nature unleashed

the untamed world of missouri ponds, forests and prairies

MDC DISCOVER nature SCHOOLS

TEACHER

nature unleashed

the untamed world of missouri ponds, forests and prairies

teacher guide

Conservation Department Missouri
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Missouri Department of Conservation

foreward

Teachers all over Missouri field tested and unleashed this unit into the lives of their students, and now nature is about to be unleashed for you and your students!

Before you begin...
- please read through the wealth of information packed into the introductory materials
- have students read each chapter (outside when possible!) before beginning each lesson.
- adapt activities to suit the needs of your students!

Activities are intended to provide teachers and students with ample opportunities to have fun while learning outdoors. AND... GLEs are aligned with objectives, content, essential activities and assessment items!

Now, unleash your students outside and into nature and let the learning begin!

An entire population of Missouri Department of Conservation employees and outside contributors made this project possible. We appreciate the time, effort and expertise that each of these human organisms dedicated to unleashing nature into the lives of students.

Illustrator: Mark Raithel (except for artwork in *Optional Activities 4.B* and *5.A*)
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table of contents

teacher notes

discover nature schools

Discover Nature Schools (DNS) is a science/conservation education program at its best. Instructional units comprise the backbone of the DNS program and include exciting and engaging hands-on activities designed to bring students in grades K–12 outdoors and closer to nature.

Each unit includes colorful and engaging student books as well as teacher guides with activities designed to meet Missouri Department of Elementary and Secondary Education (DESE) state standards and Grade Level Expectations (GLEs). Use of science notebooks by students is an important and integrated component.

Lesson plans guide teachers toward utilizing immediate school grounds as important resources for student learning. At the heart of the DNS program is the belief that the more students equate the outdoors with learning, the more comfortable they become outdoors and the more in tune and familiar they become with outdoor environments. As students become more comfortable and familiar with learning and documenting outdoor experiences, the more they begin to think and act like observant scientists sensitive to and inquisitive about changes in outdoor environments.

Student books and teacher guides (as well as training in their use) are available to all Missouri educators. However, teachers who enroll formally in the DNS program are eligible for additional resources including grant opportunities for field experiences and classroom materials to support each instructional unit.

DNS units

Nature Revealed — Pre-school (in development)
Nature Unfolds — Kindergarten–2nd grade
Nature Unleashed: The Untamed World of Missouri Ponds, Forests, and Prairies — Grades 3–5
Conserving Missouri's Aquatic Ecosystems — Grades 6–8
Nature Unbound: The Impact of Ecology on Missouri and the World — Grades 9–12

unit overview

Nature Unleashed: The Untamed World of Missouri Ponds, Forests and Prairies (*Nature Unleashed*) is a unit designed to be taught at the elementary grade level. Fourth grade Ecology GLEs are the primary targets, but this unit also addresses fourth grade GLEs for Matter and Energy, Living Organisms and Inquiry.

Several GLEs included in the unit apply to the third and fifth grades. Third grade GLEs included address food chains. Fifth grade GLEs related to Inquiry and are included to assist in preparing fifth grade students for the Science MAP test.

Essential activities should guide students toward designing a field trip; gathering, recording and organizing data while on the field trip; and presenting the data from the field trip. The field trip is a culminating activity intended to allow students to demonstrate their ability to think and act like scientists.

This Teacher Guide contains introductory materials addressing the integration of science notebooks into all activities and scientific inquiry and field investigations into most activities.

Lesson plans with activities for teaching each chapter in the student book are provided (see *Lesson Components Overview* for more details) as well as charts showing alignment with GLEs and state standards.

Nature Unleashed activities are designed to be adapted easily by teachers to meet student needs. Most activities in this unit are designed to get students outdoors and exploring, investigating and asking questions about immediate areas around their school. However, a variety of activities have been included to provide more tools to meet diverse learning styles of students and to allow for teaching styles and preferences.

Detailed teaching strategies are provided to guide beginning teachers through an understanding of the content matter and of how to teach the content matter. A detailed outline of answers to objectives is included with each lesson for teacher reference. Science notebooks are a key component of every lesson, and science notebooks designed specifically for use with the *Nature Unleashed* unit are available for every student. The "Test" serves as both the pre-test and the post-test and is provided as Appendix H.

The "So, what do you know?" sections at the end of each lesson provide lesson assessment opportunities. An *Assessment Item Bank* is also included to provide additional assessment pieces for the Unit for teachers who wish to use the them.

big charts

Student science notebooks include headings on pages with lines and blank space to allow students to keep notes and create charts, graphs, sketches, labeled drawings, etc. Each science notebook also includes four *Big Charts*, one for each ecosystem studied including the "Schoolyard" ecosystem.

Students begin filling in their *Big Chart: Pond Ecosystem*, *Big Chart: Forest Ecosystem* and *Big Chart: Prairie Ecosystem* in Lesson 2. Large pond, forest and prairie posters available from MDC are used in Lesson 2 along with the same posters with keys in Chapter 2 of the student book.

Big Charts for ponds, forests and prairies contain:

1. "Living Things" section which includes:
    a. column to list each organism illustrated on the specific ecosystem poster
    b. check-off columns to indicate whether an organism is:
        i. plant
        ii. animal
        iii. producer
        iv. consumer
        v. herbivore
        vi. carnivore
        vii. omnivore
        viii. decomposer
        ix. scavenger
        x. predator
        xi. prey
2. "Non-living Things" section to list non-living things for each ecosystem.

Big Chart: Schoolyard Ecosystem contains the identical columns and sections as the other *Big Charts* but is created entirely by students to represent the living and non-living things they observe in their own schoolyard/outside area.

Big Chart keys are provided for all but the schoolyard ecosystem.

safety precautions

Most activities for *Nature Unleashed* lessons are designed to be held outdoors. Students should become comfortable outdoors working alone or in groups and should regard the schoolyard and accessible areas around the school as their natural classroom and laboratory. Students should also respect any boundaries and rules set by teachers while working in these outdoor natural classrooms/laboratories.

Preparatory walks prior to bringing students outside are suggested primarily for teachers to familiarize themselves with examples of living and non-living things students will be asked to observe and investigate later that day during one or more activities. However, these preparatory walks also help teachers determine if there are any objects or areas they will require students to avoid during *Nature Unleashed* activities, such as openings in fences; areas beyond school property; areas that are slippery, muddy or wet from recent storms; maintenance activities; etc. It is advisable for teachers to help students recognize and avoid poison ivy bushes and vines.

Extreme weather aside, outdoor exploration and observation during light rain and snow can provide students with surprising and unusual information about the behavior of organisms found in their schoolyard ecosystem and offer insight into new and interesting interactions among living things and non-living weather factors (water, air temperature, wind). Well-established clothing and behavior guidelines will reduce or eliminate any potential hazards to students while outdoors in any weather.

unit time frame

Nature Unleashed unit (all lesson activities)—approximately 13–15 days (1 hour/day) excluding summative assessments

"Estimated Time" section suggests how much time it may take to teach each lesson and activity. Actual time will be affected by the following factors:

- grade level
- daily schedule of the school
- need for review of previous learning based on the extent of student prior knowledge
- need for reteaching based on the results of formative assessments
- additional resources/knowledge of teacher
- time allotted for group presentations based on class size
- time allotted for cooperative learning activities
- number of activities given as homework rather than completed as class activities
- availability of resources for student use
- number and type of "Extension Activities" and "Optional Activities" used
- number of additional outdoor bird behavior observation periods (recommended)

Lesson Title	Estimated Time
1 It's All Connected	**Activities 1.1, 1.3, 1.4**—30–40 minutes **Activities 1.2, 1.5**—20–30 minutes
2 It's What's Inside That Counts	**Activity 2.1**—30 minutes to one hour depending on number of ecosystems covered **Activities 2.2, 2.3, 2.4**—20–30 minutes **Activity 2.5**—Varies but could be up to 2 hours for discussion, research, design and creation of feeders, etc.
3 Having What It Takes—To Survive	**Activities 3.1, 3.2, 3.3**—30–40 minutes **Activity 3.4**—20–30 minutes
4 Chain of Foods	**Activities 4.1, 4.2, 4.3**—30 minutes
5 You Eat What?!	**Activities 5.1, 5.2, 5.3, 5.4**—30–40 minutes
6 You Want Flies With That?	**Activities 6.1, 6.2, 6.3**—30 minutes
7 It All Makes Sense	**Activity 7.1**—30 minutes **Activity 7.2**—30–40 minutes **Activity 7.3**—20–30 minutes
8 Humans Are Organisms, Too	**Activity 8.1**—30–40 minutes

lesson plan components

A lesson is defined as a logical grouping of information to be taught. Individual lessons will most likely be taught over several days. A lesson in this teacher guide does not necessarily equate to a daily lesson plan.

components

Estimated Time—This indicates the approximate time to teach the lesson including all Essential Activities.

Science GLEs—Only the GLEs that are specifically addressed in the lesson are listed. If a portion of a GLE is not addressed, that portion is shown with the strike-through font.

Vocabulary—Listed terms reflect the terms bolded in the corresponding chapter in the student book. These are the key terms that students must master in order to fully comprehend the concepts being addressed. These terms are listed in the GLEs and will be assessed. They are defined in the student book chapters and in the student book glossary. Note that the glossary also includes other terms used in the student book that students may not know.

Lesson Objectives—Specific student objectives addressed in the lesson are listed.

Essential Questions for the Lesson—These questions could be used by the teacher to set the stage for the lesson. Teachers may elect to put them on the bulletin board, blackboard, whiteboard, etc. They are intended to help students think and address questions and ideas as scientists. Essential questions are provided to guide students toward field investigations that have the potential to provide rigorous and engaging inquiry experiences for young learners.

Teacher Notes—This section provides information to help teachers prepare for the lesson. It may contain additional content information for the teacher, notes or comments about the lesson, any advanced teacher preparation as well as suggested references for teacher background information.

Outline of Answers to Objectives—Content addressed by each objective has been outlined and included in each lesson. The page numbers included at the end of each objective refer to the relevant pages in the student reference.

Transparency Masters—Transparency masters should be printed onto clear overhead acetate sheets. This section heading only appears when transparency masters are included in a lesson.

Essential Activities—Most lessons have more than one Essential Activity, and all of these Essential Activities are essential in order to meet lesson objectives. Essential Activities include:

- Estimated time
- Objectives
- Teacher preparation
- Materials
- Procedure
- Wrap-Up/Formative Assessments
- Extension Activities—These are the only optional portions of an Essential Activity. Some Essential Activities are followed by Extension Activities. Extension Activities enhance the Essential Activities but are not required to meet the lesson objectives.

Optional Activities—These activities do not necessarily enhance specific activities nor are they required to meet lesson objectives, but they do provide opportunities for further study related to the lesson. Optional activities may include viewing video segments or investigating one piece of a lesson further. If there are no optional activities for the lesson, this section heading will not be listed.

Summary—This is the summary provided in the corresponding chapter in the student book.

So, what do you know?—An opportunity for teachers to evaluate and adjust/revisit their instruction through assessment of student learning.

At the end of each lesson, a "So, what do you know?" section has been provided. Some or all of the items for each section may be used in different ways depending on teacher preference and student needs. An answer key with points possible for each item is provided. This section has been provided to help answer the question, "What needs to be re-taught before moving on to the next lesson?"

Examples of some ways to use "So, what do you know?" include:

> Advanced Organizer—Students would complete chosen items as they read the corresponding chapter. Teachers could collect and review the items to determine student learning and understanding. Teachers may choose not to collect the items but have students use them throughout discussion of the content and revise answers as needed.
>
> Cooperative Learning—Various items could be used for group discussions.
>
> Worksheet—All or part of the section could be used as an in-class activity or as homework when appropriate. The answer key may be used if items are graded.
>
> Quiz—All or part of the section could be graded for points after completing all essential activities for each lesson.

student science notebooks

Science notebooks are an extremely useful tool for students and teachers alike. They promote good data collection and record-keeping habits as well as reference tools for students. For teachers, they provide ample opportunity for assessment of student work and data organization.

An excerpt from *Using Science Notebooks in Elementary Classrooms* by Michael P. Klentschy published in *NSTA Reports* (monthly newspaper of the National Science Teachers Association), September 2008, Volume 20, Number 1, has been reprinted and included below with permission of NSTA. This excerpt provides useful information on different approaches to and support for the use of science notebooks.

Klentschy states in the excerpt cited above that "scientists keep notebooks; students should do likewise. Scientists' notebooks include what worked and what did not work in the investigation. They sometimes learn much more from what did not work." Activities in this Teacher Guide encourage students: 1) to develop their own methods of collecting, recording and presenting data from investigations and long-term observations; 2) to share, compare and discuss their methods and findings with other students; 3) to re-evaluate their methods, discuss whether or not their investigation was a "fair test" and discuss possible alternatives to their methods; and 4) to maintain permanent records of all their discussions, observations, data recording methods, etc. In this way, students are provided "with the opportunity to use science notebooks in much the same way scientists do" (Klentschy, 2008), and students begin to recognize science notebooks as useful resources for future methods whether the methods were successful or not in the past.

For use with the *Nature Unleashed* unit, science notebooks are provided for each student. Students will be required to use their science notebooks for most lesson activities for data collection, organization of field investigation data, recording of group brainstorming ideas, reflective writing exercises, sketching, etc.

Heading information may vary, but the following, basic information is included for *each* activity heading entry. Repetition of this process will reinforce good record-keeping and data collection techniques useful to students throughout their school experiences as well as their lives.

- Date (Month/Day/Year)
- Time of Day
- Brief Description of Weather
- Location
- Outside Temperature

Klentschy, M. P., *Using Science Notebooks in Elementary Classrooms*, NSTA Press (Arlington, Virginia), 2008

Additional Resources

Britsch, Susan and Daniel P. Shepardson. "The Art of Reviewing Science Journals." *Science and Children*, Nov–Dec 2004. pp. 43–45

Campbell, Brian and Lori Fulton. *Science Notebook: Writing About Inquiry*. Portsmouth, NH: Heinemann. 2003

Campbell, Brian and Lori Fulton. "Student-Centered Notebooks." *Science and Children*, Nov–Dec 2004. pp. 26–29

Calhoun, Jeri and Ellen Mintz. "Project Notebook." *Science and Children*, Nov–Dec 2004. pp. 30–34

Leslie, Clare Walker and Charles E. Roth. *Nature Journaling*. Vermont: Storey Books. 1998.

Moriarty, Robin, Jeff Winokur and Karen Worth. "Capitalizing on Literacy Connections." *Science and Children*, Feb 2004. pp. 35–39

national science teachers association article

Article from NSTA reports—September 2008

Editor's Note:

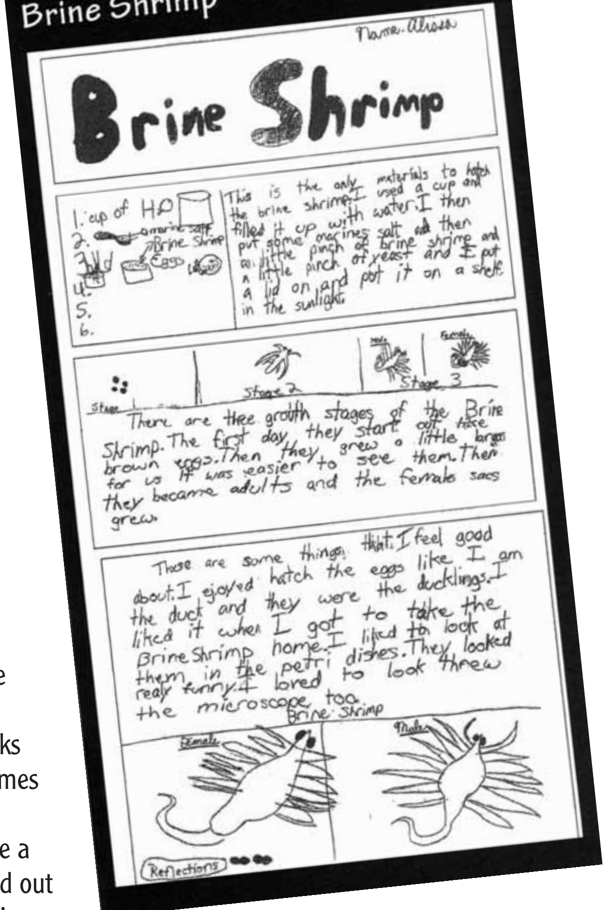
NSTA Press publishes high-quality resources for science educators. This series will feature just a few of the books recently released. The following excerpt comes from Using Science Notebooks in Elementary Classrooms *by Michael P. Klentschy, edited for publication here. NSTA Press titles are available online through the NSTA Science Store at* www.nsta.org/store.

Student science notebooks are advocated by researchers who believe that writing in science enhances student understanding of science content and process skills. Student science notebooks can be embedded into the science curriculum as a natural part of the goal to assist students in making evidence-based explanations of their science investigations.

The student science notebook is more than a record of data that students collect, facts they learn, and procedures they conduct. It is also a record of students' reflections, questions, predictions, claims linked to evidence, and conclusions, all structured by an investigation leading to an understanding of "big ideas," not just factoids in science. As such, a science notebook is a central place where language, data, and experience work together to form meaning for the student. This form of competence or expertise is developed through active construction of knowledge. Students need time and practice using science notebooks to attain expertise.

Student science notebooks, used well, become an embedded element in the curriculum and thus serve as a ready source of recorded data for both the student and the teacher. They become a direct measure of student understanding of the implemented curriculum and an important means for formative assessment. The science notebooks also reflect an accounting of the progression of an investigation as students formulate and record questions; make predictions; develop a plan of action; record observations, measurements, and data; link claims to evidence; and finally reflect on the investigation. They are the students' personal record that can be referred to and revised throughout an investigation or even an entire unit of study. The science notebooks also serve as the evidence used in group and class discussion.

Figure 2.1
Sample Page From a Third-Grade Student's Flip Chart on Brine Shrimp



There are many different approaches to having students create and utilize science notebooks: composition books, blank lab books, lined sheets of paper stapled together or loose-leaf binders.

