Open Spaces as Learning Places
PARK UNIT

THE "OPEN SPACES AS LEARNING PLACES" PROGRAM

PROGRAM STRUCTURE

The Open Spaces as Learning Places program teaches environmental science through six curriculum units focused New Haven open spaces. The program takes place over 9 weeks in both the spring and fall semesters. Each year, we teach approximately 27 hours of science education to 200 New Haven 6th grade students. In addition, through teacher training workshops and on-going support, we provide professional guidance to New Haven public school teachers.

In the **Schoolyard Unit** students learn that even the schoolyard is part of the natural world. By studying New Haven's history and creating a wildlife enhancement project in their schoolyard, students recognize the role humans and nature play in shaping the landscape.

The **Greenspace Unit** raises student awareness of open space at the neighborhood level. Children learn about local stewardship efforts of neighborhood residents to restore open space by transforming vacant lots into greenspace sites, landscaping yards, and maintaining curb strips. Students note the effects of natural change on the neighborhood environment and examine the special adaptations that allow flora and fauna to thrive in their neighborhood habitats.

The **Park Unit** takes an ecological approach to open space by focusing on a nearby city park to teach students about natural communities and ecosystems within their local park. Students begin to appreciate the ecological significance of open space. They become aware of the dynamic state of nature as they observe materials cycling through the forest environment and learn about successional change.

The **River Unit** makes regional connections, showing how watersheds join together urban communities and suburban towns to open space areas. Students study stream dynamics to see how water shapes the Earth's surface. After learning that water is a limited resource, students identify sources of pollution that threaten local rivers. After a canoe trip on a nearby river, the children explore adjacent wetland habitats rich with wildlife.

The **Pond Unit** ties together concepts from previous lessons and uses the example of a local pond for the study. The children use physical, chemical and biological measurements to analyze water quality. As they sample pond life, students observe food webs, metamorphosis and adaptations to different pond habitats. The students see successional change and learn how overlapping ecosystems provide valuable edge habitat for wildlife.

The **Cemetery Unit** provides a geological overview of landscape change. Students discover that the Earth's crust, composed of rocks and minerals, moves slightly every day. At a local historic cemetery, students look for change over time on gravestones, noting differences in resistance to weathering among rock types. They also learn that cemeteries serve as wonderful habitat for urban wildlife.

To download any of these teaching materials for free, please visit www.urbanresourcesinitiative.org.

PARK UNIT:
SUMMARY

This unit takes a community approach to open space by focusing on a nearby city park to teach students about park design, management and use. Balancing nature with the needs of city residents is an ongoing challenge in urban parks. By exploring natural communities and ecosystems within their local park, students begin to appreciate the ecological significance of open space. They become aware of the dynamic state of nature as they observe materials cycling through the forest environment and learn about successional change. The children understand that the park's past affects what they see today, and present-day actions impact the park's future.

PARK UNIT:
LEARNING OBJECTIVES

Journal

- Students are able to estimate the circumference, height and crown spread of a tree.

Worksheets/Reviews

- Students can identify the biotic and abiotic components of the terrarium ecosystem.
  Review Sheet 3.4-Park Review

- Students can construct an accurate hypothetical food chain.
  Review Sheet 3.1-Ecosystem Review

- Students can describe ways that a New Haven park has changed over time.
  Review Sheet 3.2-Park History

- Students are able to describe different parts of the tree and explain their functions.
  Review Sheet 3.3-Terrific Trees

- Students can identify the Sun as the major source of energy for terrestrial food chains.
  Review Sheet 3.1-Ecosystem Review

- Students are able to define and give examples of: producer, consumer, decomposer.
  Review Sheet 3.4-Park Review

- Students can identify special characteristics and adaptations of forest invertebrates.
  Review Sheet 3.4-Park Review

- Students are able to give examples of different ways that people use forest products.
  Worksheet 3.3-From Paper to Plastic

- Students can estimate the age of a tree cookie.
  Worksheet 3.4-Reading the Rings

Classroom Performance

- Students recognize the variety of species in the terrarium and can give examples of how the different species are interconnected and interdependent in the forest floor ecosystem.

- Students can explain the roles of decomposers in cycling nutrients and energy in an ecosystem.

- Students can describe the processes of change in forest succession.
- Students can list some consequences of pollution or over-exploitation along a food chain.
- Students are able to identify major landmarks on a map of a local New Haven park.
- Students are able to use their senses and observation skills to identify the similarities and differences among tree species and their leaves, and among individual trees.
- Students observe, listen and participate in class presentations and discussions.
- Students can identify forests and trees as natural resources.
- Students are able to locate their year of birth in the growth rings of a tree cookie.

PARK UNIT																		
Science Curriculum Standards and Framework - Grade 6		Classroom Activities					Outdoor Activities							Focus Activities				Journal
Content Standards	Expected Performances	Communities and Ecosystems	Chain Gang	Everything is Connected	Seeds on the Move	Park-Past and Present	Tree Steward Walk	Tree Morphology	Leaf Race	Hug a Tree	Forest Layers	Creepy Crawler Race	Reading the Landscape	TREE mendous	Tree Cookie Stories	Forest Timeline	Keying Out	Measure Up Change
Scientific Inquiry, Literacy, and Numeracy	**C INQ.1** Identify questions that can be answered through scientific investigation.											x			x		x	x
	C INQ. 2 Read, interpret and examine the credibility of scientific claims in different sources of information															x		
	C INQ. 3 Design and conduct appropriate types of scientific investigations to answer different questions	x	x	x			x	x			x	x	x		x		x	x
	C INQ. 5 Use appropriate tools and techniques to make observations and gather data	x	x	x		x	x	x	x		x	x			x		x	x
	C INQ. 6 Use mathematical operations to analyze and interpret data						x	x							x			x
	C INQ. 8 Draw conclusions and identify sources of errors						x	x	x	x	x		x		x		x	
	C INQ. 9 Provide explanations to investigated problems or questions	x		x				x			x	x	x		x			
	C INQ. 10 Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic	x	x	x			x	x			x		x	x	x	x	x	x
6.2 Matter and Energy in Ecosystems	**C 4.** Describe how abiotic factors, such as temperature, water and sunlight, affect the ability of plants to create their own food through photosynthesis	x	x	x				x			x			x	x	x		x
	C 5. Explain how populations are affected by predator-prey relationships	x	x	x														
	C 6. Describe common food webs in different Connecticut ecosystems		x	x														
6.4 Science and Technology in Society	**C 11.** Explain how human activity may impact water resources in Connecticut, such as ponds, rivers and the Long Island Sound ecosystem					x												

PARK UNIT

English Language Arts Standards and Curriculum Framework - Grade 6		Classroom Activities				Outdoor Activities							Focus Activities				Journal
Content Standards	**Expected Performances**	Communities and Ecosystems	Chain Gang	Everything is Connected	Park-Past and Present	Tree Steward Walk	Tree Morphology	Leaf Race	Hug a Tree	Forest Layers	Creepy Crawler Race	Reading the Landscape	TREE mendous	Tree Cookie Stories	Forest Timeline	Keying Out	Measure Up Change
1.1 Students use appropriate stategies before, during, and after reading in order to construct meaning.	**a.** Activate prior knowledge, establish purposes for reading and adjust the purposes while reading.														X		X
	b. monitor comprehension and apply appropriate stategies when understanding breaks down.														X		X
	c. Select and organize relevant information from text to summarize.														X		
	e. Draw conclusions and use evidence to substantiate them by using texts heard, read, and viewed.				X										X		
1.2 Students interpret, analyze, and evaluate text in order to extend understanding and appreciation	**a.** Generate and respond to questions.				X								X		X		X
	b. Interpret information that is implied in a text.														X		
	e. Discuss and respond to texts by making text-to-self, text-to-text and text to-world connections.				X								X		X		
	f. Identify and discuss the underlying theme or main idea in texts.														X		
1.3 Students select and apply strategies to facilitate word recognition and develop vocabulary in order to comprehend text.	**a.** Use phonetic, structural, syntactical and contextual clues to read and understand words.	X															
	d. Develop vocabulary through listening, speaking, reading and writing.	X	X	X									X		X		
	e. use content vocabulary appropriately and accurately (math, music, science, social studies, etc).	X	X	X										X			
3.1 Students use descriptive, narrative, expository, persuasive, and poetic modes.	**a.** use oral language with clarity, voice and fluency to communicate a message														X		
4.2 Students seek and write using standard language structures and diction appropriate to audience and task.	**a.** use sentence patterns typical of spoken and written language to produce text.																X

PARK UNIT																		
Math Curriculum Standards and Framework - Grade 6		Classroom Activities					Outdoor Activities							Focus Activities				Journal
Content Standard	Expected Performances	Communities and Ecosystems	Chain Gang	Everything is Connected	Seeds on the Move	Park-Past and Present	Tree Steward Walk	Tree Morphology	Leaf Race	Hug a Tree	Forest Layers	Creepy Crawler Race	Reading the Landscape	TREE mendous	Tree Cookie Stories	Forest Timeline	Keying Out	Measure Up Change
2.1. Understand that a variety of numerical representations can be used to describe quantitative relationships.	**a. (1)** Locate, order and compare whole numbers, fractions, decimals and integers on number lines, scales and the coordinate grid.					x												
	a. (2) Explain orally and in writing when a situation requires an exact answer or when an estimate is sufficient.							x										x
2.2. Use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.	**a. (1)** Estimate and predict reasonable answers and recognize and explain when an estimate will be more or less than an exact answer.							x										x
	a. (2) Use a variety of computational strategies (mental computation, paper-and-pencil and calculator) to add, subtract, multiply, and divide multidigit numbers in the context of multistep word and practical problems.						x	x							x			x
	a. (6) Create and solve a variety of provlems involving fractions, decimals, mixed numbers, money and simple percents.							x										x
3.1 Use properties and characteristics of two- and three- dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.	b. (1) Use the rectangle as a basic shape to model and develop formulas for the area of triangles, parallelograms, trapezoids and circles.							x										x
	b. (2) Recognize the relationships among radius, diameter, circumference and area of circles.							x										x
3.2 Use spatial reasoning, location and geometric relationships to solve problems	a. (1) Explore similarity of polygons as a result of dilations (a reduction or enlargement) and their effects on their measurements.							x										x
3.3 Develop and apply units, systems, formulas, and appropriate tools to estimate and measure.	**a. (1)** Estimate and determine length, area, volume, mass, and angle measurements.							x										x
	a. (2) Select and use appropriate units, strategies, and tools to measure and solve problems involving length, perimeter, area, volume, capacity, weight, mass, temperature and angles.							x										x

PARK UNIT:
BACKGROUND INFORMATION

This unit introduces students to basic ecological concepts. The children learn that everything is connected to something else. They understand how this interdependence ties humans to natural processes.

Ecology is the study of interrelationships between living organisms and between living and non-living parts of the environment. A **community** is comprised of living things in one area and their interactions with each other. For example, in the school community, the students interact with the teachers, the principal, the nurse, the lunch server, the custodian and their peers. An **ecosystem** includes all living and non-living things within a specific area and their interactions with each other.

Materials are cycled through ecosystems. Major cycles make life on earth possible, including the food, water, carbon, and nitrogen cycles. The sun is the energy source that drives natural processes in every ecosystem. Green plants store the sun's light energy by making food. The process of transforming light energy into food energy is called **photosynthesis**. During photosynthesis, plants release oxygen as they turn carbon dioxide and water into simple sugars in the presence of sunlight and **chlorophyll**, a pigment in leaves. In the living part of an ecosystem, energy flows from the sun through **food chains** composed of **producers** (green plants that make their own food), **consumers** (organisms that eat other organisms) and **decomposers** (organisms that break down dead organisms). Each living thing in a food chain takes in energy and gives out energy.

All living things are dependent on the food energy produced by green plants. Plants use some of the food they make for growing, reproducing and staying alive. Consumers get their energy by eating the green plants (**primary consumers**) or by consuming organisms that ate green plants (**secondary consumers**) or by eating organisms that ate organisms that consumed green plants (**tertiary consumers**). There is a one-way flow of energy in food chains with ninety percent of the energy wasted at each step of the chain. Although energy is lost through the food cycle, materials are recycled as they work their way through natural systems. Decomposers, mostly molds and bacteria, break down organic matter and release nutrients back into the system to be reused by plants and animals.

Plants and animals are not limited to one food chain. A plant can be eaten by a number of different animals that depend on a wide range of food sources. A **food web** composed of interconnected food chains is a good way of representing food cycle interactions. Another useful model is a **food pyramid** with producers at the bottom, primary consumers on the second level, secondary consumers third and tertiary consumers at the top. The food pyramid illustrates how green plants provide a solid base for the food cycle but as energy is lost, the numbers of individual decrease at each level. Animals rely on organisms below them in the food pyramid. The loss of a single species or the introduction of a toxin at the bottom that moves up the pyramid can cause the system to crash. Ecosystems comprised of a variety of organisms are less vulnerable. **Biodiversity** creates a more stable system.

Another important principal of ecology is that systems are not static. The environment is always changing due to human and natural influences. The process of one community or ecosystem changing to another is called **succession**. Old field succession, when an abandoned field changes over time to become a forest, is a good example of this community-driven process. Fast-spreading, fast-growing species disperse into abandoned, grassy areas, allowing shrubs, tall grass and wildflowers to take hold. **Pioneer** tree species that require lots of sunlight move in next. As the living components of the site change, so do the non-living conditions, creating an environment for new types of communities. If natural or human disturbances do not alter the site, forest development continues through the **mixed-aged** period where distinct forest layers become apparent. In the final even-age stage, the **climax** forest's thick canopy blocks the sun, allowing more shade-tolerant species to occupy underlying areas. Forest ecosystems show predictable patterns in structure, composition and morphology.

Forests are composed of layers of plants. The tops of the tallest trees make up the **canopy layer** where there is much sunlight and most of the forest's photosynthesis takes place. Shorter trees growing under the canopy make up the **subcanopy** layer. Some of the **understory** trees are offspring of the canopy trees while others are different species adapted to more shady conditions. Underneath the subcanopy lies the **shrub layer**. Shrubs have many woody stems and usually do not grow as tall as trees. The **herb layer**, near the bottom of the forest**,** consists of ferns, grasses, wildflowers, seedlings and other groundcover plants. The **forest floor**, strewn with fallen leaves, branches and hollow logs and home to mosses, lichens and fungi, is an area of decomposition where the forest's waste products are recycled into usable nutrients.

A group of individuals of the same species that live within a certain area is called a **population**. Members of a population compete for resources that are available to them. If a resource is in short supply in a certain area, the size of the population is limited by that resource. Plants and animals have distinct roles or **ecological niches** in their habitats. **Introduced species** (plants and animals brought in from another site that are not naturally found in an area) and **invasive species** (organisms that tend to take over where they live) can disrupt the balance of natural systems when they displace native species, particularly in disturbed areas. Human actions that alter species composition and limit habitat diversity can have a devastating impact on system health.

Forests are a renewable resource that humans depend on for timber, paper, wood products, food, energy and recreation. In addition, forested areas help prevent erosion, improve air quality, offer shade and provide valuable habitat for a wide range of plant and animal species. **Forestry**, the science of managing forests, tries to balance the demands on forests. The need to harvest timber often conflicts with the desire to maintain forests for recreation, wildlife and species preservation. On the other hand, certain recreational uses can have a destructive impact on forest habitats. Fire, disease and insects threaten forests as well and must be taken into consideration when deciding to protect forested areas. In the past, most forests were managed for only one purpose, but in recent years, forest managers have started to adopt **multiple use management** strategies that allow forested areas to be managed for several different uses. In developing management plans, forest managers must consider competing uses so that forests can be used productively and satisfy many needs.

PARK UNIT:
CLASSROOM ACTIVITIES

CLASSROOM ACTIVITY ONE

Title: Communities and Ecosystems
Objectives: Students will learn about interactions within natural communities and ecosystems.
Time: 10 minutes
Materials: Classroom terrarium
Preparation: None
Procedure:

- Introduce the discussion by referring to the terrarium that the students assembled during Classroom Activity Two, Greenspace Unit. Ask the children which elements of the terrarium are living.
- Explain that a group of living things that interact with each other is called a community.
- Ask if the students can think of other communities (use the example of the school community where students, teachers, and administrative staff interact with each other).
- Explain that in natural communities there are producers, consumers and decomposers. Living things interact by growing, being eaten and then getting broken down. Refer to the terrarium community by showing which are the producers, consumers and decomposers. Use this activity to check on the live animals in the terrarium.
- Ask the children which elements in the terrarium are non-living. Explain that the interactions between the living and non-living components of the terrarium comprise an ecosystem (the plant takes nutrients from the soil, the insects eat the plants, etc.).
- Ask the children if they can think of any other ecosystems (pond, forest, etc.).

CLASSROOM ACTIVITY TWO

Title: Chain Gang
Objectives: Children will learn about the transfer of energy through food chains.
Time: 10 minutes
Materials: Models of producers, consumers and decomposers (stuffed animals, rubber creatures etc.)
Preparation: Organize plant and animal models into a series of food chains.
Procedure:

- Illustrate food chains using models of various animals (for example: plant - cricket - toad - snake - hawk). Start out with a simple food chain and then try to make more complicated ones.

- At the end of each food chain explain that the animal at the top of the food chain dies and is decomposed. Discuss how materials are recycled back to soil.

CLASSROOM ACTIVITY THREE

Title: Everything's Connected

Objectives: Students will gain a greater understanding of the interconnectedness of an ecosystem by creating food webs and food pyramids.

