TheCornellLab of Ornithology

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Kids Discover the Trail!

PRE-VISIT CLASSROOM LESSONS

*Please complete these lessons **before** your field experience at the Cornell Lab.*
These lessons and those at the Cornell Lab address fifth-grade standards.

Time Needed:

3 class sessions,
40-50 minutes each

Goals

Students will explore the concept of biodiversity and prepare to become participatory scientists helping to preserve biodiversity. They will use authentic data to gain a better understanding of the four habitats they will study on their field experience.

Materials for each student:

- ☐ Exploring Biodiversity Student Journal (paper copies given out at January meeting)
- ☐ Habitat graphs for the four habitats (one packet for each student group)
- ☐ Pencil
- ☐ *Peterson's First Guide to Birds*

For the class:

- ☐ Biodiversity and Participatory Science slide show

Learning Targets

1. I can define biodiversity and explain why it's important.
2. I can explain what participatory science is and how it is used as a tool for monitoring and protecting biodiversity. ***NYS Learning Science Standards P-12: Earth's Systems 5-ESS3-1***
3. I can list 3 examples of bird diversity (features that vary between species).
4. I can list at least 2 plants and 2 animals found in each of four habitats in the Northeastern US (pond, swamp, mature forest, younger forest). ***NYS Science Learning Standards P-12: Science findings are limited to questions that can be answered with empirical evidence 5-ESS3-1***
5. I can draw/describe a bird species found in one of the four habitats, using a field guide. ***NYS Next Generation ELA: 5W5 Draw evidence from literary or informational texts to support analysis, reflection, and research.***
6. I can explain the information represented in bar graphs of citizen science data collected by past years' KDT students. ***NYS Next Generation Mathematics Grade 5: NY-5G***
7. I can use these participatory science data to draw conclusions and make predictions about the likelihood of finding various species in each of the four habitats, compare 2 or more habitats, and determine the most common and least common species in one habitat. ***NYS Next Generation Mathematics Grade 5: NY-5G***
8. I know that individuals and communities are doing things to help protect Earth's resources and environments. ***NYS Science Learning Standards P-12: Human Impacts on Earth Systems 5-ESS3.C***

Using this guide: The green text indicates Teacher's script, and green text boxes give background information and answers to some Student Journal Questions.

OVERVIEW

Session One: Biodiversity & Habitat **(Approx. 40-50 minutes)**

- ✓ Learn what biodiversity is and why it's important
- ✓ Learn what Participatory Science is and how it is used to preserve biodiversity
- ✓ Learn basic characteristics of four habitats of Sapsucker Woods
- ✓ Become familiar with several species of plants and animals found in each habitat of Sapsucker Woods

Session Two: Data Exploration **(Approx. 40-50 minutes)**

- ✓ Use species presence data to determine which habitat a graph represents
- ✓ Explore habitat data from previous years' KDT students
- ✓ Use graphs to predict which species students are most likely and least likely to find in a given habitat of Sapsucker Woods
- ✓ Use graphs to compare two habitats by determining which species they have in common, which are in only one, and drawing conclusions about why that is
- ✓ Use graphs to explore the concepts of generalists and specialists

Session Three: Bird ID & Physical Features of Bird Diversity
(Approx. 40-50 minutes)

- ✓ Explore field guides and use them to find examples of bird diversity
- ✓ Sketch a bird from one of the four habitats, using their field guides
- ✓ Go outside to observe and sketch a live bird
- ✓ Discuss useful field marks

Session One: Biodiversity & Habitat
(Approx. 40-50 minutes)

In this first session students will explore the important concept of biodiversity and prepare for the field experience at the Cornell Lab of Ornithology. Use the script and information below, and the questions on pp. 1-2 in the **Student Journal**, to guide discussion while using the **"Exploring Biodiversity" Slide Show**.

Slide 1: ***What do you think biodiversity is?***
Have students write their answers on p. 1 of the Student Journal, then discuss as a class. See "Background for Teachers" on p. 4 of this lesson plan for a good definition of biodiversity.

Slide 2: ***Biodiversity can be measured on many scales. How or why is biodiversity important?***
Have students write their answers on p. 1 of the Student Journal, then go to slide 3.

Slide 3: Discuss the bullet points, including any the students hadn't thought of, or that they would add to the list. See "Background for Teachers" on p. 4 for more information on these features.

Slide 4: ***All over the country, and the world, there are places where plants and animals have declined or even disappeared. Why do you think this is happening?***
Development, habitat loss, climate change, invasive species…

How do we preserve biodiversity? We must first know what plants and animals are found in an area. Scientists do this by conducting surveys—collecting data on which plants and animals are found in each area. They can use this data to keep track of changes and manage natural areas to preserve their biodiversity. But scientists can't be everywhere, so many researchers rely on Participatory Scientists.