In primary grades, class or group science notebooks may be created for a unit of study instead of individual student notebooks. Classroom teachers often form covers in the shape of the unit of study, such as a round cover if the students are studying the planets or the Moon. Students as early as kindergarten should be encouraged to keep a record of science investigations. Often these entries will come in the form of scribbles or drawings only decipherable to the student. These form the foundation for later work, when more specific criteria and writing prompts or sentence starters are more formally introduced. The main objective is for teachers to initially provide students with the opportunity to record their science investigation. Figure 2.1 is a sample page from a flip chart a third-grade student created during an investigation of brine shrimp.

This page is an example of a student just starting to use a science notebook. The classroom teacher was focusing on observation and recording data with this investigation. The sample shows the procedures this child followed in hatching the brine shrimp. It also depicts an understanding of the growth cycle of the brine shrimp with drawings and observations recorded. Finally, the sample page includes a reflection of how the student felt about the investigation.

Scientists keep notebooks; students should do likewise. Scientists' notebooks include what worked and what did not work in the investigation. They sometimes learn much more from what did not work. These notebooks include data, drawings, charts, and reflections, as well as new questions. Scientist entries are a record of what was learned at the time of the investigation and are not crossed out or erased when new discoveries take place. Newer ideas, thoughts, and reflections are added as new entries. Classroom teachers should adjust their teaching to provide students with the opportunity to use science notebooks in much the same way scientists do. The chapters that follow provide teachers with the support necessary to accomplish this task.

citations

- Amaral, O., L. Garrison, and M. Klentschy. 2002. Helping English learners increase achievement through inquiry-based science instruction. *Bilingual Research Journal* 26 (2): 213–239.
- Campbell, B. and L. Fulton. 2003. *Science notebooks.* Portsmouth, NH: Heinemann.
- Klentschy, M., and E. Molina-de la Torre. 2004. Students' science notebooks and the inquiry process. In *Crossing borders in literacy and science instruction: Perspectives on theory and practice*, ed. W. Saul, 340–354. Newark, DE: International Reading Association.
- Rivard, L., and S. Straw. 2000. The effect of talk and writing on learning science: An exploratory study. *Science Education* 84 (5): 566–593.
- Shepardson, D., and S. Britsch. 2001. The role of children's journals in elementary school science activities. *Journal of Research in Science Teaching* 38 (1): 43–69.

field investigations

Use of science notebooks and field investigation techniques by students are integrated components of the *Nature Unleashed* unit. The following excerpt from *Field Investigations: Using Outdoor Environments to Foster Student Learning of Scientific Processes* developed for the Association of Fish and Wildlife Agencies' North American Conservation Education Strategy and developed by the Pacific Education Institute is included here to provide teachers with background information on the importance of field investigations and how it relates to student learning.

***

Field investigations help students become **systems thinkers**, learn the skills of scientific inquiry, and understand that science **doesn't only happen in a laboratory or classroom**. Outdoor experiences in natural settings increase students' problem solving abilities and motivation to learn in social studies, science, language arts and math.

When planning and conducting field investigations, students and scientists grapple with the difficulties of working in a natural system and at the same time develop an understanding of its complexities and subsystems. Systems-thinking involves thinking about relationships, rather than about individual objects. A system can be defined in a number of ways:

- An assemblage of inter-related parts or conditions through which matter, energy, and information flow.
- An organized group of related objects or components that form a whole.
- A collection of things and processes (and often people) that interact to perform some function. The scientific idea of a system implies detailed attention to inputs and outputs and interactions among the system components.

State and national science education standards encourage instruction that focuses on problem-solving and inquiry—activities which characterize the pursuits of scientists. In field investigations, students pose a research question then plan and conduct an investigation to answer that question. Students use evidence to support explanations and build models, as well as to pose new questions about the environment. Students learn that the scientific method is not a simple linear process and, most importantly, experience the difficulty of answering essential questions such as:

What defines my environment?
What are all the parts and interrelationships in this ecosystem?
What is a healthy environment?
What is humans' relationship to the environment?
How has human behavior influenced our environment?
How can our community sustain our environment?
What is my role in the preservation and use of environmental resources?

Field investigations help students become informed citizen scientists who add knowledge to the community's understanding of an area in order to make issues of concern visible and share differing points of view about the preservation and use of community natural resources.

Classroom science often overemphasizes experimental investigation in which students actively manipulate variables and control conditions. In studying the natural world, it is difficult to actively manipulate variables and maintain "control" and "experimental" groups, so field investigation scientists look for descriptive, comparative, or correlative trends in naturally occurring events. Many field investigations begin with counts (gathering baseline data). Later, measurements are intentionally taken in different locations (Ex: urban and rural, or where some natural phenomenon has created different plot conditions), because scientists suspect they will find a difference. In contrast, in controlled experiments, scientists begin with a hypothesis about links between variables in a system. Variables of interest are identified, and a "fair test" is designed in which variables are actively manipulated, controlled, and measured in an effort to gather evidence to support or refute a causal relationship.

For conceptual clarity, we have identified three types of field investigations—descriptive, comparative, and correlative.

Descriptive field investigations involve describing and/or quantifying parts of a natural system.	**Comparative** field investigations involve collecting data on different populations/organisms or under different conditions (Ex: times of year, locations) to make a comparison.	**Correlative** field investigations involve measuring or observing two variables and searching for a relationship.

Each type of field investigation is guided by different types of investigative questions. Descriptive studies can lead to comparative studies, which can lead to correlative studies. These three types of studies are often used in combination to study the natural world.

Ryken, A. E., Otto, P., Pritchard, K., & Owens, K. (2007). Field Investigations: Using Outdoor Environments to Foster Student Learning of Scientific Processes. *Pacific Educational Institute.*

*Reprinted with permission from Dr. Margaret Tudor, Co-Executive Director of the Pacific Educational Institute, Market Place Office Building, 724 Columbia St. NW, Suite 250, Olympia, WA 98501 (*mtudor@wfpa.org*).*

recording outside temperature with students

Consider the following when purchasing thermometers for student use:

- Provide one thermometer for every two or three students.
- If only a few thermometers are available, rotate temperature-reading responsibilities among students. However, all students should record temperature readings taken prior to each activity.
- Choose thermometers that are protected with some sort of plastic outer shell to prevent shattering or cracking when dropped.
- Choose thermometers that are calibrated in Celsius alone or in conjunction with Fahrenheit. The Missouri Department of Elementary and Secondary Education requires students to use Celsius when recording temperature.
- Choose thermometers with calibrations that are large and clear enough for students to read.
- Provide a box or container in which to store thermometers safely.
- Wipe thermometers carefully with a soft, damp cloth when necessary before storing.

Procedure for gathering outdoor temperature:

1. Instruct students to hold thermometers carefully at the top (where the highest numbers are located) or by the plastic shield.
2. Students should not shake or swing thermometers but should hold thermometers steady.
3. Have students take an initial thermometer reading to serve as a base line.
4. While holding the thermometer up and away from their bodies, students should check every few minutes for changes in the thermometer reading.
5. When students notice that no change in the reading has occurred after several checks, they should record the final reading in their science notebook heading.
6. To determine temperatures of various locations around the schoolyard or field experience area, students should take the initial, base line thermometer reading and then carefully place the thermometer in the specific location to be measured (under a bench; under a rock ledge; on top of a rock; on the grass in the shade of a tree; etc.).
7. Students should check every few minutes for changes in the thermometer reading.
8. When students notice that no change in the reading has occurred after several checks, they should record the reading in their science notebook next to the description of the location(s) to be measured.
9. Students should carefully wipe dirt, leaves, etc. from thermometers with a soft, damp cloth.
10. Thermometers should be returned carefully to the designated storage box or container.

wrap-up/formative assessment strategies

There are many different strategies available to teachers to determine whether students have grasped and understand concepts addressed by the objectives indicated for each lesson and activity. A few suggested strategies are listed below and referenced throughout the unit where specific, formative assessment strategies have not been included.

Regardless of the strategies used to gather information about what students know and what they can do, it is important to use the information gathered to inform and enhance teacher instruction. Students may remain anonymous for some strategies.

exit note

Ask students to write an exit note that includes a question they still have about what they learned in the activity and/or a question they would like to investigate. Exit notes can be written on a piece of paper and placed in an "Exit Note" box placed near the classroom door, written on a Post-it note and stuck to a designated spot on the wall near the door, written on a piece of paper and stuck to a self-stick bulletin board, etc. Determine whether student submissions should remain anonymous. **Exit notes should be reviewed to determine what concepts need to be re-taught before moving on to the next activity.**

group report with presentation

Divide the class into groups of four students. Number each group's team members 1–4. Within each group, give each group one or more questions to answer related to the activity. Activity objectives and the questions students are being asked will determine the length of time required for this strategy. Explain that all group members should be prepared to give a brief presentation of the answers to their question(s). Roll a dice for each group to determine who will give the presentation for the group.

popcorn balls or snowballs

Prepare question(s) in advance or pose one based on any problem areas arising during the activity. Ask students to answer one multiple choice question and have each student write an explanation of his/her answer choice on a piece of paper. Instruct students to crumble up their paper like a snowball or ball of popcorn. When ready, have students toss their snowballs/popcorn balls to other students. Repeat tosses at least three times to ensure balls of paper are thoroughly mixed up. Ask a student to read the answer and explanation on his/her paper. Call upon other students to do the same before asking students if they agree or not with the answer selected and explanation given. Discuss as needed.

think-pair-share

Assign a question or problem for the class. Allow time for individuals to think silently about it and then have students pair up and exchange thoughts. Have the pairs share their responses with the class.

open-ended inquiry questions

Ask a student an open-ended inquiry question. Ask the rest of the class whether they agree or disagree with the student's answer and why? Ask additional questions and discuss as needed.

summary

At the completion of a lesson or an activity, have students summarize what they learned. Students can record this information in their science notebooks by writing and/or drawing. Teachers should collect science notebooks. Teachers can then determine what students really understand and determine content that needs to be re-taught. The content of students' science notebooks can be graded or not depending on teacher's preference for each activity. *Summary Paragraph Guidelines and Scoring Key* are provided as Appendix E.

reference materials

teacher and classroom resources

Note: These materials are available free of charge from the Missouri Department of Conservation.*

Posters * *(It is recommended that posters be laminated for classroom use.)*
Animal Cards poster (E00077)
Forests: Layers of Leaves poster (E00126)
Life on the Forest Floor poster (E00004)
Missouri's Natural Communities: Forests (SCI049) **
Missouri's Natural Communities: Prairies (SCI048) **
Missouri Pond Life poster (E00002)
Prairie: Life Among the Grasses poster (E00088)

References *
Butterfly Gardening & Conservation (E00471)
Common Missouri Spiders (E00429)
Feeding Backyard Birds (E00450)
Fifty Common Trees of Missouri (F00088)
Introduction to Missouri Fishes (FIS020)
Introduction to Missouri Furbearers (SCI138)
Missouri Owls (E00455)
Missouri's Most Irritating Plant (Poison Ivy) (E00055)
Missouri's Raptors (Eagles, Hawks, Falcons & Vultures (E00452)
Missouri's Toads and Frogs (E00430)
Missouri's Turtles (E00468)
Native Plants for Your Landscape (E00594)
Snakes of Missouri (E00448)

References for supplemental lessons *
Conserving Missouri's Caves and Karst (SCI002)
Exploring Missouri Wetlands poster (E00003)
Missouri's Natural Communities: Glades (SCI047) **
Missouri's Natural Communities: Karst (SCI050) **
Outside In: Amazing Glades (E00123)
Rivers & Streams poster (E00509)

* Missouri Department of Conservation free publications can be ordered by sending an e-mail to *pubstaff@mdc.mo.gov* or writing to Publications, Missouri Department of Conservation, PO Box 180, Jefferson City, MO 65102-0180. Many publications can be downloaded from the Web. The main address is: *www.MissouriConservation.org*.
** These publications contain posters as well as additional detailed background information for teachers.

recommended classroom resources

(Publications with numbers in parentheses are available for purchase from the MDC Nature Shop.)

Amphibians and Reptiles of Missouri. Tom R. Johnson. 2000. (01-0190)
Birds of Missouri. Stan Tekiela. 2001.
Field Guide to Feeder Birds: Eastern and Central North America. Roger Tory Peterson. 2000.
Field Guide to Backyard Bird Song: Eastern and Central North America. Richard K. Walton and Robert W. Lawson. 1999.
Golden Guides from St. Martin's Press: Birds. Herbert S. Zim and Ira N. Gabrielson. 2001.
Golden Guides from St. Martin's Press: Insects. Clarence Cottam and Herbert S. Zim. 2001.
Golden Guides from St. Martin's Press: Mammals. Herbert S. Zim and Donald F. Hoffmeister. 2001.
Key to Missouri Trees in Winter. Jerry Cliburn and Ginny Wallace. 1990. (01-0081)
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alignment to missouri standards

missouri science concepts (strands 1–6) addressed

- **EC.1.A.** All populations living together within a community interact with one another and with their environment in order to survive and maintain a balanced ecosystem.
- **EC.1.D.** The diversity of species within an ecosystem is affected by changes in the environment, which can be caused by other organisms or outside processes.
- **EC.2.A.** As energy flows through the ecosystem, all organisms capture a portion of that energy and transform it to a form they can use.
- **EC.3.C.** Natural selection is the process of sorting individuals based on their ability to survive and reproduce within their ecosystem.
- **LO.1.A.** Organisms have basic needs for survival.
- **LO.1.E.** Biological classifications are based on how organisms are related.
- **ME.2.C.** Electromagnetic energy from the sun (solar radiation) is a major source of energy on Earth.

alignment to missouri show-me process standards

1.8 Organize data, information and ideas into useful forms (including charts, graphs, outlines) for analysis or presentation (*Activities 2.3*; *3.1*; *3.3*; *5.1*; *5.2*; *5.3*)

2.1 Plan and make written, oral and visual presentations for a variety of purposes and audiences (*Activities 1.4*; *3.1*; *3.3*)

alignment to communication arts standards

Writing.2.D.5.a. Compose text using words that are specific, accurate, and suited to the topic. (*Activity 6.2*)

Writing.2. Compose well-developed text – paper (*Activities 1.2* and *8.1*)

Writing.3.A.5. Compose a variety of texts. c. including a summary (narrative or informational) (*Activity 2.3*)

science grade level expectations alignment

In this unit, students develop the Science Grade Level Expectations (GLEs) listed in the Targeted Learning column below. While supporting students in the development of these skills, teachers should consider students' prior learning and keep in mind their future learning. The GLEs listed in the Targeted Learning column may be addressed in more than one lesson. In the Lesson # column, the lesson number(s) are listed followed by which GLE or which portion of a GLE is covered by the lesson. The Depth of Knowledge (DOK) coding indicated in the row directly below the GLE is from the Missouri Department of Elementary and Secondary Education (DESE). For the assessment column, SR means selected response, CR means constructed response and the number refers to the test item number.

The GLE number coding is in the format used by DESE. The first two letters refer to the strand. (LO=Living Organisms, EC=Ecology, ME= Matter and Energy, IN=Inquiry) The first number refers to the "Big Idea" number under the strand. Next, the single uppercase letter refers to the "Concept" under the Big Idea. The following number refers to the grade level. The lower case letter refers to the specific GLE for that grade. See example below.

LO.1.A.3.a. = Living Organism. 1. There is a fundamental unity underlying the diversity of all living organisms. A. Organisms have basic needs for survival. 3rd grade. a. Describe the basic needs of most plants (i.e., air, water, light, nutrients, temperature).