Time: 20 minutes

Materials: Scissors, long roll of string, index cards, tape, pictures of different consumers in a food web, pictures of the sun, soil, air and water, building blocks, small pictures of producers and consumers that make up a food pyramid

Preparation: Cut out thirty pictures of invertebrates, mammals, birds, reptiles and amphibians and mount them on index cards. Cut out and mount pictures of a green plant, soil, air, water, the sun, and a mushroom. Tape pictures of plants and animals onto square building blocks.

Procedure:

- Place three chairs in the center of the room. Put the non-living (sun, water, air and soil) items all on one chair, the producers on another chair, and the decomposers on the last chair. Have the children arrange their chairs in a circle around the center chairs.
- Give each child a picture of an animal. Explain that they are part of an ecosystem with non-living and living components. Remind them that the living parts of ecosystems and communities are the producers, consumers and decomposers. Tell them that they are the consumers and point to the other chairs to show them the producers and decomposers. The non-living and the living interact in the form of food chains. There are a number of food chains in an ecosystem because there are many producers, consumers and decomposers. Point to the non-living items and explain why plants need them to grow. (They use the sun's energy, soil, and air to make their own food.) Certain animals (herbivores and omnivores) eat these plants. These animals may later be eaten by other animals (omnivores and carnivores)-- the process continues until the food chain ends with the death of the top consumer. Through decomposition, nutrients return to the soil and the food cycle continues.
- Illustrate a food chain by tying the string to the non-living chair and then wrapping it around the leg of the producer chair. Explain that the food chain begins with the plants that need the non-living to grow. Ask the students which of the animals that they are holding would eat a plant (Who has an herbivore or an omnivore?). Wrap the string around the chair of the student with that picture. Ask which animal would eat that animal. Wrap the string around that chair. Eventually, no one else in the room will eat the animal. This animal is the top consumer. Tell the students that the animal eventually dies and is decomposed (wrap the string around the decomposer chair) and returned back to the soil (wrap the string around the non-living chair). Using the same string, begin a new sequence. When every child has the string wrapped around his/her chair at least once, ask the students what they have made. Congratulate them on making a food web!

- Ask the students what would happen if a specific animal were removed from the food web. Give an example such as pesticide sprayed in an area kills all the crickets. Cut the string attached to the cricket and show how the web unravels. The toad's food source disappears which in turn affects the snake and then the hawk. Talk about unintended consequences to the overall health of an ecosystem that occur when pesticides are sprayed to eliminate things like West Nile virus or when hunters use lead shot.
- Stress how everything big or small, living or non-living, is important. Point out that consumers lower down in the food chain that get eaten first usually have many young. Use blocks to create a food pyramid with producers on the bottom, primary consumers on the next level, secondary consumers one row higher, etc. Remove one of the blocks toward the bottom and watch the pyramid tumble.

Adapted from LEAP

CLASSROOM ACTIVITY FOUR

Title: Park —Past And Present

Objectives: Students will practice map reading as they become familiar with the history and landscape of a city park.

Time: 20 minutes

Materials: New Haven Parks map, maps of the park and New Haven's Park Movement and Park History handouts (Handout 3.1 and 3.2)

Procedure:

- Explain that the next open space field trip is to a city park. Show them the New Haven park map, reminding the students of the "emerald necklace" of larger city parks and the "inner ring" of smaller neighborhood parks. Point out their school, the Greenspace site and the park they will be visiting.
- Take the students back in time, giving them the historical background of the park. Ask them to find various places on their maps that correspond to the historical narrative. Continue the discussion about park use and management up to the present day. Emphasize that the students can shape the park's future.

At the end of this lesson the teacher may choose to assign the Ecosystem Review Sheet

CLASSROOM ACTIVITY EXTENSIONS

1. Excursion! Organize a trip to visit the New Haven Park Ranger closest to your school. Call the Parks Department at (203) 946-8027 or, better yet, search the current calendar of Ranger Programs at their website http://cityofnewhaven.com/parks. Ranger Programs include hawk watching, tracking, fishing, maple syruping and others.

2. Chain Activity: Get students thinking about how everything is connected. Break students into four groups and name them the Food, Water, Shelter, and Space groups. Then call one person at a time from each group into the circle to eventually make a huge circle of all the students. Have them stand shoulder to shoulder and then eventually take one step forward before turning to face the person in front's head. Tell them to sit down cross-legged so that each student is sitting on the person behind's knees. Remind them of the concept of what makes a good habitat (food, water, shelter & space) and then show them what happens when one of the factors (H20, for instance) is taken out (chain falls over partly). Remind them that everything in the natural world is connected and interdependent on other factors, using the habitat in the Greenspace site as a prime example.

PARK UNIT:
OUTDOOR ACTIVITIES

(To the Park)
OUTDOOR ACTIVITY ONE

Title: Tree Steward Walk
Objectives: Students will recognize the curb strip as open space and will become tree stewards to help with street tree management.
Time: 20 minutes
Materials: Clipboard, pencils and Tree Steward worksheet (Worksheet 3.1)
Procedure:

- Begin by defining the curb strip as open space. Explain that there are more than 30,000 street trees in New Haven but less than ten maintenance workers in the Parks Department's tree division to care for all of them. Have the students divide 30,000 by 10 to see how many trees each maintenance worker has to care for (3000!).
- Tell the children that they are going to act as tree stewards for New Haven. The Parks Department relies on members of the community to monitor the health of street trees.
- Give each student a clipboard, Tree Steward worksheet and pencil. Explain that as they walk to the park, they need to look carefully at the street trees and record on their tree steward form any trees that appear to need maintenance (trees growing into power lines, dead branches, damaged bark, etc.). The information will be passed on to the Parks Department.

(At the Park)
OUTDOOR ACTIVITY TWO:

Title: Tree Morphology
Objectives: Students will recognize differences in morphology as they measure and identify.
Time: 20 minutes
Materials: Pencils, clipboards, Fandex tree guides, tape measurer, yardstick and tags, Tree ID Worksheet (Worksheet 3.1), increment borer and core sample
Preparation: In an open area at the park, find examples of seven different species of trees and mark them with numbered tags. Choose common trees with distinctive leaves that do not have poison ivy growing near them.
Procedure:

- Tell the students that foresters survey areas by identifying and measuring trees. Demonstrate how to measure the circumference, height and crown spread of one of the marked trees.

- Circumference - Show students where a forester measures the thickness of a tree (diameter at breast high – 4 1/2 feet from the ground). Explain that you will be measuring how big the tree is around at that same height. Have students guess the measurement by putting their arms around the tree. Go ahead and measure the tree comparing the results to the students' estimates.
- Height - 1) Ask for a volunteer and then hand the measuring tape to the eager student, telling the child to climb to the top of the tree. Stop the student before he/she starts to climb and explain that foresters are able to determine the height of a tree using special instruments so they do not have to climb every tree. Tell them that they are going to try out some of these techniques. Ask the students if anyone is five feet tall (any even height measurement is fine). Double check by measuring the student and lead him/her to the base of the tree. Have the rest of the class stand a distance from the tree and estimate how many five foot tall students (or alternate height), stacked one on top of another, would be needed to reach the top of the tree. Ask for several different answers. 2) Measure the height of the tree again using a second method. Have another student help out by holding up a yardstick at shoulder height with the fist at eye level and the arm fully extended. Adjust the yardstick so the length extending above the child's fist is equal to the distance from the fist to the eye. Tell the student to walk backwards facing the tree until the student can see the entire tree (base to top) within the length of the yardstick. Then measure the distance of the student from the tree – that is an estimate of the height of the tree.
- Crown Spread - Tell the students that the top of a tree is called the crown. The crown spread is the distance the branches extend from the trunk of the tree. Ask the students to form a huge circle around the tree that matches the crown. The students will have to look up to be sure they are standing under the tip of the furthest branch on all sides of the tree. Measure the distance between students directly across from each other on different sides of the tree. Average the distances to come up with an estimate of the crown spread. If it is a sunny day, be sure to point out the shade under the crown of the tree. Ask the children to look closely at how the crown of a tree affects the conditions underneath. Compare the open area to a forest where the crowns of many trees come together. Ask the students how trees in a forest influence areas below. Tell them that the next activity will take them into the forest and they will experience first hand how conditions change under the treetops.
- Repeat measurements on a much smaller marked tree. Compare measurements and ask students which tree is older. Note that the most accurate way of aging a tree is by counting its growth rings. Show them an increment borer and a core sample. Tell them that foresters bore holes in trees to get core samples that reveal the growth rings. Explain that the tree heals afterwards similar to the way humans recover from minor cuts. Let them know that they will have a chance to count tree rings in class next week.
- Explain that the marked trees are out in the open and have plenty of room to spread out. Trees in a forest are often crowded and need to compete for resources so they grow tall toward the sunlight.
- Distribute Fandex tree guides to pairs of students. Ask them to identify all of the marked trees by matching their leaves to the pictures in the field guide. Discuss the

results by comparing the size, shape and texture of the leaves. Note the difference between needle-like evergreens and broadleaf deciduous trees.

Adapted from NatureScope — Trees Are Terrific, pp. 56-58

OUTDOOR ACTIVITY THREE

Title: Leaf Race
Objectives: Children will distinguish variations among leaves.
Time: 10 minutes
Materials: Leaves from designated trees
Preparation: Collect twenty leaves from each of the seven marked trees. Group together two sets of the seven different leaves and place the sets in different Ziploc bags. Put the remaining leaves in a separate bag.
Procedure:

- Divide the class into two groups and line them up for a relay race. Give each student a leaf from one of the Ziploc bags. As you give out the leaves, ask each child to identify which tree his/her leaf comes from (if they are unsure, help them to remember). Place the remaining leaves in a pile, one hundred feet from the students.
- Tell the students that one at a time, they will run and try to find a leaf in the pile that matches the leaf they were given. They will pick up the leaf and race back to the starting line where the facilitator will check to see if the two leaves match and the child will identify their leaves. If they are different, the student needs to go back to the leaf pile and try again. When there is a correct match, the next student in line runs to the leaf pile. Continue until all the students have found a match.
- Stress that everyone is a winner because they all matched their leaves.

Adapted from Project Learning Tree, p. 11

OUTDOOR ACTIVITY FOUR

Title: Hug A Tree
Objectives: Students will understand the unique nature of individual trees through tactile exploration.
Time: 15 minutes
Materials: Blindfolds (one for every two students)
Preparation: None
Procedure:

- Tell the children that now that they have measured and identified the trees, they could probably tell the difference with their eyes closed!
- Students work in pairs. One partner is blindfolded and the other person guides the student over to one of the marked trees after turning the student around a few times to

disorient him/her. The blindfolded person hugs or touches the tree until the child thinks he/she will be able to identify it. The guide then spins the blindfolded person again and leads the partner back to the place where the student started. The person opens his/her eyes and tries to locate the tree. Stress that the "guide" needs to be gentle when leading their blindfolded partner!

- Partners switch roles and repeat the activity.

Adapted from Project Seasons pp. 107-108

OUTDOOR ACTIVITY FIVE

Title: Forest Layers
Objectives: Students will examine forest layers.
Time: 15 minutes
Materials: None
Preparation: None
Procedure:

- Lead students into a forested area and ask them to stop, look and listen. Tell them to: 1) tip their head back so that they can see the tops of the trees (the canopy); 2) look straight ahead (the subcanopy); 3) lower their chin (the shrub layer); 4) bend their knees (the herb layer); and, 5) sit down (the forest floor). Explain that without moving from one spot, they have studied the layers of a forest.
- Ask them how the layers differ. Be sure they think about sunlight, moisture and temperature. Do they notice changes in the vegetation from high to low and are there clusters of the same types of trees? Point out seedlings and saplings to show tree life stages. Ask them what kinds of animals they might see in the different forest layers. Try to spot wildlife, listen for sounds and search for animal signs. Point out hollow trees and brush piles, describing how they offer hiding places and homes for wildlife.
- Lay down a white sheet and shake some overhanging branches. Check the sheet for shrub layer and subcanopy inhabitants that fell to the ground.
- Look for insect galls on leaves and stems and explain how invertebrates develop in these leaf hotels feasting on the plant that is their host.
- Peek around the low vegetation, turn over rocks and logs, and look in the leaf litter for hidden creatures well adapted to the cool, moist conditions of the herb layer and the forest floor. Compare the school terrarium to the living and non-living components of these layers, noting the similarity in habitat. See if the students can find ferns, moss, lichens and fungi. Describe how moss and other woodland plants reduce erosion by locking in the soil on steeper slopes (The concept of erosion will be reinforced in Classroom Activity Three, River Unit). Discuss how many forest floor inhabitants are decomposers, recycling nutrients as they break down dead organic materials. By enriching the soil, they keep the forest ecosystem healthy.

OUTDOOR ACTIVITY SIX

Title: Creepy Crawler Race

Objectives: Students will appreciate the special characteristics of forest floor and herb layer inhabitants, noticing details about the animals' behavior and appearance as they race to the finish in a very unusual competition.

Time: 10 minutes

Materials: Poster board, permanent marker, clear container (jar with ventilation holes in the lid), live specimens (crawling invertebrates and amphibians)

Preparation: Collect a wide assortment of creatures from the herb layer and the forest floor that are similar to the ones in the terrarium tank (salamanders, centipedes, sow bugs, pill bugs, millipedes, slugs, ground beetles, spiders, worms, etc.). Draw concentric circles on a large piece of poster board. Label the center circle as the start and areas outside of the largest circle as the finish.

Procedure:

- Place the racetrack on the ground in an open area where there is room for the entire class. An enthusiastic introduction helps engage squeamish students in the activity right from the start. Explain to the students that they are in for the experience of a lifetime, one that few people will ever have. They have been invited to cheer on contestants at the Creepy Crawler Racetrack. The students need to predict the outcome of the race by guessing which of the competitors will win, place and show. Tell them that they have an advantage because the contestants are the same creatures that they have in their school terrarium. Remind them of the different animals and have them vote on how well each of the competitors will race. Ask them which characteristics will make certain contestants faster than others (size, shape, number of legs, movement, etc.).
- Set limits for the activity by emphasizing that the students must be respectful of the contestants. The students must be careful not to step on the animals as they reach the finish line.
- Release the container of "creepy crawlers" in the starting area of the racetrack. Encourage the students to cheer!
- Discuss the results of the race, analyzing why some animals did better than others (size, shape, number of legs, movement, etc.). Ask if the students' predictions were correct. Congratulate the students on being such enthusiastic spectators!

Adapted from Hug a Tree, p. 63

OUTDOOR ACTIVITY SEVEN

Title: Reading the Landscape

Objectives: Students will read the landscape to see how topography, natural processes and human factors influence landscape composition.

Time: 20 minutes

Materials: Park History handout (Handout 3.2)

Preparation: Review Park History handout.

Procedure:

- Lead an interpretive walk along a trail, pointing out unique landscape features. The topics discussed on this interpretive walk will be reinforced in the Focus Activities of this unit. Note the effect of topography on the vegetation and emphasize the importance of soil conditions. Ask the students to take in a broader perspective by looking beyond the forest. In much the same way as the students observed the different forest layers, ask them to look high, straight ahead and then low. See if they notice variation in the physical environment as they move down from higher to lower elevations. Relate their observations to the biological changes that they noticed. Explain that physical factors influence the type of natural community that takes hold in an area.
- Tell the students that landscape composition changes over time in quite predictable ways. As an ecosystem develops, plants take each other's place in a regular pattern called succession. The changing vegetation creates new habitat for wildlife. As the plants and animals change, so does the physical environment, creating conditions for a new community of living things. Remind the students of the interdependence of biotic and abiotic components in an ecosystem. Succession continues until a stable community develops.
- An example of succession is an old field that slowly turns into forest. Grassy, non-woody plants are replaced by shrubby growth and tall grass and wildflowers. Soon fast growing pioneer trees colonize the site followed by mixed age species. The climax forest characterized by an even age composition marks the last stage of succession. Ask the students to look carefully at the structure and composition of the park areas to determine which successional stages they see around them.
- Explain to the students that natural events (fire, an old tree falling over, storms, volcanic eruptions, disease etc.) create openings that promote successional change. Stress that nature is constantly changing.
- Discuss human impact on natural systems within the park (mowing, clearing, construction, trails, introduced species, invasive species, pollution, etc.). Explain how people start succession by clearing areas, slow it down by mowing and speed it up by adding fertilizer. Relate the discussion to the Greenspace site, asking the children about succession in the vacant lot.
- Describe how introduced and invasive species out-compete native species for resources, taking over disturbed areas. Point out examples in the park.
- Discuss park usage and management. Identify different user groups and ask students for ideas to improve the park.
- Continue the discussion on the way back to school.

Adapted from Reading The Forested Landscape

At the end of this lesson the teacher may choose to assign the Park History Review Sheet.

OUTDOOR ACTIVITY EXTENSIONS

***Note:** There are more activities listed as the Park Unit's Outdoor Activities than can be completed during a regular class period (110 minutes worth). Make a note of which activities your class did not get to and consider using some of these activities as extensions at a later date.

1. Minibeast Pits: Trap small insects and critters living in your local park by baiting them into pits. Create pitfall traps by digging holes in the dirt just large enough to put tin cans into. Bait the critters by placing some food in the bottom of the can (the sweeter and stickier the better). Flag the holes if you want to avoid people stepping directly on them. Wait no more than a day before coming back to see whether you have caught anything. If students have, assign them the task of drawing and observing the critters in their nature journals and then looking them up in a field guide in order to identify them correctly. Encourage students to be extremely careful and meticulous with their observations as many smaller insects look nearly identical.

