

5TH-8TH GRADE UNIT

LESSON 1 Urban Forest Connections

NUTSHELL

In this lesson, students combine their knowledge with information from dictionaries to define “urban forest” and “ecosystem.” They relate their school to an ecosystem and then create a web diagram to show the connections that parts of urban forests have.

They extend that idea to the connections urban forests have to other ecosystems using the water cycle as an example. To conclude, students write a few paragraphs to describe and compare urban forest ecosystems and rural forest ecosystems.

BIG IDEAS

- An urban forest is all the trees and other vegetation in and around a town, village, or city. Plants, people, and animals are part of the urban forest. (Subconcept 1)
- An urban forest is an ecosystem. An ecosystem is an area that contains living (e.g., trees, people, animals) and nonliving (e.g., soil, buildings, roads) things existing together and interacting. Humans play a dominant role in the ecosystem. (Subconcept 2)
- Urban forest ecosystems are part of matter cycling and energy webs. (Subconcept 4)

OBJECTIVES

Upon completion of this lesson, students will be able to:

- Define urban forest.
- Define ecosystem.
- Explain how humans are a major part of the urban forest ecosystem.
- Describe how urban forests are part of matter cycles and energy webs.
- Compare and contrast urban and rural forests.

SUBJECT AREAS

Language Arts, Science

LESSON/ACTIVITY TIME

- Total Lesson Time: 135 minutes
- Time Breakdown:
 - Introduction 15 minutes
 - Activity 1 45 minutes
 - Activity 2 45 minutes
 - Conclusion 30 minutes

TEACHING SITE

Classroom

BACKGROUND

We may not think of the trees along our streets, in parks, along rivers, and in yards as part of a forest, but they are. All the trees, other plants, and animals in a city, town, or village are part of an urban forest.

A forest is an ecosystem. An ecosystem is all the living and nonliving things in an area interacting with each other. In an urban forest, the increased influence of humans means that in addition to trees, other plants, animals, sun, and soil, there are people, buildings, concrete, asphalt, pets, and more. This makes the urban forest a unique type of forest ecosystem, but still one connected to other ecosystems.

It is important to note that rural forest ecosystems are not devoid of human influence. The difference between urban and rural forest ecosystems is in the degree of impact that people have on the forests.

MATERIALS LIST

FOR THE CLASS

- Dictionaries
- Marker/chalk board

FOR THE TEACHER

- Overhead transparency of Teacher Page 🍎1, *Ecosystem Web* (optional)
- Teacher Page 🍎2, *Water Cycle Example*

When thinking about the interactions that occur in an urban forest, it may help to keep in mind that things that don't really seem "natural" to us are still part of this ecosystem. Just as rocks are part of other ecosystems, concrete and asphalt are part of urban forests. A squirrel in a rural forest relies on nuts and seeds to eat.

In an urban forest, they may add bread that people throw for birds or even discarded french fries to their diet. Human influence is everywhere in an urban forest.

Trees face different challenges and benefits from their locations. In a rural forest, trees compete for nutrients, sunlight, space, and water. A well-maintained tree in an urban forest may be watered and fertilized so it doesn't need to compete for water and nutrients. However, an urban tree may also be subjected to more air and water pollution. Competition for sunlight is fairly constant in both forest ecosystems.

VOCABULARY

Ecosystem: An area that contains organisms (e.g., plants, animals, bacteria) interacting with one another and their nonliving environment (e.g., climate, soil, topography).

Energy Web: A system where energy is transferred through a series of interconnected food chains.

Forest: An ecosystem that is characterized by a dominance of tree cover and contains a variety of other organisms (e.g., other plants, animals).

Matter Cycling: An ecosystem function in which elements are deposited, used by organisms, and stored or exported.

Rural Forest: A forest ecosystem found in the countryside outside of cities, towns, or neighborhoods.

Urban Forest: A forest ecosystem that includes all the trees and other vegetation in and around a town, village, or city. Plants, people, and animals are part of the urban forest.