Lesson #	Assessment	Prior Learning	Targeted Learning	Future Learning
Lesson 1 LO.1.A.3.a. Foundation for EC.1.A.6.a. & EC.1.B.6.a.-c.	CR 8 CR 9 CR 10	LO.1.A.1.a. Identify the basic needs of most animals (i.e., air, water, food, shelter) LO.1.A.1.b. Identify the basic needs of most plants (i.e., air, water, light)	LO.1.A.3.a. Describe the basic needs of most plants (i.e., air, water, light, nutrients, temperature) Note: This lesson lays the foundation for abiotic and biotic factors by addressing living and non-living things. It also has students demonstrate how organism, population, community, non-living things and ecosystem are connected.	LO.1.A.6.a. Describe the common life processes necessary to the survival of organisms (i.e., growth, reproduction, life span, response to stimuli, energy use, exchange of gases, use of water, elimination of waste) EC.1.A.6.a. Identify the biotic factors (populations of organisms) and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition) that make up an ecosystem EC.1.B.6.a. Identify populations within a community that are in competition with one another for resources EC.1.B.6.b. Recognize the factors that affect the number and types of organisms an ecosystem can support (e.g., food availability, abiotic factors such as quantity of light and water, temperature and temperature range, soil composition, disease, competitions from other organisms, predation)
			[DOK a. 1]	

Lesson #	Assessment	Prior Learning	Targeted Learning	Future Learning
Lesson 2 EC.1.A.4.b. **Lesson 3** EC.1.A.4.a. only camouflage, migration & hibernation **Lesson 7** EC.1.A.4.a. all except for migration & hibernation	SR 1, 4 SR 2 SR 6	EC.1.A.K.a. Describe how the seasons affect the behavior of plants and animals.	EC.1.A.4.a. Identify the ways a specific organism may interact with other organisms or with the environment (e.g., pollination, shelter, seed dispersal, camouflage, migration, hibernation, defensive mechanism) EC.1.A.4.b. Recognize that different environments (i.e., pond, forest, prairie) support the life of different types of plants and animals.	EC.1.A.6.a. Identify the biotic factors (populations of organisms) and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition) that make up an ecosystem
			[DOK a. 1; b. 1]	
Lesson 3 EC.3.C.4.a. EC.3.C.4.b. EC.3.C.4.c. EC.3.C.4.d.	CR 11 CR 12 SR 5 SR 7	EC.1.A.K.a. Describe how the seasons affect the behavior of plants and animals.	EC.3.C.4 a. Identify specialized structures and describe how they help plants survive in their environment (e.g., root, cactus needles, thorns, winged seed, waxy leaves) EC.3.C.4.b. Identify specialized structures and senses and describe how they help animals survive in their environment (e.g., antennae, body covering, teeth, beaks, whiskers, appendages) EC.3.C.4.c. Recognize internal cues (e.g., hunger) and external cues (e.g. changes in the environment) that cause organisms to behave in certain ways (e.g., hunting, migration, hibernation) EC.3.C.4.d. Predict which plant or animal will be able to survive in a specific environment based on its special structures or behaviors	EC.3.C.6.a. Relate examples of adaptations (specialized structures or behaviors) within a species to its ability to survive in a specific environment (e.g., hollow bones/flight, hollow hair/insulation, dense root structure/compact soil, seeds/food, protection for plant embryo vs. spores, fins/movement in water) EC.3.C.6.b. Predict how certain adaptations, such as behavior, body structure, or coloration, may offer a survival advantage to an organism in a particular environment
			[DOK a. 2; b. 2; c. 1; d. 2]	

Lesson #	Assessment	Prior Learning	Targeted Learning	Future Learning
Lesson 4 EC.2.A.3.a. & ME.2.C.3.a. LO.1.E.5.b. EC.2.A.3.b. EC.2.A.3.c. EC.2.A.3.d. **Lessons 5 & 6** EC.2.A.3.d.	 SR 3 CR 13 CR 17 CR 14 CR 18 CR 18	ME.2.C.1.a. Identify light from the Sun as a basic need of most plants	EC.2.A.3.a. Identify sunlight as the primary source of energy plants use to produce their own food ME.2.C.3.a. Recognize the Sun is the primary source of light and food energy on Earth LO.1.E.5.b. Distinguish between plants (which use sunlight to make their own food) and animals (which must consume energy-rich food) EC.2.A.3.b. Classify populations of organisms as producers or consumers by the role they serve in the ecosystem EC.2.A.3.c. Sequence the flow of energy through a food chain beginning with the Sun EC.2.A.3.d. Predict the possible effects of removing an organism from a food chain	EC.2.A.6.a. Diagram and describe the transfer of energy in an aquatic food web and a land food web with reference to producers, consumers, decomposers, scavengers, and predator/prey relationships EC.2.A.6.b. Classify populations of unicellular and multicellular organisms as producers, consumers, and decomposers by the role they serve in the ecosystem EC.1.B.6.c. Predict the possible effects of changes in the number and types of organisms in an ecosystem on the populations of other organisms within that ecosystem ME.2.C.6.b. Recognize the Sun is the source of almost all energy used to produce the food for living organisms
			[DOK EC.a. 1; b. 1; c. 1; d. 2] [DOK ME.a. 1] [DOK LO.b. 1]	

Lesson #	Assessment	Prior Learning	Targeted Learning	Future Learning
Lesson 5 EC.2.A.4.a. EC.2.A.4.b. **Lesson 6** EC.2.A.4.c.	 CR 17 CR 15, 17 CR 16, 17		EC.2.A.4.a. Classify populations of organisms as producers, consumers, decomposers by the role they serve in the ecosystem EC.2.A.4.b. Differentiate between the three types of consumers (herbivore, carnivore, omnivore) EC.2.A.4.c. Categorize organisms as predator or prey in a given ecosystem	EC.2.A.6.a. Diagram and describe the transfer of energy in an aquatic food web and a land food web with reference to producers, consumers, decomposers, scavengers, and predator/prey relationships EC.2.A.6.b. Classify populations of unicellular and multicellular organisms as producers, consumers, and decomposers by the role they serve in the ecosystem
			[DOK a. 1; b. 1; c. 2]	
Lesson 6 EC.1.D.4.a. only hunting/ conservation of species **Lesson 8** EC.1.D.4.a.	 CR 19 CR 19	EC.1.A.1.a. Identify ways man depends on plants and animals for food, clothing, and shelter	EC.1.D.4.a. Identify examples in Missouri where human activity has had a beneficial or harmful effect on other organisms (e.g., feeding birds, littering vs. picking up trash, hunting/ conservation of species, paving/ restoring greenspace)	EC.1.D.6.a. Describe beneficial and harmful activities of organisms, including humans (e.g., deforestation, overpopulation, water and air pollution, global warming, restoration of natural environments, river bank/coastal stabilization, recycling, channelization, reintroduction of species, depletion of resources), and explain how these activities affect organisms within an ecosystem EC.1.D.6.b. Predict the impact (beneficial or harmful) of a natural environmental change (e.g., forest fire, flood, volcanic eruption, avalanche) on the organisms in an ecosystem EC.1.D.6.c. Describe possible solutions to potentially harmful environmental changes within an ecosystem
			[DOK a. 1]	

GLE	Assessment	Prior Learning	Targeted Learning	Future Learning
Inquiry GLEs are aligned to specific activities that include inquiry. The coding used in the assessment column refers to the specific activity by number. For example, 3.2 refers to the 2nd activity in Lesson 3. Assessing inquiry GLEs is at the teacher's discretion.				
IN.1.A.5.a.	3.1	IN.1.A.4.a. Formulate testable questions and explanations (hypotheses)	IN.1.A.5.a. Formulate testable questions and explanations (hypotheses)	IN.1.A.6.a. Formulate testable questions and hypotheses
			[DOK a. 3]	
IN.1.B.5.a. IN.1.B.5.b. IN.1.B.5.c. Thermometers IN.1.B.5.c. Hand lenses IN.1.B.5.d.	1.1; 1.3; 1.4; 2.3; 2.4; 3.1; 7.1; 7.2 1.1 All except 1.2, 1.5, 3.4, 4.1, 6.2 5.4 7.1 All	IN.1.B.4.a. Make qualitative observations using the five senses IN.1.B.4.b. Make observations using simple tools and equipment (e.g., hand lenses, magnets, thermometers, metric rulers, balances, graduated cylinders, spring scale) IN.1.B.4.c. Measure length to the nearest centimeter, mass using grams, temperature using degrees Celsius, volume to the nearest milliliter, weight to the nearest Newton	IN.1.B.5.a. Make qualitative observations using the five senses IN.1.B.5.b. Determine the appropriate tools and techniques to collect data IN.1.B.5.c. Use a variety of tools and equipment to gather data (e.g., hand lenses, ~~magnets~~, thermometers, ~~metric rulers, balances, graduated cylinders, spring scales~~) IN.1.B.5.d. Measure ~~length to the nearest centimeter, mass to the nearest gram, volume to the nearest milliliter~~, temperature to the nearest degree Celsius, ~~weight to the nearest Newton~~	IN.1.B.6.a. Make qualitative observations using the five senses IN.1.B.6.b. Determine the appropriate tools and techniques to collect data IN.1.B.6.c. Use a variety of tools and equipment to gather data (e.g., microscopes, thermometers, computers, spring scales, balances, magnets, metric rulers, graduated cylinders, stopwatches) IN.1.B.6.d. Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, temperature to the nearest degree Celsius, force (weight) to the nearest Newton, time to the nearest second
			[DOK a.1; b.2; c.1; d.1; e.2]	
IN.1.D.5.a.	2.3 3.1 3.3	IN.1.D.4.a. Communicate the procedures and results of investigations and explanations through: ■ oral presentations ■ drawings and maps ■ data tables ■ graphs (bar, single line, pictograph) ■ writings	IN.1.D.5.a. Communicate the procedures and results of investigations and explanations through: ■ oral presentations ■ drawings ~~and maps~~ ■ data tables ■ graphs (bar, ~~single line, pictograph)~~ ■ writings	IN.1.D.6.a. Communicate the procedures and results of investigations and explanations through: ■ oral presentations ■ drawings and maps ■ data tables (allowing for the recording and analysis of data relevant to the experiment, such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities) ■ graphs (bar, single line, pictograph) ■ writings
			[DOK a. 2]	

lesson 1: it's all connected

estimated time
2–3 hours

science GLEs
LO.1.A.3.a. Describe the basic needs of most plants (i.e., air, water, light, nutrients, temperature)

vocabulary
Living things
Non-living things
Organism
Population
Community
Environment
Ecosystem

lesson objectives
1. Describe the basic needs of most plants and animals.
2. Identify the living and non-living components of an ecosystem.
3. Explain why non-living components of an ecosystem are important for the living components.
4. Demonstrate how organism, population, community and ecosystem are connected.

essential questions for the lesson
1. How are plants and animals connected to the air, light, soil, rocks, water and other non-living things?
2. What's the "recipe" for an ecosystem?

teacher notes
Students should have read Chapter 1, "It's All Connected," on pages 2–3 in their student books prior to engaging in these activities. This lesson includes a review of the basic needs of most animals from grade 1 GLE LO.1.A.1.a.

Since students will be using the schoolyard for many activities in this lesson and throughout the *Nature Unleashed* unit, it is very important that the teacher be thoroughly familiar with the schoolyard and any safety issues or concerns. Students will begin using science notebooks in Lesson 1 and will continue using them throughout the unit. Refer to *Student Science Notebooks* section and the *National Science Teachers Association Article* in the Teacher Notes section.

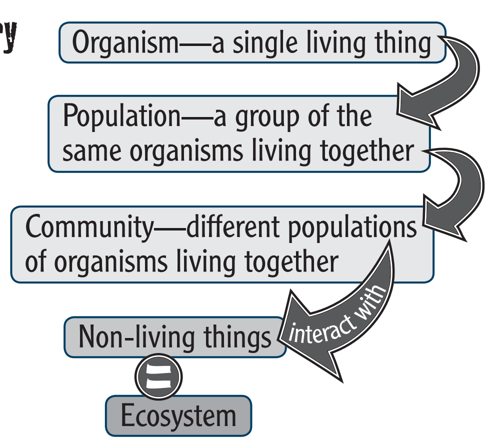
outline of answers to objectives
See following page.

transparency masters
Transparency 1.1: Organism
Transparency 1.2: Population
Transparency 1.3: Community
Transparency 1.4: Non-living Things

essential activities
Activity 1.1: Living or Non-living?
Activity 1.2: Space—It's a Basic Need, Too
Activity 1.3: Organism, Population, Community, Ecosystem?
Activity 1.4: Schoolyard Ecosystem Interactions
Activity 1.5: Making Connections

so, what do you know?—Lesson 1 questions and answer key

summary



outline of answers to objectives—lesson 1

1. Describe the basic needs of most plants and most animals. (page 2)
   a. Plants need air, water, light, nutrients, space and temperature.
   b. Animals need air, food, water, shelter and space.

2. Identify the living and non-living things of an ecosystem. (page 2)
   a. Living—plants and animals
   b. Non-living—sun, air, rocks, soil, water, temperature and landforms (hills, valleys, mountains) are examples of non-living things.

3. Explain why non-living things are important for the living things. (page 2)
   a. Living things cannot live without the non-living things.
   b. Living things interact with the non-living things in their environment.

4. Demonstrate how organism, population, community and ecosystem are connected. (pages 2, 3)
   a. An organism is a single living thing that can grow and reproduce.
   b. Two or more of the same organism living in the same area at the same time forms a population.
   c. Multiple populations of organisms living together in the same place at the same time forms a community.
   d. Populations of plants and animals living together in communities interact with each other, or act on each other, and with the non-living things in their environment (Environment is the immediate area around a plant or animal). Living and non-living things that interact in an environment form an ecosystem.

activity 1.1 : living or non-living?

estimated time 30–40 minutes

objectives
Students will be able to
1. Describe the basic needs of most plants and animals.
2. Identify living and non-living components in the schoolyard.

teacher preparation
Students should have read Chapter 1, "It's All Connected," on pages 2–3 in their student books prior to engaging in these activities.

This will be the first time students use their science notebooks. Provide time at the beginning of the activity to explain why they will use science notebooks and to guide them through the process of completing the headings for each entry. *Student Science Notebooks* in the Teacher Notes section provides background information. How outside air temperature readings are taken depends upon the number of thermometers available and the thermometer-reading skill levels of students. It is recommended that enough thermometers be available to allow one for every three or four students. This keeps everyone engaged in the process. If fewer thermometers are available, have students take turns taking the outside air temperature and sharing the reading with the entire class. All students should record outside air temperature in their science notebooks. If students are unfamiliar with the process, provide several short outdoor sessions to explain and demonstrate the process to students and to allow them ample time to practice prior to beginning *Activity 1.1.* The taking of outside air temperature should not consume more than a few minutes of class time.

The first set of questions in the Procedure below serve as a review of GLEs from first grade regarding basic needs of animals. Have students prepared for an outdoor field investigation. (See *Field Investigations* in the Teacher Notes section.)

Take a preparatory walk around the schoolyard and note where you find examples of living organisms as well as examples of non-living things (Ex: rocks; water; sunlight; soil*; air temperature; hills; sidewalks; buildings; playground equipment; fences, etc.). During the course of the activity, if students are unsure and/or unable to find examples, refer to your notes and provide subtle prompts for students to discover examples.

Students may have difficulty recognizing that the phrase "living things" refers to the living components of an ecosystem. Living things are things that are able to grow and reproduce (create more of themselves). Living things that have died and are decaying are considered to be dead and may no longer be considered living because they cannot grow and reproduce. However, dead and decaying things may still contain energy stored in their cells that may possibly provide food for things that are still living.

materials
Science notebooks
Pencils
Thermometers
Field guides (optional)

procedure
1. Have student bring their science notebooks, pencils, and thermometers into the schoolyard or area of choice. Explain to students why they will use science notebooks for this unit and guide them through the steps of completing the headings including the taking and recording of outside air temperature. (See *Recording Outside Temperature with Students* in the Teacher Notes section)
   - Date—should include the month, day and year
   - Time of Day—should include the actual time
   - Location—brief record of where the activity will take place (in schoolyard; near playground equipment; in butterfly garden; outdoor classroom, etc.)
   - Outside Air Temperature—should be recorded in Celsius
   - Weather—brief description of current weather conditions (windy and cold; hot and sunny; rainy; snowy; snow flurries; cold and sunny, etc.)

2. In their science notebook, have students note that there are two sections, one on top labeled "Living Things" and the other on the bottom labeled "Non-living Things." Explain that the other columns on the page will be used with another activity.
   Q. How do we know something is a living thing?
   A. Answers will vary: Living things grow and reproduce (make more of themselves); they need to eat and drink in order to survive; they breath; they can die; they need things to survive; they have basic needs, etc.

3. Instruct students to observe their schoolyard carefully by standing in one place and turning to look all around or by moving slowly within a designated area.

4. Instruct students to observe the living things they see and list them in their science notebook in the "Living Things" section.

5. Instruct students to observe the non-living things they see and list them in their science notebook in the "Non-living Things" section.

6. Allow students to list what they observe generically (bird, insect, plant, etc.) unless they know the specific, common names (robin, ant, dandelion, etc.).

7. Have students review their lists of living and non-living things. [If students have placed "dead" leaves, flowers, insects, etc. in the "Non-living" column. Leaves, flowers, insects, etc. that are dead are no longer living and no longer able to grow and reproduce. Therefore, they belong in the "Non-living Things" column. Dead and decaying animals and plants may still pass along energy left in their cells to other plants and animals that eat them. Rocks are non-living because they NEVER had basic needs such as air, water, light, nutrients, space, temperature or shelter. Plants and animals need those basic things to survive. That's why plants and animals are considered living things—whether they have died or not.]
   Q. After looking over your science notebook lists (and/or understanding and revisiting lists to make the distinction explained above), how many things would you switch from one section to the other?

8. Have students circle the thing(s) they wish to change and draw an arrow from the circled thing(s) to the correct section. Ask students to explain why they are making changes. Follow-up/review distinctions as needed.
   [Explain that in addition to having basic needs, plants and animals grow and reproduce (create more of themselves). Non-living things do not have basic needs nor do they grow or reproduce. Discuss as needed.]

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

activity 1.2 : space—it's a basic need, too

estimated time 20–30 minutes

objectives

Students will be able to
1. Explain why all living things need space.
2. Predict in writing what might happen to plants growing in severely crowded environments.

teacher preparation

This activity may be done indoors or outdoors but does require enough open space for students to stand together comfortably. Prepare a flat, open area by placing an X with chalk or place some flat item on the ground (a rubber baseball base or some other flat object that will not blow away or be moved easily by students standing over it) where students will be asked to gather. Although this activity only addresses the need for space, it is an effective way to illustrate the importance of all basic needs of plants and animals. **Be aware that this activity requires students to stand very close to each other.**

materials

Science notebooks
Pencils
Chalk (or flat object)
Writing Prompt Scoring Guide (Appendix C)

procedure

1. Stand facing the X and have students gather randomly in front of you and scattered around the X. There is no need for students to gather in any formal arrangement, and at this point, they do not even need to be aware of the X.

2. Point out the chalk X/flat object on the ground/floor in the middle of the students and explain to them that each time you clap your hands, they will take one step towards the spot/object. Do not tell students why they are doing this. The effectiveness of this activity depends on students slowly becoming aware of their shrinking space.

3. Try one practice clap. Repeat instructions, if necessary.

4. Begin the activity and continue to clap your hands very slowly allowing students time to take each step, to stand for a moment, and to become aware of their new proximity to their classmates.

5. Continue until students are sufficiently "starved for space:"
   Q. How comfortable are you right now?
   A. Answers will vary: uncomfortable; squashed; etc.
   Q. What would your life be like if you had to live it this way?
   A. Answers will vary: unhappy; angry; uncomfortable; unhealthy from being too close to others; unable to move around enough to get food (hungry); etc.
   Q. What do you need more than anything right now "to survive?"
   A. SPACE! Explain that all living things such as animals do need air, food, water, and shelter, but they also always need the right amount of space to survive. When people are crowded together, they are uncomfortable and spread diseases more easily. Animals that live crowded together often have difficulty finding enough food and shelter, sometimes fight for space, and catch diseases more easily from each other.

6. Allow students to move away from each other and give themselves some space.
   Q. Now that you have been crowded humans, what might have happened if you had been a group of plants crowded that closely together?
   A. Crowded that closely together, the plants might not have been able to get enough light, water or nutrients to survive.