2. Plant a Tree: Have the class research what types of trees grow best around their school. Use this assignment as a way for students to learn about the soil type, climate zone, pollution tolerance, and other factors that might influence the health of the tree they want to plant. Then have a contest to decide what type of tree to select as a class (based on student research). Have students choose the tree they would like to plant and give a short oral presentation on the reasons this tree would grow well in their schoolyard and why it would best represent your class as a whole. Encourage students to research the cultural and historical significance of their tree as well as the scientific name. Where did the Hemlock tree get its name? What is the story behind the Tamarack tree? Once all presentations have been made, have students vote on which tree they want to select for their planting. Pick a day to plant the tree and invite others (parents, other teachers, administrators and school staff) to come celebrate their class tree planting. Ask knowledgeable neighbors, Greenspace participants or parents to volunteer shovels and other expertise on the actual planting and maintenance process. Afterwards, have students design a marker to place next to the tree to remind others when the tree was planted and by whom.

PARK UNIT:
FOCUS ACTIVITIES

FOCUS ACTIVITY ONE

Title: TREEmendous

Objectives: Students will recognize trees as an important natural resource and understand how a tree works by learning about the structure and function of its parts.

Time: 15 minutes

Materials: Live trees (deciduous and evergreen), large tree cookie, household products made from different tree parts (see Tree Products handout), index cards, tape, yarn, scissors, hole puncher, push pins, descriptions of tree parts (roots, stem, branches, leaves, flowers, outer bark, phloem, cambium, sapwood, heartwood etc.), From Paper to Plastic worksheets and answer sheets (Worksheets 3.3), Tree Products and Tree Parts handouts (Handouts 3.3 and 3.4)

Preparation: Place a variety of small household objects manufactured from trees in a paper bag (see Tree Products handout). Cut out and mount descriptions of tree parts onto index cards to create tree part flashcards (see Tree Parts handout). Punch a hole in the card and string some yarn through the hole. Make the yarn into a loop by tying a knot.

Procedure:

- Define what a tree is. Trees have woody roots, trunks and limbs that provide support so they can grow much taller than other plants. Redwood trees in the Pacific Northwest are the tallest living organisms, growing to more than 350 feet tall. Trees also tend to live longer than other plants. Bristlecone pines can live for more than 4,500 years.
- Explain that there are more than 20,000 tree species throughout the world. Trees vary greatly in size and shape, how much sunlight and water they need, the hardness of their wood, how long they will live, whether or not they produce flowers and if they are deciduous with broad leaves that are replaced every year or evergreens with needle-like leaves that are dropped every 2 to 4 years.
- Tell the students that trees are a very important natural resource. People use trees for building, manufacturing different products and as a source of food and energy. Trees also provide food and shelter for wildlife, help prevent erosion and improve air and water quality. Ask the children to think of some ways that they use trees (shade, climbing, hiding, forts, watching wildlife, pencils, houses, etc.).
- Explain that the different parts of a tree are used to make a wide variety of products that people use everyday. Ask the students to name eight different parts of a tree (roots, wood, bark, leaves, flowers, fruits, seeds and sap). Show the students a paper bag containing common household products made from different parts of trees (see Tree Product handout). One by one, go through the eight tree part categories removing corresponding objects from the bag.
- Distribute From Paper to Plastic worksheets to the students and an answer sheet to the teacher and challenge them to find 40 objects in the picture that come from trees. Ask them to work on their search after class or at home.

- Explain that as the demand for wood products continues to grow, forests must be managed carefully. Early settlers cleared so much land for farming that by the mid-1800's, most of America's forests had disappeared. In the early 1900's, forest management started to take hold as people recognized the need to manage forested areas for multiple uses - timber, wildlife, recreation etc. Proper forestry techniques were developed that helped conserve rather than destroy forested areas. In addition, people began to appreciate the importance of preserving stands of untouched, old-growth forests as habitat for rare species of wildlife and as monuments to the past. Without management, forests and all the benefits they offer would be gone forever.
- After illustrating the importance of different tree parts to people, discuss how tree parts help the tree. Demonstrate using live trees (deciduous and evergreen) and a large cross section of a tree. Describe the function of each of the tree parts by reading a description, pointing to the corresponding part on the live tree or the tree cookie and hanging or pinning the card in the correct position. Be sure the students understand that the outermost and innermost parts of a tree's trunk are dead. A hollowed out tree can still grow, produce leaves, make food and transport materials as long as the living parts just under the outer bark remain intact. The living section of the tree's trunk contains the tree's plumbing system (phloem and xylem) and cell making layer (cambium).

Adapted from Hands On Nature, pp. 131-132, Project Seasons, pp. 109-110 and NatureScope—Trees are Terrific, pp. 4-7, 48-50, 65-66 and 70

FOCUS ACTIVITY TWO

Title: Tree Cookie Stories
Objective: Children will discover the life story of a tree by reading its growth rings.
Time: 15 minutes
Materials: Reading the Rings worksheets and answer sheets (Worksheet 3.4), pencils, small tree cookies, and hand lenses
Preparation: None
Procedure:

- Distribute tree cookies, hand lenses and worksheets, explaining to the students that they will be looking at the tree cookies very closely to read the story of their tree's life in its growth rings.
- Review the parts of the trunk. Tell them that each year a tree makes new wood by adding cells under the bark. Depending on the conditions, a tree grows differently which is revealed in its growth rings of new cells. A growth ring consists of a wide, light part showing fast spring growth and a small, dark band reflecting slow summer growth. The more a tree grows, the wider the bands. Explain why trees shut down in colder months, describing how water is needed for photosynthesis but it is not available when the ground is frozen. Deciduous trees drop their broad leaves in the fall because they make the trees vulnerable to freezing and are not needed for making food until spring. Evergreens do not lose their thick, waxy, needle-like leaves before winter because of the protection offered by the leaves' shape and texture.

- Fill in the Reading the Rings worksheet as a group activity to give the students a better understanding of tree growth patterns.
- Have the students determine the age of the trees on the worksheet by counting the dark rings. Remind them that dark and light rings together reflect one year's growth. Be sure they understand that the newest rings are closest to the bark and that the center rings show when the tree was a seedling and a sapling.
- Ask the students to perform the same activity on their tree cookie. Have them estimate the age of their tree and look for variations in growth over the years. Explain that different tree samples illustrate the same scenarios depicted in the worksheet. See if they can identify some factors that might have influenced their tree's growth. Be sure they understand why trees exhibit more growth some years than others. Have them report their findings to the rest of the class.
- Compare a tree cookie from a younger tree that has a larger circumference to one from an older tree with a smaller circumference. Refer back to field trip observations of tree growth patterns in forests. Differences in growth can be attributed to variations among tree species as well as local conditions (space, moisture, soil, sunlight, etc.).
- Having them pretend that the tree was just cut down, ask them to find the year they were born. Explain that this activity is a math exercise as well as science because they will have to count back from the furthermost ring to the year they were born. Think of some other recent historical events and have them locate those dates on their tree cookies. Check their answers, guiding them through the challenges as needed.

Adapted from Project Seasons pp. 123-126 and NatureScope — Trees Are Terrific, pp. 16-19, and 23

FOCUS ACTIVITY THREE

Title: Forest Timeline

Objectives: Students will explore forest dynamics by following the developmental stages of old-field succession. Children will gain a deeper understanding of the interdependence of abiotic and biotic components of forest ecosystems by looking closely at the structure and function of forest layers.

Time: 15 minutes

Materials: Succession handouts (Handout 3.5), stapler and staples

Preparation: Create a pictorial history of an area going through old-field succession by Xeroxing pictures of different developmental stages. Create a book for each student by stapling together the handouts. The story begins with an abandoned farm and ends with a mature forest.

Procedure:

- Distribute timeline booklets that illustrate change in forest structure and composition in an area undergoing old-field succession.
- Describe how the environment is always changing due to human and natural influences. Explain to the students that the succession booklet traces the history of an area that was cleared for farming and then abandoned. Over the years, the field becomes a forest as different plants take hold, creating new habitat for wildlife. Remind the students of land use patterns in New Haven with agriculture dominating early settlement times. New Haven's rocky terrain made agriculture difficult for early settlers, forcing many to abandon farming for manufacturing.
- Read through the picture book page by page with the class as you talk about the characteristics of pioneer, mixed-age and climax species and the interaction of abiotic and biotic components in a developing forest. Challenge them to find different species of wildlife as the forest develops.
- Discuss how fast-spreading, fast-growing species disperse into grassy areas, allowing shrubs, tall grass and wildflowers to take hold. Pioneer tree species that require lots of sunlight move in next. The community driven process continues as living components change non-living conditions, encouraging new types of communities to become established. If natural or human disturbances do not alter the site, development continues through the mixed-age period where distinct forest layers become apparent. In the final even-age stage, the climax forest's thick canopy blocks the sun, allowing more shade-tolerant species to occupy underlying areas.
- Point out that the topography, substrate and climate influence the type of forest that develops.
- Introduce different scenarios that would impact forest development. Be sure to include natural processes and human influences (tree falling down in a storm, trail construction, fire, development, etc.). Relate the discussion to the Greenspace site and have the students think about what the area would look like today if it had not been built on. Then ask them what would have happened over hundreds of years, if the community had not stepped in to create a Greenspace site after the lot had been built on and later abandoned. Caution them to remember that natural processes would continue to change the site and so would people. Human impact can slow down, or speed up succession and it also can alter the composition of a site.
- Talk about introduced and invasive species competing with native species to dominate an area. Stress how disturbed areas are particularly vulnerable to introduced and invasive species.

Adapted from How the Forest Grew

FOCUS ACTIVITY FOUR

Title: Keying Out

Objectives: Students will study leaf morphology as they use a dichotomous key to identify trees.

Time: 30 minutes

Materials: Tree Key handouts (Handout 3.6), Leaf ID worksheets (Worksheet 3.5), three-ring binders with plastic sheets, construction paper, paint, paintbrush, contact paper, Velcro, and dried, flat leaves (white oak, red oak, maple, sweetgum, tulip poplar, pine, spruce, locust, horse chestnut, etc.)

Preparation: Collect dry, flat leaves from the trees on the Tree Key handout. Laminate two leaf samples from each type of tree by pressing them between two pieces of contact paper. Cut around each leaf, leaving a half-inch border. Place the adhesive side of a Velcro circle on the back of each leaf. Paint a diagonal line across a piece of construction paper. Make 2 –4 leaf prints on either side of the line using unlaminated leaves from one of the trees. Lightly paint the rough side of the leaf and make a print by pressing the painted side down near the diagonal line that represents a branch. Be careful to make the print in the appropriate spot along the branch to reflect the tree's opposite or alternate leaf pattern. Attach the laminated leaves to the leaf prints with the other adhesive side of the Velcro circle. Repeat with leaves from the different trees to create a leaf booklet.

Procedure:

- Explain to the students that now that they know how trees work and why they are important, it is time to learn to identify them. Introduce them to a dichotomous key as a useful way of narrowing in on the identity of a tree. Describe how a key sorts through distinctive features to help tell things apart. There are keys for many living things including birds, insects, wildflowers and shrubs. In fact, a key can even be used to identify students.
- Select eight students to stand at the front of the classroom. Ask the remaining students to think of characteristics that would help tell their eight classmates apart. Male versus female is a good starting point. Try to narrow the subgroups into even smaller groups using other physical features (height, eye color, hair texture, etc.) until the students are all singled out. Explain that a dichotomous tree key works the same way but instead of human traits, it uses distinctive tree features.
- Distribute the Tree Key H.O. Describe how the key starts at the bottom of the page and moves up along a path with many branches. At every fork, a question is asked about leaf characteristics. An answer for a particular leaf leads either to the right or the left. Keep following the path, answering questions at each fork until it dead ends. The identity of the tree is written at the end of the path.
- Distribute the leaf booklets and Leaf ID worksheets to groups of 4-5 students and challenge the students to identify all the trees. Use Leaf #1 as an example, leading them through the Tree Key until the path dead ends at the name of the tree. Ask the students to work together to fill in the answers to the rest of the numbered leaves. Circulate among the groups to help guide the students through the activity. Point out

that the leaves should look familiar since the same types of leaves were used in the Leaf Relay Race at the park.

Adapted from NatureScope — Trees are Terrific pp. 14-15

At the end of this lesson the teacher may choose to assign the Terrific Trees and Park Review Sheets.

FOCUS ACTIVITY EXTENSIONS

1. Tree Readings: If your class enjoyed the story How the Forest Grew, consider making a regular habit of reading about trees. Some suggestions taken from Daniel Kriesberg's book, *A Sense of Place: Teaching Children About the Environment with Picture Books*, include Harry Behn's *Trees*; Eve Bunting's *Someday a Tree*; Lillie D. Chafflin's *I Have a Tree*; Arthur Dorros' *A Tree is Growing*; Lois Ehlert's *Red Leaf, Yellow Leaf*; Robert Frost's *Birches*; Zoe Hall's *The Apple Pie Tree*; Bruce Hiscock's *The Big Tree*; Scott Russell Sanders' *Meeting Trees*; and Jan Thornhill's *A Tree in the Forest.* Get started on these and keep your eyes out for more tree books at your local library.

2. Visiting Forester: New Haven is unique for a city its size in many ways. One unique jewel of the city is that the oldest operating forestry school in the United States is located right in town: the Yale School of Forestry. Invite a forest manager or forest management student to speak to the students about forestry as a profession. Encourage them to explain about the variability of forestry jobs out there--including both community/urban and rural management jobs. Ask them to explain both the production and conservation side of their work.

3. Take a Hike! Organize a longer day trip, either on a weekend or as a weekday field trip, to either East or West Rock Parks to do a big hike. You could climb to the top of East Rock or do a loop trail around Lake Wintergreen--the possibilities are endless! Use the hike as a chance to study the succession in the forest in more detail. Ask around to find some volunteers who are familiar with hiking and the trails in New Haven. Also, ask parents to come along as chaperones and get them in on the fun of being outside!

PARK UNIT:
NATURE JOURNAL

ASSIGNMENT THREE

Title: Measure Up Change
Objectives: Students will measure, identify and look for changes on their tree.
Time: Conducted between last day of Park Unit and first day of River Unit.
Materials: Nature journal, Measure That Tree worksheet (Worksheet 3.6), pencil, crayon, ruler, string, scissors and tape measurer (if available)
Preparation: None
Procedure:

Tell the students that they will be measuring their special tree, applying the same techniques that were used in the park. Hand out worksheets that explain how to gather data on the height, circumference and crown spread. Explain that they need to follow the directions carefully and fill in answers to all the questions. The students should:

(1) Carefully complete the worksheet. All they will need for their measurements is a ruler and some string. A measuring tape would be helpful but is not necessary.
(2) Collect at least one leaf from their tree. If they pick up the leaf from the ground, they must check to be sure that it matches leaves on their tree. They should place the leaf between pages in their nature journal to press it flat. They need to leave the leaf there so it can be identified at school.
(3) Study the texture of the bark by holding up a page from their nature journal to the trunk of the tree and rubbing a crayon back and forth across the paper. Laying down a peeled crayon lengthwise works best. Tell them to try a leaf rubbing as well.
(4) Look carefully for change on their tree. Did anything new grow (leaves, buds, flowers, seeds, fungi, lichens, etc.)? Did anything fall off (leaves, seeds, flowers, bark, branches, etc.)? Did the tree change color or does it smell different? Has anything harmed their tree in any way? Are animals using the tree for food or as a home? Explain that they should take time to observe their special tree very closely, comparing what they see to the list they prepared when they first chose their tree.

***Note:** Facilitator/Teacher should have students write assignment in notebooks on the last day of the Park Unit. Assignments should be collected, corrected, and a classroom discussion should be held before the start of the next Unit.

PARK UNIT:
HANDOUTS, WORKSHEETS & REVIEW SHEETS

PARK HANDOUT 3.1 New Haven's Park Movement

The greening of New Haven with a city-wide system of public parks was a response to concern over urban congestion caused by rapid industrialization. In a thirty year period from 1880 to 1910, New Haven gained nearly 1,100 acres of parkland, half its present day total. Activism by the wealthy elite initiated park building with the creation of East Rock Park, New Haven's first public park. The Park was managed by a private commission that later expanded to become the New Haven Commission of Public Parks. As the park movement moved forward, management shifted from private to public initiative and control.

The success of East Rock Park in the early 1880's resulted in nine more major parks, all on the periphery of the city, being established by the end of the next decade. This stage of the park movement was the "pleasure ground era". East Rock Park drew thousands of visitors annually, attracting positive attention to the City but it failed to serve the needs of all New Haven residents, rich and poor. Its distance from the center of the City and its orientation as a pleasure ground for the wealthy were shortcomings reflected in the other major parks as well.

As the urban environment continued to deteriorate and discontent over public parks catering to the wealthy became widespread, an inner city, "reform park" movement took hold from 1900 to 1930. Smaller parks, emphasizing recreation rather than aesthetics, were set up in working class neighborhoods to provide an escape from urban life. New Haven's city-wide park design took shape, incorporating ideas from a comprehensive city plan developed by landscape designers, Frederick Law Olmsted Jr. and Cass Gilbert in 1910. The park design included an "emerald necklace" of larger parks and an "inner ring" of small neighborhood parks that reflected the accomplishments of both the "pleasure ground" and the "for the people" periods of the park movement. Over the years, New Haven's park system expanded to include more than 90 public parks covering 2,200 acres of land. Today's parks are a legacy to the City's past and one of New Haven's most valuable resources.

Sources:
Citizens Park Council of Greater New Haven. (1990)
Withgott, Jay. (1990)

PARK HANDOUT 3.2 I. East Rock Park

Park Summary

East Rock Park, New Haven's first public park, is the City's largest and most varied park. It was established in 1880 through donations of land by private citizens and Yale University. Over the years, land was added to the park until it reached it present day total of over 400 acres. In 1882, Donald Mitchell was hired to draw up a plan for the park's "harmonious development". Mitchell's plan showcased the cliffs of East Rock and the wildness of the park, providing roads and manicured gathering areas for the public.

