

Who are my Neighbors? An Urban Ecology Lesson Plan

Lesson designed by Griffin S. Bray, CIG

Instructor Information

The following information is designed to give teachers an overview of each activity in the lesson plan and explain how it was intended to be done. Please note that you may (and are encouraged to) modify the activities to best suit your needs. The lesson plan consists of three activities: an activity on identifying the animals in the environment, an activity on identifying the trees in the environment, and an activity on identifying the ground plants in the environment. All three activities are designed to be completed in “the field,” which may be any easily accessible outdoor area (e.g. school yard, garden, even a parking lot). As these are outdoor activities, PLEASE ensure that all students are prepared to go outdoors (see “Materials” below). Ideally, this lesson would be done in spring or fall (as organisms will be more abundant and easier to identify) but it can be done at any time of the year.

This lesson is for middle school students. It is designed to take approximately three days to complete (one per activity).

General Materials (more specific lists will be given for each activity):

- A copy of the lesson plan
- Appropriate clothing, ideally close toed shoes, hat, water bottle, long pants, backpack, jacket/sweatshirt (if necessary), etc.
- Pen/pencil for each student
- Notebook/notepad for each student/group
- Clipboard for each student/group
- Field guides (suggestions/alternatives are listed in each activity)
 - Alternatives to traditional field guides are printouts (see page on “Field Guides/Resources” at the end of the package), or identification apps if the students are allowed/own smartphones

- Please note that all of the activities can also be done without field guides if necessary or desired.
- String/twine or hula-hoops
- 3 large sheets of poster board for recording data

Instructor Guidelines for activities:

All three activities are designed as “guided” field exploration activities. Students will be allowed to discover the area on their own and learn for themselves what things are present in their environment. The activities in this lesson share a few components. Each begins with a brief overview of what will be examined during that activity, followed by exploration. All explorations should begin with a set of ground rules for the students to follow (stay in the designated area, work in groups, no running, no shouting, be respectful of others, etc.). After exploration there should be a discussion of what students found and why these organisms are here. More in-depth guidelines are included in the write up for each activity.

Background Information:

Urban ecology is the study of the organisms that live in an urban environment and their interactions with their surroundings. Unlike many other branches of ecology, urban ecology is particularly concerned with how humans interact with and shape the biotic community in an area (What is Urban Ecology?, 2019). Urban ecology is an interdisciplinary field, integrating social sciences (e.g. geography, economics) and physical sciences (e.g. biology, geology) to research topics including man’s relationship to cities, nature’s relationship to cities, and human interactions with and impacts on nature (What is Urban Ecology?, 2019). These three broad categories cover a multitude of more specific topics. Some of the more prevalent areas of study in the field include looking at the effect of urban environments on species behavior, such as how parks impact bird migration or how streetlights affect fireflies and moths; the effects of habitat loss and fragmentation on the local animals; and how humans are shaping the species that are found in an area (Lepczyk, 2018; Rebele, 1994).

Urbanization is projected to increase in the coming decades, bringing more people into urban environments like cities and subdivisions. As they move farther away from rural areas, people tend to lose their connections to “nature,” even as they ignore the plants and animals that

live alongside them (Pyle, 1993). This makes an urban ecology education all the more necessary as it can reconnect people to nature and help them put many life science lessons into a familiar context (Urban Ecosystems, 2019).

With urban ecology being such a broad field, there are many different avenues that an educator can take. Probably the most easily understandable ways to address urban ecology for younger children is through the lens of nature in urban environments. Using this approach, students and educators can examine the different assemblages of species in the area and discuss why these species are there. From here, educators can also begin to address broader topics such as human impacts on the ecosystem (e.g. pesticides, gardening, disturbances) or the ecosystem services (e.g. water retention/filtration, air filtration, aesthetics, pollination) that the urban ecosystems provide. Most importantly, it connects students to the topic in a personal way, relating ecological ideas to the things that they see every day (Urban Ecosystems, 2019). The following lesson plan will focus on exploring the urban environment through surveys of animals, trees, and ground plants in an urban area in order to introduce the students to the ecosystem in the place that they live and study. More detailed background information will be given in each activity.