Q. As a plant in that crowd, what would you have needed to help you survive?

A. Space! Plants need air, light, nutrients, water and temperature, but plants, like all living things, also need the right amount of space in order to survive.

wrap-up/formative assessment

Explain to students that they will put themselves in the place of a plant that is growing in very crowded conditions (in the middle of many, many other plants) and predict what might happen to that plant.

Instruct students to use their science notebook to write three paragraphs about "A Day in the Life of a Crowded Plant." Students may approach the topic generically as a flower, tree, bush, etc. or specifically as a rose bush, an oak tree, a daisy, etc. Encourage students to keep in mind the basic needs of all living things, especially plants. Give students a copy of *Writing Prompt Scoring Guide.*

evaluation

See *Writing Prompt Scoring Guide* in Appendix C of this Guide.

activity 1.3 : organism, population, community, ecosystem?

estimated time 30–40 minutes

objectives

Students will be able to
1. Differentiate between organisms and populations.
2. Explain relationships among ecosystem components.
3. Compare general ecosystem components to their schoolyard/surrounding school area.

teacher preparation

The first part of this activity asks students to reference their list of living and non-living things from the first page of their science notebooks and, after spending a short time observing the outdoor area, instructs them to add any new ones to their initial list. Students will eventually complete a *Big Chart: Schoolyard Ecosystem* (provided in the center of student science notebooks) that will include this information.

This is an outdoor activity. Take a brief preparatory walk around the schoolyard and note where you find examples of living organisms and populations of organisms. During the course of the activity, if students are unsure and/or unable to find examples, refer to your notes and provide subtle prompts for students to discover examples.

Black and white overlay templates (Transparency Masters) are provided with this activity as an additional visual tool to reinforce the relationships of ecosystem components (organism, population, community + non-living things = ecosystem). Copy templates onto clear overhead acetate sheets and layer them using an overhead projector, a Smart Board or simply hold them up against a white background.

materials

Science notebooks
Pencils
Thermometers
Overlays (4 Transparency Master templates are provided.)

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.

2. Instruct students to move slowly through their schoolyard again and to observe the living things they see and add any that are not already on their list in their science notebooks in the "Living Things" section. This time, have students use the "Number" column to record how many of each different living thing they see.

3. Allow students to list what they observe generically (Ex: bird; insect; plant; etc.) unless they know the specific, common names (Ex: robin; ants; dandelion; etc.).

4. Instruct students to observe the non-living things they see and list any not already on their list in their science notebooks in the "Non-living Things" section (soil, walls, building, sidewalks, cars; air; sunlight; water as rain, pond, puddle; temperature; playground equipment; fences, etc.).
   Q. Looking at the first living thing on your list, how many have listed an organism? How many have listed a population?
   A. Observe the show of hands for each question.

5. Review definition of organism: a single living thing capable of growing and reproducing.

6. Review definition of population: a group of the same organisms living together in the same place and at the same time.
   Q. How do you know if your first entry is an organism or a population?
   A. Example 1: One ant = an organism
   More than one of the same kind of ant = probably a population of ants in the area

Example 2: One sowbug/roly-poly bug = an organism
More than one sowbug/roly-poly bug = a population
Example 3: One bird = organism
More than one of the same kind of bird = population

7. For each entry, instruct students to make a check mark in the "Organism" column if it is a single living thing or in the "Population" column if there is more than one of the same living thing.

8. **Q. How many have checked off one plant as an organism?**
A. Answers will vary.
Q. How do we know if this plant is a living or a non-living thing and that it is an organism?
A. Plants are living things that need air, nutrients, water, light, temperature and space to survive, and it would be an organism because there is only one of it.

9. Review definition of organism (a single living thing capable of growing and reproducing).

10. Review definition of population (a group of the same organisms living together in the same place and at the same time).
Q. Are your plant entries examples of organisms or populations?
A. Example 1: One tree/plant = an organism
More than one of the same tree/plant = probably a population of trees/plants in the area
Example 2: One flower/more than one flower
Example 3: One dandelion/more than one dandelion

11. For each plant entry, instruct students to make a check mark in the "Organism" column if it is a single living thing or in the "Population" column if there is more than one of the same living thing.
Q. [If the two or more birds, ants, bees, flowers, trees, etc. (or other animals and plants) observed are different species (look very different), state to students] How do you know if these birds, ants, bees, flowers, trees, etc. are part of the same population?

12. Review definition of population and open it for discussion. Field guides may be helpful.
Q. Why do you think these organisms (ants, sowbugs, birds, trees, plants, dandelions, etc.) are living and growing here in this schoolyard?
A. The basic needs of all living things (plants and animals combined) are air, food, water, shelter, space, nutrients, light and temperature. These organisms find what they need to live, grow, reproduce and survive here.
Q. I wonder whether or not these plants and animals could be part of a community?
A. A community is a group of different populations of organisms living in the same place and at the same time.
Q. I wonder if there is such a thing as a schoolyard community. How would we know if we had one?
A. All the organisms and populations checked off under "Living Things" in their science notebooks or on their charts are living together and at the same time here in their schoolyard/area surrounding their school. Therefore, these plants and animals are part of the schoolyard community.

13. Instruct students to look at their "Non-living Things" section.
Q. How do you know these entries (sidewalk/water/sunlight/fence/rocks/etc.) are non-living things?
A. Living things need air, water, nutrients, food, shelter, light and space to survive, and they grow and reproduce. Non-livings things have no basic needs. Non-living things do not need air, food, water, shelter and space. Non-living things do not grow or reproduce. Non-living things have never been living and do not "survive."
Q. I wonder whether or not these plant and animal populations that are part of our schoolyard community could be part of an ecosystem.
A. Open it for discussion. All the populations of plant and animal organisms living together in communities and interacting with other living things and the non-living things in their environment (the immediate area around a plant or animal) form an ecosystem.
Q. I wonder if there is such a thing as a schoolyard ecosystem. How would we know if we had one?
A. The populations of organisms in this schoolyard community are interacting with each other and with the things listed under the "Non-living Things" section. Therefore, technically, they form a schoolyard ecosystem.

14. Have students vote on a name for their specific schoolyard ecosystem and enter that name at the top of their charts.

15. Display Overlay 1, *Transparency 1.1: Organism*, and discuss.

16. Place Overlay 2, *Transparency 1.2: Population*, over Overlay 1 (Organism) and discuss.

17. Place Overlay 3, *Transparency 1.3: Community*, over Overlays 1 and 2 and discuss.

18. Place Overlay 4, *Transparency 1.4: Non-living Things*, over Overlays 1–3 and discuss.

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

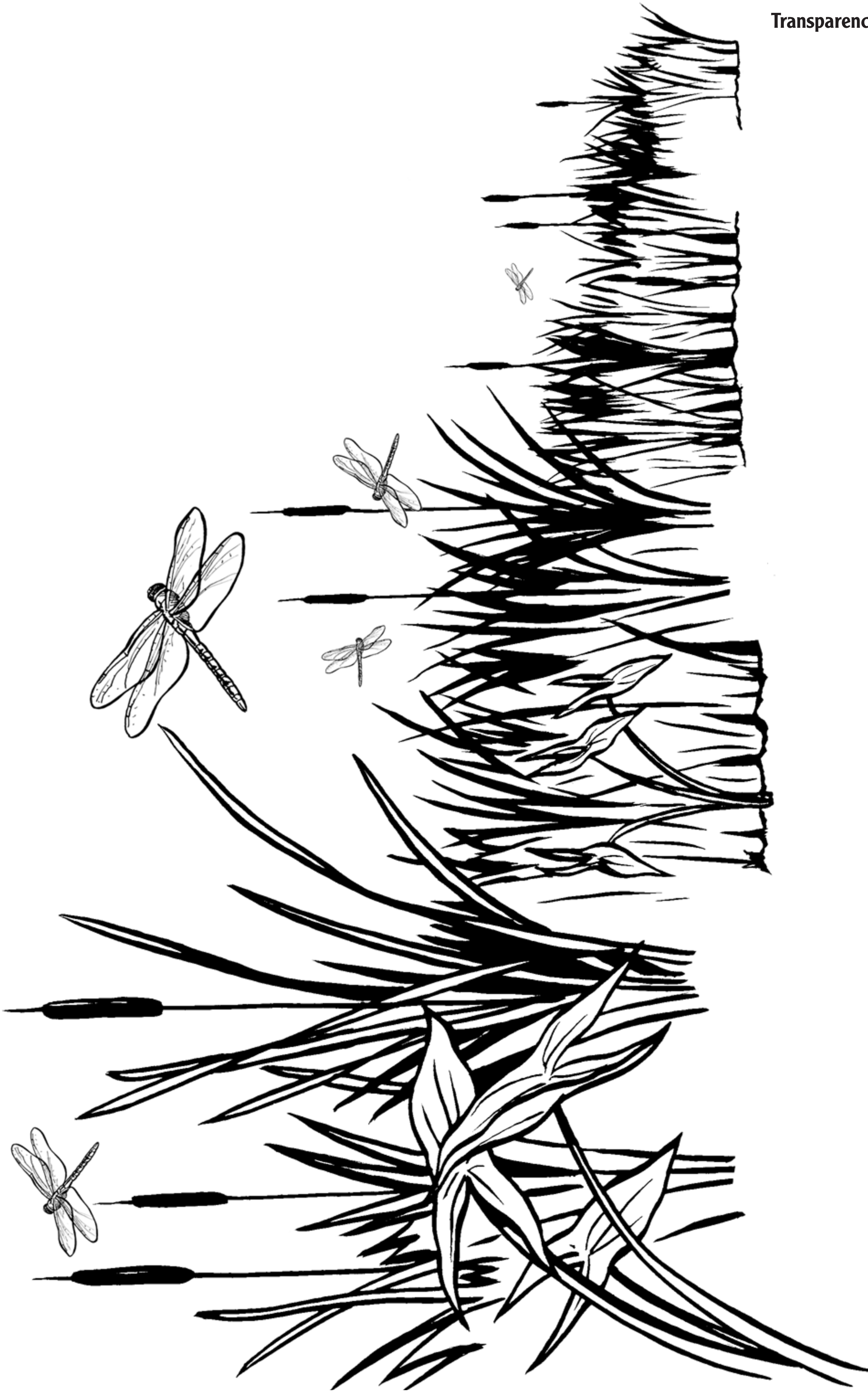
extension activities

Extension Activity 1: Have students work in small groups. Each group should select or be assigned a section of the schoolyard to study. Sections should be large enough for each group of students to move about and observe it comfortably. Each group will identify the living and non-living components, as well as organisms, populations, etc. they observe. Groups should decide how they will gather and organize their data which should be recorded in their science notebooks. Have groups share their findings with the class and explain how and why they chose their method of organizing their data (tables, Venn diagrams or other graphic organizers).

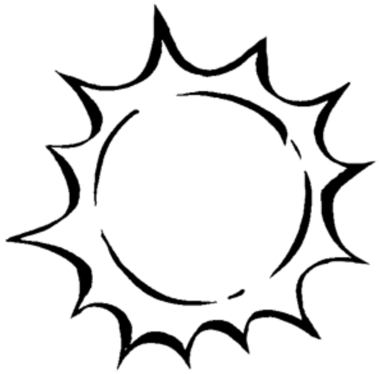
When comparing student data, students should organize the following data in their science notebooks:

Components found in all sections	Explain	Components found in only one section	Explain	Similarities among sections	Explain

Extension Activity 2: Students will work in groups to decide what data they wish to collect in a specific location in their schoolyard over the course of a week. Students will use their science notebooks to collect and record date of their choice at the same location at four different times of the day. Data collection should occur at the same times throughout the week. Students will compare and contrast the results and draw conclusions as to why there were any similarities and/or differences for the different times of the day as well as for the different days. Students will organize their data and present it to the class. Science notebook headings as well as temperature readings should be part of their data collection procedure.



Transparency 1.4—Non-living things



activity 1.4 : schoolyard ecosystem interactions

estimated time 30–40 minutes

objective

Students will be able to

1. Illustrate interactions among their schoolyard community of populations of living organisms with each other and with non-living things that form their schoolyard ecosystem.

teacher preparation

Take a preparatory walk around the schoolyard and note where you find examples of living organisms interacting with other organisms and with non-living things. During the course of this activity, if students are unsure and/or unable to find examples, refer to your notes and provide subtle prompts for students to discover examples.

materials

Science notebooks	Two different colored pencils, pens or crayons, etc.
Pencils	Binoculars (optional)
Thermometers	

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.

2. Explain to students that they will be observing their schoolyard ecosystem today to observe and record how living things are interacting with other living things and with non-living things.

3. Instruct students to observe their schoolyard carefully as they have been doing in *Activities 1.1*, *1.2* and *1.3*, standing in one place and turning to look all around or moving slowly within the designated area.
   Q. How are living things (organisms and populations of organisms) interacting with other living things out here today?
   A. Answers will vary. Birds are eating insects. Insects are eating other insects. Birds are eating seeds. Insects are eating nectar, grass, etc. Insects are crawling through the grass, sitting or resting on a flower, tree, bush, etc. Birds are eating/resting on flowers, trees, bushes, etc.
   Q. How are living things (organisms and populations of organisms) interacting with non-living things out here today?
   A. Answers will vary. Birds are landing/resting on a fence, window sill, sidewalk, etc. Insects are crawling under the playground equipment, on the fence or sidewalk, through the soil, etc.

4. Instruct students to open their science notebooks to the page containing their living and non-living lists and to add any new living things they observe to their "Living Things" sections and add any new non-living things they observe to their "Non-living Things" section.

5. Instruct students to use one of their colored pencils to draw lines between living things that they observe today interacting with each other.

6. Instruct students to use the other colored pencil to draw lines between living things that they observe today interacting in some way with non-living things.

7. Instruct students to provide a key at the bottom of their science notebook page to show which color was used for which interactions.

wrap-up/formative assessment

- Ask students what they think the living things were doing when they were interacting with the living and the non-living things.
- Have students break into groups to discuss this, record their discussion ideas and conclusions on the science notebook page for the day, and present their conclusions to the class based on their science notebook entries and their "imagination."
- Check for understanding of living and non-living things.
- Check for understanding of organisms interacting with living and non-living things in the schoolyard ecosystem.

activity 1.5 : making connections

estimated time 20–30 minutes

objective

Students will be able to

1. Demonstrate how organism, population, community, and ecosystem are connected and how living things interact with other living things and non-living things in a pond ecosystem.

teacher preparation

This activity will work best in a clear, open area outdoors. *Pond Ecosystem Cards* templates are provided. One set requires one copy of the sun card and three copies of each of the other cards. Increase or decrease the number of plants/animals, as needed, to provide one card per student. To facilitate the activity, punch holes in the top of each card and attach and knot a piece of string long enough to slip easily over students' heads. Students should display the picture on their cards throughout the activity.

This activity serves as reinforcement of the basic ecosystem concepts as well as an assessment of student understanding of the concepts. Use as few prompts as possible. Encourage students to help each other.

materials

Pond Ecosystem Cards (at least 3 of each except 1 sun)

procedure

1. Shuffle cards and distribute one card per student telling them that they will represent (pretend to be) the picture on their card. Have them display their cards clearly.

2. Instruct students with cards representing living things to move to your left side.

3. Instruct students with cards representing non-living things to move to your right side.

4. Address the students to your left (living things): If you are certain that you are a living thing and are an organism, organize yourselves into populations. If necessary, provide prompts and elicit the definition of a population. Living things should now be organized into four groups: a population of leopard frogs; a population of dragonflies; a population of catfish; and a population of cattails.

5. Continue to address the living things: If you are certain you are organized into populations, now organize yourselves into a community. Provide prompts and/or definitions, if necessary. Populations should now be intermingled.

6. Address the students representing the non-living things to your right: If you are certain you are a non-living thing, place yourself where you think you belong in the community we have here on my left.

   Q. How do you all feel about your arrangement?

   A. Answers will vary. If students take this as an opportunity to point out suggested shifts in the group, discuss these suggestions and shift accordingly.
   Example: If this is a pond, maybe we should bring the students with water cards closer together.
   Example: Shift the sun where he/she can "see," "shine on," etc. all the living things.

   Q. What did the addition of non-living things provide for the living things?

   A. Rocks provided shelter. Water, air, light and temperature provided the basic needs for the cattails to survive. Water and air provided basic needs for the frogs, dragonflies and catfish to survive. Sun provided light.

   Q. What do the living things provide for each other?

   A. They provide shelter and food. Cattails provide shelter for the frogs, dragonflies and catfish. Frogs eat the dragonflies.

   Q. Once everyone agrees on how the groups are organized and understand how and why they interact with each other: What do you represent as a whole?

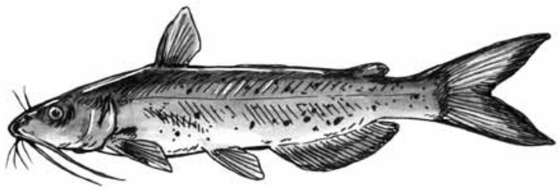
   A. An ecosystem. Provide prompts and/or definitions, if necessary.

wrap-up/formative assessment

See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

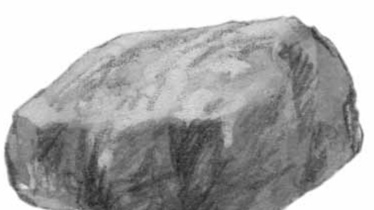
frog

dragonfly



catfish

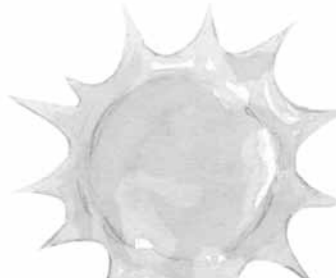
cattail



rock

air temperature

water



sun

so, what do you know?—lesson 1

1. What 6 things do plants need to live?

______________________ ______________________ ______________________

______________________ ______________________ ______________________

2. What 5 things do animals need to live?

______________________ ______________________ ______________________

______________________ ______________________

3. Read the list of things below and underline the non-living things.

Air	Dragonfly	Rock
Cloud	Human	Water
Deer	Sun	Cattail

4. A single living thing is called an ______________________.

5. A ______________________ is a group of the same organisms living together.

6. Why are non-living things important to living things? ______________________________________

7. Different ______________________ of organisms living together form a community.

8. Organisms are ______________________ ______________________ that can grow and reproduce.

9. When a community of different populations of organisms interact with non-living things in their environment an ______________________ is formed.