Slides 5: ***Here is an example of real-world loss of bird biodiversity that was conducted by a team of researchers led by the Cornell Lab of Ornithologists. With the help of participatory scientists, they found that since 1970, there were 2.9 billion fewer breeding birds in North America. That's 1 in 4 birds gone – even common birds like Blue Jays. Why might fewer birds be a bad thing?***
Birds eat insect pests that impact people and damage food crops. Birds help with pollination and seed dispersal. Bird-watching supports the economy (lots of people buy binoculars, bird seed, and go on trips to see birds). Birds indicate ecosystem health. Birds are beautiful!

Slide 6: ***Luckily there are things you and I can do to protect birds including: make windows safer so birds don't crash into them, keep cats indoors, use native plants, avoid pesticides, drink shade-grown coffee which supports migratory bird habitat, reduce plastic use, and do participatory science. The good news is that conservation works because raptors, turkeys, waterfowl (ducks), and woodpecker species increased their populations since 1970 because people and governments protected bird habitat, banned chemicals like DDT, and increased funding to protect those species.***

Learn more about the research and the 7 Simple Actions at https://www.3billionbirds.org/.

Slide 7: ***So who are these participatory scientists that we keep mentioning? Participatory scientists are people like all of you, collecting data for science.***

Slide 8: ***On your field trip to the Cornell Lab of Ornithology, you will be helping the Lab scientists preserve biodiversity by conducting Biodiversity Surveys in Sapsucker Woods! It's important to repeat the surveys in the same way for several years so researchers can look for changes. This is a key tool in managing for biodiversity. When you conduct these surveys, you become a Participatory Scientist.***

Slide 9: ***On your trip to the Lab, you will work in 4 participatory science teams to collect biodiversity data. This helps scientists at the Lab keep track of any changes in the species there so they can manage the habitats to preserve biodiversity. Your data will also help future students understand what is found in each habitat. And you'll be using data collected by last year's students to explore questions about the habitats in the second part of this lesson.***

Slide 10: ***Let's learn about the habitats you'll be studying when we go to the Lab of Ornithology.***

Slide 11: ***These are four of the main habitats found in Sapsucker Woods.***
Have students write these in their Student Journal (p. 1) and review the definition of a habitat.

Slide 12-16: ***We'll use these three main clues to figure out which habitat we're in. Let's look at these characteristics for our four habitats.*** Go through the three characteristics for the Mature Forest, Younger Forest, Swamp, and Pond habitats. After slide 14, ask students to answer the last two questions on p. 1 of their Student Journals.

Slides 17-64 are species slides, with a picture and brief description of each species. Have students use the table on page 2 of their student journals to keep track of which plants and animals they already know and which are new to them.

The color-coded key at the top of each slide shows which habitat(s) the species is found in.
Slides 45-60 include sounds for each bird and amphibian. To play, click the speaker icon.

Slide 65: Wrap up the lesson. Remind students that on the day of their field trip, they should bring their Student Journals and be prepared to go outside rain or shine.

Background for Teachers: The Importance of Biodiversity

Biodiversity refers to the variety of life on our planet, including all living creatures and their habitats. Each species is the result of thousands, even millions, of years of evolution. You can see by breaking down the word that it is about the **diversity** of **bio**logical organisms. Just as we recognize that diversity is a good thing in our culture, it is also true in nature.

1. Biodiversity is an **important feature of healthy ecosystems**

    a) **Diverse ecosystems adjust better to disturbances** like extreme fires and floods.
    b) Diverse ecological communities are **more resistant to the spread of disease**. An example from agriculture: monocultures (large areas planted with only one crop) are much more likely to be overtaken by disease than areas planted with a variety of crops.
    c) **A diverse ecosystem is a more stable one.** When an ecosystem's diversity is reduced, you can get a breakdown in the health of that environment. For example, the loss of pollinators such as bees can lead to a decline in those fruits whose plants rely on the bee pollinators. Similarly, if we lose the beech trees in Sapsucker Woods, it could impact Cayuga Lake because the creek running through this beech-maple forest (and picking up nutrients and organisms in Sapsucker Woods) eventually feeds into the lake.

2. Biodiversity is important for the **ecological services** allowing us to live healthy and happy lives.

    a) **The array of foods and materials we rely on.** Without a diversity of pollinators, plants, and soils, our grocery stores would have fewer kinds of produce.
    b) **Most medical discoveries** to cure diseases were made through research into plant and animal biology and genetics. Every time a species becomes extinct we have the potential to lose a new vaccine or drug that might have saved human lives.
    c) **For the wonder and beauty of it all**. Our planet has an incredible diversity of plants, animals, and landforms. These natural wonders are a source of great enjoyment and inspiration for humans the world over.