During the early 20th century, park improvement efforts, including the installation of tide gates and the filling of wetlands along the Mill River that winds through the Park, changed the park landscape dramatically. The tide gates, built under the direction of the Frederick Law Olmsted, Jr. and Cass Gilbert design firm, reduced tidal saltwater flow into the Park. Freshwater marshes took hold in upstream sections of the Mill River while downstream salt marshes, closer to the tide gates, were invaded and degraded by the common reed, Phragmites australis.

The present day East Rock Park provides historical, recreational and environmental opportunities to thousands of park visitors each year. The Park's landscape and design reflect its past with newer improvements attracting a wide range of park users. Athletic facilities include a skating rink, community-built playground, tennis and basketball courts as well as a variety of sports fields. The Trowbridge Center and the ranger station offer a variety of nature programs and displays. An extensive network of trails around the base of East Rock up to the summit make it a favorite hiking spot for nature enthusiasts. The Park includes a horticultural haven, the Pardee Rose Garden, built in 1935. Its greenhouses are maintained through a partnership with a local high school, with students helping to grow thousands of flowers that beautify the city each year.

East Rock's topography is dramatic with a traprock ridge dominating the landscape, 369 feet at its summit with two secondary hills, Indian Head and Snake Rock to the south. The steep dolerite cliffs of hardened, molten rock rise above a talus slope of broken traprock on a lower bed of red sandstone and shale deposited by streams 200 million years ago. The Mill River meanders through the Park from the dam at Lake Whitney, past the tide gates, under I-91 until it meets the Quinnipiac River and flows into the New Haven Harbor.

Plant communities reflect the topography of East Rock Park and the underlying soil. At the base of East Rock, the floodplain of the Mill River is dominated by marshy plants and woody swamp vegetation. Along the lower slopes, most of East Rock is mixed deciduous woodland except for the mowed sections of the Park. Moving up East Rock, scattered trees rather than dense forest appear wherever soil has collected on the very steep slopes of the rock cliff. Summit vegetation, dominated by grasses and shorter trees, is stunted by the shallow soil and harsh conditions at the top of the ridge.

East Rock Park's wildlife is as diverse as its vegetation. Mammals, reptiles, amphibians, fish and invertebrates thrive in the Park but East Rock is known most for its birdlife. The Park is a key link for migrating birds with over two hundred species recorded in the Park. In the fall, birdwatchers gather to watch kettles of hawks circling

overhead and during spring migration, more than twenty species of migrating warblers can be seen in the Park. Birdlife along the River is equally impressive with herons, egrets, ospreys, kingfishers and a variety of waterfowl frequently spotted on Mill River canoe trips or quiet walks along secluded floodplain trails.

Challenges and Stories
As the students complete each challenge, the facilitator shares related historical anecdotes about the park.

Challenge #1:
Find the **summit** with the **monument** and the smaller hills, **Indian Head** and **Snake Rock.**

Historical Anecdotes:

A hermit once lived on the summit all alone in a stone hut. Next, a man named Elizur Hubbel moved up to East Rock and built a resort called Mountain House with a bowling alley! Hubbel also quarried East Rock.

The last person to live on the summit was an eccentric man named Milton Stewart. He charged people 10 cents just to see the view from the summit! He built a huge resort that featured prize fighting. He also constructed a 40-foot ark, a model of a sharpie, at the summit to carry him to safety in the event of a great flood. The City tried to buy the land from him for the park but he refused to sell it. Finally, the city used eminent domain to seize the land. The ark was turned into a huge flower planter! Stewart was angry and retaliated by building 12 ugly houses on State Street called "the Dirty Dozen".

The Soldiers and Sailors Monument at the summit was erected in 1887 to honor New Haven veterans killed in the Revolution, War of 1812, Mexican-American War and the Civil War.

Challenge #2:

Find the **Mill River**. Follow it down from **Lake Whitney**, past the **Whitney Dam**, through the **tide gates** and under **I-91**.

Historical Anecdotes:

The Mill River eventually joins the Quinnipiac River and flows into New Haven Harbor. The Mill River was dammed up to create a reservoir for drinking water causing the river to become a trickle of water. The water company stopped pumping out drinking water several years ago, allowing the river to rebuild itself into a healthy riparian area. The Regional Water Authority has decided to make use of this reservoir once again. If this occurs, the river may be degraded as in years past.

One hundred years ago, Lake Whitney was a popular skating, boating and swimming spot. During winter, blocks of ice were collected and sole. Downstream from the dam,

the Mill River had some great swimming areas but there was at least one regulation: No swimming naked after 9 a.m.!

Hunting and trapping of beaver, otter and muskrats occurred along the riverbank. Before the tide gates limited saltwater flow up the river, haying of salt marshes and crabbing were both popular activities.

Challenge #3:

Find the **springs—Cold Spring** and **Colonial Spring**

Historical Anecdotes:

Springs feed the Mill River. People used to fill jugs with fresh drinking water from Cold Spring and Colonial Spring. Now the water is no longer safe to drink without being treated. Pollution from factories and sewage has threatened the river for hundreds of years but recent storm water/sewage separation and tougher industry regulations have improved water quality.

Challenge #4:

Find **College Woods**. .

Historical Anecdotes:

Yale owned College Woods, managing it as a woodlot for firewood. The University donated the 20-acre College Woods area to East Rock Park. At one time there were clay tennis courts. The courts were later used as a dog run. They have since been taken down and the Woods now house a playground, basketball court, pavilion and the Trowbridge Center.

Challenge #5:

Find the **Giant Steps**.

Historical Anecdotes:

The Giant Steps lead to the Summit. In the 1800s hundreds of people would climb the giant steps—it looked like a "long line of ants"! Near the base of the Steps was a favorite rock quarry called Corner quarry. Rocks from the spot were used to build extensions onto Long Wharf.

Challenge #6:

Find the **Pardee Rose Gardens**.

Historical Anecdotes:

Years ago the Parks Department kept 60 sheep at a farm on the site. The sheep were walked to areas such as College Woods to graze, acting as lawnmowers. The Pardee Rose Gardens include greenhouses for raising and selling plants. Many of the flowers

PARK HANDOUT 3.2 I. East Rock Park (cont.)

planted throughout the city are from these gardens. Students from the Sound School help to maintain the facility. The Gardens can be rented out for weddings and other special events.

Challenge #7:

Find the **North Meadows**. Follow **Farnham Drive** all the way down to **Orange Street**.

Historical Anecdotes:

Sledding was a favorite activity and there was a lot less traffic on the streets! Children would take their sleds to the North Meadow by Davis Street and slide all the way back to Orange Street on Farnham Drive.

Challenge #8

Find **Blake Field** and **Rice Field**.

Historical Anecdotes:

Ringling Brothers Barnum and Bailey Circus used to set up the Big Top at what is now Blake Field!

Challenge #9

Find **Wilbur Cross High School**

Historical Anecdotes:

In 1956, Wilbur Cross High School was built on park property. Imagine what the area would look like today without the construction. The citywide trend to build schools on park property allowed hundreds of acres of open space to disappear. Today the Park Commission protects parks from similar construction. The Commission plays an important stewardship role for the New Haven park system.

Challenge #10

Find **I-91.**

Historical Anecdotes:

In the early 1960s the Connecticut State Highway Commission proposed building a four-lane connector from Willow Street to Whitney Avenue in south Hamden. The plans called for channeling the Mill River into a concrete trough between the north and southbound lanes. The Save the Park Committee formed to fight the proposal. They succeeded in preventing construction and solidified into Friends of East Rock Park, which has served as a model for park friends groups throughout the city.

Sources:
Brainard, Ellen et al (ed.). (1971); Citizens Park Council of Greater New Haven. (1990); Withgott, Jay. (1990)

PARK HANDOUT 3.2 II. West River Memorial Park

Park Summary

West River Memorial Park, a long, narrow, 200 acre public park, stretches along both sides of the West River from New Haven to West Haven. The Park is an important link in a system of contiguous park units that extends from West Rock State Park to New Haven Harbor. The City acquired land for West River Memorial Park from 1923-1924 to honor New Haven veterans who had died in World War I. Inspired by the pool in front of the Washington Monument, the original park design included plans for a towering monument reflected in a straightened channel of the West River. The channel was eventually dugout on the east side of the River as was a horseshoe shaped lagoon to the west, providing fill for a roadway through the Park and an upland recreational area. Although the large monument was never erected, a smaller memorial statue stands at the north end of the Park, dedicated to Timothy Ahearn, a New Haven World War I hero.

The West River is the primary feature of West River Memorial Park. The area was originally a large salt marsh used mostly for salt hay by early settlers. Growing concern over breeding mosquitoes in marshy areas combined with an impetus towards reclaiming wetland areas for human usage, led to the installation of tide gates in 1919. The landscape was further impacted when dredged materials from the West River were dumped onto adjacent marshes in the 1930's. The end result was the conversion of West River Memorial Park from a salt marsh to a brackish marsh dominated by the common reed, Phragmites australis. Limiting tidal saltwater flow altered plant and animal communities in the Park and degraded water quality by preventing cyclical flushing of the waterway.

West River Memorial Park is an underutilized resource despite its natural beauty. The Park is wedged between New Haven and West Haven, surrounded by major thoroughfares and a cemetery. Although the Park has the potential to join together adjacent neighborhoods, many area residents are unaware of the Park's existence. Physical, social and political barriers limit park usage. Plans are being developed to overcome these obstacles by improving access, expanding recreational opportunities and enhancing environmental conditions. One proposed change for improving water quality involves redesigning the tide gates in a way that would allow controlled tidal flushing. West River Memorial Park is a unique natural area with a wide diversity of plant and animal species that offers an escape from urban existence for Greater New Haven residents.

PARK HANDOUT 3.2 II. West River Memorial Park (cont.)

Challenges and Stories
As the students complete each challenge, the facilitator shares related historical anecdotes about the park.

Challenge #1:

Find the **West River**. Follow it down from **Derby Avenue** all the way to the **tide gates** at **Orange Avenue**.

Historical Anecdotes:

The West River is a very long river that flows through many different towns before it reaches New Haven. It starts in a wetland in Naugatuck State Forest. If you threw a stick in the River at West Rock State Park, it would float down through Edgewood Park into West River Memorial Park and eventually end up in New Haven Harbor to get tossed around by waves on the beach. During high tide, the stick might get swept back up the River until it reaches the tide gates.

The twelve tide gates prevent tidal waters from flowing into West River Memorial Park. Before the tide gates were installed, the water in the River was much more salty and the Park was a huge salt marsh. Some saltwater still sneaks through cracks in the tide gates, allowing migrating, anadromous alewives (Alosa pseudoharengus), a type of herring, to travel upstream to spawn in freshwater areas and return to saltwater after hatching. Fishing and crabbing are popular activities in the Park.

The water quality in West River Memorial Park has deteriorated over the years. Storm drains empty runoff from the streets into the River and during large rain events, a combined sewage outflow dumps raw sewage into the Park. Canoes often get stuck where debris has collected at the base of the combined sewage outflow. Park managers are addressing concerns over water quality in proposals for removing or redesigning the combined sewage outflow. In addition, changes to the tide gates are being considered that would allow controlled tidal waters to flush out park waters.

Challenge #2:

Find the straight **channel**. Look for the two places where it connects to the **West River**.

Historical Anecdotes:

In 1927, a dredge was used to dig out a channel that would act as a reflecting pool for a huge monument at the north end of the Park similar to the Washington Monument. Mud from the dredging was pumped over adjoining marshes. The monument was never put in but there is a smaller statue in honor of Timothy Ahearn, a New Haven World War I veteran.

PARK HANDOUT 3.2 II. West River Memorial Park (cont.)

In an effort to improve the sightlines along the channel, Oak Street, which bisected the Park across a large bridge was closed and the bridge removed. Remnants of the old trestles from the Oak Street trolley line can be seen today off a peninsula close to where the West River connects with the channel. A picturesque view of West Rock from the southern end of the Park at Orange Avenue where the channel again meets the River, inspired a famous painting by Frederic Edwin Church in 1849.

Yale University started to use the channel for crew practice in 1947 and built a boathouse. In 1969, the International Rowing Course Foundation proposed an Olympic course that involved extending the channel into Edgewood Park. The rowing area would be open to the public and the Foundation would provide rowing shells to local high schools. Strong public opposition and lack of funds squashed the proposal.

Challenge #3:

Find **Marginal Drive** and point to the parking lot used by the **baseball stadium**.

Historical Anecdotes:

Dredging material was used to fill in wetlands and create Marginal Drive, a roadway through the Park. Marginal Drive was closed to vehicular traffic in 1980 due to illegal dumping and safety concerns. The paved roadway is a popular spot for biking, hiking and jogging and is used as a parking area by the baseball stadium.

Challenge #4:

Find **Horseshoe Lagoon** and try to spot where it flows into the **West River** under **Marginal Drive**.

Historical Anecdotes:

South of St. Lawrence Cemetery, a lagoon was excavated in the shape of a horseshoe with an island in the middle. It is connected to the West River under Marginal Drive. In the mid 1900's, the lagoon and the River were used by thousands of swimmers with swimming instruction, dressing sheds and toilets provided for park users. Drowning incidents in the lagoon led to an attempt to fill it in but this proposal was never completed. Although the lagoon is no longer used for swimming, it remains a favorite fishing area. Fishermen net migrating alewives as they swim through the tunnel under Marginal Drive into the lagoon. The herring are used as bait for larger fish such as striped bass and bluefish.

Challenge #5:

Find the two canoe launches at either end of the channel.

PARK HANDOUT 3.2 II. West River Memorial Park (cont.)

Historical Anecdotes:

West River Memorial Park is a popular location for Canoe New Haven, a citywide canoe program for Greater New Haven residents sponsored by the New Haven Department of Parks, Recreation and Trees. There are canoe launches at both ends of the Park, one in West Haven and the other in New Haven. Nature enthusiasts spot a wide range of plant and animal species as they canoe on the River, especially during fish migration when food is plentiful for osprey, egrets, herons and kingfishers. In the 1990's, volunteers put up osprey platforms along the West River to provide nest sites for breeding osprey.

Challenge #6:

Find all the recreational areas in the Park (basketball, soccer, playground, etc.)

Historical Anecdotes:

In addition to water related activities, West River Memorial Park offers a variety of recreational opportunities including a newly renovated basketball court, soccer fields and a playground.

Challenge #7:

Find the section of the Park completely surrounded by water with the best hiding places for animals because people can get there only by boat.

Historical Anecdotes:

West River Memorial Park is a refuge for wildlife, including deer, fox, coyote, muskrat, otter, beaver, wild turkey, hawk and vulture. One time, a black bear was spotted in the Park! It was a young bear that wandered down from northwest Connecticut and created quite a stir when it interrupted parents' day at the University of New Haven. It was so scared that it ran across Rte 1 to find a hiding spot in West River Memorial Park. Department of Environmental Protection officers darted it with a tranquilizer and transported it back to where it came from.

You can see a lot of different animals in the Park because there are areas where wildlife can escape people. Park planners recognize the importance of West River Memorial Park as a haven for wildlife and in developing park improvement plans, they stress maintaining natural areas for wildlife as well as considering human recreational needs.

Sources:
Casagrande, David G. (1997).

Citizens Park Council of Greater New Haven. (1990)

PARK HANDOUT 3.2 III. Edgewood Park

Park Summary

Edgewood Park, one of the oldest and largest parks in New Haven, is a 123-acre area divided into an upper and lower park. Thousands of years ago, the West River carved the valley in which the Park lies with help from the glaciers that covered much of New England 20,000 years ago. The glacier in New Haven was as tall as West Rock. When the ice melted, the water level of the West River rose until it was as high as the upper part of the Park. As the water drained out of the valley, it took with it mountains of soil, creating the valley in the middle of the Park. Before the 1800's, the West River meandered in large loops across the floodplain valley that is now the lower part of Edgewood Park. By the mid 1800's, increased pressure to convert wetlands into parks and developed areas caused people to straighten the course of the West River in order to reclaim adjacent marshes by filling them with dredge. Since that time, the River has started to meander again, carving out the natural course of an older, slow-flowing river.

Edgewood Park was established in 1889 when Donald Grant Mitchell, landscape architect and novelist, donated 60 acres of his estate on the west side of the West River to the City of New Haven. His farm, called Edgewood, was the namesake for the Park. Edgewood Park grew in size as Mitchell urged other landowners to donate land and the City began acquiring property on the east side of the West River. Park boundaries expanded further when the almshouse in the upland section of the Park moved to the Springside area and the City acquired a horse track called Hamilton Park.

The early 1900's brought landscaping improvements to the Park such as planting Norway maples, creating footpaths, athletic fields and ponds. The Park's design was shaped by many people over the years, including park founder, Donald Mitchell, the team of Cass Gilbert and Frederick Law Olmsted, Jr. and landscape designer, Beatrix Farrand. Edgewood Park is a reflection of the original designers' belief that an urban park could provide a balance between natural and built environments.

The ecology of the marshes in Edgewood Park changed dramatically with the installation of tide gates at Orange Avenue in 1919. The twelve tide gates reduced tidal flow in the River, eliminating the salt marshes in Edgewood Park that were replaced by a predominately freshwater environment. Recreational areas continued to increase as wetland areas were filled in to accommodate human needs.