FOOD CHAINS

Energy is defined as the ability to do work. It takes energy for living organisms to breathe, reproduce, and grow. In an ecosystem, energy passes from one organism to the next in a sequence. This is called a food chain. (Nutrients are also passed along in the food chain.) Producers form the beginning of the food chain by capturing the sun's energy through photosynthesis. Primary consumers eat producers, obtaining the chemical energy of the producers. Secondary consumers reap the energy stored in the primary consumers. Decomposers consume the remaining energy and break down organic molecules in the remains of all members of the food chain.

Food chains can be as short as two links. Chains longer than four or five links are not as common, but can occur. An example of a food chain would be aspen leaf – caterpillar – frog – snake – fox. Another simpler food chain could be aspen leaf – deer – wolf.

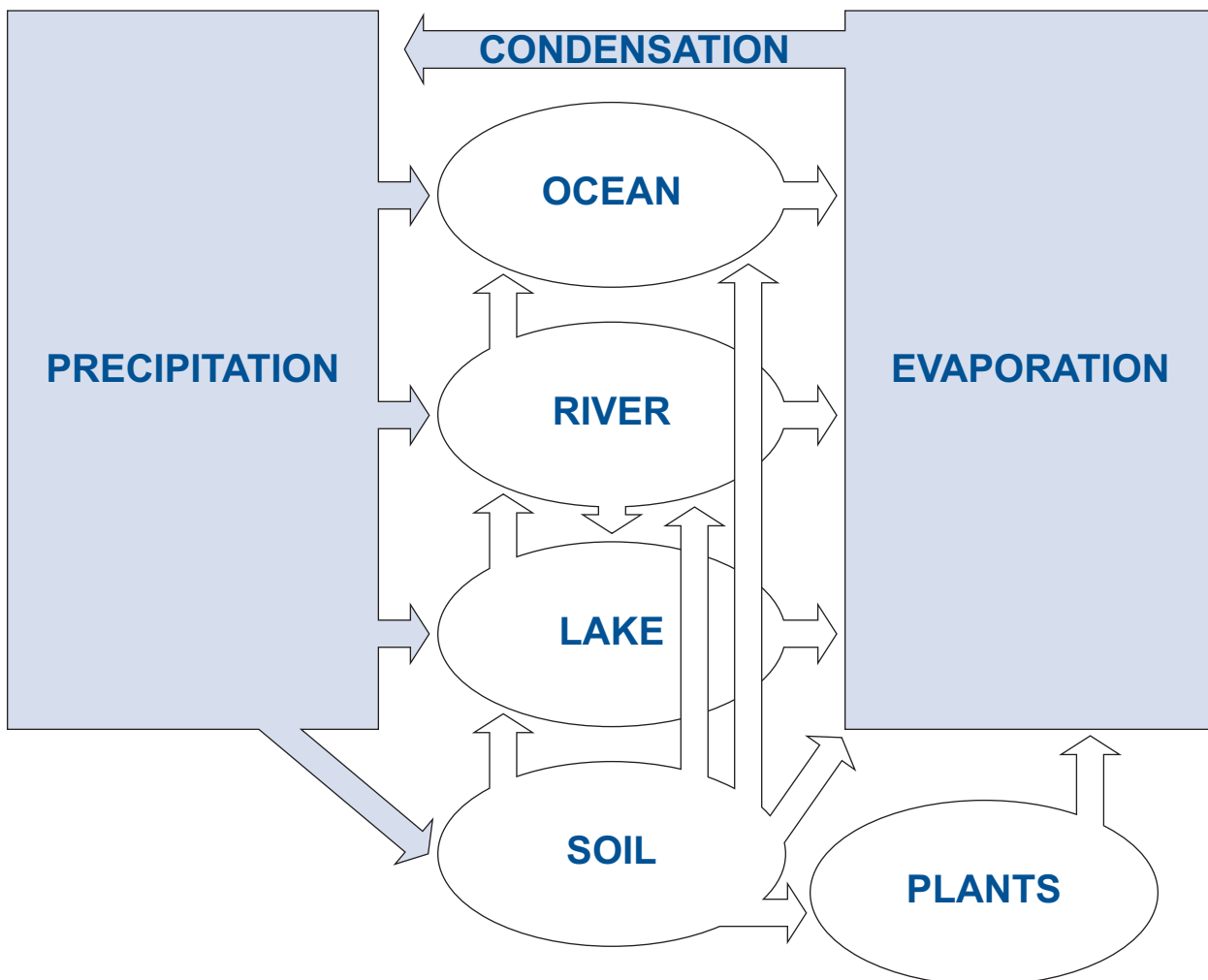