Sources:

- Lepczyk, C. (2018). Urban Ecology: where the wild meets the city. Retrieved from <https://blogs.plos.org/everyone/2018/08/02/urban-ecology-where-the-wild-meets-the-city/>
- Pyle, R.M. (1993). *The Thunder Tree: Lessons from an Urban Wildland*. New Haven, CT: Yale University Press.
- Rebele, F. (1994). Urban ecology and special features of urban ecosystems. *Global Ecology and Biogeography Letters*, 4, 173-187. DOI: 10.2307/2997649
- Urban Ecosystems. (2019). Retrieved from <https://www.caryinstitute.org/eco-inquiry/teaching-materials/urban-ecosystems>
- What is Urban Ecology? (2019). Retrieved from <https://www.ius.edu/field-station/what-is-urban-ecology.php>

Who are my Neighbors? An urban ecology lesson plan

Audience: Middle school students in an urban environment

Concepts being addressed: Ecosystem structure, organism interactions, and human impacts on an ecosystem

Standards addressed (MI NGSS): LS2.C, LS4.D, and ESS3.C

Objectives: Students will be able to:

1. Identify common organisms that share their place.
2. Recognize the diversity of species present in their place.
3. Understand at a basic level (or higher) how humans alter the assemblage of organisms.

Activities:

1. Animals Around Us (survey of animals)
2. Our Urban Forest (survey of trees)
3. The Lawn Community (survey of ground plants)

This lesson plan is designed to take three days, one per activity. These days do not need to be consecutive, and the order of activities may be changed from their suggested order. Each activity is estimated to take between an hour and a half to two hours, but can be made shorter or longer as desired.

Please identify the area where you would like to conduct the lesson beforehand. This area may be anywhere that is accessible (e.g. school yard, nearby park, even a parking lot), although you may want to check that there are a reasonable number of animals and plants to be observed.

Activity #1: Animals Around Us

Materials needed:

- Appropriate clothing
- Pen/pencil for each student
- Notebook/notepad for each student/group
- Clipboard for each student/group
- Field guide for each student/group (Suggested: *Peterson First Guide to Urban Wildlife*. Alternatives: iNaturalist app [if phones are allowed/accessible]; printouts from the internet[see “Field guides”])
- Sheet of poster board for recording data

Background:

Throughout the world wild animals are becoming increasingly better adapted to urban landscapes (Andrews, 2013; Vaughan, 2015). Many of these animals are attracted to these urban environments because they provide the basics of what the animals need in their habitat: food, water, shelter, and/or space (Vaughan, 2015). For example, animals like foxes, mice, rats, squirrels, and songbirds are attracted to our cities and neighborhoods because of the large amount of food available (Vaughan, 2015).

Living in urban areas has also changed the behavior of some animals. For example, squirrels, raccoons, birds, and other wildlife have learned how to find human food scraps, and will even come up to people to beg for food sometimes (Strauss, 2019). Additionally, some animals (e.g. squirrels, coyotes) have even learned how to safely cross roads (Andrews, 2013). This activity is designed to familiarize students with the variety of animals that inhabit their place (schoolyard, neighborhood, etc.).

Sources:

Andrews, C.G. (2013). Urban Animals: Wildlife Is Adapting to City Life. *Good Nature Travel*. Retrieved from <https://www.nathab.com/blog/urban-animals-wildlife-is-adapting-to-city-life/>

Strauss, R. (2019). The 10 Most Common Urban Animals. *ThoughtCo*. Retrieved from <https://www.thoughtco.com/urban-animals-4138316>

Vaughan, A. (2015). Urban wildlife: when animals go wild in the city. *The Guardian*. Retrieved from <https://www.theguardian.com/environment/2015/mar/08/urban-wildlife-animals-in-city>

Procedure:

1. Assess student's familiarity with ecology and nature. Ask questions like "What is 'nature'?" and "Where is nature found?" Define and explain the concept of "urban nature" and "urban ecology." A good way to describe this is to ask students to describe the kinds of nature they've seen in their neighborhoods.
2. Take the class outside to the decided study area. Before exploration, go over rules for observations (stay in the designated area, work in groups, no running, no shouting, be respectful of others, others as necessary). Break the students into groups and give them the materials for the survey (clipboard, notepad, pens, field guides, etc.). Give a *brief* overview of how to use the field guides, and ask students to focus on observations rather than names.
3. Let the students observe, writing down the different things that they see (I suggest having different groups look at different types of organisms or giving each group one part of the area to observe.). Let students explore on their own, but stay in the area, observing students and helping them if necessary.
4. Ask students to share their results. Ask leading questions if necessary (e.g. "What types of animals did you find?", "How many were there?", "What animals were more common?", etc.)
5. Discuss what animals need in an environment (food, water, shelter, space). Ask the students if they think that these animals are finding what they need. How do they think could humans impact the things that animals need?
6. In the classroom, have the students write their results on a sheet of poster board. Put down the general type of animal (e.g. Birds, Mammals, Insects, etc.), the "specific" type (e.g. Starling, Sparrow, Bee, Squirrel, etc.), and the number for each specific type. Save this chart for later.

Evaluation: Have the students research one of the animals that they identified and write one page about it. Share the research with classmates the next day.

