WindWise Education

Wind Energy Activities for Students

LESSON 15: ARE BIRDS IMPACTED BY SMALL WIND TURBINES?

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ARE BIRDS IMPACTED BY SMALL WIND TURBINES?

LESSON 15

KEY CONCEPT

Students will conduct field studies to learn how biologists study wind turbine impacts on birds. Data collected will be shared as part of a citizen science project.

TIME REQUIRED

4+ class periods

GRADES

6–12

SUBJECTS

Science
Technology
Living Environments

NOTE

This activity is intended for schools with a wind turbine on site. However, it can be conducted at non turbine schools as well. Research findings in non turbine sites are of great value for comparison.

KidWind PROJECT®

www.KidWind.org

BACKGROUND

Birds and wind turbines may occupy the same air space, and sometimes turbines are placed in locations where birds fly. People are concerned about the potential impacts that turbines could have on birds. Other impacts to birds, such as birds striking building windows, are also a concern.

Wildlife biologists conduct research on different animals, including birds, at wind turbine locations in order to assess risk. These scientists carry out research according to standard procedures, and checks are made to assess the accuracy of the information collected. Information collected helps to inform decision making.

The public can contribute to scientific understanding by collecting data and sharing it with others via citizen science projects.

OBJECTIVES

By the end of the lesson, students will be able to:

- Accurately distinguish and identify several common local birds using identification tools
- Design and carry out experimental procedures involving transects
- Illustrate the importance of recording accurate data
- Investigate the impact that citizen science can have on our knowledge of the world around us

METHOD

Students observe birds around their school. They use transects to conduct field work to assess whether birds are being impacted by turbines or other human-made structures.

Data collected is recorded in an online database.

MATERIALS

- ❑ Items that look like birds for assessing searcher error—see sidebar for ideas
- ❑ Hot dogs for assessing scavenger rate
- ❑ 4 foot sections of string—1 piece of string per 2 students
- ❑ Markers for the transect area and found items (e.g. survey flags)
- ❑ GPS for marking transect areas and found items (optional)
- ❑ Camera for recording birds seen during observation time and for recording any mortality events (optional)
- ❑ Internet access to upload data collected and to access online resources
- ❑ Binoculars (optional)
- ❑ Student reading passages and student worksheets*

Additional Resources for every lesson can be found at http://learn.kidwind.org/windwise/. Resources include presentations, videos, extension activities, and other materials.

BIRD IDENTIFICATION RESOURCES

- Bird field guide such as Peterson's
- Local bird identification information—local nature centers, parks and birding clubs may have a printed guide to use
- Merlin bird identification application for Apple and Android (free) http://merlin.allaboutbirds.org/
- Birdsleuth K–12 resources (free) from Cornell Laboratory of Ornithology http://www.birdsleuth.org
- Cornell Laboratory of Ornithology's guide to bird watching www.allaboutbirds.org

GETTING READY

Ask your students the following questions:

- Why are people concerned about birds around wind turbines?
- Why do birds get hit by wind turbines?

Read at least one article about birds and wind turbines. These are some good options:

- http://science.howstuffworks.com/environmental/green-science/wind-turbine-kill-birds.htm
- http://news.nationalgeographic.com/news/energy/2014/04/140427-altamont-pass-will-newer-wind-turbines-mean-fewer-bird-deaths
- www.motherjones.com/environment/2014/01/birds-bats-wind-turbines-deadly-collisions
- http://ecowatch.com/2014/04/16/wind-energy-threat-birds-overblown

Watch a video about birds and wind. These are good links:

- Wind Energy and Wildlife Part 1: Texas Parks and Wildlife: www.youtube.com/watch?v=N6sx-dmQlnU
- Wind Energy and Wildlife Part 2: Texas Parks and Wildlife: www.youtube.com/watch?v=ceCwBTXFuC8

Learn more about how wind fits into the nation's energy portfolio:

- WindWise Introduction and Lessons 1–3
- http://www.npr.org/2009/04/24/110997398/visualizing-the-u-s-electric-grid
- http://www.eia.gov/totalenergy/data/monthly/pdf/flow/electricity.pdf

Have a general discussion with your students about wild birds, and ask what human-made dangers (including wind turbines, building window strikes, and other threats) could put birds at risk.

Talk about the concept of citizen science—data collected by the public in order to support scientific research—and its use in many efforts to understand our natural world www.scientificamerican.com/citizen-science/. Learn more about engaging students in birding citizen science projects www.birdsleuth.org/tips-for-cit-sci-engagement/.