FOOD WEBS

A food web is a set of interconnected food chains. Energy and materials circulate within an ecosystem through food webs. The chains become a web when there are mutual food sources. Consider the previous examples. Aspen leaf – caterpillar – frog – snake – fox and aspen leaf – deer – wolf are interconnected by the leaf. If we added dandelion – rabbit – fox, that adds more connections. When all of these are combined, we have a complex food web in an ecosystem.

CYCLING OF MATTER IN ECOSYSTEMS

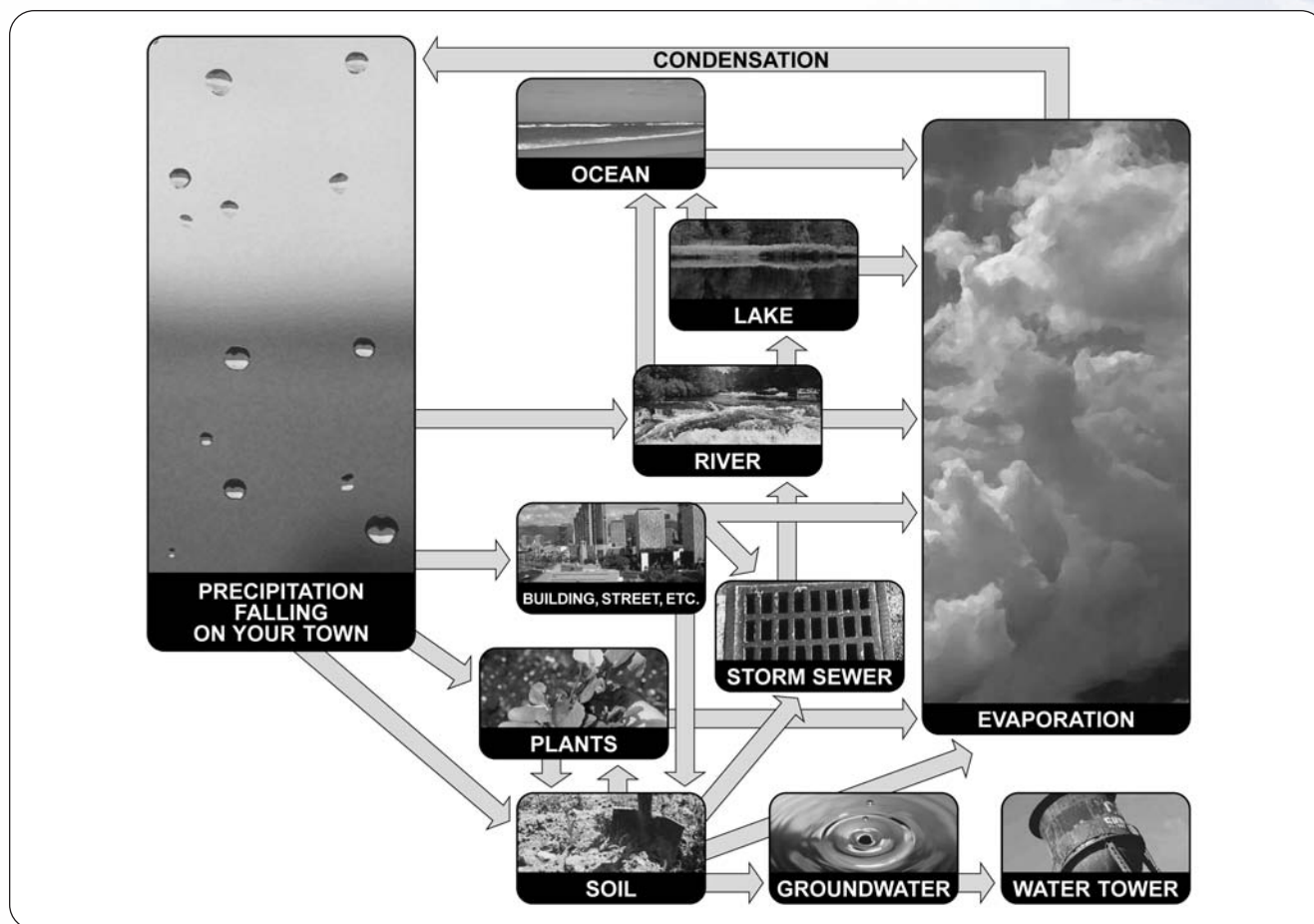
Matter cycles from biotic (living) communities to the abiotic (nonliving) environment and back again. There are a variety of cycles that materials flow in. Some of them are the carbon cycle, nitrogen cycle, phosphorus cycle, sulfur cycle, and water cycle. These are important to organisms because they involve materials used to make the chemical components of cells. Matter cycles through food webs and by other means.