Today, the Park's landscape offers a wide range of habitats, including red maple wetlands, cattail marshes, ponds, woodlands and the West River. Nature trails cut through secluded areas on either side of the River that meanders the length of the Park. Edgewood Park supports a variety of wildlife and is a favorite birding spot with more than 100 bird species recorded within the Park. In addition to more natural open space areas, there are highly managed sections of the Park with manicured lawns, ball fields, playgrounds, a skate park, tennis and basketball courts. Edgewood Park is a hugely popular park that links surrounding neighborhoods by providing cultural, environmental and recreational opportunities to a wide range of park users.

PARK HANDOUT 3.2 III. Edgewood Park (cont.)

Challenges and Stories

Challenge #1:

Find the **West River**. Follow the River from **Whalley Avenue**, under the **Edgewood Avenue bridge** until you reach the southern end of the Park at the **Chapel Street bridge**.

Historical Anecdotes:

The West River runs the length of the Park with wetlands and woods on either side. Nature paths through these hidden areas are great spots for seeing wildlife. Five deer were spotted at one time getting a drink in the West River.

The Park includes higher and lower areas because the West River once was a huge river that flowed very quickly and carved out the middle section of the Park. Twenty thousand years ago, an enormous glacier, the size of West Rock, covered New Haven. As the glacier melted, the West River was filled with water and flowed so fast that it carried mountains of earth with it. The lower section of the Park is the old river basin of the huge West River. When children sled down the steep hills in Edgewood Park, they are sliding down the old riverbanks of the West River.

The West River today is much smaller but it is still very important. It is a very long river that starts in Naugatuck State Forest and runs through many different towns before it reaches New Haven and eventually flows into New Haven Harbor and Long Island Sound. Water from the West River is diverted into reservoirs, purified at water treatment plants and used as drinking water.

Occasionally, big storms cause the River to flood. Storm waters from upstream areas and from city streets flow into the River, filling it with so much water that it overflows. The marshes and swamps in the lower section of the Park act like a huge sponge and soak up the floodwaters. The middle part of the Park is a floodplain for the West River. During large rain events, the open areas of the Park become large lakes with ducks and geese swimming past picnic benches. Slowly, the water is absorbed and the Park looks the way it did before. In June 1982, there was a great flood that was such a huge storm that the wetlands couldn't soak up the water before it flooded Westville Village and nearby homes. The great flood was a devastating event for the surrounding communities and caused considerable damage to the Park.

Challenge #2:

Find the two **footbridges** in Edgewood Park.

PARK HANDOUT 3.2 III. Edgewood Park (cont.)

Historical Anecdotes:

The footbridges are quiet spots for enjoying the natural beauty of the West River. If you look carefully, you might spot a muskrat, some fish or even an eel. The spring is the best time to look for fish because thousands of anadromous alewives, a type of herring, swim upstream from the ocean to spawn in freshwater areas. The American eel does just the opposite. It swims from freshwater sections to the ocean to reproduce. Fish migration is a good opportunity for seeing herons, egrets and ospreys, birds that like to hunt the alewives. During high tide, saltwater from the harbor flows up the river. In 1919, tide gates were installed to control tidal flooding in upstream park areas. The tide gates shut when it is high tide, preventing the alewives from swimming upstream. Some cracks in the tide gates allow alewives to sneak through but migration would be much easier without the tidegates.

As you stand on the foot bridges, you might notice that the River is quite straight even though it doesn't flow very fast. Older, slower rivers are usually very squiggly with large meanders or curves. During the mid 1800's people straightened the river in order to reclaim wetlands for parks and development. Before that time, the West River looked like a huge snake with large meanders. Very slowly, the River is starting to meander, following its natural course.

Challenge #3:

Find all six **ponds** in the Park—**Lily, Iris, Green, Duck, Edgewood** and **Long ponds**. Try to figure out which ones actually are old sections of the West River that were cut off when fill was deposited during the straightening of the River in the 1800's.

Historical Anecdotes:

Edgewood Park has many different ponds. Some of the ponds are man-made (Lily Pond and Duck Pond) while others are old meanders of the West River. When the River was straightened, the dredge was deposited on either side, filling in wetlands and cutting off sections of the river. These isolated pieces of the original river became ponds. This process can happen naturally and is how an oxbow lake is formed. When a meander gets really huge, a river sometimes takes a short cut. It flows straight and bisects the meander, leaving behind an isolated body of water.

The Lily Pond was dug in the early 1900's as a place to plant water lilies. It was stocked with fish and fenced in for mute swans. During the summer, fishermen practiced casting their fishing lines at the pond and in wintertime, it was a popular skating spot. Although lilies still grow there, the Pond is no longer maintained and it is slowly filling in with soil from eroding slopes. Through a natural process called pond succession, it will become a marsh, then a field and finally, a forested area. In 1937, Beatrix Farrand, a famous landscape designer, helped create a rhododendron grove near the Lily Pond. The

pathway through the area is called "the green tunnel" because the rhododendrons now grow untended in a dense thicket around the trail.

The Duck Pond, dug in 1907, is one of the most popular spots in Edgewood Park. People relax on the benches, bird watch and fish at the pond. The Duck Pond is home to a variety of waterfowl, including ducks, geese, swans, herons and egrets but the large bird population is taking its toll on the water quality of the Pond. Bird droppings act as fertilizer for algae and pond weeds, speeding up pond succession. The plants are growing so fast that they are choking up the pond. Plans are underway to dredge the Duck Pond to keep it from filling in and disappearing over time.

The other ponds in the Park are old meanders of the West River. These water areas are becoming shallower as well because of the eroding park landscape. They are slowly filling in as the steep slopes break down. Sediment from the old riverbanks of the West River is being deposited in the ponds. Turtles, frogs, fish and a wide range of aquatic invertebrates make their home in the shallow waters.

Challenge #4:

Find the old **Archery Field** in the open area on the west side of the River near the **middle footbridge**.

Historical Anecdotes:

In 1930, a large meadow was created for an archery field known as Robin Hood Dell. New Haven Archers would show off their skills to park visitors by setting up targets in the field. The clearing is now overgrown with weeds, berry bushes and wildflowers. The old archery field is an important natural area that provides edge habitat for snakes, songbirds, mice, rabbits, foxes and deer.

Challenge #5:

Find the **catch basin** just past the archery field near where the **Iris Pond** connects to the West River.

Historical Anecdotes:

The Iris Pond, once a meandering loop of the West River, is a woodland swamp named for the Blue Flag Iris that grows there. At the far end of the Pond, a catch basin was installed to hold water drained from the streets. The catch basin slows down storm water so heavier objects can settle before the water flows into the West River.

PARK HANDOUT 3.2 III. Edgewood Park (cont.)

Challenge #6:

Pretend you are riding your bike through the Park on the **park road**. Start at the **basketball court/tennis court area** and ride over the footbridge to **Coogan Pavilion**. Try out some obstacles at the **skate park** while you are there. Bike all the way up to the **Duck Pond** and sit on a bench to watch the ducks, geese and swans. If you are lucky, you might spot a heron or an egret. It's great that you took a break because now you have to bike uphill to the **sundial**. Cool down in the spray shower. Bike over to the **ranger station** to look at some animals and then over to the **playground** to look for your friends. What? They're playing basketball. Back you go!

Historical Anecdotes:

The park road that you were riding on used to be open to cars. During the winter, the road occasionally would be closed to traffic so children could sled all the way down the steep hill to the Duck Pond. The park road is now permanently closed to vehicular traffic, allowing park users to walk and bike safely through the Park.

Coogan Pavilion used to be an outdoor skating rink. There was a huge fireplace in the building where people would gather to warm up. In the 1990's, park users went to the State for funds to restore the skating rink. They couldn't raise enough funds for an ice skating rink but they were able to build a skate park for inline skating, skateboarding and biking.

Challenge #7:

Find the **Park Headquarters** where you sign up for summer camps and after-school sports programs.

Historical Anecdotes:

The Park Headquarters is an old police station. It is the center for the Parks Department that manages and maintains all ninety parks in New Haven. Just down the hill from the building is one of the best wildlife areas in the Park. Even though lots of people use the sports fields down there, the area connects to the largest wetland in the Park. Edgewood Park's field, water, wetland and woods habitats attract more than 100 different kinds of birds as well as a wide range of mammals, reptiles, amphibians and invertebrates. Edgewood Park balances the needs of people and nature.

Sources:

Bhatt, Seema et al. (1990)
Brower, Ann et al. (1999)
Citizens Park Council of Greater New Haven. (1990)

PARK HANDOUT 3.3 Tree Products

This list includes some examples of household items that come from different tree parts.

Leaves: tea, oxygen, mulch, shade

Sap: maple syrup, rubber gloves, rubber balls, rubber bands, pencil erasers, chewing gum, paint, soap

Bark: baseballs, cinnamon, cork bulletin boards

Roots: sassafras tea

Fruit: olives, apples, pears, oranges, avocados, chocolate, furniture polish, spices (allspice, nutmeg etc.)

Seeds: pistachios, walnuts, almonds, coconuts

Flowers: cloves, herbal teas, perfume

Wood: many wooden objects (baseball bats, blocks, picture frames, paintbrush handles, bookends, bowls etc.)

Cellulose from wood: books, candy wrappers, cereal boxes, paper towels, newspapers, magazines, toilet paper, cellulose sponges, eyeglass frames, film, toothbrush handles, combs, rayon clothing

Adapted from Project Seasons, pp. 109-110 and NatureScope —Trees are Terrific, pp. 65-66

PARK HANDOUT 3.4 Tree Parts

Flowers: Although flowers come in different shapes, sizes, textures, scents and colors, their role is the same. After pollination and fertilization, they produce seeds.

Seeds: Tree seeds are packaged in various ways but they all function to produce another generation of trees.

Leaves: Leaves make food for the tree through a chemical reaction called photosynthesis. They use carbon dioxide from the air, water taken up by the roots, and the sun's energy in the form of sunlight to make sugar (glucose). Photosynthesis requires the presence of a green pigment called chlorophyll that is found in all green plants. Chlorophyll absorbs the sunlight needed for photosynthesis. During photosynthesis, the leaves release oxygen and 99% of the water absorbed by the tree evaporates through a process called transpiration.

Twigs: Twigs hold up the flowers, seeds, leaves and buds.

Branches: Branches support the twigs.

Buds: New branches, twigs, leaves and flowers (and later on seeds) grow from buds.

Roots: Roots are long, underground branches that anchor the tree in the soil and allow it to absorb water and nutrients.

Trunk: The trunk supports the tree by giving it strength, and it contains the central plumbing system for the tree that allows water and minerals to be carried up from the roots to the leaves, and food from the leaves to be transported down to the branches, trunk and roots.

Outer bark: Although outer bark varies in texture and thickness from tree to tree, its function, to protect the tree from injury and disease, remains the same.

Inner bark (phloem): The thin layer next to the outer bark known as the phloem contains channels that transport food from the leaves to the rest of the tree. The sap within the phloem consists of water with dissolved sugars and nutrients. During most of the growing season, food is transported from the leaves to the living parts of a tree but at certain times of the year, the phloem also transports stored sugars up from the roots to the rest of the tree.

Cambium: Next to the phloem is the thinnest layer (often only one or two cells thick) called the cambium. It makes new cells during the growing season that become part of the tree's plumbing system (phloem and xylem). The cambium makes the trunk, branches, and roots grow thicker.

PARK HANDOUT 3.4 Tree Parts (cont.)

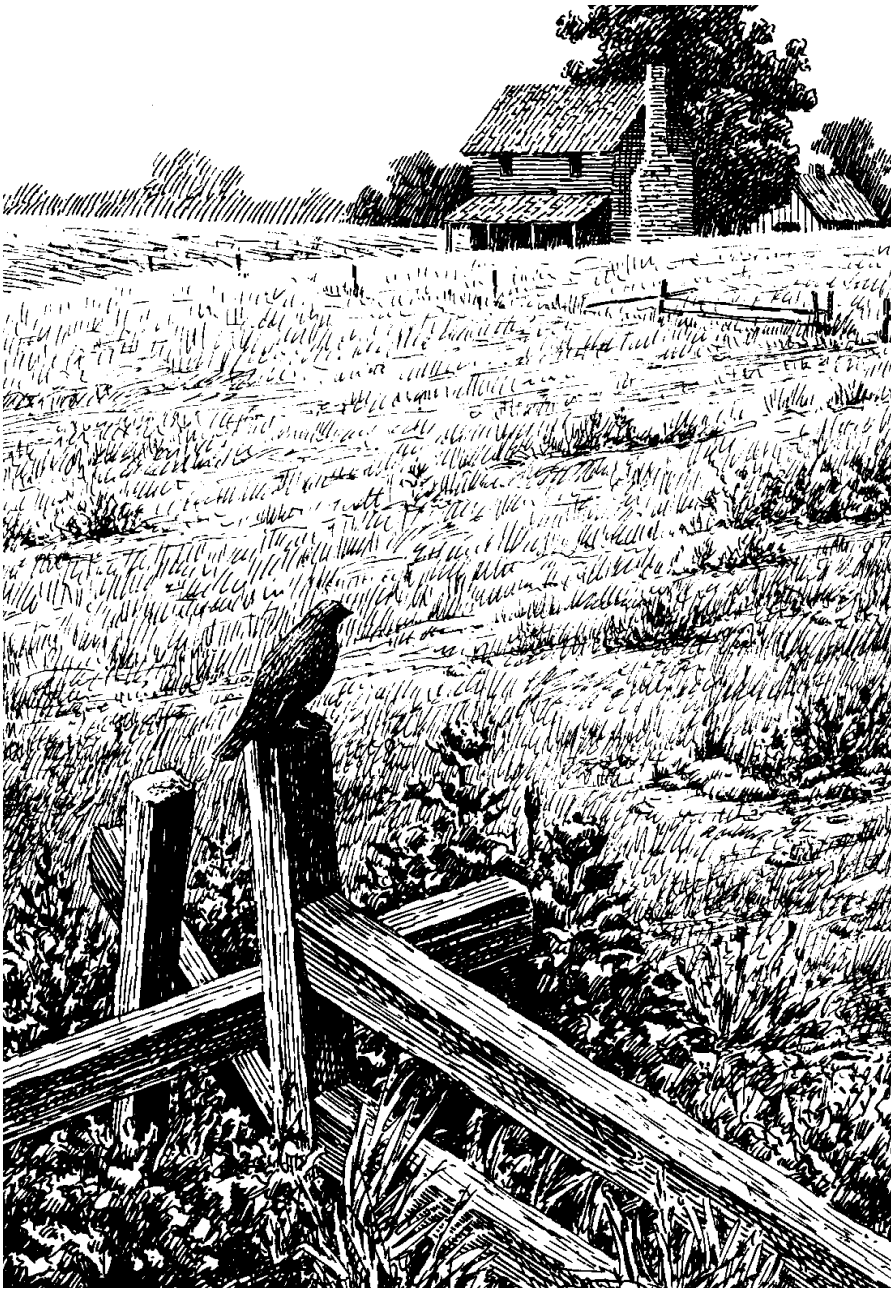
Sapwood (new xylem): Adjacent to the cambium is the area with the youngest wood, the sapwood or new xylem. Every year, the cambium adds new layers to the sapwood that forms a pipeline of thick-walled cells, transporting water and minerals up from the roots to the rest of the tree. The sapwood also stores nutrients and transports them across the tree, from one part to another.

Heartwood (old xylem): The trunk on an older tree consists mostly of heartwood or old xylem filled in with a resin-like substance that prevents the wood from transporting materials. The heartwood gives support to the tree and is darker in color than the new xylem. Sometimes the heartwood decays, leaving behind a hollow tree that is more vulnerable to toppling over or splitting apart during a storm.

HOW THE FOREST GREW

Have you ever wondered where forests come from and how they grow? This is a story about a hardwood forest. It takes 200 years back in time to see how the forest land looked back then and how it has changed over time. This book describes forest *succession*.

PARK HANDOUT 3.5 Succession Handouts (cont.)



A farmer cleared the land to plant his crops. After a while, the farmer and his family moved away and abandoned the field.

Changes began.

Seeds blew in or were dropped by birds. The seeds grew and the land filled with wildflowers and weeds.

In a few years, shrubs took root. They provided *habitat* for small mammals like rabbits and woodchucks. Birds came and fed on the berries. The land began to look different.