Activity #2: Our Urban Forest

Materials needed:

- Appropriate clothing
- Pen/pencil for each student
- Notebook/notepad for each student/group
- Clipboard for each student/group
- Field guide for each student/group (Suggested: *Peterson First Guide to Trees of North America* OR *Audubon Familiar Trees of North America East*. Alternatives: iNaturalist app [if phones are allowed/accessible]; printouts from the internet [see “Field guides”])
- Sheet of poster board for recording data

Background:

One of the most immediately visible aspects of urban ecology is the urban forest, or the trees in a city (Tarran, 2006). This “forest” isn’t the same as a natural forest where the trees grow rather densely in a single areas; an urban forest is just the term for all of the trees within an urban area. These trees provide a number of benefits to the ecosystem, especially to the people. Trees help to collect and filter air and water, reducing air pollution and helping to reduce flooding (Benefits of Urban Trees, 2012). They also help stabilize the ground and prevent erosion (Benefits..., 2012). Studies have shown that having plenty of trees in an urban area increases happiness and mental health as well (Benefits..., 2012; Food and Agriculture Organization of the United Nations [UN FAO], 2016). Trees can also make food for us, as well as provide critical habitat components (e.g. food, shelter) for animals such as birds and squirrels (UN FAO, 2016). However, it is also important to be mindful of how urban forests are structured, as the trees are often all from only a few species which can lead to epidemics of diseases (e.g. Dutch Elm disease, the Emerald Ash Borer, Tar Spots, Chestnut blight) and reduce overall diversity in an area (MacDonagh, 2015). Additionally, some common landscaping trees are non-native, which can reduce animal diversity, and some of them can even become invasive.

This activity is designed to help familiarize students with the urban forest where they live or study.

Sources:

- Benefits of Urban Trees. (2012). *Ecology.com*. Retrieved from <https://www.ecology.com/2012/10/31/benefits-urban-trees/>
- Food and Agriculture Organization of the United Nations. (2016). Benefits of urban trees. Retrieved from <http://www.fao.org/resources/infographics/infographics-details/en/c/411348/>
- MacDonagh, L.P. (2015). The High Cost of Urban Monocultures. *DeepRoot*. Retrieved from <https://www.deeproot.com/blog/blog-entries/the-high-cost-of-urban-monocultures>
- Tarran, J. (2006). Trees, Urban Ecology, and Community Health. *TreeNet*. Retrieved from <https://treenet.org/resources/trees-urban-ecology-and-community-health/>

Procedure:

1. Assess student's familiarity with trees. Ask questions about what trees do for us, what trees do for the ecosystem, etc.
2. Take the class outside to the decided study area. Before exploration, go over rules for observations (stay in the designated area, work in groups, no running, no shouting, be respectful of others, others as necessary). Break the students into groups and give them the materials for the survey (clipboard, notepad, pens, field guides, etc.). Review how to use field guides if necessary. Again, emphasize observations over names.
3. Let the students observe, writing down the different trees that they see and counting them (I recommend giving groups different parts of the study area to look at.). Let students explore on their own, but stay in the area, observing students and helping them if necessary.
4. Ask students to share their results. Ask leading questions if necessary (e.g. "What types of trees did you find?", "How many were there?", "Were the trees the same in all of the sections or were they different?" etc.).
5. Discuss the trees in urban environments. Talk about how the trees got here, what the trees do for us and the environment, and how we can affect the trees. You can also talk about diversity and monocultures in the context of street trees if desired.
6. In the Classroom, have the students write their results on a sheet of poster board. Put down the type of tree (either the general category [maple, oak, honey locust, etc.] or species, depending on how precise students were) and the number of each type. Put this chart with the animals chart for later use.

Evaluation: Have the students research one of the tree types that they identified and write one page about it. Share the research with classmates the next day.

Activity #3: The Lawn Community

Materials needed:

- Appropriate clothing
- Pen/pencil for each student
- Notebook/notepad for each student/group
- Clipboard for each student/group
- String/twine or hula-hoop for each group
- Field guide for each student/group (Suggested: *Peterson's First Guide to Wildflowers* may be acceptable, but it is not perfect. Alternatives: iNaturalist app [if phones are allowed/accessible]; printouts from the internet [see "Field guides"])
- Sheet of poster board for recording data

Background:

In most urban areas people love their lawns and will aggressively try to get rid of any “weeds” that they may find. However, these weeds somehow find their way into just about every green space and sidewalk crack available. This is not necessarily a bad thing; many “weeds” have environmental benefits. Many species of weed grow in poor soils and help to increase soil nutrient content as they grow and die (Nauta, n.d.). Their deep roots also help to reduce erosion, hold excess water, and break up compacted soils (Antonius, 2016; Nauta, n.d.). Additionally, many of these weeds provide food for animals like rabbits, squirrels, or leaf-eating insects, as well as giving bees and pollinators flowers to visit (In fact, quite a few weeds are considered to be wildflowers.) (Nauta, n.d.). Without these plants lawns become monocultures (areas with just one species) and lose a lot of the animal biodiversity that the weedy plots (called polycultures) help to support (Graber-Stiehl, 2018; Nauta, n.d.).