SIMPLIFIED WATER CYCLE DIAGRAM



The water cycle is the key to the other cycles. Water is often what carries the phosphorus, nitrogen, and sulfur from place to place. The water cycle is a series of movements of water above, on, and below the surface of the Earth. The water cycle consists of different stages including evaporation, condensation, transpiration, precipitation, and runoff. Water may be stored temporarily in the ground, oceans, lakes, rivers, icecaps, and glaciers. It evaporates from the Earth's surface, condenses in clouds, and falls back to the Earth as precipitation. Almost all the water on the Earth has passed through the water cycle countless times. The illustration on page 52 shows some very simplified paths that water may follow.

The water cycle connects all parts of the Earth. Different parts impact the water cycle differently. Most water that falls on rural environments either flows into water bodies or is absorbed into the surface. Consider what might happen to water that falls on a city. There is less area in an urban forest covered by soil or water bodies that can readily absorb a raindrop compared to other ecosystems. Concrete sidewalks, asphalt streets, rooftops, and cars shed rain as it falls. Gutters and storm sewers carry water away from hard surface areas to prevent flooding. This water is eventually directed into lakes and rivers. Water that does soak into the soil will either end up in groundwater or will be taken up by plants and used in photosynthesis. The diagram below is a simplified example of how our communities interact with the water cycle.



It is important to remember that the water humans use also fits into this cycle. Municipalities get their water from a variety of sources. Sources can include large natural bodies of water, such as Lake Michigan, groundwater that is then stored in a water tower, and reservoirs filled with rainwater. That water is pumped into our homes and businesses. Some is put on lawns; it soaks into the soil and eventually back into groundwater. Some is used inside in our sinks, toilets, showers, dishwashers, etc. That inside water flows down the drain and into the sewage pipes. The sewage pipes carry water to a sewage treatment plant where waste is removed by a series of complex processes. That water, with the contaminants removed, is discharged into a nearby lake or river.


PROCEDURE INTRODUCTION (↑↓)

(Modified from Unit 7-8 Lesson 2 from the *LEAF K-12 Forestry Lesson Guide*.)

1. Ask students (by a show of hands) how many have heard the term “urban forest.” If some students have, ask them to explain what they think it means. List their definitions on the board/chart paper, leaving space to also write the definitions of urban and forest.
2. Have several student volunteers look up the meanings of “urban” and “forest” in a dictionary.
3. Add these definitions to the board/chart paper. There may be various definitions for each word.
4. Discuss what seem to be the key parts of each definition. (*Urban is in the context of city or town; forest includes trees and undergrowth in an area.*)
5. Put these key parts together to form a class definition of urban forest. (*An urban forest is all the trees and other vegetations in and around a town, village, or city.*) Discuss similarities and differences between this definition and what students thought the meaning was before looking it up.
6. Tell students they will be learning more about urban forests and what they are comprised of.