10. List one example of a living thing. Explain how you know this thing is living.

11. Place the term by the picture that best shows an example of what the term means.

a. Community
b. Ecosystem
c. Organism
d. Population

bluegill

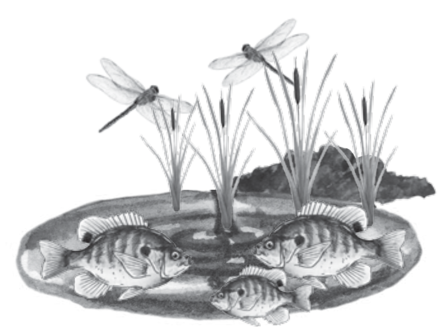
____

bluegill, dragonflies, cattails

____

bluegill

____



bluegill, dragonflies, cattails, water, soil, etc.

____

so, what do you know?—lesson 1

answer key

1. What 6 things do plants need to live? (6 points)

Light	Nutrients	Water
Space	Temperature	Air

2. What 5 things do animals need to live? (5 points)

Air	Food	Shelter
Water	Space	

3. Read the list of things below and underline the non-living things. (5 points)

<u>Air</u>	Dragonfly	<u>Rock</u>
<u>Cloud</u>	Human	<u>Water</u>
Deer	<u>Sun</u>	Cattail

4. A single living thing is called an ___organism___. (1 point)

5. A ___population___ is a group of the same organisms living together. (1 point)

6. Why are non-living things important to living things? ___Living things need non-living things to survive.___ (1 point)

7. Different ___populations___ of organisms living together form a community. (1 point)

8. Organisms are ___living___ ___things___ that can grow and reproduce. (1 point)

9. When a community of different populations of organisms interact with non-living things in their environment an ___ecosystem___ is formed. (1 point)

10. List one example of a living thing. Explain how you know this thing is living. (2 points)

    The answer should include the name of any living thing plus an explanation. The explanation should indicate that living things are organisms that can grow and reproduce. Plants and animals are examples of living things. [Other explanations that convey the same meaning are acceptable.]

11. Place the term by the picture that best shows an example of what the term means. (4 points)

    a. Community
    b. Ecosystem
    c. Organism
    d. Population

bluegill

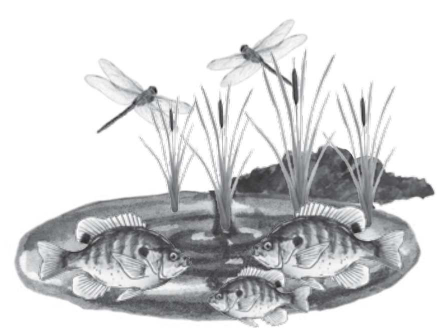
c. Organism

bluegill, dragonflies, cattails

a. Community

bluegill

d. Population



bluegill, dragonflies, cattails, water, soil, etc.

b. Ecosystem

lesson 2: it's what's inside that counts

estimated time
2–4 hours

science GLEs
EC.1.A.4.b. Recognize different environments (i.e., pond, forest, prairie) support the life of different types of plants and animals.

vocabulary
Pond
Pond ecosystem
Forest
Forest ecosystem
Prairie
Prairie ecosystem

lesson objectives
1. Identify examples of different plants and animals found in pond, prairie and forest ecosystems.
2. Explain why different plants and animals live together in an ecosystem.

essential questions for the lesson
1. Why do different plants and animals live together in different ecosystems?
2. Why do different ecosystems support the life of different plants and animals?

teacher notes
Students should have read Chapter 2, "It's What's Inside That Counts," on pages 4–9 of their student books prior to engaging in these activities.

Review the MDC video segments, which are included on your *Nature Unleashed* DVD, to determine which ones you want to incorporate where. MDC free publications *Feeding Backyard Birds*, *Hummingbirds*, *Bluebirds*, *Wetland Birds* poster, *Prairie Birds* poster should be ordered if you do not already have copies for classroom use.

NOTE: On the Forest—Layer of Leaves poster in the student books, #31 on the seedling in the bottom of the poster is a hickory seedling and not a sassafras seedling. The sassafras seedling (also labeled #31) is in the upper right hand corner of the poster.

outline of answers to objectives
See following page.

essential activities
Activity 2.1: It's What's Inside That Counts
Activity 2.2: There's No Place Like Home
Activity 2.3: What Are You Doing Here?
Activity 2.4: Is There a Difference?
Activity 2.5: It's For the Birds

optional activities
Optional Activity 2.A: MDC Video Segments

so, what do you know?—Lesson 2 questions and answer key

summary
Ponds, forests and prairies are all ecosystems found in Missouri. Each one is different, but each one has both living and non-living things and each one supports the survival of different types of plants and animals. Populations of plants and animals live in ecosystems that supply them with the food, water, shelter, air and space they need to survive.

outline of answers to objectives—lesson 2

1. Identify examples of different plants and animals found in a pond, prairie and forest.
   a. Pond ecosystem—examples (pages 4, 5)
      1) Plants: algae, black willow tree, box elder tree, cattail, common sedge, coontail, duckweed, filamentous algae, pin oak tree, sycamore tree, yellow water lily, water primrose
      2) Animals: raccoon, muskrat, human, great blue heron, mallard duck, green frog, red-eared slider, common snapping turtle, northern water snake, northern crayfish, fishing spider, water strider, green darner dragonfly, mosquito, yellow drake mayfly, blue-fronted dancer damselfly nymph, blue-fronted dancer damselfly, giant floater mussel, predacious diving beetle, freshwater jellyfish, water flea, pond snail, largemouth bass, bluegill, fathead minnow, channel catfish, carp
   b. Forest ecosystem (pages 6, 7)
      1) Plants: white oak and acorn, flowering dogwood, oak tree, hickory tree, redcedar, red maple seed, hickory nut and seedling, sassafras seedling,Virginia creeper vine, mayapple, Dutchman's breeches, blue violet, mosses
      2) Animals: bobcat, fox squirrel, white-tailed deer, woodland vole, wild turkey, white-breasted nuthatch, great horned owl, pileated woodpecker, ovenbird, gray treefrog, rough green snake, tiger salamander, three-toed box turtle, walking stick, bald-faced hornet nest, lo moth, spicebush swallowtail caterpillar, termites, carpenter ant, sowbug, centipede, earthworm, cicada nymph junebug grub
   c. Prairie ecosystem (pages 8, 9)
      1) Plants: big bluestem, little bluestem, Indian grass, prairie blazing star, purple coneflower, switch grass, compass plant, sideoats grama grass, prairie fringed orchid, royal catchfly, prairie rose, blackberries, gaura
      2) Animals: badger, coyote, spotted skunk, prairie vole, plains pocket gopher, thirteen-lined ground squirrel, greater prairie-chicken, northern harrier, upland sandpiper, bobwhite quail, bobolink, grasshopper sparrow, northern crawfish frog, bullsnake, speckled kingsnake, ornate box turtle, great plains skink, grassland crayfish, regal fritillary, leaf beetle, honeybee, round-winged katydid, prairie mound ant, prairie mole cricket, yellow garden spider

2. Explain why different plants and animals live together in an ecosystem.
   a. The ecosystem supplies their specific needs for air, food, water, shelter and space.
      1) Pond ecosystem (page 4)
         a) Lots of water
         b) Sunlight warms water and creates different layers of light that organisms use to find food and shelter.
         c) Thick gooey mud at the bottom of the pond provides shelter and nutrients.
         d) Water-loving plants and animals
         e) Food provided by the plants and animals that live in and around the pond.
         f) Some organisms live in the water; other organisms depend on the plants and animals that live in the pond.
      2) Forest ecosystem (page 5)
         a) Land covered mostly by trees
         b) 3 layers
            (1) Canopy
               (i) Lots of sun
               (ii) Tallest trees that love lots of sun
               (iii) Provides shade for understory and forest floor plants
            (2) Understory
               (i) Smaller shade-loving trees, shrubs and vines
            (3) Forest floor
               (i) Shade-loving plants
               (ii) Roots of plants and trees compete with other organisms for nutrients, water and space in the soil
               (iii) Provides homes for animals living on or below forest floor
               (iv) Low-growing plants and layers of decaying leaves, branches and trees
         c) Food provided by the plants and animals that live in every layer of the forest
         d) Water—found in every layer of the forest

3) Prairie ecosystem (page 6)
   a) Lots of sunlight
   b) Many prairie grasses that grow in thick clumps and wildflowers [forbs]
   c) Few woody shrubs and trees
   d) Deep soil
   e) Water from rain & deep in the soil
   f) Shelter provided by prairie grasses that grow in thick clumps and burrows in the soil
   g) Food provided by the plants and animals that live there
   h) Space—travel lanes throughout the space between clumpy grasses and flowers
   i) Fire is a vital non-living part of the prairie to keep off trees and other plants that would take over and harm a prairie ecosystem.

activity 2.1 : it's what's inside that counts

estimated time 30 minutes to 1 hour

objectives

Students will be able to
1. Give examples of different plants and animals that live in pond, forest and prairie ecosystems.
2. Explain why different plants and animals live together in an ecosystem.

teacher preparation

Student should have read Chapter 2, "It's What's Inside That Counts," on pages 4–9 in their student books prior to engaging in these activities.

This activity may be done indoors or outdoors. Provide the full-sized posters for reference. Students will begin by referencing the full-sized posters only but will eventually reference the three book-sized posters provided in their student books in Chapter 2. This activity may be broken down into separate activities depending on available time. If completed on different days, have students prepare new science notebook headings for each activity part.

Information gathered from the posters and student books should be recorded in the appropriate columns on the specific *Big Chart* found in the center of each student's science notebook. *NOTE: Student Big Charts do not contain enough lines to accommodate every plant and animal listed in each of the three posters. Big Chart Ecosystem Teacher Keys are provided for each ecosystem poster and are comprehensive. Student entries based on the plants and animals they identify specifically or generically in their groups will vary. It is not necessary for students to record each and every plant and animal listed in the three poster keys. This activity suggests that students include at least 20 animals and 5 plants from each poster.*

materials

Science notebooks
Pencils
Thermometers (if outdoors)
Full-sized posters: *Missouri Pond Life*; *Forests—Layers of Leaves*; *Prairie—Life Among the Grasses*
Big Charts (in center of science notebooks)
Student books

procedure

1. Have students complete their science notebook headings and take and record outside air temperature, if outdoors.

2. Instruct students to open their science notebooks to the center pages to find their *Big Chart: Pond Ecosystem*. Explain that they will use this *Big Chart* as well as all the others to enter information throughout the unit.

Pond

3. Display *Missouri Pond Life* poster(s) for student reference.

4. Have students work in small groups to reference the full-sized *Missouri Pond Life* poster. Instruct students to use their *Big Chart: Pond Ecosystem* to list the following information from the pond poster:
   a. animals (listed under "Organism" and then checked off under the "Animal" column)
   b. plants (listed under "Organism" and then checked off under the "Plant" column)
   c. non-living things (listed in the open box provided at the bottom of the chart)

5. Have students share their lists and add any plants, animals or non-living things they may have missed.

6. Instruct students to reference the *Missouri Pond Life* poster on pages 4 and 5 of their student book to add enough animals and plants to provide a total of at least 20 animals and 5 plants. They may include as many non-living things as they wish within the space provided.

Q. What do the organisms in your lists have in this pond ecosystem to help each of them survive?
A. Food (plants and other animals to eat), water, air, space, shelter (under water, in and around plants, mud, etc.).

7. Discuss the non-living things students listed (water; mud or soil; sunlight; temperature; rocks; landforms; air, etc.).

8. Using the *Missouri Pond Life* poster in their student books, have students look for interactions among living things with other living things and for interactions among living things and non-living things.
   Q. How are the organisms in your lists interacting with other living things? Why?
   A. Answers will vary. A big fish is eating a smaller fish. A water bug is eating a tadpole. A fish is hiding in some plants. A dragonfly is resting on a leaf. A spider is eating a fish.
   Q. How are the organisms in your lists interacting with non-living things? Why?
   A. Answers will vary. A crayfish is "living" in a hole in the mud. Fish, bugs, snails, crayfish, a turtle are "living" in the water. A beaver [looks as if it] is drinking the water. Animals are breathing the air. Plants are using light and using nutrients in the mud to grow.
   Q. I wonder why these plants and animals are part of this pond poster?
   A. These plants and animals find what they need to survive here (food, water, shelter, space, etc.).

Forest

9. Have students work alone or in groups to reference the full-sized *Forests—Layers of Leaves* poster. Instruct students to use their *Big Chart: Forest Ecosystem* to record the following information from the forest poster:
   a. animals (listed under "Organism" and then checked off under the "Animal" column)
   b. plants (listed under "Organism" and then checked off under the "Plant" column)
   c. non-living things (listed in the open box provided at the bottom of the chart

10. Have students share their lists and add any plants, animals or non-living things they may have missed.
    Q. What did you do with the shelf mushroom?
    A. It is an organism but it is not considered a plant. It does not get its energy from the sun but from nutrients in dead or decaying matter.

11. Instruct students to reference the *Forests—Layers of Leaves* poster on pages 6 and 7 of their student book to add enough animals and plants to provide a total of at least 20 animals and 5 plants. They may include as many non-living things as they wish within the space provided.
    Q. What do the organisms in your lists have in this forest ecosystem to help each of them survive?
    A. Food (plants and other animals to eat), water, air, space, shelter, nutrients. light, etc.

12. Discuss the non-living things students listed (water; soil; sunlight; temperature; rocks; landforms; air, etc.).

13. Using the *Forests—Layers of Leaves* poster in their student books, have students look for interactions among living things with other living things and for interactions among living things and non-living things.
    Q. How are the organisms in your forest lists interacting with other living things? Why?
    A. Answers will vary. Squirrel, frog, owl, bird (nuthatch), and butterfly (moth) are resting on the tree. The salamander, insects (termites), sowbug, a bird (ovenbird), turtle (box turtle) are using a dead log [which was a living thing but is now no longer living] as shelter. A "mouse" (vole) is eating plants. A centipede is eating an ant.
    Q. How are the organisms in your lists interacting with the non-living things? Why?
    A. Answers will vary. The plants are using light and nutrients from the soil. Everything is breathing the air. The temperature is warm enough for moths and insects and plants to live and grow.
    Q. [Optional question for discussion only] What forest plants and animals would you possibly see or not see in a savanna? Why?
    A. Answers will vary. Possibly see: Deer, bobcat, birds, box turtles, etc. walking through, flying by, using some of the trees and grasses for food and shelter, etc. Possibly not see: Plants that need less light to survive, salamanders that need moisture, etc.

Prairie

14. Have students work along or in groups to reference the full-sized *Prairie—Life Among the Grasses* poster. Instruct students to use their *Big Chart: Prairie Ecosystem* to record the following information from the prairie poster:
    a. animals (listed under "Organism" and then checked off under the "Animal" column)
    b. plants (listed under "Organism" and then checked off under the "Plant" column)
    c. non-living things (listed in the open box provided at the bottom of the chart

15. Have students share their lists and add any plants, animals or non-living things they may have missed.

16. Instruct students to reference the *Prairie—Life Among the Grasses* poster on pages 8 and 9 of their student book to add enough animals and plants to provide a total of at least 20 animals and 5 plants. They may include as many non-living things as they wish within the space provided.

    Q. What do the organisms in your lists have in this prairie ecosystem to help each of them survive?

    A. Food (plants and other animals to eat), water, air, soil; sunlight; temperature; rocks; landforms; air, etc.

17. Discuss the non-living things students listed (water; soil; sunlight; temperature; rocks; landforms; air, etc.).

18. Using the *Prairie—Life Among the Grasses* poster in their student books, have students look for interactions among living things with other living things and for interactions among living things and non-living things.

    Q. How are the organisms in your lists interacting with other living things? Why?

    A. Answers will vary. A mouse (vole), a butterfly, bees, a turtle (three-toed box turtle), and a squirrel (thirteen-lined ground squirrel) are eating flowers and berries. A frog is eating a crayfish. Birds (quail) are landing in grasses. A spider is using a plant for shelter and to spin its web to catch food. A mouse (vole) is using dead grasses [still considered living things] as shelter.

    Q. How are the organisms in your lists interacting with the non-living things? Why?

    A. Answers will vary. Animals are using holes in the ground for shelter. Everything is breathing the air. Plants are using the light and temperature to grow and survive. Plants are using the nutrients in the soil to grow.