This activity focuses on showing students the plant diversity in their study area. To do this, students will conduct a quadrat survey. Quadrats are simply designated small areas for studying the makeup of the community (Questions about Quadrats, n.d.). Generally quadrats are 1 meter by 1 meter areas, although they may be any size (Questions about Quadrats, n.d.). For this activity, you can create quadrats by marking the areas off with string or twine (cut the twine into thirteen-foot pieces for a 1 meter by 1 meter plot). An easy alternative to using string is to

use a hula-hoop to mark off the area, as the hula-hoops will all be the same size and are easy to move and place.

Sources:

Antonius. (2016). Advantages of weeds. *Horticulture.org*. Retrieved from <https://www.horticulture.org.za/advantages-of-weeds/>

Graber-Stiehl, I. (2018). Lawns Are an Ecological Disaster. *Gizmodo*. Retrieved from <https://earth.gizmodo.com/lawns-are-an-ecological-disaster-1826070720>

Nauta, P. (n.d.). Benefits of Weeds – 6 Reasons To Keep Some Around. *SmilingGardener*. Retrieved from <https://www.smilinggardener.com/organic-pest-control/benefits-of-weeds/#hiddencontent>

Questions about Quadrats. (n.d.). *Science & Plants for Schools*. Retrieved from <https://www.saps.org.uk/secondary/teaching-resources/260-questions-about-quadrats>

Procedure:

1. Talk about ground plants. Discuss their role in the ecosystem and what they do for us. Ask the students for their ideas on why plants are important and whether or not “weeds” are a good thing.
2. Take the class outside to the decided study area. Before exploration go over rules for observations (stay in the designated area, work in groups, no running, no shouting, be respectful of others, others as necessary). Explain the sampling technique (count the different types of plants and the number of each type in your roped area/ hula-hoop).
3. Break the students into groups and give them the materials for the survey (clipboard, notepad, pens, field guides, etc.). Review how to use field guides if necessary. Again, emphasize observations over names. Let students explore on their own. Stay in the area, observing students and helping them if necessary.
4. Ask students to share their results. Ask leading questions if necessary (e.g. “What did you find?”, “How many kinds of plants were in your area?”, “Which plants were most common?” etc.).
5. Discuss urban plants. Talk about monocultures versus polycultures and how diversity of ground plants affects animals and plants. This is also a good time to discuss how people can affect the diversity of the plants through our actions (herbicides, pesticides, mowing, planting).
6. In the classroom, have the students write their results on a sheet of poster board. Put down the number of species and how many of each species there were. Compare this chart with the animal and tree charts. Are there any noticeable differences? Why do you (the students) think that is?

Evaluation: Have the students write a one-page report about the study and their findings. Do they think that the ecosystem is healthy? Ask them to include why they think the ecosystem is like this and how people may have affected it.

Field Guides/Resources

The following is a brief description of the field guides recommended in the text as well as information on where to find them.

The field guides recommended in this lesson are *Peterson First Guides*. These are simple field guides that are designed with children in mind. They do not have identification keys and provide basic information about the organisms in the guide. This is more than enough for the activities in this lesson. Despite this, these guides are not perfect. The *Guide to Urban Wildlife* is limited in scope as it tries to touch on almost every type of urban wildlife (land animals, plants, microbes, fungi, etc.) across the entire continent. The *Guide to Trees of North America* is very good, but lacks good pictures of the bark. The *Guide to Wildflowers* is very limited, as it goes by flower color; this requires the plants to be in flower when using it, which is unlikely. However, with that said, the *Guide to Urban Wildlife* and the *Guide to Trees of North America* are well suited to the activities in this lesson. *Peterson First Guides* are widely available at reasonable prices (each guide costs about \$7 on Amazon.com and can be found at most bookstores).

I understand that many schools may not have the budget or desire to buy a set of field guides for one lesson plan. To give schools a free alternative to the field guides, I have also created a website with very basic guides to the common animals, trees, and ground plants of urban areas in Southeastern Michigan. The guide is by no means comprehensive and it does not go into detail about any of the species, but it can be used in the absence of any field guides. Each page is designed to go along with one of the activities and provides pictures of the organism as well as a very brief description. Everything on the site may be reproduced and used in whatever way educators using the lesson plan see fit. (Link: <https://sites.google.com/a/umich.edu/urban-ecology-guide/>)

Teachers may be able to find additional resources online for the different animals and plants in their area.