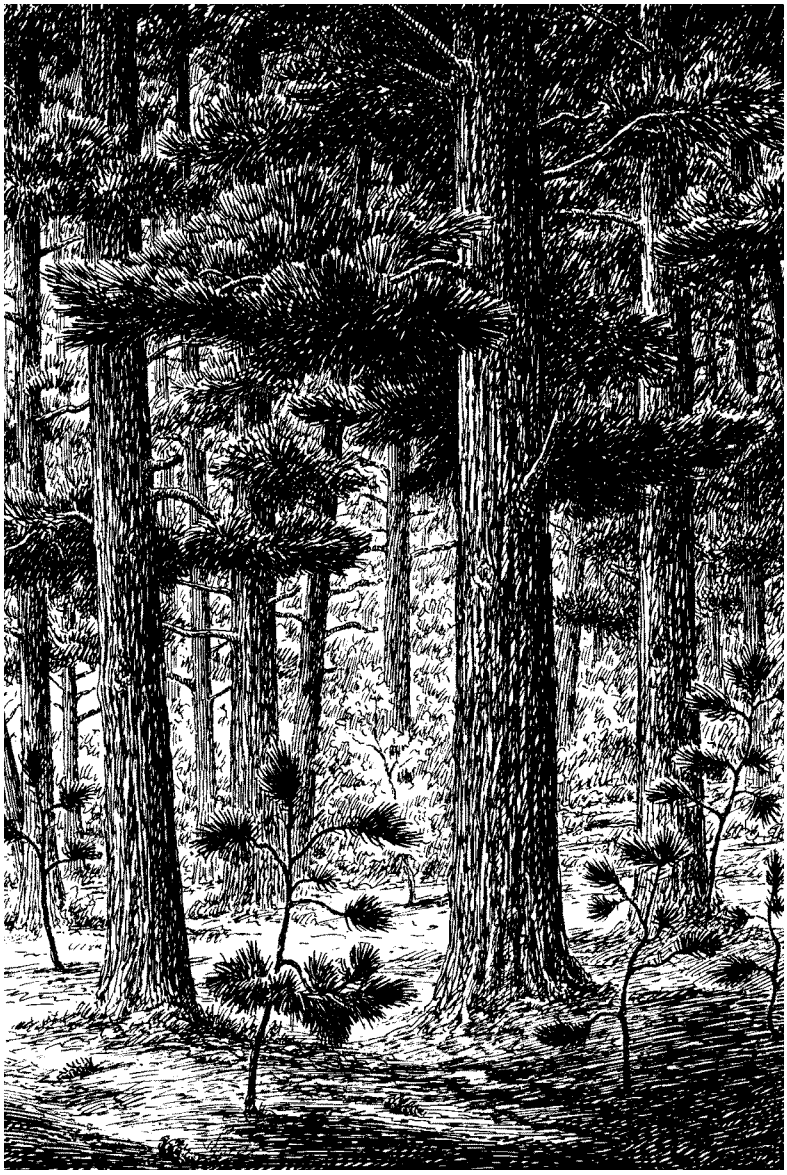
PARK HANDOUT 3.5 Succession Handouts (cont.)

Then one summer, five years after the farm family left, a pine seedling sprouted. The wind had blown its seed from a nearby forest.

That same summer, more pine seedlings sprouted. The first trees that take hold on a piece of land are called *pioneer trees*. These pioneer species love the sunlight and grow fast.

As the pine trees grew, brush-dwelling birds moved onto the land. They replace the field-dwellers. Towhees, warblers and field sparrows made their home amongst the pine trees.

Weasels and foxes also enjoyed living in this habitat. They caught mice, rabbits and birds for their dinner.



Twenty years after the first pine seed sprouted, the land was covered with white pine trees. Their branches blocked out the sun. The old weeds and grasses died in the shade. New pine seedlings tried to grow but it was too shady.

Only seedlings that liked the shade grew beneath the pine trees. Red oak, red maple and ash trees took the places of the pine trees.

PARK HANDOUT 3.5 Succession Handouts (cont.)

The forest became a mixture of *deciduous* and *coniferous* trees. This change from one kind of tree to a new kind is called forest *succession*.

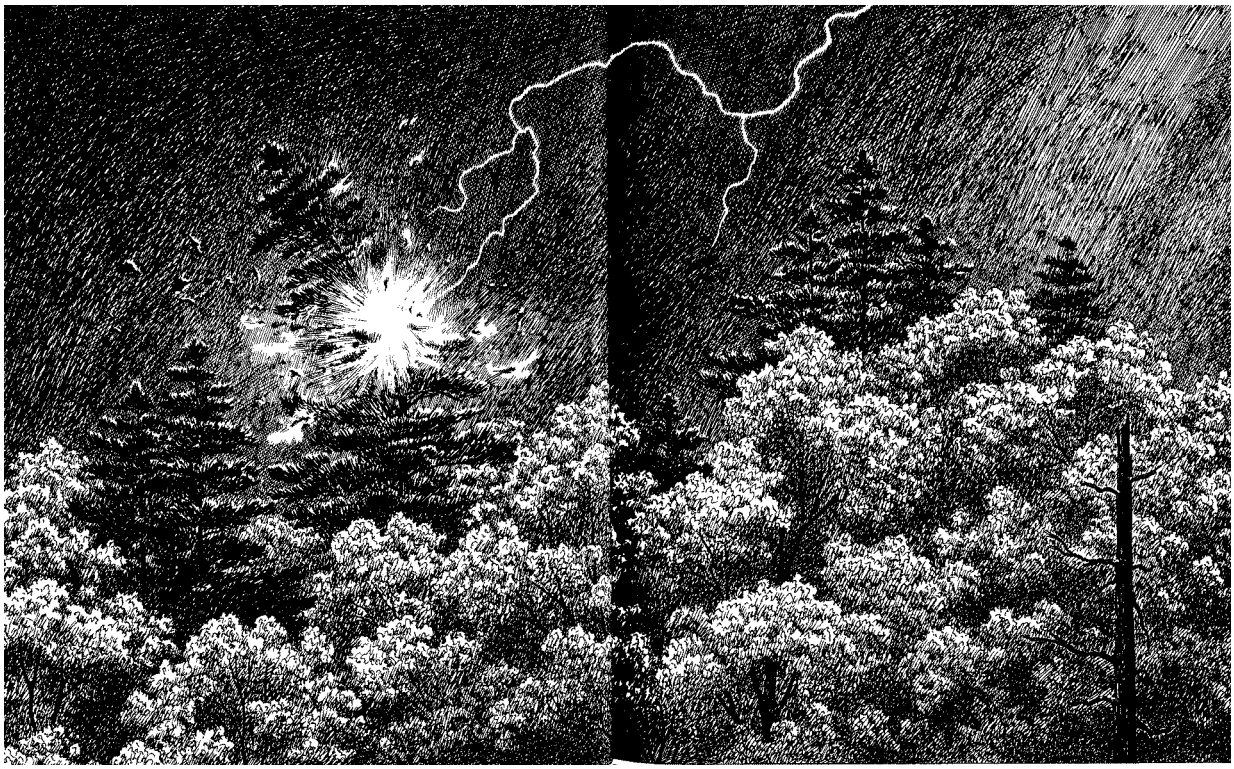
As the kinds of trees on the land changed, so did the animal life. The meadow mice moved because their food and nesting materials were all gone. White-footed mice took their place and built their nests in hollow stumps and logs.

Deer came to live on the land because there were places for them to hide and tender shoots for them to eat.

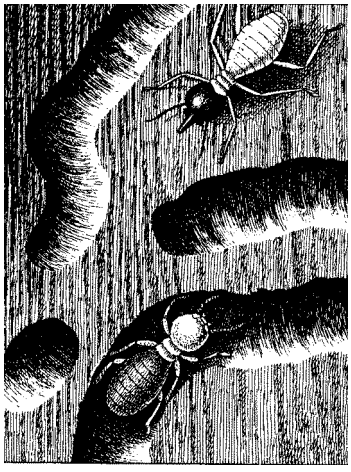
Squirrels and chipmunks brought nuts onto the land. Some of these sprouted with the other seeds.

PARK HANDOUT 3.5 Succession Handouts (cont.)

Fifty years after the farmer and his family had left, a storm broke over the land. Lightning struck the tallest pines, killing some and damaging others.

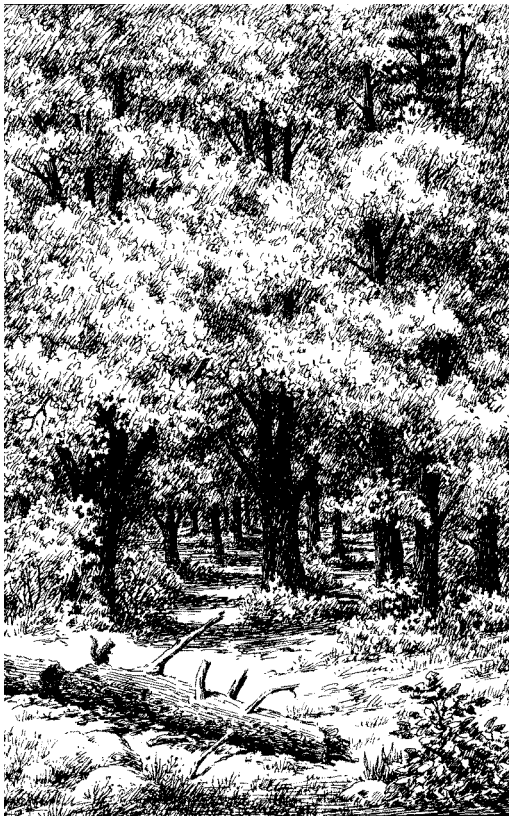


But this is how forests grow. Insects and disease hurt the other pines. Every time one of them died, it made room for the new and different trees that had been sprouting on the forest floor.



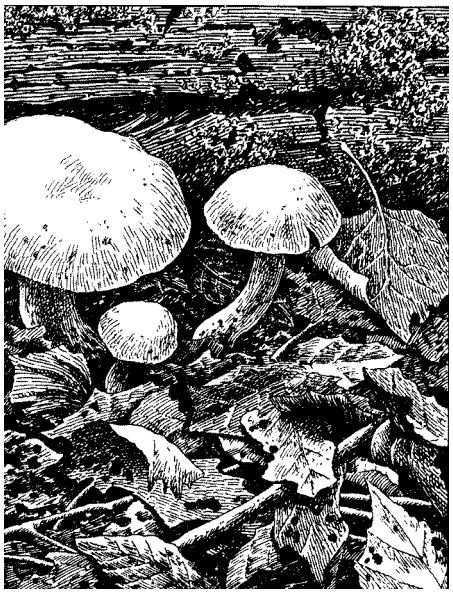
PARK HANDOUT 3.5 Succession Handouts (cont.)

Thirty years later, the pioneer white pines were nearly all gone. Red oaks, red maples, and ash trees were everywhere. The forest had reached its *middle stage*.



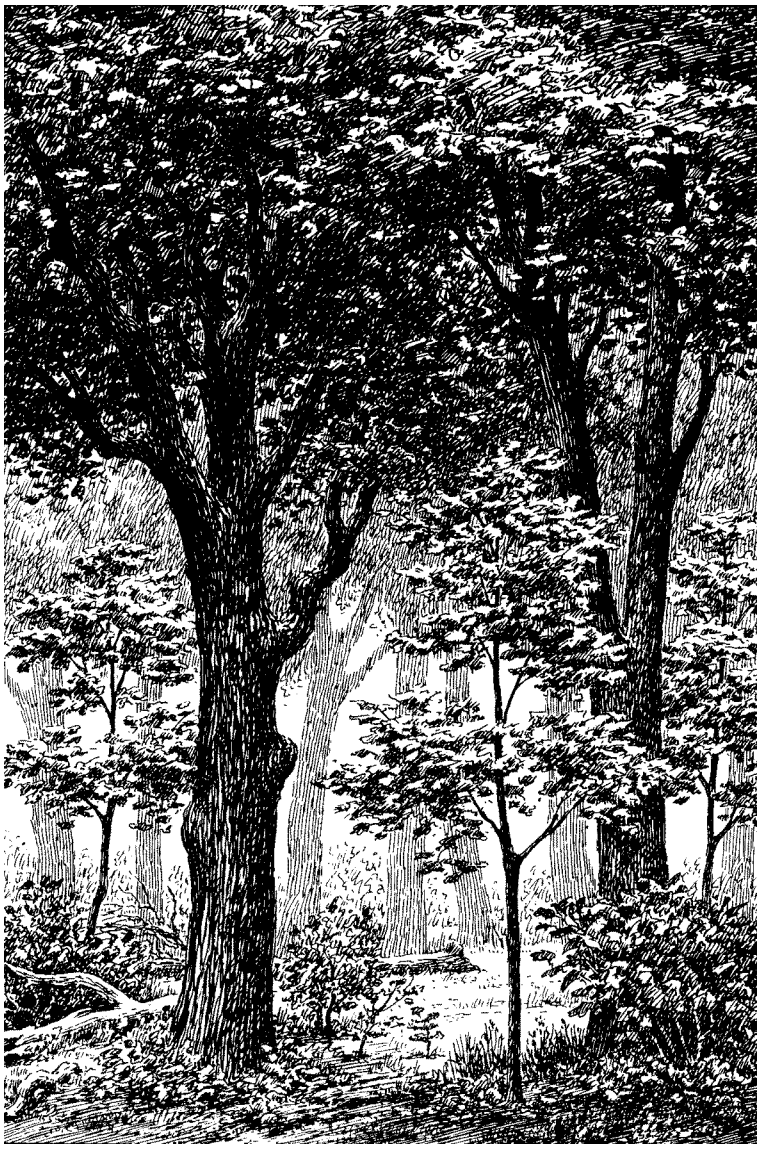
Now new seedlings sprouted on the forest floor. These were the beeches and the sugar maples, trees that like the deep shade.

Every autumn the trees lost their leaves. They fell to the ground and decayed and made a rich layer of stuff called *humus*. The slowly, bacteria, worms and fungi turned the humus into soil.



PARK HANDOUT 3.5 Succession Handouts (cont.)

One hundred years had passed. Now, whenever a red oak, red maple or white ash tree died, it made room for smaller beeches and sugar maples. These formed a layer below the older trees called an *understory*.

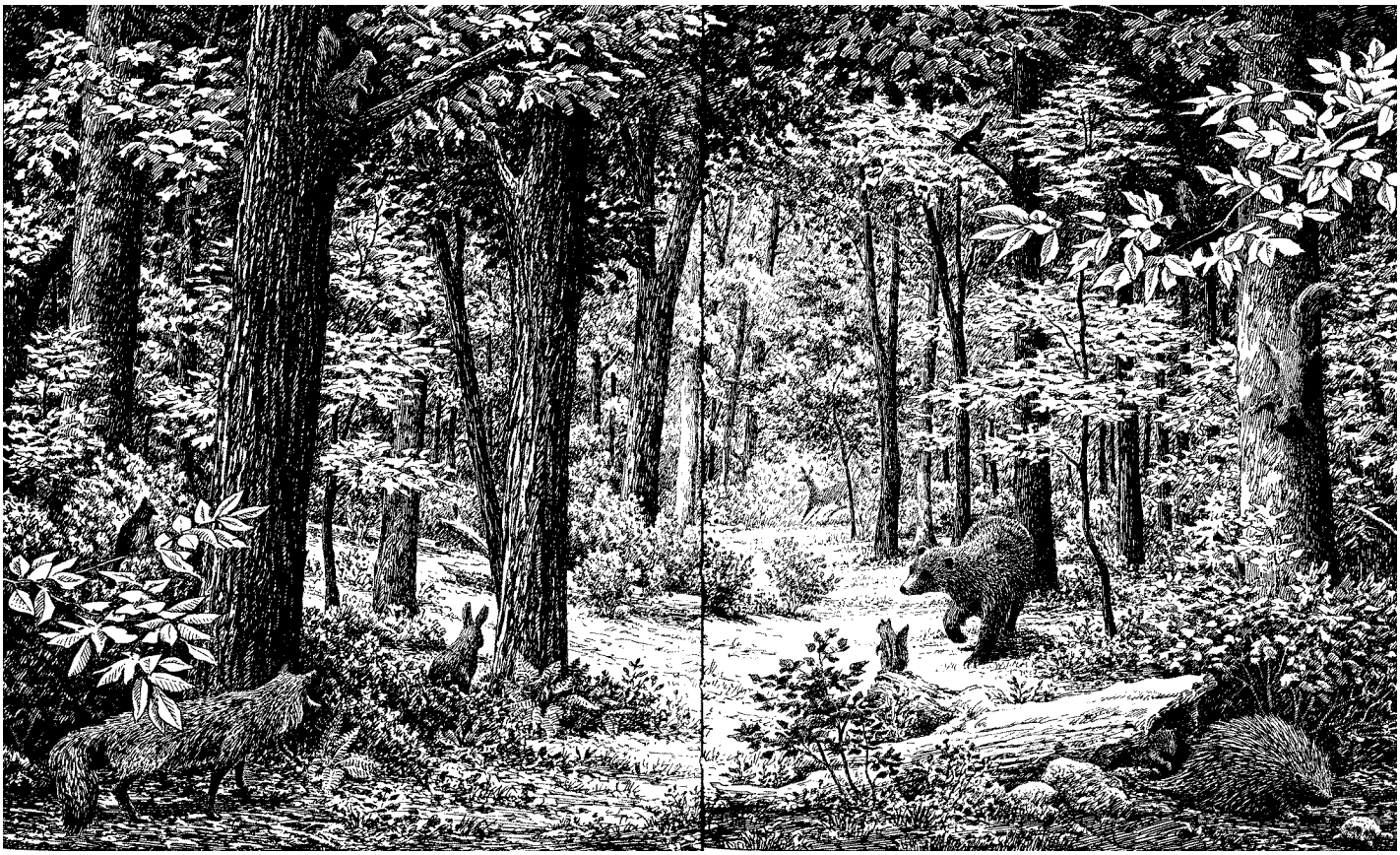


Year after year, the beeches and sugar maples pushed their branches toward the sky. Hemlocks grew in their shade. One by one, most of the red oak, red maple and ash trees disappeared.

