

## **LESSON 3: SETTING UP THE BIODIVERSITY INVESTIGATION**

### **OVERVIEW:**

The purpose of this lesson is to connect the issues around biodiversity to the students' field site. The lesson starts with a class discussion where students talk about what they believe the bird biodiversity is at their field site, and whether or not they believe it is likely to be higher in some areas compared to others. Then in groups students develop the research question they will be investigating in this module as well as their predictions for that research question. Students will return to this investigation four times during the module to collect data and then to analyze the data by applying the various science concepts they have learned throughout the module. Finally, at the end of the module, they will apply what they have learned about the bird biodiversity at their field site to their action plan for their field site.

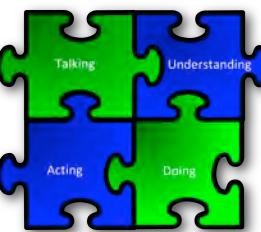
### **SUB-QUESTION:**

What is the bird biodiversity of our field site?

### **WAYS OF KNOWING URBAN ECOLOGY:**

<i>Students will...</i>	
	<b><u>Understand</u></b> No specific goals connected with understanding urban ecology in this lesson.
	<b><u>Talk</u></b> No specific goals connected with talking about urban ecology in this lesson.
	<b><u>Do</u></b> <ul style="list-style-type: none"> <li>• Develop a testable research question and prediction regarding the bird biodiversity at their study site that includes a measurable outcome variable and considers the potential human impacts on the bird biodiversity.</li> <li>• Design an investigation to answer their research questions including determining what data to collect and how to collect it.</li> </ul>
	<b><u>Act</u></b> No specific goals connected with acting on urban ecology in this lesson.

### **WAYS OF KNOWING URBAN ECOLOGY:**

	<b><u>Understanding</u></b> No specific goals connected with acting on urban ecology in this lesson.
	<b><u>Talking</u></b> No specific goals connected with acting on urban ecology in this lesson.
	<b><u>Doing</u></b> <ul style="list-style-type: none"> <li>• Students will develop a testable research question and prediction regarding the bird biodiversity at their study site that includes a measurable outcome variable and considers the potential human impacts on the bird biodiversity.</li> <li>• Students will design an investigation to answer their research questions including determining what data to collect and how to collect it.</li> </ul>
	<b><u>Acting</u></b> No specific goals connected with acting on urban ecology in this lesson.

**SAFETY GUIDELINES:**

There are no specific safety concerns associated with this activity.

**PREPARATION:****Time:**

1 class period

**Materials:****Activity 3.2**

PowerPoint

Orthophoto of the study site for each group

Copies of student handouts

**Teacher Background Knowledge**

- An orthophoto is an aerial photograph. You can obtain an orthophoto of your field site using Google Earth - <http://earth.google.com/> You may want to use an altitude of about 0.5 miles or 2640 feet - this allows students to see a large stretch of neighborhood while still being able to discern details. In the bottom right hand corner of Google Earth, it says “eye alt” which tells you the current altitude in feet.

**INSTRUCTIONAL SEQUENCE****Activity 3.1: Discussion of bird biodiversity at field site**

1. Tell students that they will now be taking what they have been learning about biodiversity and use it to design an investigation at their field site to explore bird biodiversity. Ask students to think back to previous times when they have been at the field site. Although they have not specifically been investigating birds, ask them to think about the birds at their field site:
  - What number of individual birds do they think live at their field site? How many species of birds do they think live there? What species of birds do they think live there? What areas of their field site do they think they will be more likely to find birds? Why?
  - There are no correct answers to these questions. The purpose is to get students thinking about bird biodiversity before designing their field study. You may want to probe students to think about what types of habitat different birds need to survive and where they would find those at their field site.

**Teaching Alternative**

- The brainstorming of biodiversity of their field site can also be used as an individual “Do Now” or warm up activity at the beginning of class where students write down their ideas before they are discussed as a class

**Activity 3.2: Developing a research question & predictions**

1. Use the PowerPoint to remind the students of the various scientific inquiry practices that they have been using during their investigations at their field site. Tell them today they will be working on generating research questions, creating predictions and designing their investigation.

