LESSON 7: MICROHABITATS AND COMMUNITY RELATIONSHIPS

OVERVIEW:

In this activity, students will collect biological and physical data from various parts of a local habitat. Students will develop their understanding of ecosystems by hands on exploration. The important concepts are that: Organisms living in an ecosystem are linked together by their need for similar conditions and organisms in ecosystems interact in a variety of ways: symbiosis, competition, predator /prey, etc.

SUB-QUESTION:

Why are organisms found in specific parts of an ecosystem and not in others?

Ways of Knowing Urban Ecology:

	Students will…
Understand	• Understand that urban ecosystems are made up of a variety of microhabitats. *(ecosystem state and structure, scale)* • Organisms can become threatened if their microhabitat becomes threatened. *(ecosystem change)*
Talk	*No specific goals connected with talking about urban ecology in this lesson.*
Do	• Compare different microhabitats and the different organisms supported in them. • Differentiate between random sampling and purposeful sampling.
Act	*No specific goals connected with acting on urban ecology in this lesson.*

SAFETY GUIDELINES:

Safety precautions associated with field visits:

- All group members must remain with the group at all times
- Stay on marked trails
- Avoid picking up plants or animals (beware poisonous plants!)
- Never enter deep or moving water.
- Have pre-established meeting times and places in case anyone gets separated.
- Have a clear and well distributed agenda for the visit
- Have well established routines such as always starting and ending field visits with a circle-up at the site.
- Carry a cell phone
- Carry a first-aid kit and know what's in it and how to use it.
- "Pack it in, pack it out" – do not leave any equipment or litter at the field site, especially any hazardous test chemicals.
- Represent your school community well when out in the field.

PREPARATION:

Advance preparation: Go to the field site and distribute the hula hoops either randomly or in a manner to maximize the diversity of microhabitats, such as some sunny and some

shady sites. Take a photograph of the entire study site for use the next day during the discussion of sampling. If a photograph is not available, an aerial photograph may be sufficient (which can be obtained using Google Earth), or a rough sketch on an overhead of the study site showing where there are grassy areas, pavement, trees, shrubs, etc.

Time:

2 class periods

- Day 1: 7.1 Collect Data in the Field
- Day 2: 7.2 Analyze Data

Materials:

A photograph of the study site either with a computer projector or on an overhead (for day 2)

Each group needs:

Hula Hoops

Bug nets

A few collection jars

Soil corers (optional)

trowels

Insect field ID guides

Plastic bags for plant collection

White sheet for beating the bushes

Sling psychrometer (optional)

Sling psychrometer tables (obtained from internet)

Thermometer

Light meter (optional)

Forceps

Magnifying glass

Measuring tape (25 meter or longer)

INSTRUCTIONAL SEQUENCE

Activity 7.1: Collect Data in the Field

1. Do Now: Write on the board: What determines why animals are found in some places and not others?"
    - Record answers on the board or overhead. Discuss similarities and differences between answers to the question. Draw out the idea that climate is very important for determining where a plant or animal lives.
2. Remind the class that previously they had worked on the overall picture of their study site and its characteristics. Today they will be examining their site in more detail by looking for characteristics of smaller portions of the site- microhabitats.
3. In this activity the group will be looking at several different microhabitats within your study site or school yard. You will be using hula hoops, ideally in different colors or numbered differently to delineate the different study plots. The question

being investigated is "Why are some organisms found in one microhabitat and not in another?"
    - Know the locations of the microhabitats for analysis. For instance distances from the school (Which one is closest? Farthest?). This will help with the analysis.
4. Students should have already read the lab instructions and data collection sheets for homework. Students will work in small groups of 4-6. Once at the study site each group will be primarily be responsible for collecting data at one of the hula hoop study sites. Within each group students should divide up the labor:
    - 1-2 students collecting and cataloging insects and any other critters found within their hula hoop
    - One student collecting abiotic data, temperature, light, relative humidity within the hula hoop.
    - One student collecting and cataloging each of the different plants at the site. Being able to name and ID the plants is not as important as being able to tell that plants are different types. Also describing the vegetation structure and height.
    - One student examining the soil in the site
5. Instruct students in the use of the thermometer, sling psychrometer, light meter and other equipment.
6. Instruct students in the use of bug collecting techniques:
    - Collection jars can be closed around bugs on a branch
    - Butterfly nets can be swept through the vegetation.
    - The sheet or towel can be spread around the base of a bush on the ground. Shaking the bush causes the animals to fall onto the sheet for easy collection.
7. Bring the class to the study site and assign each group to one of the microhabitats. Different colored hula hoops work well to differentiate the sites. Allow students 25 minutes to collect all of the data on the data sheet. Data sheets can be customized depending on the equipment on hand.