Additional questions for students:

- How does siting play a role in lowering the impact wind turbines may have on wildlife?
- Is there any correlation between flyways and wind turbine sites? Why?
- What are regulatory agencies and the wind industry doing to decrease impacts to birds from wind turbines?

Note about working with wildlife:
It is extremely important to use caution around wildlife. If you find a dead or injured bird or bat, do not touch it. Animals could carry disease such as rabies in bats, West Nile in birds, etc. If an animal is injured, contact your local wildlife rescue. Some species are protected and should not be handled by anyone other than licensed professionals, contact your state wildlife agency if you think you have encountered a protected species.

ACTIVITY

PART 1: LOOKING FOR BIRDS

Time: One class period

Before your class begins monitoring to see if your school's wind turbine (or other structures on site if you do not have a wind turbine) is causing any bird mortality, take some time to learn what birds are flying around and near your school.

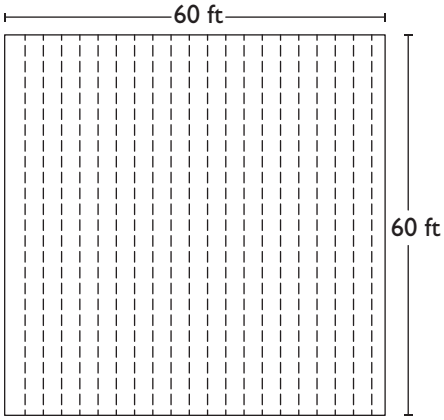
Review and discuss basic bird identification characteristics such as size, behavior, and flight patterns.

Take students outside and give them the bird observation data sheet. Place students in various locations across school grounds. Ask them to remain in that location for 15 minutes, look for birds, and record what they see on the data sheet. You'll notice the data sheet does not require species. It can be hard even for seasoned birders to correctly identify birds, so students can record more general information until they are more confident in making accurate identifications. If you can identify the species, accuracy should be encouraged. Use one of the bird identification resources on the previous page.

PART 2: ASSESS AND CALCULATE SEARCHER ERROR

Time: One class period

Everyone makes mistakes, right? When biologists look for birds that have been hit by wind turbines, they often have a tough job on their hands. Many birds blend into their environment. For example, a bird may have a tan coloration that camouflages it in tall, dry grass around a wind turbine. In addition, most birds that are hit by wind turbines are smaller so they can be harder to find. The possibility that a researcher will miss finding a bird needs to be considered when calculating the total number of birds impacted by a wind turbine. This error, called searcher error, is a calculation that is conducted for each person searching. Since every place is different, this calculation is done at all wind turbine research sites.



Step 1: Set up the transect areas.
A transect is a path along which searchers collect information. The transects in this activity will be conducted in a square area on school grounds that measures 60 feet by 60 feet. The transect paths that the student teams will walk will be 3 feet across. Transect areas either extend around the ground surrounding a wind turbine

CITIZEN SCIENCE OPPORTUNITY!

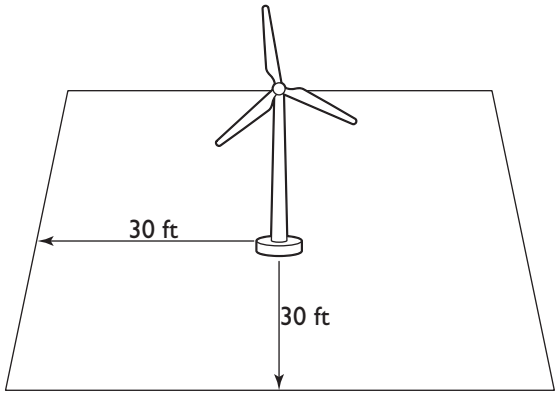
- You can add your bird observations into Ebird, a globally recognized citizen science database of bird observations compiled by people like you and used for a variety of scientific applications: www.ebird.com.
- Ebird also provides educators with guidance on how to work with school groups: http://dl.allaboutbirds.org/usingebirdwithgroups

TEST FOR SEARCHER ERROR

Some ideas for items to put in the transect area to assess searcher error:

- Tied or glued bundle of brown feathers
- Crumpled brown paper
- Brown dyed cotton balls

or are placed in a grassy area adjacent to the school building and near windows. This will allow you to search areas where birds could be impacted by turbines or building windows. The transect area should be walkable. Students will be divided up into groups of four and then teams of two to complete this activity.