**Teacher Background Knowledge**

- In this activity students are developing their research question. In order to help students think about why bird biodiversity is higher in some areas than others, we suggest using some type of comparative questions where students are comparing different areas or different points in time. A couple of example questions are provided below.

**Teaching Alternatives**

- You can choose to have different groups of students investigate different research questions or you may decide to have the entire class investigate a single class question. Either way we suggest beginning by having students brainstorm possible research questions and predictions in groups and then discussing those ideas as a full class.
2. Share with students the PowerPoint slide that describes four important characteristics of the research questions that they will be developing for their field study – testable, include an outcome (dependent) variable, be specific and include a comparison. Discuss that specifically for this study you would like them to create a question that allows them to make a comparison in order to help them figure out what impacts the bird biodiversity of a site.
    - You may want to provide an everyday example to illustrate a question that includes a comparison. For example: 1. Where do high school students hangout after school? (not a comparison) 2. How many high school students go to work compared to a mall after school? (a comparison)
    - In later lessons, it is suggested that students do a comparison of two different sites or locations, this is only an example and might not be possible for all classes.
    - Tell students that the comparison aspect is important because otherwise the numbers of the indices will not really mean much without context.
  3. Place students into small groups to work on developing a research question and predictions. Give each group an orthophoto of their study site and the student activity sheet to scaffold their creation of the research questions and predictions. Have students develop their research questions and predictions.
  4. Have each group share their question and prediction. If you are choosing to do a whole class research question: write the questions/predictions on the board and try and come up with a consensus about the research question. Individual groups may have different predictions. This may result in a richer conversation at the end of the module. Below are some examples of possible research questions and predictions that the class could develop.

Comparison type	Sample Questions	Sample Prediction
Spatial/Habitat  <i>Note: these locations can be within your study site or to a remote site (For example using data from another school)</i>	Which location (A or B) will have higher biodiversity?	I think location A (near the athletic fields) will have a higher biodiversity of bird than location B (near the parking lot) because there are more trees there
		I think location B (near the parking lot) will have a higher biodiversity of bird than location A (near the athletic fields) because there is a dumpster and I see birds feeding there all the time
Temporal  <i>Note: To do a fair temporal comparison, the data must be from the same time of the year otherwise seasonal variations will impact the comparison.</i>	Has the biodiversity of this site changed over time?	I think the bird biodiversity will be higher at our schoolyard this year than last year because some kids at my school put in a garden last summer.

### Activity 3.3: Designing our study

- Now that each group has a question and prediction (or you have developed a full class question), have student design their research study, reminding them that they can always modify their plan after their first visit if their procedure does not work.
  - You may want to remind the students about how in the previous two lessons with the three sites in the city a transect was used to select those three sites. A transect is a sampling plan that scientists often use to collect biodiversity data. A transect is a physical path that is laid out at a sampling site so that you can use exactly the same locations each time you collect data. Students may want to use a transect in their design of how to collect data for their study.
- Have students use their orthophoto of their field site to consider how and where they want to collect data. You may wish to tell students ahead of time how many opportunities they will have to collect data (e.g., 3 days).
  - If it is convenient and the weather permits, in addition to looking at a photo you may just want to take the students outside to the field site to walk around for a few minutes. Students should take notes on how and where they want to collect data. Remind them to be thinking of a point of comparison.

### Teaching Alternatives

- If you are doing the investigation as a whole class, you may either have students work in teams first and then use the variation to come to a class consensus or you may wish to conduct this entire section as a whole class discussion. Ideally though each group will still leave with a written draft of their study design.
- By the end of class each group should have a written draft of what they intend to study. However, it's important for students to grasp that these are revisable and you may wish to give students time to revise their studies after their first field visit.

**Concluding the Lesson**

1. Have the student groups briefly share their plan for collecting data. Before the groups share, you may want to suggest that the students listen to the other groups to see if there are any other groups that have similar research questions where they may want to share or combine data sets.