Teacher Background Knowledge – Sling Psychrometer

- A sling psychrometer is a tool used to determine relative humidity. To make one, you'll need two thermometers and a wooden board that is wide enough to hold them side by side, plus a foot of string, a small wet cloth, tape, and a rubber band.
- Drill a hole into the center of the end of the board that will be the top. Tie the string through the hole. Tape the thermometers side by side onto the board, parallel to the length of the board, with the bulbs of the thermometers extending beyond the bottom edge. Wrap the wet cloth around one thermometer bulb, and secure it with the rubber band; leave the other bulb bare.
- Holding onto the string, swing (or "sling") the device in front of you for a few minutes. This may spray water from the bulb, so make sure the area is clear. Then stop swinging and read the temperature on both of the thermometers. The one wrapped in cloth will probably show a lower temperature than the dry-bulb thermometer because water in the cloth evaporated, cooling the cloth and the thermometer. The drier the air, the more water will evaporate from the wet cloth,

and the greater the temperature difference will be between the two thermometers. For the most accurate reading, swing your psychrometer for several minutes, until the thermometer wrapped in cloth stays at a constant temperature. See the tables attached at the end of this document to determine the relative humidity from the temperature difference between the two thermometers, and make the appropriate table available to your students (depending on the scale of the thermometers, either Fahrenheit or Celsius).

Source: http://www.almanac.com/weathercenter/sling.php, the Old Farmer's Almanac

Sling Psychrometer Tables can be found easily using an internet search engine.

Teaching Strategy

- Try to find a variety of different microhabitats, if they are available. For example, types of sites could contain shrubs, trees, mown field, or parts of a sidewalk or parking lot; a site could be along the side of the school building; some sites might be heavily trafficked areas such as near a picnic table or along a pathway; or a site might be near water if possible within the larger study site. The variety of sites will provide opportunities for a richer discussion as students compare their different sites.
- Tomorrow there will be a discussion about the difference between random and purposeful sampling and their uses.

8. Bring the class back together to compile the data sheets from each group onto a class data set. Fill in only the presence or absence data for the top portion of data table 1. Collect and compile the abiotic data from each group. Leave the total species, total unique species and number of sites found calculations blank for now.
    - See "Example Class Data Sheet" for optional tables
9. Optional Extension: Students could also record the number of each organism present in addition to just presence or absence data.
10. Option: have a single student compile the data sheets onto one class data set.

This concludes day 1 of the lesson.

***Teacher Content Knowledge*:**

Important terms:

- Habitat: where an organism lives, such as a forest or desert.
- Microhabitat: a small portion of a larger habitat with similar structure and microclimate, such as the area underneath a log or the fur on a dog's back.
- Climate: long term patterns of temperature and precipitation of an area
- Microclimate: the climate of a microhabitat, especially as differentiated from the larger climate.

Activity 7.2: Analyze Data

Preparation ahead of time: Make copies of the class data sheets to distribute to each student. This could also be disseminated electronically.

1. Do Now: List 3 interesting things that you saw in your microhabitat.
2. Hand out class data set to each student. Ask students to complete the calculations of total species number for each, site, number of sites each organism is found, and number of organisms unique to each site. (Areas highlighted in grey in the completed example below).
3. Tell students to take a few minutes once they've completed the calculations to write down any general patterns they see in the data. Were the study sites similar or all varied? Do they notice anything interesting? Give students 3 minutes to write their answers.
4. Tell students the study they just did was a type of sampling. Sampling is when a smaller group is chosen from the whole to study more easily the larger group. There are many different ways to sample an area or population.
5. Show on an overhead or projector a photograph of the study site with the positions of the microhabitats indicated. Ask them what might have been different in the data if you had randomly thrown the hula hoops in the air and studied where they landed. If students have difficulty, ask what type of terrain they said there was a lot of in their field study survey – grass, forests, pavement, etc., to show where most of the hula hoops would likely have landed. Have them consider what the result was of that microhabitat study.
6. Have students brainstorm, writing student responses on the board under the two headings "Random" and "Purposeful" what reasons we might have for studying our site in a random way versus a purposeful way (the way we did it) where the teacher chose particular sites for the study.
7. Once the ideas are on the board, discuss those that are particularly relevant to a discussion of sampling (see the gray box below for some key ideas about sampling). Especially if the main ideas of random and purposeful sampling are not apparent to the class, explicitly define them for your students. This may be done as: Random sampling is when the smaller group being studied is chosen without a specific pattern or plan, and gives results typical of the larger group. Purposeful sampling selects the smaller group to be rich in information.

Teacher Background Knowledge – Sampling

- In our microhabitat study, we have used maximum variation sampling, a type of purposeful sampling. This involves purposefully picking a wide range of variation on dimensions of interest. This documents unique or diverse variations that have emerged in adapting to different conditions.
- One alternative would have been to use random sampling, where the microhabitats being studied would have been chosen at random and represented the whole of the study site more faithfully.
- Below are some key reasons for using random or purposeful samplings.

Random: Every area has an equal chance of being studied; reduces chance of bias; gives data reflecting the entire site that represents the site's actual proportions.

Purposeful: Allows us to take into consideration populations that may represent a very small portion of the whole site, including where we might find unique species; Gives a picture of many microhabitats, without considering the majority of the site over and over again

8. Students should each complete the analysis questions on the Analysis page of the student worksheet. If time does not permit, have students finish analysis questions for homework.
    - Students will also make two different graphs of their data. You can decide more specifically what they are to graph. For instance, the first graph could be a bar graph of a specific species (or total amount of species) of the different habitats from example class data sheet 1. The second graph could be a line graph of temperature, light condition, soil moisture, vegetation height or any of those components from example class data sheet 2.
    - Students should be encouraged, while writing the conclusions to each graph, to compare the graphs, and the conclusions with their other data.

Conclusions

1. End of class Reflections: Have students revisit the Do Now question. From the previous day: "What determines why animals are found in some places and not others?" using evidence from the activity.