Wrap-up/Formative Assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

big chart—pond ecosystem answer key (includes all plants and animals listed on poster)

ORGANISM	Plant	Animal	Producer	Consumer	Herbivore	Carnivore	Omnivore	Decomposer	Scavenger	Predator	Prey
1–Raccoon		X		X			X			X	X
2–Muskrat		X		X			X			X	X
3–Human		X		X			X			X	
4–Great blue heron		X		X		X				X	X
5–Mallard duck		X		X			X			X	X
6–Green frog		X		X		X				X	X
7–Red-eared slider turtle		X		X			X			X	X
8–Common snapping turtle		X		X			X		X	X	X
9–Northern water snake		X		X		X				X	X
10–Northern crayfish		X		X	X				X		X
11–Fishing spider		X		X		X				X	X
12–Water strider		X		X		X				X	X
13–Green darner dragonfly		X		X		X				X	X
14–Mosquito		X		X			X				X
15–Yellow drake mayfly		X		X			X			X	X
16, 17–Blue-fronted dancer damselfly (nymph)		X		X		X				X	X
18–Giant floater mussel		X		X			X			X	X
19–Predacious diving beetle		X		X		X				X	X
20–Freshwater jellyfish		X		X			X			X	X
21–Water flea		X		X			X			X	X
22–Pond snail		X		X	X						X
23–Largemouth bass		X		X		X				X	X
24–Bluegill		X		X		X				X	X
25–Fathead minnow		X		X			X			X	X
26–Channel catfish		X		X			X		X	X	X
27–Common carp		X		X			X		X	X	X
28–Algae	X		X								
29–Coontail	X		X								
30–Duckweed	X		X								
31–Water primrose	X		X								
32–Yellow water lily	X		X								
33–Common sedge	X		X								
34–Cattail	X		X								
35–Black willow tree	X		X								
36–Box elder tree	X		X								
37–Pin oak tree	X		X								
38–Sycamore tree	X		X								
Non-living things—water, mud, rocks, air, sun, temperature				**Notes**							

big chart—forest ecosystem answer key

(includes all plants and animals listed on poster)

ORGANISM	Plant	Animal	Producer	Consumer	Herbivore	Carnivore	Omnivore	Decomposer	Scavenger	Predator	Prey
1–Bobcat		X		X		X				X	X
2–Fox squirrel		X		X	X						X
3–White-tailed deer		X		X	X						X
4–Woodland vole		X		X	X						X
5–Wild turkey		X		X			X			X	X
6–White-breasted nuthatch		X		X			X			X	X
7–Great horned owl		X		X		X				X	X
8–Pileated woodpecker		X		X			X			X	X
9–Ovenbird		X		X		X				X	X
10–Gray treefrog		X		X		X				X	X
11–Rough green snake		X		X		X				X	X
12–Tiger salamander		X		X		X				X	X
13–Three-toed box turtle		X		X			X			X	X
14–Walking stick		X		X	X						X
15–Bald-faced hornet nest (not an organism)											
16–Io moth		X		X	X						X
17–Spicebush swallowtail caterpillar		X		X	X						X
18–Termite		X		X				X			X
19–Carpenter ant		X		X		X		X	X	X	X
20–Sowbug		X		X				X	X		X
21–Centipede		X		X		X				X	X
22–Earthworm		X		X				X	X		X
23–Cicada nymph		X		X	X						X
24–Junebug grub		X		X	X						X
25–White oak ~~and acorn~~ tree	X		X								
26–Flowering dogwood tree	X		X								
27–Oak and hickory forest (not one organism)											
28–Redcedar tree	X		X								
29–Red maple ~~seed~~ tree	X		X								
30, 31*–Hickory ~~nut and~~ seedling (*Seedling labeled #31 by the squirrel is a hickory seedling)	X		X								
31*–Sassafras seedling (*Seedling labeled #31 in the upper right corner is the sassafras seedling)	X		X								
32–Virginia creeper vine	X		X								
33–Mayapple	X		X								
34–Dutchman's breeches	X		X								
35–Blue violet	X		X								
36–Moss	X		X					X			
37–Shelf mushroom								X			
Non-living things—water, rocks, air, sun, temperature				**Notes**							

big chart—prairie ecosystem answer key (includes all plants and animals listed on poster)

ORGANISM	Plant	Animal	Producer	Consumer	Herbivore	Carnivore	Omnivore	Decomposer	Scavenger	Predator	Prey
1–Badger		X		X		X				X	X
2–Coyote		X		X			X		X	X	X
3–Spotted skunk		X		X			X		X	X	X
4–Prairie vole		X		X	X						X
5–Plains pocket gopher		X		X	X						X
6–Thirteen-lined ground squirrel		X		X			X			X	X
7–Greater prairie-chicken		X		X			X			X	X
8–Northern harrier hawk		X		X		X				X	X
9–Upland sandpiper		X		X			X			X	X
10–Bobwhite quail		X		X			X			X	X
11–Bobolink		X		X			X			X	X
12–Grasshopper sparrow		X		X			X			X	X
13–Northern crawfish frog		X		X		X				X	X
14–Bullsnake		X		X		X				X	X
15–Speckled kingsnake		X		X		X				X	X
16–Ornate box turtle		X		X			X			X	X
17–Great plains skink		X		X		X				X	X
18–Grassland crayfish		X		X			X	X	X	X	X
19–Regal fritillary butterfly		X		X	X						X
20–Leaf beetle		X		X	X						X
21–Honeybee		X		X	X						X
22–Round-winged katydid (pink form)		X		X	X						X
23–Prairie mound ant		X		X				X	X	X	X
24–Prairie mole cricket		X		X			X			X	X
25–Yellow garden spider		X		X		X				X	X
26–Big bluestem	X		X								
27–Little bluestem	X		X								
28–Indian grass	X		X								
29–Prairie blazing star	X		X								
30–Purple coneflower	X		X								
31–Switch grass	X		X								
32–Compass plant	X		X								
33–Sideoats grama grass	X		X								
34–Prairie fringed orchid	X		X								
35–Royal catchfly	X		X								
36–Prairie rose	X		X								
37–Blackberries	X		X								
38–Gaura	X		X								
Non-living things—water, rocks, air, sun, temperature				**Notes**							

activity 2.2 : there's no place like home

estimated time 20–30 minutes

objectives

Students will be able to

1. List shared characteristics of plants and animals found in all three pond, forest, and prairie ecosystems.
2. Explain why certain plants and animals would be found only in a pond, forest or prairie ecosystem.

teacher preparation

Have full-sized Pond, Forest and Prairie posters available. This activity may be done indoors or outdoors.

materials

Science notebooks
Pencils
Thermometers
Big Charts

procedure

1. Have students complete their science notebook headings and take and record outside air temperature. Instruct them to make two column headings on their notebook page: SAME PLANTS *and* SAME ANIMALS

2. Instruct students alone or in groups to reference the information they entered on all three of their *Big Charts* from *Activity 2.1.*

3. Have students make a small dot in pencil next to all the same plants that are listed in all three ecosystem *Big Charts* and then record the "dotted" plants under the "SAME PLANTS" heading in their notebook.

4. Have students make a small star in pencil next to all the same animals that are listed on all three ecosystem *Big Charts* and then record the "starred" animals under the "SAME ANIMALS" heading in their notebook.

5. Have students share their lists in their groups and/or with the class.

6. Discuss whether or not the plants and animals listed as being found in all three ecosystems are really the same plants or animals.
   Q. Some of you have listed turtles/birds/snakes/etc. as being the same animals found in all three ecosystems. I wonder if these are really the same kinds of turtles/birds/snakes/etc.
   A. These turtles/birds/snakes are not exactly the same on these posters. These turtles/birds/snakes/etc. are different kinds of turtles/birds/snakes/etc.
   Q. Why wouldn't they be the same?
   A. The red-eared slider in the pond needs water more than the box turtles found in the forest and prairie. The great blue heron eats mostly fish, so it would probably not find what it needs to eat in a forest or prairie. All snakes are able to swim, but the water snake needs to be close to water to catch its food of fish and frogs while the forest and prairie snakes eat the rodents and birds found in their ecosystems.
7. Some of you listed flowers, grasses, trees, etc. as plants found in all three ecosystems.
   Q. How might pond plants such as duckweed, cattails and algae survive in a forest?
   A. Answers will vary. These plants need water more than the forest plants and more than they would find in a forest—except temporarily during times of flooding. These plants would not be able to survive without sufficient water and sunlight in an ecosystem with so many trees and such a dense canopy.
   Q. How might an oak tree (forest) or a coneflower (prairie) survive in the middle of a pond?
   A. These plants would not survive because there would be too much water.
   Q. I wonder why there are frogs in all three ecosystems.
   A. These are different types of frogs with different ways of interacting with their environments, and they find what they need to survive in their different ecosystems. The green frog in the pond does leave the water but only for short periods of time. The gray

treefrog in the forest needs to keep its skin moist but not constantly wet. [Camouflage is discussed in Chapter 3, but students who know the concept might notice how well the gray treefrog and green frog blend into their environments and use that as reasoning for those frogs being found in different ecosystems.] The northern crawfish frog finds its preferred food (grassland crayfish) in the prairie.

8. Throughout these discussions, instruct students to erase the light dots and stars placed next to the plants and animals they thought were the same but now realize are not and are not found in all three ecosystems. According to these posters, there would not be any plants or animals left with dots or stars. No specific plant or animal is found in all three ecosystems.

   Q. Why do you suppose these plants and animals are found on only one of these three ecosystem posters?

   A. The plants and animals on these posters find exactly what they need to survive in their ecosystems. Each ecosystem meets the basic needs of the plants and animals illustrated and listed on each poster.

   Q. I wonder if this is exactly how it is in real ponds, forests or prairies. If you were walking in a real prairie, what pond or forest animals do you think you might see? Why?

   A. Answers may vary but could include humans, deer, mosquitoes, dragonflies, bobcats, snakes, some insects, etc. These animals would possibly move through the different ecosystems in search of food, water, shelter (temporary), recreation (humans), etc. Some might even spend extended periods of time in one or more of them if they are able to find their basic needs. Trees are plants that grow in places other than just forests, and cattails are not only found growing in or near ponds.

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

activity 2.3 : what are you doing here?

estimated time 20–30 minutes

objective

Students will be able to
1. Compare and contrast their schoolyard ecosystem with pond, forest and prairie ecosystems.
2. Predict which ecosystem (pond, forest or prairie) is most like the schoolyard ecosystem.

teacher preparation

This is an outdoor activity. Take a brief preparatory walk around the schoolyard and note where you find examples of ecosystem components in the schoolyard. During the course of the activity, if students are unsure and/or unable to find examples, refer to your notes and provide subtle prompts for students to discover examples. Be prepared to prompt students for sensory observations.

Students will reference and fill in the *Big Chart: Schoolyard Ecosystem* by observing and collecting data on their schoolyard/outdoor area.

materials

Science notebooks
Pencils
Thermometers
Big Charts

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.

2. Ask students to predict which ecosystem (pond, forest or prairie) is most like their schoolyard ecosystem.

3. Instruct students to stay in one place for a few moments, close their eyes and think about what they smell, hear and feel. After a few moments, have them open their eyes and record their sensory observations in their science notebooks. Provide prompts, if necessary, while their eyes are closed.
   Q. How does your skin feel out here today? Why?
   A. Answers will vary. Warm from sunshine; too hot because the temperature is so high; sweat on their faces from the gym class they just finished; cool from shade or wind; very cold from wind and temperature; wet from rain or fog, etc.
   Q. What kinds of smells and sounds do you notice?
   A. Answers will vary. Smell of the concrete because it is wet from rain; flowery smells from a nearby garden; earthy smells from damp soil; truck, bus, car exhaust smells from nearby traffic; sweet smells of someone's perfume; etc. Sounds of nearby traffic, children at recess, people talking near the school; bird songs/calls; crickets chirping or insects buzzing; wind blowing through the trees or making the American flag on the school's flagpole flap; dogs barking, etc.
   Q. How comfortable are you right now here in your schoolyard ecosystem?
   A. Answers will vary.
   Q. While you are part of this schoolyard ecosystem, do you have what you need to survive?
   A. Answers may vary, but basically, basic needs of the students are met—food, water, shelter, air and space.
   Q. Looking around carefully, what other living things do you see besides humans?
   A. Answers will vary. Refer to your notes to provide prompts: birds by the fence; grass and flowers in the outdoor classroom; weedy looking plants growing in the sidewalk cracks; insects crawling around the sidewalk cracks; insects flying around; rabbits in the bushes, etc.
   Q. What are they doing here in your schoolyard ecosystem?
   A. They have what they need (food, water, shelter, air, space, etc.). These plants and animals have things to eat and places to hide and grow, etc. This is a comfortable temperature for them, etc.

4. Instruct students alone or in groups to open their science notebooks to the *Big Chart: Schoolyard Ecosystem*.

5. Explain that they have used posters of other ecosystems to observe living and non-living things found in each. Now they will do the same with their schoolyard ecosystem and add the information to their *Big Chart: Schoolyard Ecosystem.*

6. Instruct students to observe their schoolyard carefully, standing in one place and turning to look all around or moving slowly within the designated area. The slower they move, the more they will see, and the fewer animals they will startle and scare off.

7. Instruct students to refer to their original science notebook lists of living and non-living things observed in the schoolyard from *Activity 1.3* and include any organisms from those lists not in their *Big Chart: Schoolyard Ecosystem.*

8. Have them share their updated *Big Chart: Schoolyard Ecosystem* lists with the class.
   Q. Why do you think these plants and animals (organisms) were observed in our schoolyard ecosystem?
   A. Answers will vary. These organisms find what they need to survive here—food, water, shelter, air and space, etc.
   Q. There might be other organisms that pass through our schoolyard ecosystem, but why do you think these are the only ones we observed today?
   A. Other living things may be too big to find food and shelter here. This area doesn't have the right food for some other living things. There isn't enough soil/dirt for other/more plants to grow. There may be more animals here, but we just can't see them now, etc.

9. Instruct students to look around their schoolyard ecosystem and list at the bottom of their *Big Chart: Schoolyard Ecosystem* the non-living things they observe.

10. Have students share their lists in their groups or with the class.
   Q. Looking at all your *Big Charts*, how do the plants, animals and non-living things in your schoolyard ecosystem compare to those of the pond, forest and prairie?
   A. Answers will vary depending on school's location and setting.
   Q. What were some of the organisms you observed here today that surprised you or didn't seem as if they belonged in our schoolyard ecosystem?
   A. If there are no ponds or other water sources in the schoolyard ecosystem but students observed dragonflies, cattails, raccoons, etc. there might be a pond or other water source nearby, and the animals were moving among environments and ecosystems to find food, water, shelter and space. Cattails often grow in areas that stay boggy but not necessarily full of water all the time.
   Q. Why do you suppose they were here?
   A. The schoolyard ecosystem isn't a forest by definition, but there are trees growing in it. Trees are plants that also grow in places other than forests. Animals from the prairie poster such as bees, birds, and insects (even snakes and turtles) often move among environments because their basic needs are met.

11. Have students work alone or in groups to create Venn diagrams to illustrate each of the following ecosystem relationships:
   a. Pond/Schoolyard
   b. Forest/Schoolyard
   c. Prairie/Schoolyard
   Q. Which of the three ecosystems (pond, forest or prairie) did you predict would be most like your schoolyard ecosystem?
   A. Student predictions may vary.
   Q. Which of the three ecosystems (pond, forest or prairie) is most like your schoolyard ecosystem?
   A. Answers will vary.

12. Based on what you have read, on your observations, and on our discussions, raise your hand if you think our schoolyard ecosystem is most like a pond ecosystem. Note the number on the board. Ask a student or students with raised hands to explain why. Repeat for the forest ecosystem and for the prairie ecosystem.
   Q. Which of the three ecosystems (pond, forest or prairie) is most like your schoolyard ecosystem?
   A. The schoolyard may clearly reflect characteristics of one of the three ecosystems. If it appears to share characteristics of the other ecosystems, have students list the shared characteristics and decide on one ecosystem with the most characteristics in common with the schoolyard.

wrap-up/formative assessment

Have students write a summary paragraph to explain the components of an ecosystem.

evaluation

See *Summary Paragraph Guidelines and Scoring Key* in Appendix E of this Guide.

extension activities

Extension Activity 1: My Backyard Is Most Like?

Have students compare their backyards to the schoolyard. Which ecosystem is their backyard most like? Have students write a short essay on their choice or sketch/illustrate their backyard in their science notebooks and label elements of their backyards that reflect the comparable ecosystem.

Extension Activity 2: Tree Investigation

Have students stand by a tree and observe any activity at or on the tree. They should record the information in their science notebooks.

1. How big is the tree (approximately)? (It's so big I can't wrap my arms around the trunk. I can just barely wrap my hands around the trunk. I can wrap my hands around the trunk.)
2. What type of tree is it?
3. How many different types of organisms do you see and how many of each?
4. What part of the tree did you find each type of organism?
5. Do you see single organisms or populations of organisms? Explain.

Extension Activity 3: Web Investigation

Have students select either a pond, forest or prairie ecosystem to research using the Internet. Students should prepare and present a short report on that ecosystem. Each report should include the following:

1. Two new facts learned about the ecosystem in general
2. Descriptions of two organisms (plant and/or animals) not mentioned on the poster of that ecosystem in their student book plus information on what each eats (for animals) or what eats it (for plants and animals)
3. One outrageous, disgusting, amazing, incredible, etc. fact about each of the two new organisms.

activity 2.4 : is there a difference?

estimated time 20–30 minutes

objectives

Students will be able to
1. Explain why different plants and animals live together in an ecosystem.
2. Describe factors that affect observation of organisms in an ecosystem.

teacher preparation

This is an outdoor activity. Take a brief preparatory walk around the schoolyard and note your observations of living things. Note any changes in what you observe today compared with earlier walks and outdoor activities. Students will be asked to observe and record these kinds of differences. During the course of the activity, if students are unsure and/or unable to notice any differences, refer to your notes and provide subtle prompts for students to discover examples. Be prepared to encourage students to look closely at the ground near trees and plants and underneath rocks, mats, pieces of wood, piles of sand or soil, etc. Some of the differences may be observed because students are prompted to look more closely at the schoolyard areas.

Create a classroom chart of student outside air temperature data for comparison. Students can reference it to recognize and discuss patterns, relationships, etc. between outside air temperature and animal behavior, organism interactions, etc.

materials

Science notebooks
Pencils
Thermometers

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.

2. Instruct students alone or in small groups to move around and investigate their schoolyard/outdoor area carefully. Instruct students to record their observations in their science notebooks.

3. After a few moments, have students share their observations.
   Q. What differences do you notice today compared to what you observed and recorded in your science notebooks from other days? Why do you think there are these differences?
   A. Answers will vary. More birds and insects because the weather warmed up; fewer animals because it is raining; no bees in the grassy and flower area because someone mowed the plants, etc. It's a different time of day, so there are fewer kids at recess. It's a colder day, so animals are somewhere trying to keep warm. Birds may be more active other times of the day. Trees have lost more of their leaves because it's fall and it was windy last night, etc.

wrap-up/formative assessment

Allow students time to sit quietly outside and illustrate the differences or describe in words how and why something they observed during this activity surprised them because it was different from earlier observations.

activity 2.5 : it's for the birds

estimated time Varies (1–2 hours)

objectives

Students will be able to
1. Research birds common to their schoolyard ecosystem and explain why and how certain birds should/could be attracted to their schoolyard ecosystem for observation.

teacher preparation

Consider bringing students outside for this brainstorming activity especially if you have noticed increased bird activity recently.