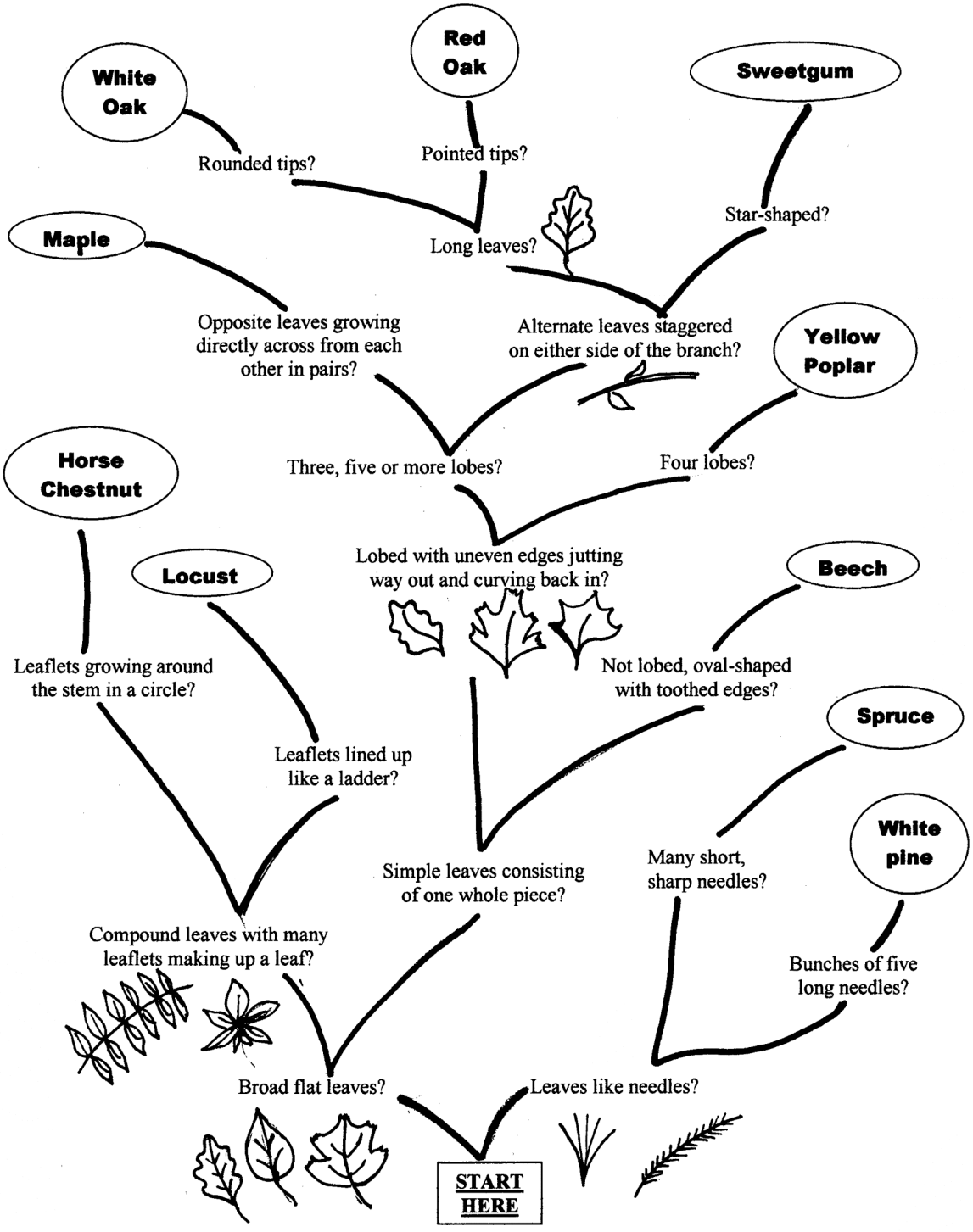
Now it is one hundred and fifty years after the forest began, the beeches and sugar maples dominate the forest. What was once open fields is now a magnificent forest, and is home to many wild animals, including foxes, bobcats, deer, squirrels, mice, porcupine, and many other creatures.

PARK HANDOUT 3.5 Succession Handouts (cont.)

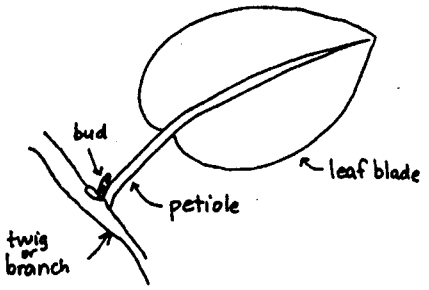
A forest never stands still. Old trees are dying and making room for new trees every day.



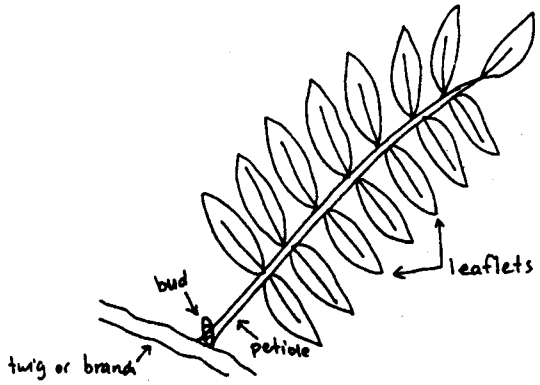
PARK HANDOUT 3.6 Tree Key Handouts



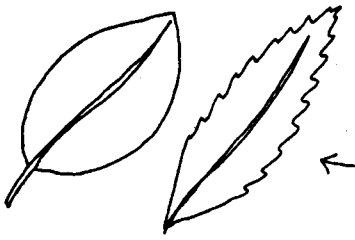
HELPFUL HINTS FOR TREE KEY



A simple leaf is one whole blade on a stalk (petiole)
Each leaf has its own bud.



A compound leaf has many leaflets (more than one) on a single petiole. Remember, each leaf has its own bud, but the leaflets do not.



These leaves are not lobed

These leaves are lobed.
Lobes are like fingers.

PARK WORKSHEET 3.1 Tree Steward Checklist

Did you know that there are over **30,000** street trees in New Haven but less than **10** people in the tree division of the Parks Department to care for them all? That means that each person has to care for 3,000 trees!

Please help the Parks Department by acting as a tree steward and helping care for the street trees. As you walk to the park, look carefully at each street tree that you pass and record any trees that appear to need maintenance. The information that you collect will be given to the Parks Department.

If you see any of the problems on the list below, write down the species and location of the tree, and mark an X in the box of the problem the tree has. THANK YOU!

Name of Tree Steward:_____

Name of street: _____

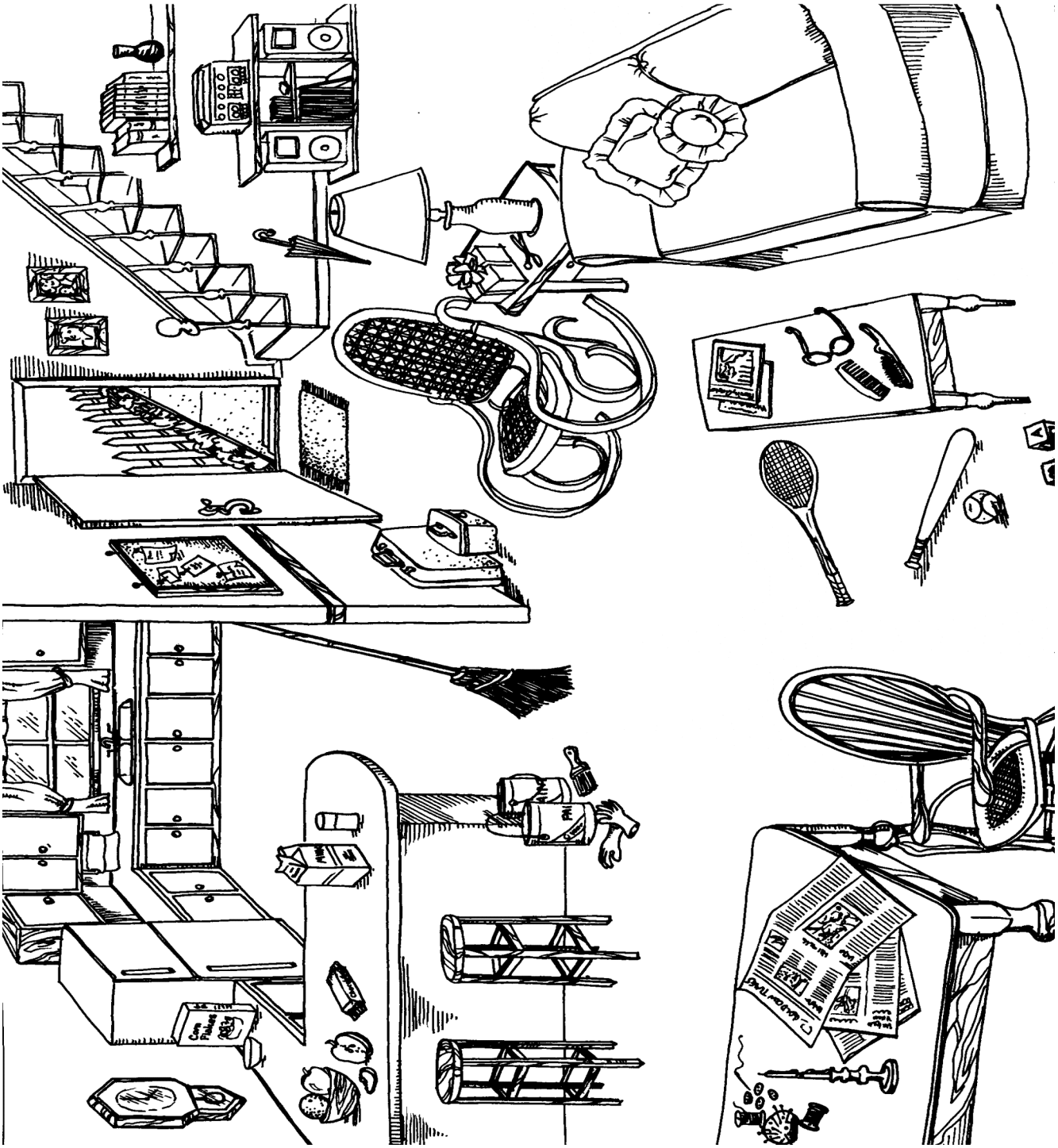
TYPE OF TREE	Closest house number	Branches growing into power lines	Dead Branches	Damaged Bark	Root Damage	OTHER COMMENTS

PARK WORKSHEET 3.2 Tree ID Worksheet

Use your tree guide to figure out the species of each of the labeled trees in the park. Write the name of the tree next to its number below.

Number	Tree species
1	
2	
3	
4	
5	
6	
7	

PARK WORKSHEET 3.3 From Paper to Plastic Worksheet



PARK WORKSHEET 3.3 From Paper to Plastic Worksheet (cont.)

DIRECTIONS AND ANSWERS

Directions

Tell the kids that there are more than 40 things in the picture that are made, in some way, from trees. Then have them use a pencil to circle all of the "tree objects" they can find. Afterward, go over their answers using the information below. Then let the kids color the picture.

Answers

Wood products in the picture:

Banister, baseball bat, blocks, bookshelf, broom handle, bulletin board frame, cabinets, chairs, clock, counter, door, fence (seen through open door), fruit bowl, molding (on walls), paintbrush handle, picture frames, sofa, stairs, stereo cabinet and speakers, spools for thread, stools, tables, tennis racket, umbrella handle, window frame, wood inside walls

Paper products in the picture:

Books, candy wrapper, cereal box, gift (wrapping and box), magazines, milk container, newspaper, notes on bulletin board, paper towels, record album covers

Cellulose products in the picture:

Buttons, comb, curtains, eyeglasses frame, hairbrush handle, luggage, pillows, rug, upholstery on sofa

Bark products in the picture:

Baseball (has a cork center), bulletin board

Gum, Resin, and rubber products in the picture:

Paint, rubber gloves

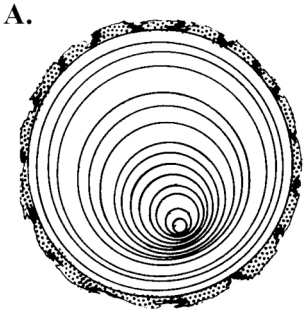
Tree foods in the picture:

Apples, chocolate bar (cacao tree beans are used to make chocolate), orange

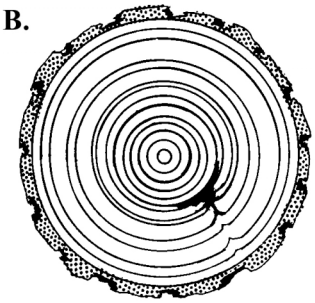
NatureScope — Trees Are Terrific, pp. 65-66 and p. 70

PARK WORKSHEET 3.4 Reading the Rings

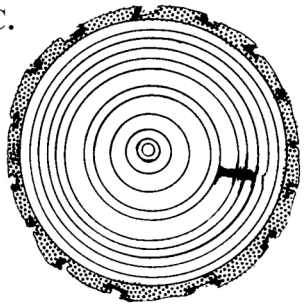
A.



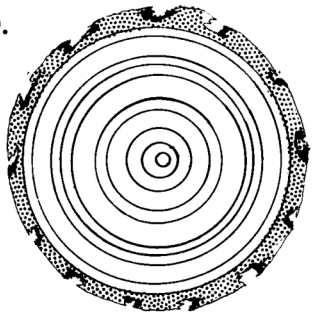
B.



C.

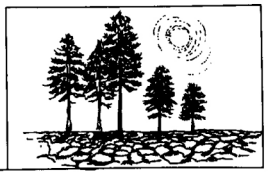


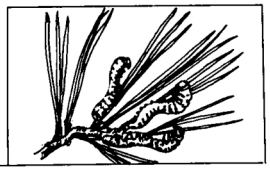
D.

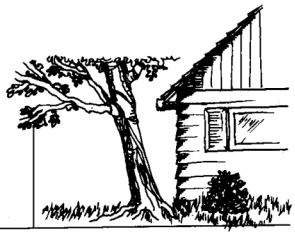


1. *Fallen tree* _____ 

2. *Fire* _____ 

3. *Drought* _____ 

4. *Insect attack* _____ 

5. *Construction* _____ 

6. *Growing on slope* _____ 

7. *Dead branch* _____ 

PARK WORKSHEET 3.4 Reading the Rings (cont.)

DIRECTIONS AND ANSWERS

Directions

Explain that each cross section represents a different tree. On the right-hand side are pictures showing seven factors that can affect tree growth. Go over the factors with the children so they understand each one. Then discuss each cross-section and the factor or factors that could have influenced its growth pattern. Have the children draw lines from each cross section to the matching factor or factors.

Answers

Cross section A:

The cause of the uneven growth shown in the rings might be a fallen tree leaning against the tree (picture 1). The tree grew more on one side that the other, and curved up around the fallen tree. This uneven ring pattern could also belong to a tree growing on a steep slope (picture 6).

Cross section B:

The cause of the scarring in this cross section was a forest fire during the tree's sixth growing season (picture 2).

Cross section C:

The mark beginning in year six is all that's left of a branch that died and fell off (picture 7). Eventually the tree's trunk grew around the remains of the branch and covered it. (The branch could also have been broken or cut off.)

Cross section D:

The narrow rings shown in this cross section could have been caused by several factors such as drought (picture 3), heavy insect damage (picture 4), or damage from construction (picture 5). If a tree lost all or most of its leaves because of an insect attack or drought, it would not be able to make food and would grow very little that year. And root damage from the construction of a house or sidewalk too close to the tree would reduce the water and minerals the roots take up. Ask the children if they can think of other factors that might cause narrow growth rings. (disease, cold winter, a spring frost, transplanting, competition from other trees for sunlight and nutrients, and so on)

NatureScope — Trees Are Terrific, pp. 16-17 and p. 23

PARK WORKSHEET 3.5 Leaf ID Worksheet

NAME_____

Using the tree key, try to identify which type of tree each leaf was taken from.

LEAF #1 _____

LEAF #2 _____

LEAF #3 _____

LEAF #4 _____

LEAF #5 _____

LEAF #6 _____

LEAF #7 _____

LEAF #8 _____

LEAF #9 _____

LEAF #10 _____

PARK WORKSHEET 3.6 Measure Your Tree!

Take the time to get to know your special tree a little better by measuring it. You will be **estimating** the size of your tree by using your body as a measuring tool. Back in the classroom, your body measurements will be changed into meters using a measuring tape.

CIRCUMFERENCE

Measure the **circumference** or thickness of your tree by seeing how big your tree is around. Wrap your arms (if you have a thick tree) or your fingers (if you have a thin tree) around the trunk of your tree. Try to estimate, or guess, as closely as you can how much of your **total arms length**, or your **total hand length** is needed to get around the tree. The distance from the fingertips of your left hand to the fingertips of your right hand is your total arms length. The distance from the tip of your pinky finger to the tip of your thumb is your total hand length. If your tree is very thick, you might have to add on a little more to your measurement. Maybe it is a little smaller and you need to subtract a bit from your total arms length.

For example, if you could almost wrap your arms around your tree (minus the distance from your fingertips to elbow on one arm), you would write that the circumference of my tree is about _¾_ of my total _arm_ lengths. If you could wrap two hands around your tree (thumbs and pinkies on opposite hands touching), you would write that the circumference of the tree is about _2_ of my total _hand_ lengths.

The circumference of my tree is about _____ my total _____ lengths.

HEIGHT

Measure the **height** of your tree by trying to figure out how tall it is. Stand next to the trunk of your tree and look up. Using your **height** as a measurement, try to estimate or guess how many of you it would take to reach the top of the tree. Your height is the distance from your heels to the top of your head.

For example, if your tree were three times as tall as you are, you would write that the height of my tree is _3_ times my height.

The height of my tree is about _____ times my height.

CROWN SPREAD

Measure the **crown spread** or the size of the top of the tree. The crown spread is the area within the tips of the tree's longest branches on all sides of the tree. On a sunny day, you can use the shadow from your tree to estimate the crown spread. Measure the distance around the crown spread by walking along the edge of your treetop's shadow. A step is each time you put one of your feed down on the ground. Walk slowly, keeping track of the number of steps it takes to get across the shadow of the tree's crown. The distance of your step from where you put one food to down to where you put your other foot down is your **pace**.

PARK WORKSHEET 3.6 Measure Your Tree! (cont.)