ACTIVITY 1 – URBAN FOREST ECOSYSTEM WEB (↑↓)



1. Ask students to name some of the parts of your school. Stress that you are not just talking about the school building, but the institution. (*Examples could include classrooms, halls, gymnasium, auditorium, lunch room, students, teachers, secretaries, principal, lunch room staff, bus drivers, books, desks, animals kept in classrooms, plants, etc.*) You may wish to write these on the board for reference. Begin a web-building exercise by linking one part to another with a verb. (*Teacher teaches students.*) Ask a student to continue using the word you left off with and linking it to another part. (*Students sit in desks.*) Continue until either all examples have been used or all students have had a chance to participate. Tell students that they just demonstrated how their school functions as a system.

2. Explain that, in a way, their school functions as an ecosystem. Ask for a volunteer to look up the word “ecosystem” in the dictionary. While the volunteer is looking, have the rest of the class suggest definitions. Have the volunteer read the definition out loud. (*An ecosystem is an area that contains organisms interacting with one another and their nonliving environment.*) Ask the class if they think their school qualifies. (*Yes, there are living things such as people, animals, and plants and nonliving things such as desks, books, and the building.*) Ask students to remember the definition of an urban forest they learned in the Introduction. Ask them if they think an urban forest qualifies as an ecosystem. (*Yes, there are living things such as people, squirrels, birds, trees, grass, flowers, and bacteria and nonliving things such as roads, sidewalks, buildings, soil, sun, and water that all interact.*)
3. Put Teacher Page  1, *Ecosystem Web* on the overhead projector or write the information on the board. Explain that this graphic illustration of an urban forest ecosystem lists some of the parts (humans, water, buildings, and trees) of an urban forest. As a class, discuss why each of the examples is included. (*They are all living or nonliving things in an urban forest ecosystem.*)

To get students started, draw lines between the parts and ask the class to suggest verbs that describe how they are connected. (*Humans drink water, humans live in buildings, trees shade buildings, buildings shade trees, humans plant trees, etc.*)
4. Leave the overhead transparency projected and ask students to get out a piece of paper. Have each student make their own web on the paper. They should use the information you have on the overhead and also add their own ideas of parts and connections. The parts can be more specific examples of things already covered or more general things. (*Examples could be cars, parking lots, shrubs, grass, pigeons, squirrels, sidewalks, sun, etc.*) Tell students there will be more than one connection from many of the parts. Some parts may even connect in to each other in more than one way. (*e.g., Humans build buildings, humans live in buildings.*)
5. Wrap up by adding some of the students’ ideas to the overhead transparency. Ask students what they think their ecosystem webs show. (*Answers will vary. Examples should include that humans have a major impact on the urban forest ecosystem, everything is connected somehow, there are many ways things are connected, etc.*)

ACTIVITY 2 – URBAN FORESTS AND THE WATER CYCLE (↑)

1. Now that the class has created the urban forest ecosystem web, ask if they think it is independent of other ecosystems. (*No.*) Explain that all the connections they identified as part of an ecosystem can also be explained in different ways. (*Food web, energy web, cycling of matter.*)