For extensive information on birds common to the area near the school, visit Cornell University's Ornithology Web site *www. birds.cornell.edu/AllAboutBirds/BirdGuide*. Have bird field guides (provided in the classroom kit) available to students. Have MDC publications available (*Feeding Backyard Birds*, *Hummingbirds*, *Bluebirds*, *Wetland Birds* Poster, *Prairie Birds* Poster, etc.). Birdseed can be costly. However, retailers (Wal-Mart; PetSmart; PETCO; Lowe's; various supermarkets and hardware stores; etc.) often discard birdseed bags that are torn or damaged. Contact local retailers to find out if they 1) have any damaged bags of seed available for free and/or 2) would they contact you if and when they do have damaged bags they would willing to donate to your class. Bird feeders are also costly to purchase and to build, but there are many simple, inexpensive ways to feed birds using natural objects and recycled materials. If possible, schedule a student/parent/family night to create recycled bird feeders.

materials

Science notebooks
Pencils
Thermometers
Field guides to North American birds/Eastern US birds
MDC bird publications
Internet access
Library books

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.
   Q. We know that our schoolyard ecosystem does have some/all of the basic things organisms need to survive (water, food, shelter, air and space). Considering what our ecosystem does have, what animals would be easy and safe to try to attract to our schoolyard ecosystem for observation over a long period of time?
   A. Answers may vary, but provide prompts to support suggestions that birds would be safe and (possibly) easy to attract. Acknowledge other suggestions and discuss why these might be difficult, dangerous, etc., to attract to the schoolyard ecosystem.
   Q. I wonder how we might be able to attract more birds.
   A. If there were food, water and shelter for the birds, they would find what they needed around the schoolyard ecosystem and would stay near the area. They would be easy to observe.
   Q. How would we know which ones to attract and how to attract them?
   A. Research birds that would be in Missouri all year and the types of food they eat. Use the Internet or school library to research birds common to the area.

2. Have students work alone or in groups to decide their research methods, options and choices.

3. Instruct each one/group to compile a list of birds commonly found in the area near the school. Consolidate all lists, have students vote on their top 10–20 (depending on class size) and divide the birds evenly among the students/groups. Students/groups should research 2–4 birds.

4. Instruct students/groups to provide answers to the following questions for each of their assigned birds:
    a. What part of the year is this bird found in the area?
    b. What does the bird eat?
    c. How would you provide this food for the bird?
    d. Where does the bird prefer to nest?
    e. Why and how would you provide shelter for this bird?
    f. What eats this bird?

5. Have students present the information for each of their birds and discuss which ones would be easiest to attract and observe. Have students vote individually or as groups on their top three, four, etc., choices.

6. *Attempt to attract at least three or four common birds. Other birds will probably be attracted to the feeders, and these will provide additional observation opportunities.*

7. Once birds have been decided, instruct students/groups to refer to earlier research by the class and brainstorm how they will provide the food for the chosen birds.

8. Encourage students to investigate using recycled materials to create the feeders.

9. Plan a time to create feeders and to place them (preferably outside the classroom window) where students will easily observe, collect data and maintain records of their behavior and interactions throughout the Unit/year.

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

optional activity 2.a : mdc video segments

1. *Forest: Frogs & Grouse* (5:01 minutes)—Discover what the ruffed grouse and the wood frog have in common at Daniel Boone Conservation Area near Warrenton.

2. *Salamanders* (4:20 minutes)—Tag along as MDC herpetologist Jeff Briggler goes in search of one of our state's least-seen and least-known creature: some of Missouri's 19 species of salamanders.

3. *Wildflowers* (5:10 minutes)—Experience the color and beauty of Missouri wildflowers. From coneflower to coreopsis, spiderwort to shooting star, larkspur to lily, Fleabane to foxglove and daisy to dogwood, we'll bring you the flowering beauty found in the Show-Me State.

4. *Parking Lot Prairie* (8:29 minutes)—Before there were parking lots and plows, there were prairies. Join a group of Kansas City students in their attempt to turn back time.

5. *Prairie Day St. Louis* (6:07 minutes)—Spend a day on the prairie at this special event west of St. Louis.

6. *Prairie Day Kansas City* (4:51 minutes)—Enjoy an annual Kansas City area event: a toe-tapping encounter with life...as it is and as it was...on Missouri's vanishing prairie.

7. *Prairie-chickens #1* (7:06 minutes)—Their numbers are on the decline. Journey to west-central Missouri and see how local citizens are working together in an effort to save the greater prairie-chicken.

8. *Prairie-chickens #2* (5:40 minutes)—Visit a "booming" business that's helping spread the word about the plight of Missouri's fascinating prairie-chickens...a plight that could still lead to extinction.

so, what do you know?—lesson 2

1. A ______________________________ ecosystem is a watery environment. It has mud, sunlight, air, shelter and temperature. Some plants and animals live in water all or part of their lives. Others may not live in the water, but depend on the plants and animals that do.

2. Lots of large trees that love the sun and lots of small trees, shrubs, vines and other shade-loving plants live with animals that depend on the air, water, shelter, sunlight, soil, and food found in a ______________________________ ecosystem.

3. Huge grasslands with many types of clump grasses and wildflowers are part of ______________________________ ecosystems. Animals that depend on these plants and non-living things for food, water, shelter, light and air live here.

4. In the blank by each living thing, write the name (pond, forest or prairie) of the ecosystem that plant or animal is part of.

___________________ Three-toed box turtle

___________________ Bass

___________________ Big bluestem

___________________ Blackberries

___________________ Cattail

___________________ Duckweed

___________________ Grasshopper sparrow

___________________ Great horned owl

___________________ Mallard duck

___________________ Mayapple

___________________ Muskrat

___________________ Ornate box turtle

___________________ Prairie vole

___________________ Purple coneflower

___________________ Regal fritillary butterfly

___________________ Sassafras seedling

___________________ Sideoats grama grass

___________________ Snapping turtle

___________________ Fox squirrel

___________________ Tiger salamander

___________________ White oak

___________________ Yellow water lily

so, what do you know?—lesson 2

answer key

1. A ____pond____ ecosystem is a watery environment. It has mud, sunlight, air, shelter and temperature. Some plants and animals live in water all or part of their lives. Others may not live in the water, but depend on the plants and animals that do. (1 point)

2. Lots of large trees that love the sun and lots of small trees, shrubs, vines and other shade-loving plants live with animals that depend on the air, water, shelter, sunlight, soil, and food found in a ____forest____ ecosystem. (1 point)

3. Huge grasslands with many types of clump grasses and wildflowers are part of ____prairie____ ecosystems. Animals that depend on these plants and non-living things for food, water, shelter, light and air live here. (1 point)

4. In the blank by each living thing, write the name (pond, forest or prairie) of the ecosystem that plant or animal is part of. (1 point each, total 22 points)

Forest	Three-toed box turtle	Prairie	Ornate box turtle
Pond	Bass	Prairie	Prairie vole
Prairie	Big bluestem	Prairie	Purple coneflower
Prairie	Blackberries	Prairie	Regal fritillary butterfly
Pond	Cattail	Forest	Sassafras seedling
Pond	Duckweed	Prairie	Sideoats grama grass
Prairie	Grasshopper sparrow	Pond	Snapping turtle
Forest	Great horned owl	Forest	Fox squirrel
Pond	Mallard duck	Forest	Tiger salamander
Forest	Mayapple	Forest	White oak
Pond	Muskrat	Pond	Yellow water lily

lesson 3: having what it takes—to survive!

estimated time
2–3 hours

science GLEs
EC.3.C.4.a. Identify specialized structures and describe how they help plants survive in their environment (e.g., root, cactus needles, thorns, winged seed, waxy leaves)
EC.3.C.4.b. Identify specialized structures and senses and describe how they help animals survive in their environment (e.g., antennae, body covering, teeth, beaks, whiskers, appendages)
EC.3.C.4.c. Recognize internal cues (e.g., hunger) and external cues (e.g., changes in the environment) that cause organisms to behave in certain ways (e.g., hunting, migration, hibernation)
EC.3.C.4.d. Predict which plant or animal will be able to survive in a specific environment based on its special structures or behaviors
EC.1.A.4.a. Identify the ways a specific organism may interact with other organisms or with the environment (e.g., ~~pollination, shelter, seed dispersal,~~ camouflage, migration, hibernation, ~~defensive mechanism~~)

vocabulary
Specialized structures
Behave
Camouflage
Behavior
Internal cues
External cues
Hibernate

lesson objectives
1. Define specialized structures.
2. Identify specialized structures of plants and describe how they help plants survive within pond, forest and prairie ecosystems.
3. Identify specialized structures and senses and describe how they help animals survive within pond, forest and prairie ecosystems.
4. Explain how camouflage is a survival tool.
5. Recognize internal cues (e.g., hunger) and external cues (e.g., changes in the environment) that cause organisms to behave in certain ways (e.g., hunting, migration, hibernation).
6. Predict which plant or animal will be able to survive in a specific ecosystem based on its special structures or behaviors.
7. Identify the ways a specific organism may interact with other organisms or with the environment (e.g., ~~pollination, shelter, seed dispersal,~~ camouflage, migration, hibernation, ~~defensive mechanism~~).

essential questions for the lesson
1. Why do plants and animals need special structures to survive in their ecosystem?
2. How do specialized structures help plants and animals survive in different ecosystems?
3. How do plants and animals respond to internal cues and external changes in the ecosystem?

teacher notes
Students should have read Chapter 3, "Having What It Takes—to Survive!," on pages 10–17 of their student books prior to engaging in these activities.

Refer to *Field Investigations* in the Teacher Notes section. Have students present some of their previous research on and reasons for attracting birds (Ex: to work as scientists work; to engage in field investigations, etc.) to the school principal as a way to engage administration as well as gain approval and permission to proceed.

Simple feeders made from natural objects and recycled materials should cost nothing. In general, the following are preferred seed choices for common Missouri birds: black oil sunflower seeds; sunflower seed chips; suet; peanut butter (often mixed with small amounts of yellow corn meal); cracked corn; thistle (niger seed). Bags labeled as songbird mix usually contain excess seed not always completely utilized by native Missouri songbirds. However, students should be given as much freedom to experiment with other seed as seed funds and supplies allow.

Birds may not visit feeders immediately. Sometimes it takes a few days for birds to feel comfortable enough to come to something new and different in their environment. Allow students observation time even if there are no birds. Prompt discussion as to why no birds have visited. Once birds do begin visiting the feeders, prompt discussion and speculation as to why birds are there now.

Join students in bird feeder observations by recording and sharing data in a "teacher's" science notebook. Examples of some general observations and speculation can be as simple as:

Friday, December 5, 2008 — Sunny/6 degrees C — 9:20 am

Students put up 2 feeders with black oil sunflower seed and 4 suet feeders. No birds yet at those feeders.

Tuesday, December 16, 2008 — Cloudy & windy/3 degrees C — 2:10 pm

Today, two nuthatch and a small black and white bird with a red patch on the back of its head (male downy woodpecker?) visited the suet feeders.

Three goldfinch were eating from the black oil sunflower seed feeders.

Juncos and doves seem to eat seed on the ground. Rarely see them on a feeder. Eating preference? Feeders too small? Feel safer on the ground?

Activity 3.1 should be conducted over a period of days and at different times of the day, if possible, for students to improve data collection and observation skills and to provide ample data for comparison and discussion. A good resource on bird watching tips as well as photos of some of the birds students may see at their feeders may be found at *www.mdc.mo.gov/kids/out-in/2004/11/3.htm*. An article on duck bills as specialized structures may be found at *www.mdc.mo.gov/kids/out-in/2004/11/1.htm*.

outline of answers to objectives

See following page.

essential activities

Activity 3.1: Where Do You Want to Eat, Bird?
Activity 3.2: Now You See Me. Now You Don't.
Activity 3.3: Finding the Right Place at the Right Time—Staying Comfortable When You Are Cold-blooded
Activity 3.4: Specialized Structure Game

optional activities

Optional Activity 3.A. MDC video segments
Optional Activity 3.B. Bird Migration—Human Style
Optional Activity 3.C. Winter "Rap"
Optional Activity 3.D. Leaves for Survival

so, what do you know?—Lesson 3 questions and answer key

summary

Specialized structures and camouflage help organisms stay safe and survive in their ecosystems. Survival means these plants and animals will be able to grow, reproduce and increase their populations.

Organisms also react to internal and external cues. These cues cause animals to behave in ways that will also help them survive.

outline of answers to objectives—lesson 3

1. Define specialized structures. (page 10)
   a. A plant or animal part or parts that enable the plant or animal to survive in the ecosystem it lives.

2. Identify specialized structures of plants and describe how they help plants survive within pond, forest and prairie ecosystems. (pages 10–13)
   a. Pond plants
      1) Waxy or slimy coatings protect them from drying out when water levels drop.
      2) Special openings on stems or leaves allow them to absorb minerals from the waters.
      3) Roots hold arrowhead and cattails in place while the above-water leaves bring air down to the roots.
      4) Duckweed plants with thread-like roots float on the water surface.
   b. Forest plants
      1) Tree roots spread out almost twice as far as a tree is tall.
      2) Tree trunks support the branches and carry water and nutrients to and from the leaves.
      3) Tree bark surrounds tree and protects it from insects
      4) Leaves use energy from the sun to produce food for the tree.
      5) Seeds have special structures too.
         a) Wing-like structures allow them to whirl and spin to the ground.
         b) Seeds with fluffy coverings blow through the air.
         c) Seed with prickly, sticky surfaces enable them to hitch a ride on animal fur or a person's clothing.
   c. Prairie plants
      1) Big bluestem, little bluestem, prairie blazing star, compass plants, and other prairie plants have deep root systems that help them reach water and nutrients, stay attached to the ground when strong winds blow, and protect them during dry weather.
      2) Stems of roses and berries have sharp thorns to discourage animals from eating them.

3. Identify specialized structures and senses and describe how they help animals survive within pond, forest and prairie ecosystems. (pages 10–13)
   a. Pond animals
      1) Great blue herons: Long toes allow them to move easily through ponds without sinking into the soft mud. Their long, slender necks and long, sharp beaks help them snatch fish and frogs from under water.
      2) Fish use gills to get oxygen out of the water.
      3) Tadpoles to frogs: tadpoles have fish-like bodies and gills that enable them to live in the pond. As the tadpoles change into frogs they develop lungs to breathe in oxygen from the air and powerful legs and webbed feet to swim quickly in water and to leap to safety on land.
   b. Forest animals
      1) Bobcats use their soft foot pads, dappled-colored fur and keen vision and smell to sneak up on rabbits.
      2) Rabbits, mice, voles and squirrels have keen hearing to hear predators approaching.
      3) Squirrels and deer have special sharp teeth to crunch through tough acorns.
      4) Birds use their specially-shaped beaks to crack tough seed shells.
      5) Deer have a four-chambered stomach so they can digest grasses.
      6) Owls have sharp talons to grasp their prey. They also have huge eyes that gather enough light so they can see at night.
      7) Flying squirrels really don't fly, but they use their loose folds of skin to glide from one tree to the next.
   c. Prairie animals
      1) Specialized eyes, ears, feet, teeth, beaks and whiskers are specialized structures for prairie animals.
         a) Badgers use large claws for digging burrows and protecting themselves.
         b) Coyotes depend on their keen sense of smell, hearing and sight to catch mice running through tall grasses.
         c) Prairie voles and plains gophers have strong front paws for tunneling undergrounds to safety and to find food.
      2) Camouflage helps prairie animals blend into the prairie grasses and flowers.

4. Explain how camouflage is a survival tool. (page 11)
   a. Whether an animal is hunting or hiding, camouflage helps the animal blend into its surroundings.

5. Recognize internal cues (e.g., hunger) and external cues (e.g., changes in the environment) that cause organisms to behave in certain ways (e.g., hunting, migration, hibernation). (pages 16, 17)
   a. Internal cues—ones that come from within the plant or animal
      1) Hunger causes animals to hunt or forage for food.
      2) Thirst causes animals to look for water.
   b. External cues—ones that are outside of the plant or animal
      1) High heat and dryness caused by lack of rain cause plants to respond by sending roots deeper in the ground to find water.
      2) Sudden movement or sound signals possible danger and prompts animals to run, fly, swim or stay perfectly still to avoid danger.
      3) When days are shorter and cooler in the fall:
         a) Snakes, lizards and some frogs seek out dens or abandoned burrows to hibernate for winter.
         b) Some frogs and snails burrow into the mud at the bottom of the pond.
         c) Tree squirrels, mice and beavers eat more food so that they gain more fat which helps insulate them from the upcoming cold. They also gather and store more food to get them through the winter.
         d) Spiders and insects whose life cycles end with winter lay eggs that will hatch in the spring.
         e) Other insects hide underground, in soft muddy pond bottoms, in small openings in tree bark or in tunnels burrowed deep within rotting logs and tree branches.
         f) Some birds fly south (migrate) to warmer climates.
         g) Certain trees and other plants prepare for winter by cutting off nutrients to leaves and stems. The leaves fall, and plants reserve energy by going dormant, slowing down growth.
      4) When days become longer and warmer:
         a) Migratory birds return.
         b) Hibernating and dormant organisms awaken.
         c) Frogs and salamanders seek mates and lay eggs.
         d) Snakes and turtles emerge.
         e) Insects hatch.
         f) Mice move more cautiously on the ground to avoid predators.
         g) Small understory trees and other plants bloom in early spring before the leaves of taller trees grow and block the sun.

6. Predict which plant or animal will be able to survive in a specific ecosystem based on its special structures or behaviors. Answers vary. Refer to *Activity 3.4: Specialized Structure Game*.