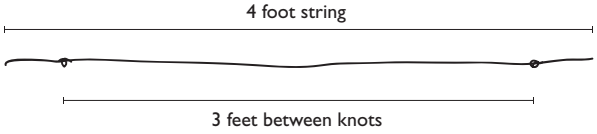


Set up enough transect areas so that each group of four students can conduct a survey of a transect for the searcher error calculation.

First, create a transect area around your school's turbine (or in the grass near your school if you do not have a turbine). The area should extend 30 feet from the turbine and be square in shape. Mark the perimeter of the transect area using flags, string, stakes, etc. If you have a turbine on site and the area where you are conducting transects has a fenced area with electrical circuiting, students will need to look inside the fence to ensure that they do not miss anything. Create additional transect areas of the same size around the school grounds and mark them in the same way as the turbine transect area. These additional areas will allow multiple teams to do this part of the activity. As much as possible, the transect areas should all be in the same type of ground cover and look the same (e.g., all in grass if that is what is around the turbine). The morning before your students come out to conduct the activity, place 15 items that are a brown color (see sidebar) randomly throughout each transect area, keeping note of how many you put out. It is important that the color of what you put out is similar to a bird.

Step 2: Conduct Surveys of the Transects

The purpose of this part of the activity is to assess the likelihood that searchers will miss finding a bird that was hit by the wind turbine. Once the items have been placed, bring the class to the transect areas. Break the class into groups of 4. Each group will have their own transect area. Give each group 2 pieces of string 4 feet long. Each team of 2 students will hold either end of a piece of string and should have 3 feet of string between them. Tie knots in the string so students have 6 inches of string (as a handle) on either side (see graphic).



Each group should then break into 2 teams with each team surveying one-half of the transect area. Surveys are conducted by teams each holding one end of the string tight and then conducting transects by walking side by side (3 feet apart) and marking any of the items that are found. Each team will cover one half of the transect area, conducting ten 60 foot transects. Marking can be done with survey flags, or any other item that works (can also use hand held GPS if available). Students should record the number of items they find on their data sheet.

Once students have completed surveying transects, teachers should inform students how many items were in their transect area so they can calculate searcher error. Determining searcher error will provide an estimate for the likelihood that a bird would be found by the student searcher team later on.

$$\text{Searcher error \#} = \frac{\text{Total items}}{\text{Number of items found}}$$

For example: If 10 of 15 items were found, the searcher error would be 1.5 and you would apply this factor to the number of birds found (# birds found x 1.5). So, using this example, if two birds are found when you conduct Part 4, it is likely that one other bird that was hit you did not find, or 3 birds total.

PART 3: ASSESS AND CALCULATE SCAVENGER RATE

Time: 4 half class periods (2 total)

To find food, a predator has to hunt and a scavenger has to scavenge! In addition to searcher error, finding birds hit by wind turbines is challenging because a bird may have been carried away or eaten could be taken away by scavengers and predators—such as dogs, cats, fox, larger birds (such as crows and vultures), and raccoons—before searchers get the chance to find it. To account for this potential, researchers calculate a scavenger rate.

To calculate a scavenger rate:
Place pieces of hot dog in the transect areas (established in Part 2). Have students note the number of pieces and mark where they were placed with survey flags or other marking item. Leave the hot dog pieces out overnight.

The next day, ask students to find the hot dog pieces that they placed outside. Determine how many were removed by scavengers in the night. Leave the remaining pieces out and repeat the search at least 3 nights and record results on the data sheet. The scavenger rate tells you if you find a bird, how likely it is that other birds may have been hit but not found due to removal by scavengers. For example, if 5 hot dog pieces are taken out of 15, then the scavenger rate is 1.5.

$$\text{Scavenger rate \#} = \frac{\text{Total number of items}}{\text{Number of items remaining}}$$

WHY PUT THIS INFORMATION ONLINE?

- Scientists are very interested in what, if any, impacts there are to birds from small wind turbines. This is a citizen science project that provides important information to scientists. Whether you have a turbine on site or not, providing data related to bird mortality on your school campus contributes to a greater understanding of human-caused impacts to birds.
- Add your class's findings at www.kidwind.org/apps/birddata

TECHNOLOGY IDEAS

You can conduct transects using technology. Some ideas if you have access include:

- Use hand held GPS or a smartphone to create and record the location of transects
- Plot the transects on Google Earth as pinpoints
- Use a camera to photograph any dead birds for identification
- Use handheld GPS or smartphones to pinpoint and record the location of any bird mortalities

PART 4: CONDUCTING TRANSECTS

Time: 15 minutes per day 2 times per week or more

Finally, after learning how to look for birds and calculating searcher error and scavenger rate, the actual surveying can begin. This part of the activity should focus on either the area around your turbine (if you have one on site), near the windows of your school building, or both. Teams of students should conduct transect searches on regular (minimum 2-3 times per week) basis for at least a month. Ideally, searches would be conducted for an entire school year. However, because there are likely going to be days that searches cannot occur, keeping track of when searches occurred and what was found will be important to project success. The transect area should extend 30 feet from the turbine base and 60 feet from the school building wall (see Part 2).