Session Two: Data Exploration

In preparation for their habitat walk and Biodiversity Survey in Sapsucker Woods, take some time to explore the survey data collected by last year's KDT students. Divide students into the same four groups you'll use for the field experience at the Lab of Ornithology and the Cayuga Nature Center.

Getting oriented
Project the sample graphs at the end of the slide show and ask these questions to get started:

- ***What is the title of graph A? Of graph B?***
- ***What is the x-axis measuring? What about the y-axis?*** X-axis is species, y-axis is percent of checklists reporting each species, giving a rough estimate of how likely you are to see that species—in that habitat on the trails in Sapsucker Woods in May and June.
- ***What is the unit of measurement for the y-axis? What's another way to say what the Y-axis measures?*** The unit is "percent." The likelihood of finding each species in that habitat at Sapsucker Woods in May/June.
- ***Fractions, like percentages, can tell us how often a species is found. How would you say 20% as a fraction? Be sure to simplify!*** 1/5

1) Explore one habitat

Go over the "Explore one habitat" questions on page two of the Student Journal, or have students work on them in their groups. See the table below for answers to questions 1-4.

Habitat	Most likely *	Unlikely (≤10%)*
Habitat 1 = Swamp	1. Plant: Fern, red maple 2. Bird: Eastern Phoebe (40%) 3. Other Animal: Water strider, mosquito, dragonfly	Pileated Woodpecker, white oak
Habitat 2 = Pond	1. Plant: Cattails, duckweed, water lily 2. Bird: Red-winged Blackbird (80%) 3. Other Animal: Mosquito, painted turtle, water strider	Red squirrel, American Robin, leaf hopper, snapping turtle, grape vine, poison ivy, sugar maple, white ash, wild strawberry, birch
Habitat 3 = Mature Forest	1. Plant: Beech, moss 2. Bird: American Robin (45%) 3. Other Animal: Mosquito, chipmunk, gray squirrel	Canada Goose, Gray Catbird, Great-crested Flycatcher, Wood Thrush, Yellow Warbler, American toad, Blue Jay, Downy Woodpecker, spicebush
Habitat 4 = Younger Forest	1. Plant: Fern, honeysuckle 2. Bird: American Robin (69%) 3. Other Animal: Mosquito, chipmunk, bee	Red squirrel, Baltimore Oriole, Canada Goose, Common Grackle, Gray Catbird, Downy Woodpecker

*** For our purposes, "most likely" refers to those species with the highest percent of surveys recorded; species you'd be lucky to see are those with a 10% likelihood or less of being recorded in that habitat. When more than one species is listed, those species have equal likelihood values.**

2) Compare 2 habitats

Give each group the graph sheets for the second (paired) habitat. Use the pairs in the table below.
Go over the questions on page 3 of the Student Journal or have students work on them in groups.

Habitat pairs	Species in common	Why?
#1 and #2 (Swamp & Pond)	Dragonfly, Red-winged Blackbird, waterstriders, bullfrog, green frog, Canada Goose, duckweed, cattails, sedges	Found in many wetland habitats
	Common Grackle, mosquito, bee	Generalist species found in many habitats
	Baltimore Oriole, American Robin, fern, moss, sugar maple, white ash	Woodland species—swamp is a kind of forest and our pond is next to a forest
	Honeysuckle, poison ivy	Found in younger habitats and edges
	Species in only one of these habitats	**Why?**
Found in Swamp but not in Pond	Eastern Phoebe, American Robin, chipmunk, gray squirrel, Great-crested Flycatcher, Red-bellied Woodpecker, Pileated Woodpecker, blueberry, skunk cabbage, red oak, multiflora rose, shagbark hickory, white oak	Most of these are present because the swamp is a kind of forest (trees, woodpeckers, squirrels) and some because it's shadier than the pond habitat (blueberries, skunk cabbage)
Found in Pond but not in Swamp	Painted turtle, Gray Catbird, Great Blue Heron, red squirrel, leaf hopper, snapping turtle, water lily, pickerel weed, grape vine, wild strawberry, birch	Main difference between these two habitats is trees or no trees. Some of these species prefer sunny, open water (turtles, herons, water lily, pickerel weed). Other species were actually seen at the edge of the pond, which is basically a younger forest habitat (squirrel, grape vine, strawberry, birch).