For example, if you walked twenty-five steps to get around your treetop's shadow, you would write that the crown spread of my tree is about 25 paces.

The crown spread of my tree is about _____ paces.

In the classroom measure your total arm length, total hand length, height and pace using a meter stick or measuring tape.

My total arm length is _____ centimeters.

My total hand length is _____ centimeters.

My height is _____ centimeters.

My pace is _____ centimeters long.

Now calculate the tree measurements in centimeters. Multiply the measurement you estimated using your body as measuring tool by the actual measurement of your body.

For example, to calculate the circumference of a thin tree, multiply the number of total hand lengths it took to go around the trunk of your tree by the number of centimeters you measured your hand length to be: 2 total hand lengths x 8 centimeters = 20 centimeters

The circumference of my tree is about _____ centimeters.

The height of my tree is about _____ centimeters.

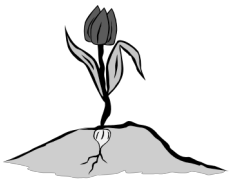
The crown spread of my tree is about _____ centimeters.

REVIEW SHEET 3.1 Ecosystem Review

Connect the Community Food Chain

- Draw an arrow from the plant to the animal that eats it.
- Now, go up the food chain and draw arrows from each animal to the animal that eats it.

HAWK



PLANT

TOAD

GRASSHOPPER

Fill in the Ecosystem

Choose from the words in the circle to fill in the blanks. HINT: you will not use one of the words.

HAWK GRASSHOPPER PLANT SOIL SUN RAIN

The _____ is at the top of the food chain.
When she dies, her body decomposes and her nutrients go back into the _____.
This then provides food for the _____ to grow.
The other non-living parts of the ecosystem, such as the bright _____ and the wet _____ , also help the plant to grow.

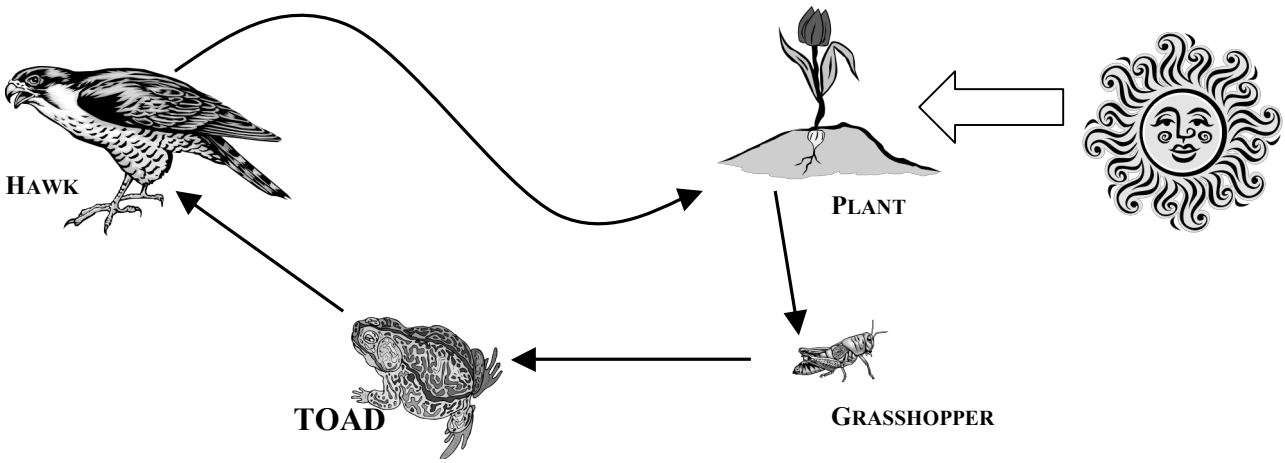
Now, go back to the pictures above, and draw a line from the animal that is at the top of the food chain back to the soil of the plant. Then draw a picture of the sun and connect it to the picture of the living thing that uses the sun's energy to grow.

REVIEW SHEET 3.1 Ecosystem Review (cont.)

ANSWER SHEET

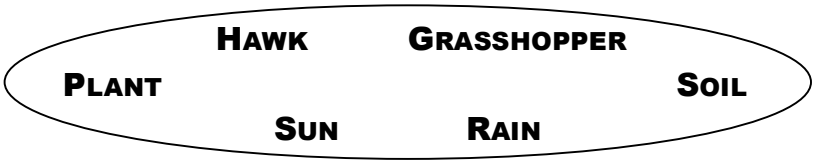
Connect the Community Food Chain

- Draw an arrow from the plant to the animal that eats it.
- Now, go up the food chain and draw arrows from each animal to the animal that eats it.



Fill in the Ecosystem

Choose from the words in the circle to fill in the blanks. HINT: you will not use one of the words.



The *HAWK* is at the top of the food chain.
When she dies, her body decomposes and her nutrients go back into the *SOIL.*
This then provides food for the *PLANT* to grow.
The other non-living parts of the ecosystem, such as the bright *SUN* and the wet *RAIN*, also help the plant to grow.
Now, go back to the pictures above, and draw a line from the animal that is at the top of the food chain back to the soil of the plant. Then draw a picture of the sun and connect it to the picture of the living thing that uses the sun's energy to grow.

REVIEW SHEET 3.2 Park History

The parks in New Haven have changed a lot over the past 100 years.
Describe one way the park we visited has changed over time.

REVIEW SHEET 3.2 Park History (cont.)

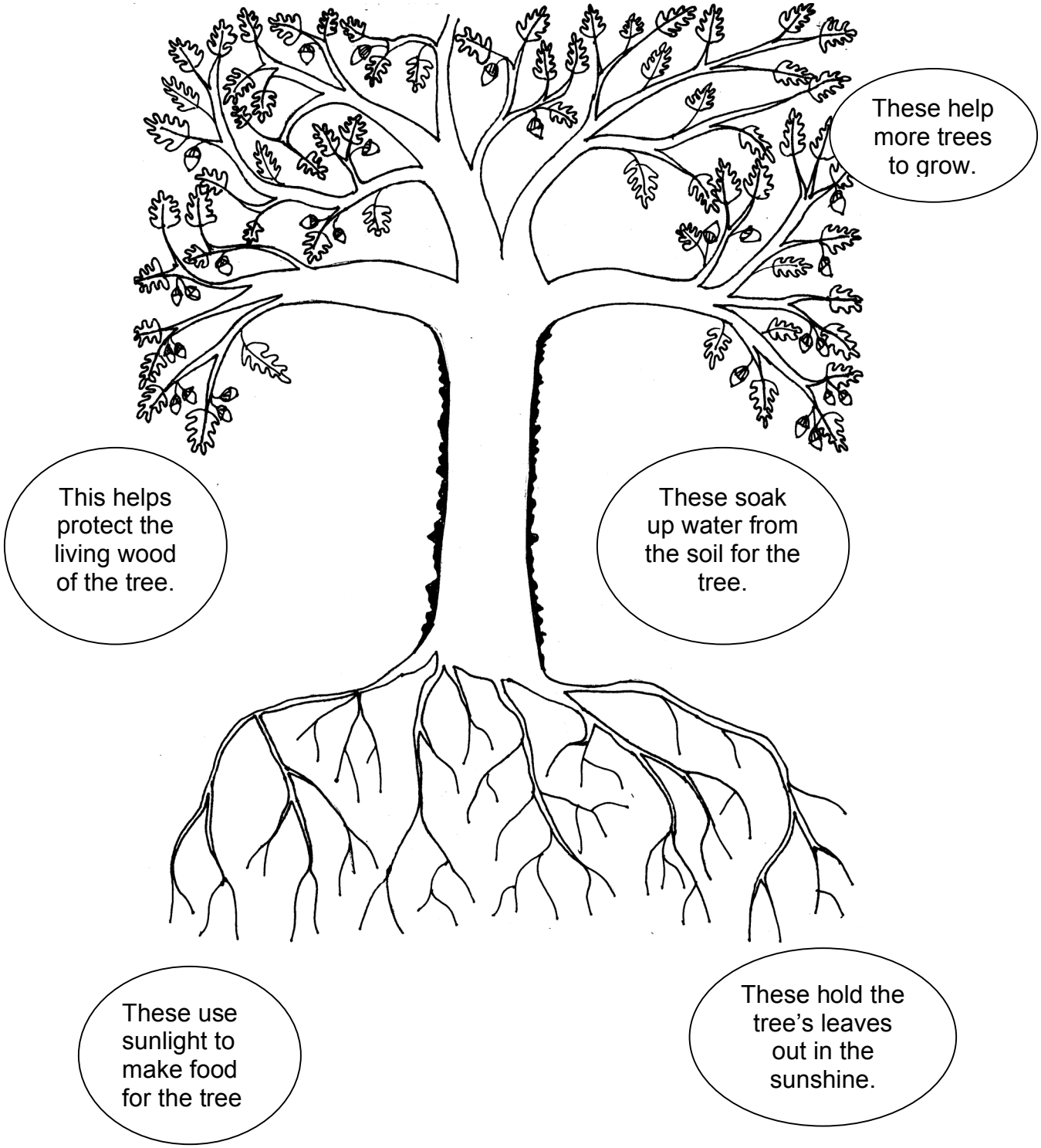
ANSWER SHEET

The parks in New Haven have changed a lot over the past 100 years.
Describe one way the park we visited has changed over time.

There are many correct answers to this question. See Park Handout 3.2 for guidance. Teachers may also choose to grade students on writing quality.

REVIEW SHEET 3.3 Terrific Trees

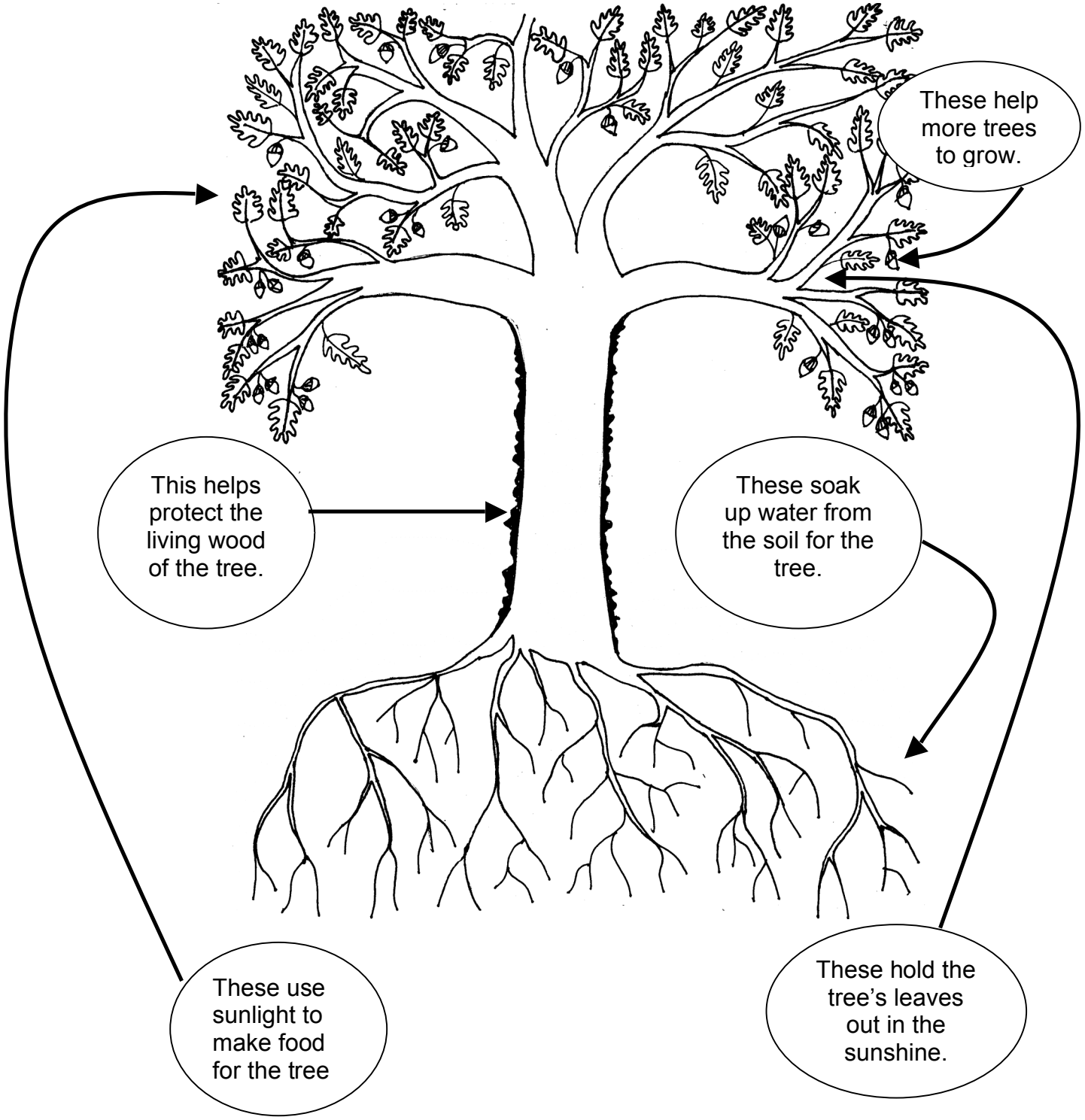
Match the circles to the parts of the tree that they describe.



REVIEW SHEET 3.3 Terrific Trees (cont.)

ANSWER SHEET

Match the circles to the parts of the tree that they describe.



REVIEW SHEET 3.4 Park Review

Draw a line to connect the scientific word to the correct definition in the box. Then draw another line from the definition to the matching picture.

Consumer	**A living thing that makes its own food.**	
Producer	**A living thing that eats dead things and helps them rot.**	
Decomposer	**A living thing that eats plants or animals.**	

What is one example of an ABIOTIC thing in your classroom terrarium?

_____

What is your favorite BIOTIC thing in your classroom terrarium?

_____

Describe a special ADAPTATION of this living thing that helps it survive in the terrarium:

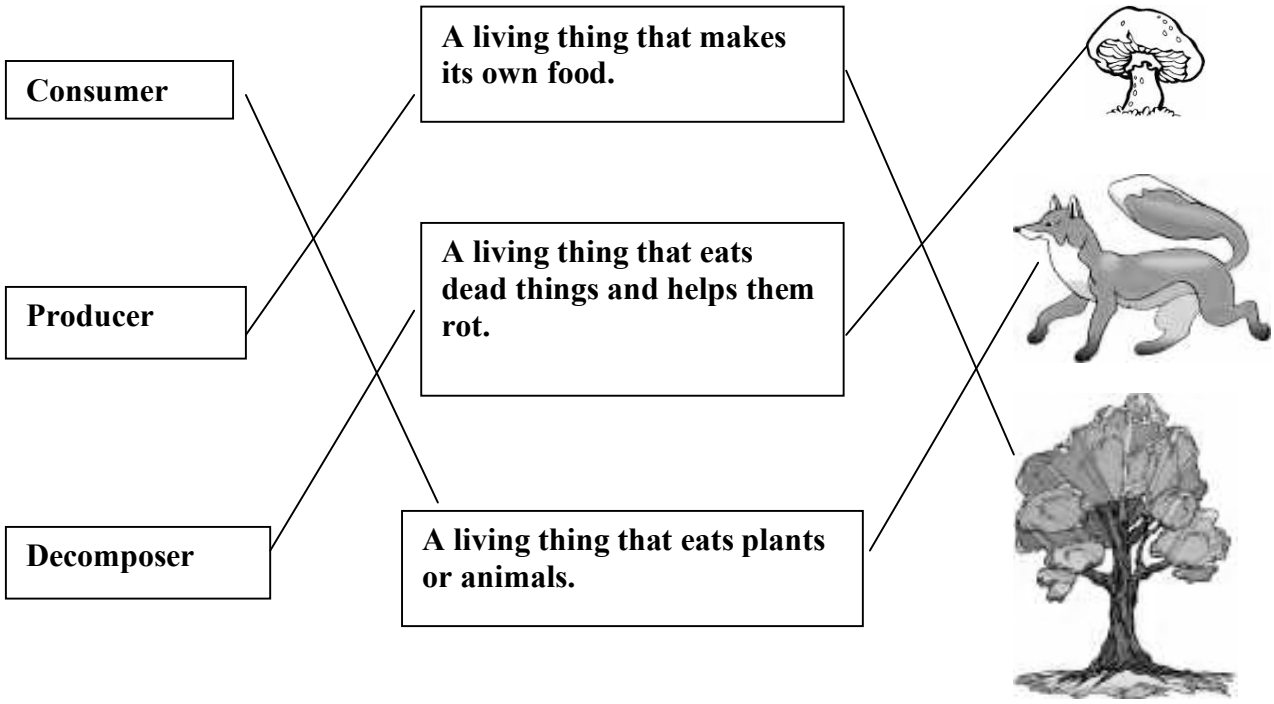
_____

_____

REVIEW SHEET 3.4 Park Review (cont.)

ANSWER SHEET

Draw a line to connect the scientific word to the correct definition in the box. Then draw another line from the definition to the matching picture.



What is one example of an ABIOTIC thing in your classroom terrarium?

ROCKS ,STONES ETC.

What is your favorite BIOTIC thing in your classroom terrarium?

SLUGS,SALAMANDERS ETC.

Describe a special ADAPTATION of this living thing that helps it survive in the terrarium:

Slugs have two sets of antennae. They use their large antennae with eyes on the end for seeing and their small antennae for smelling and feeling.
Redback salamanders can detach most of their tail. The wiggling tail distracts a predator while the salamander escapes.

(For Other Answers See: Schoolyard Handout 2.2-Terrarium)