Searchers should carefully conduct transects using the 3 foot string with their partner during the search. Use the same method for transects that you used when conducting the searcher error assessment. The location of any birds found should be marked using survey flags. Findings should be recorded on the data sheet and then uploaded to the KidWind database, www.kidwind.org/apps/birddata/.

If you use the same transects created in Part 2, you should have enough for your whole class to do. If not, teachers can either rotate each team to conduct transects or bring the whole class out and conduct bird observations (Part 1) while the transect team works.

If you find something that has died, you can mark its location and note its condition over time. This will help better understand scavenger rates.

RELATED LESSONS

- Lesson 13: What is Wind Power's Risk to Birds?

EXTENSION

Join Cornell Laboratory of Ornithology's *yardmap* project. Go online, map your school, and contribute to this citizen science project designed to improve knowledge of habitat creation and low-impact land use. http://content.yardmap.org

Name_____ Date_____ Class_____

BIRD OBSERVATION DATA SHEET

Type of bird	*or* **description of bird (if type unknown)**	**Number seen**	**Behaviors** Indicate number of birds doing this behavior			
	Size S = e.g. sparrow, cardinal M = e.g. crow L = e.g. hawk, vulture	**How Many of this type of bird did you see?**	**Perching? Where?**	**Flinging? How?** F = flying through S = soaring above P = flying from one perch to another 0 = not flying	**Flight Height** G = ground level B = below treetops A = Above treetops T = within 30 ft of the turbine blades	**Other** e.g. feeding, calling, collecting nest materials, etc.
Robin		3	Tree = 1 Ground = 2	P = 1 0 = 2	B = 1	Feeding = 2 Calling = 1
?	L, black shaggy feathers	3	Tree = 3	P = 3	B = 3	Calling = 2

Name_____ Date_____ Class_____

SEARCHER ERROR DATA SHEET

Describe how you and your partner conducted transects to look for the items on the ground.

Tally the number of items you found in your half of the transect area.

Total tally marks for your half of the transect areas _____

Total tally for the other teams half of the transect area _____

Were they easy to find?

How many items were there in total (the teacher will have to tell you)?

Calculate the searcher error

$$\text{Searcher error \#} = \frac{\text{Total items}}{\text{Number of items found}}$$

What is your searcher error?

Name_____ Date_____ Class_____

SCAVENGER RATE DATA SHEET

Total number of hot dogs left out: _____

How many hot dog pieces were removed after the first night?

Note: do not add more hot dog pieces after night 1. Leave the pieces out for 3 days.

How many after Night 2?

How many after Night 3?

Calculate your scavenger rate:

$$\text{Scavenger rate for 1 night \# } = \frac{\text{Total number of items}}{\text{Number of items remaining}}$$

Scavenger rate for 1 night # = _____

$$\text{Scavenger rate for 2 nights \# } = \frac{\text{Total number of items}}{\text{Number of items remaining cumulative over the 2 days}}$$

Scavenger rate for 2 nights # = _____

$$\text{Scavenger rate for 3 nights \# } = \frac{\text{Total number of items}}{\text{Number of items remaining cumulative over the 3 days}}$$

Scavenger rate for 3 nights # = _____

Name_____ Date_____ Class_____

TRANSECT DATA SHEET

Transect data should be inputted for each team after each transect. This is especially important if birds were found, because searcher error applies to individual searchers and scavenger rate applies to the number of days between searches.

Area where transects were conducted (around turbine, next to school, etc.): _____

_____

Time between last search and this one: _____

Number of birds found: _____

Species (if known): _____

If birds were found, apply the searcher error calculation and scavenger rate calculation

Total potential birds impacted # = total birds found × searcher error (see previous worksheet) × scavenger rate for the number of days it has been since the last search (if 1, use scavenger rate for 1 day, 2 for 2 days, 3 for 3 days. If it has been more than 3 days, use the 3 day scavenger rate).