Habitat pairs	Species in common	Why?
#3 and #4 (Mature Forest & Younger Forest)	Chipmunk, American Robin, gray squirrel, Gray Catbird, Wood Thrush, Blue Jay, Downy Woodpecker, moss, fern, mayapple, sugar maple, jack-in-the-pulpit, white ash, red maple, shagbark hickory	Found in many woodland habitats
	Mosquito, bee, dragonfly, poison ivy	Generalist species found in many habitats
	Species in only one of these habitats	**Why?**
In Mature Forest but not in Younger Forest	Great-crested Flycatcher, Red-bellied Woodpecker, American toad, red oak, trillium, false Solomon's seal, skunk cabbage, spicebush	Most of these are found only in forests that have been intact for a long time and have a shady understory
	American Crow, Yellow Warbler	Random chance
In Younger Forest but not in Mature Forest	Baltimore Oriole, Red-winged Blackbird, multiflora rose, wild strawberry, grape vine, black cherry, buckthorn	Most of these are found only in forests with more light reaching the understory
	Black-capped Chickadee, red squirrel, white pine, Norway spruce	Random chance

3) Generalists and specialists

Some animal and plant species are "generalists" while others are more specialized ("specialists"). Specialists can live only in a narrow range of conditions, while generalists are able to survive a wide variety of conditions and changes in the environment.

Hand out the remaining habitat graph sheets to each group. Look at the graphs for all 4 habitats. Discuss the following questions found on page 3 of the Student Journal.

- ***Can you find a species that is found in 3 or 4 of the habitats?***
  (American Robin, mosquito, poison ivy) ***These species are generalists, able to live in a variety of conditions.***

- ***How about a species that is only found in one habitat?***
  Why do you think that is? Some of these species just happened to be found in only one habitat by KDT students, but others (e.g. trillium) are more specialized, living in a narrow range of conditions such as the amount of water or light to the forest floor.

More resources for exploring birds and conducting Participatory Science with your students!

Find these projects and more at https://www.birds.cornell.edu/home/get-involved/

Participatory Science projects:

- Celebrate Urban Birds
- eBird
- NestWatch
- Project FeederWatch

Other resources:

- All About Birds—guide to birds and bird watching
- Bird Academy—online courses, videos, learning games and interactives
- Bird Cams—see birds live and up close
- K-12—inquiry-based science resources for educators
- Merlin—download the app or use the website to ID birds by answering 5 questions or uploading a photo

Session Three: Bird ID & Physical Features of Bird Diversity (Approx. 40-50 minutes)

In this session students will become familiar with their new field guides and use them to explore biodiversity among birds.

1) Get to know your field guide

Give each student a copy of ***Peterson's First Guide to Birds***. Have them **put their names in their book and then spend time looking through the pages** to become familiar with it. Ask students: ***How do you think the book is organized?*** Like most field guides, this one is arranged in taxonomic order—birds that are more closely related appear on neighboring pages. For example, all the ducks are grouped together, all the hawks, all the woodpeckers, etc.

2) Diversity of physical features

Using the ***Peterson's First Guide to Birds,*** have students look through pages 8-13 noting the different features used to identify birds (tail and bill shape, color patterns, etc).

Next have students **look at the various bird groups** (ducks, hawks, woodpeckers, warblers). ***How are the groups different from each other? How are bird species within a group different? What physical features can you see that vary between species?***
Groups are generally similar with respect to characteristics like bills, feet, and posture. Species can often be told apart by the colors of their feathers.

Ask students to **write three examples in their Activity Booklet**. The different bird species, each with their own unique physical features, illustrate diversity in birds.

3) Sketch a bird

Have students…

- **a) Look at the diagram of a bird with its field markings labeled.** Note the different types of markings. Some birds have these marking, while others do not. Knowing the names of the markings can help you learn how to tell birds apart.
- b) Choose a bird that is found in one of the four habitats and write its name in their Activity Booklet. Alternative: use the American Robin on page 88 of the field guide.
- c) Find the bird in their field guide.
- d) Take 10 seconds to carefully look at the picture of their bird.
- e) Close the book and draw their bird from memory on page 4 in their booklet. Label the bird's features.
- f) Look at the illustration of their bird for another 10 seconds.
- g) Close the book and make changes as needed in their drawing.
- h) Get into pairs and share with their partner which physical features, or "field marks," they saw in the first round, which in the second round, and any surprises they had during the activity. This activity gives the students important experience with gathering information from short glimpses of birds, as well as with using their new bird guides.

4) Discussion

Finish with a discussion of which field marks tend to be most useful when identifying birds (overall color, wing bars, head, bill, eye stripes, etc.).

OPTIONAL FOLLOW UP ACTIVITIES

- Have students send their bird sketches to their partner in the other school and ask their partner to try to identify the bird using their bird guide.
- Write a letter to your partner at the other school to tell them about your schoolyard habitat and any birds you saw.
- Observe a bird at home, take notes on its behavior and how it uses the habitat.
- Research a bird species and describe its habitat needs.