2. Define and discuss energy web. *(A system where energy is transferred through a series of interconnected food chains. Energy is created by plants during photosynthesis. That energy is transferred from one organism to another as part of a food chain. When the food chains connect to each other this creates a web.)* Use energy web connections to describe how an urban forest ecosystem is connected to others. *(A berry growing on a tree in a city is eaten by a bird migrating from Canada to Central America. The energy the tree created through photosynthesis is transferred to the bird, which is connected to other ecosystems.)*
3. Define and discuss matter cycling. *(An ecosystem function in which elements are deposited, used by organisms, and stored or exported. Matter cycles through energy webs and other cycles. When a plant or animal is eaten for energy, the matter in that plant or animal is also transferred. Matter is exchanged in a variety of forms and ways.)*
NOTE: If students need more discussion on matter cycling to be prepared for this lesson, see the LEAF Links section.
4. Overview the water cycle. *(Water falls from clouds as precipitation. It lands on oceans, lakes, rivers, or soil. It can flow from soil to groundwater, rivers, lakes, oceans or be taken up by plants. It will evaporate and return to the clouds from oceans, lakes, rivers, soil, or plants. Water often carries other things with it as it moves.)* A simplified illustration of this process is found on page 52. Tell students they are going to use the water cycle as an example of matter cycling.
5. Use Teacher Page  2, *Water Cycle Example* to help lead a discussion about the water cycle in urban areas. Note that the diagram on Teacher Page  2, *Water Cycle Example* will not necessarily be the same as your finished diagram. For instance, if you have a lake in your town, precipitation will fall on it directly instead of only being connected through a river.
 - Using a marker/chalk board, write “precipitation falling on our town” in a box on the left side of the board.
 - Remind students that another main part of the water cycle is evaporation. Write that in a box on the right side, leaving room to add things between the boxes.
 - Ask students what the precipitation might fall on. *(Answers could include river, lake, soil, buildings, plants, people, etc. The list will depend on what is present in your community.)* Write those answers in the space between “precipitation” and “evaporation” and circle them. Add arrows connecting the boxes and circles indicating which way water flows.
 - Add more circles with things that precipitation doesn’t land on but are still part of the water cycle. *(Groundwater, storm sewer, etc.)* Add arrows to include them in the cycle.
6. After the diagram is complete, stress to students the connections they just illustrated. Use an example if needed, such as the water that falls onto buildings could flow into storm sewers and then flow into a river. The river could carry that water to the ocean. Tell students that their community is connected to the ocean, even though it is thousands of miles away.

CONCLUSION – BEYOND THE URBAN FOREST (↑↓)

1. Write the definition of rural forest on the board. *(A forest ecosystem found in the countryside outside of cities, towns, or neighborhoods.)* Discuss the difference between rural forest and urban forest definitions. *(They are both ecosystems, but they differ in where they occur.)* Compare how humans impact urban forests to how they impact rural forests. *(Humans use forest products made from trees harvested in rural forests. They impact those forests from that use, even if they never go there. Urban forests are impacted by humans because humans live there. The immediate impact of humans on the area they live in is much greater.)*
2. Assign students to write a paper with three sections/paragraphs. The first paragraph should be a description of rural and urban forests (what they look like, what they are). If students need a visual idea of what urban forests and rural forests look like, go to the LEAF website at www.uwsp.edu/leaf. Navigate to the educator supplemental resources section. Other examples may be used from magazines, posters, the internet, but be sure they are focused on Wisconsin forests and not those in other areas of the globe. The second paragraph should be a description of things both forests have in common and the degree to which they have things in common. The third paragraph should be a description of what is different about each forest and the degree of that difference.

LEAF LINKS

The lessons listed below, for the *LEAF Wisconsin K-12 Forestry Education Lesson Guide*, contain possible enhancements, extensions, or replacements for *Urban Forest Lesson Guide: 5-8 Lesson 1*.

UNIT 5-6 LESSON 2: WHAT MAKES A FOREST?

Students explore parts of forest ecosystems and forest layers through an interactive game and discussion.

Use 5-6 Lesson 2 Introduction and Activity 1 to introduce Urban Forest Lesson Guide: 5-8 Lesson 1 from a broad perspective. It could also be used after the lesson to broaden the focus from local to global.

UNIT 5-6 LESSON 4: ECOSYSTEM EXTRAVAGANZA

Students are introduced to forest functions such as photosynthesis, energy flow, and the cycling of matter through reading and creating a diagram. The roles of producers, consumers, and decomposers in forests are also examined.

Use 5-6 Lesson 4 to contribute to Urban Forest Lesson Guide: 5-8 Lesson 1. Use the Introduction as an additional tool to help students understand connections. Activity 1, Activity 2, and Activity 3 can all be used to provide additional supporting exercises about energy webs and matter cycling.

ECOSYSTEM WEB

HUMANS

BUILDINGS

TREES

WATER

WATER CYCLE EXAMPLE

