems might be connected and how a potential solution to each could require different actions at different levels ranging from local to global.