7. Identify the ways a specific organism may interact with other organisms or with the environment (e.g.~~, pollination, shelter, seed dispersal~~, camouflage, migration, hibernation, ~~defensive mechanism~~). (pages 11, 16–17)
   a. Camouflage—Animals with camouflage blend into their surroundings.
   b. Hibernation—Animals respond to their environment. When fall days are shorter and cooler, snakes, lizards and certain frogs, for example, hibernate. They sleep or rest through winter.
   c. Migration—Ducks, geese and hummingbirds fly south or migrate from one place to another, when fall days are shorter and cooler.

activity 3.1 : where do you want to eat, bird?

estimated time 30–40 minutes (Overall time would vary depending upon observation time available over a period of time. Multiple observation periods are recommended.)

objectives

Students will be able to
1. Evaluate student-designed and student-created recycled bird feeders.
2. Complete data table and bar graphs.

teacher preparation

Students should have read Chapter 3, "Having What It Takes—To Survive!," on pages 10–17 in their student books prior to engaging in these activities.

Provide students with group time (preferably outdoors) to brainstorm which of the feeders they have already created will be used for the food they plan to provide for this observation. Each group could be assigned one or two feeders (depending on the number of students and the number of feeders available) to observe the number of birds visiting that/those feeders. Duplicate field investigations will provide good comparative data. For purposes of this activity, the same bird seed should be used in all feeders. Black oil sunflower seed would be a good first choice, but any seed available in bulk will do.

Make as many copies of *Activity 3.1 Data Table* and *Activity 3.1 Bar Graphs* as necessary. Completed *Data Tables* and *Bar Graphs* should be attached to science notebooks. The number of *Activity 3.1 Bar Graphs* pages copied will depend on the number of feeders each group is assigned to observe. The *Bar Graphs* sheet includes a graph for birds observed on a feeder and a graph for birds observed visiting below a feeder.

For the purposes of this lesson, the term "visit" refers to birds landing on a feeder or on the ground below a feeder.

Teachers should engage in this activity along with the students by observing and recording observations of bird feeding/behavior activities at the feeders in their own science notebook. Actual observation time should not exceed 10–15 minutes.

materials

Flip chart/white board (optional)
Copies of Activity 3.1 Data Table
Copies of Activity 3.1 Bar Graphs (numbers will vary)
Science notebooks
Pencils
Thermometers
Recycled bird feeders
One type of bird seed
Binoculars (optional)
Bird field guides

procedure

1. Have students complete headings in their science notebooks and take and record outside air temperature.

2. Have students work in their research groups used in *Activity 2.5*. Assign or have groups decide which one or two feeders they will observe. Have one student in each group observe the area on the ground just below their assigned feeder(s).

3. Instruct students to record the following questions in their science notebooks and base their investigations on them:
   a. How many birds visited their feeder(s)?
   b. What kinds of birds visited their feeder(s) the most?
   c. How many and what kind of birds were feeding on the ground directly below their feeder(s)? [Certain birds, such as mourning doves, prefer to feed on the ground. They may be observed eating seed knocked to the ground below the feeder(s).]

4. Instruct students to capture the information by keeping tally marks in their science notebooks when birds visit their feeder(s) and to refer to field guides to identify birds visiting their feeder(s) the most.

5. Distribute *Activity 3.1 Data Table* to students. Have students use the tallied information in their science notebooks to record their data on the *Data Table*.

6. At the end of the observation period, instruct groups to:
   a. Average out their tally marks for each feeder observed.
   b. Compile a comprehensive list of birds that visited each feeder observed and record the data in the *Data Table*.
   c. Use as many graphs (provided) to create bar graphs to illustrate the data.
   d. Complete bar graphs for birds feeding on the ground below each feeder observed.

7. Have students draw conclusions about their observations and prepare group presentations of their field investigation to the class.

wrap-up/formative assessment

Have students write one question they would like to investigate further based on their bird and/or feeder observations in this activity.

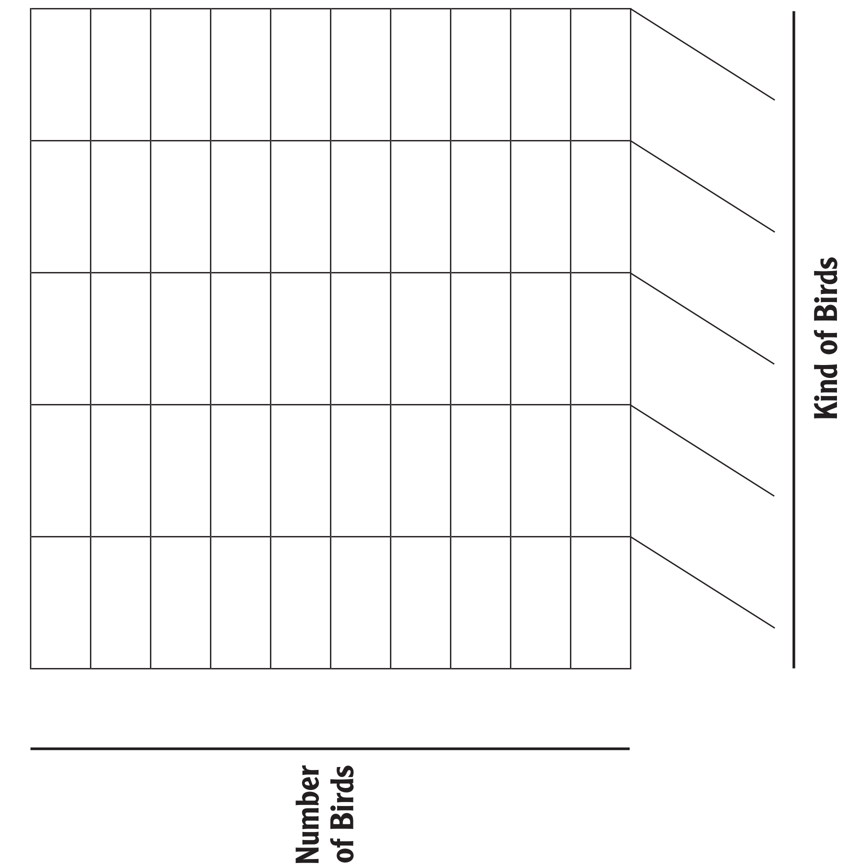
Name: ____

data table for birds visiting feeder

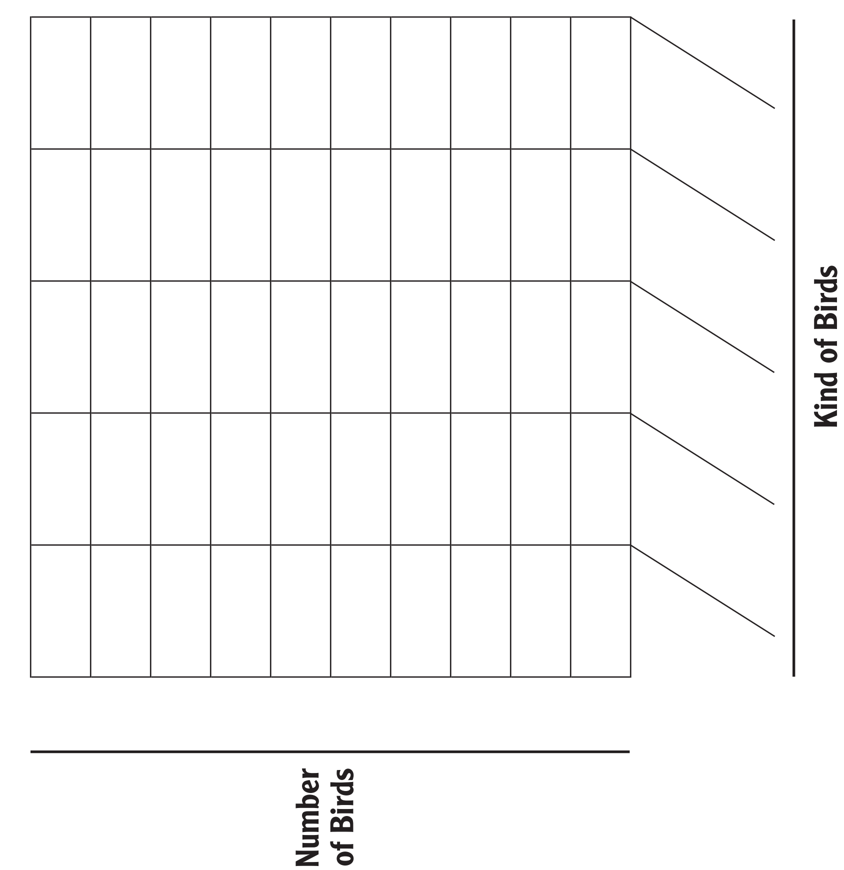
Kind of bird	Number of times this bird visited feeder	Number of times this bird visited the ground below feeder	Total

Name: ______________________________

Bar Graph Showing the Kind and Number of Birds Visiting the Ground Below Feeder



Bar Graph Showing the Kind and Number of Birds Visiting Feeder



activity 3.2 : now you see me. now you don't.

estimated time 30–40 minutes

objectives
Students will be able to
1. Explain how camouflage is a survival tool.

teacher preparation
Students may complete the first part of this activity indoors, but this is primarily an outdoor activity utilizing the schoolyard ecosystem to understand the concept of camouflage and the importance/usefulness of blending into an environment.

Once students have chosen (or been given) and colored a frog, moth *or* snake template, they must use the same animal template for the second part of the activity.

materials
Science notebooks
Pencils
Thermometers
Crayons or colored pencils
Two copies per student of at least one of the three *Animal Templates* (frog/snake/moth)
Miscellaneous extra student copies for Wrap-Up/Formative Assessment
Scissors
Clipboards (optional if coloring templates indoors)

procedure
1. Have students complete their science notebook headings and take and record outside air temperature.

2. If you plan to have students choose their animal template (frog/moth/snake), display each template and have students take their chosen animal template to wherever you plan to have them work (Ex: at their desks; on benches in the outdoor classroom; sitting on the grass and using clipboards; etc.). If supply limitations dictate making fewer copies, have enough copies available to allow two copies per student of one of the three templates *BUT* be sure to include all three templates in the activity. If animal templates are randomly distributed, hand one out to each student. In the second part of the activity, be sure each student receives a clean template of the same animal they had in the first part of the activity.

3. Instruct students to color their frog/moth/snake *any way they wish* using any colors they wish and to cut it out when they are finished.

4. Assemble students outside in their schoolyard/outdoor area and instruct them to:
   —find a place for their animal "to rest"
   —be sure they place their animal in such a way that it will not blow away
   —return to you at a pre-arranged location (within the 3-point line of the basketball court; by the swing set; on the benches in the outdoor classroom, etc.)

5. When students have returned to the pre-arranged location, walk slowly around the schoolyard with them and have them point out the colored animal templates they find. Do not allow students to move them. Once all animals have been located, have students consider the following questions:
   Q. What are the chances that your frog, moth or snake would survive in this environment?
   A. Answers will vary. A frog/moth/snake would/wouldn't have enough water, food, space or shelter (and air) to survive here.
   Q. What about being safe? Why would or wouldn't your animal be safe if another hungry animal were hunting it?
   A. Some students will recognize that the colors of their animal or where they placed their animal would cause it to stand out in the schoolyard and be easily seen by a hungry animal hunting it.

Q. If you were given a chance to color your animal again, what would you do differently?

A. Color it so it would blend in better with the colors of the schoolyard. Put it where it would be harder to see. Color it so it would be camouflaged and blend in better with its environment.

Q. Camouflage is a very useful survival tool for animals. What other animals have your read about in your student book besides frogs, moths and snakes that are camouflaged and blend into their environment?

A. Answers will vary.

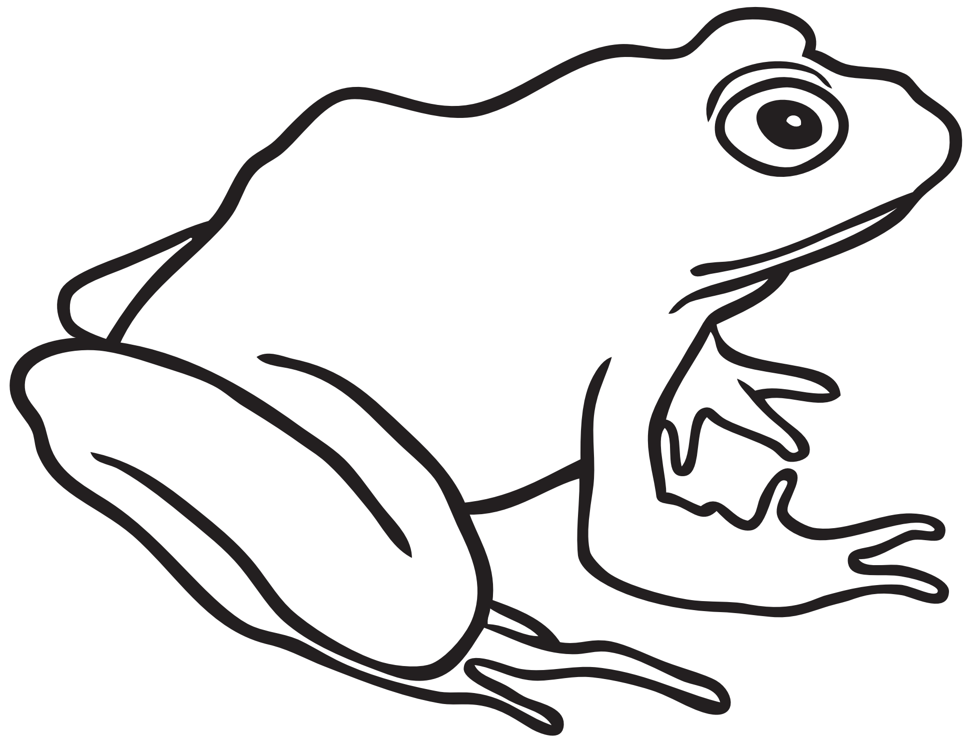
6. Match each student's colored template with a clean template of the same animal. Instruct students to color their frog, moth or snake again. This time, choose a specific environment in the schoolyard ecosystem and color the animal so that it would be camouflaged when placed in that environment.

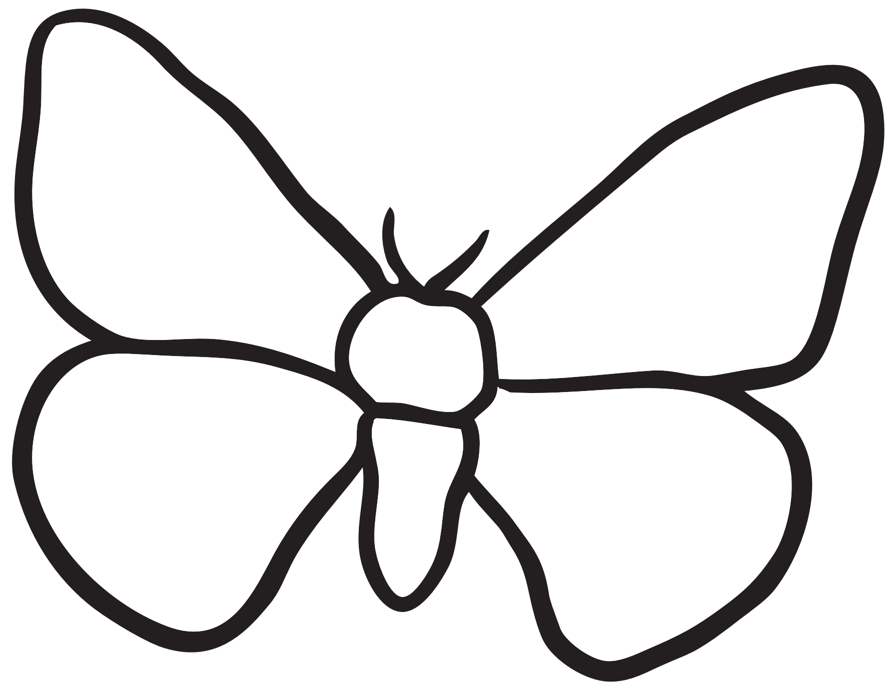
7. Have students place their camouflaged animals in the specific environments (in such a way that they will not blow away). Invite other teachers, the principal and/or other students to try to find their animals.

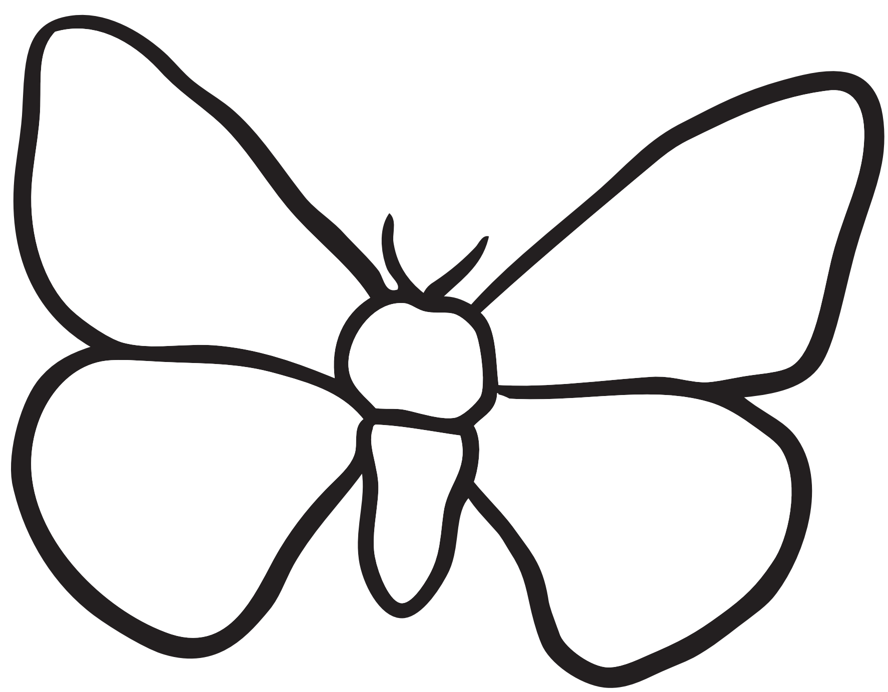
8. Discuss the effectiveness of their camouflage attempts and reinforce how camouflage is a useful survival tool for certain animals.

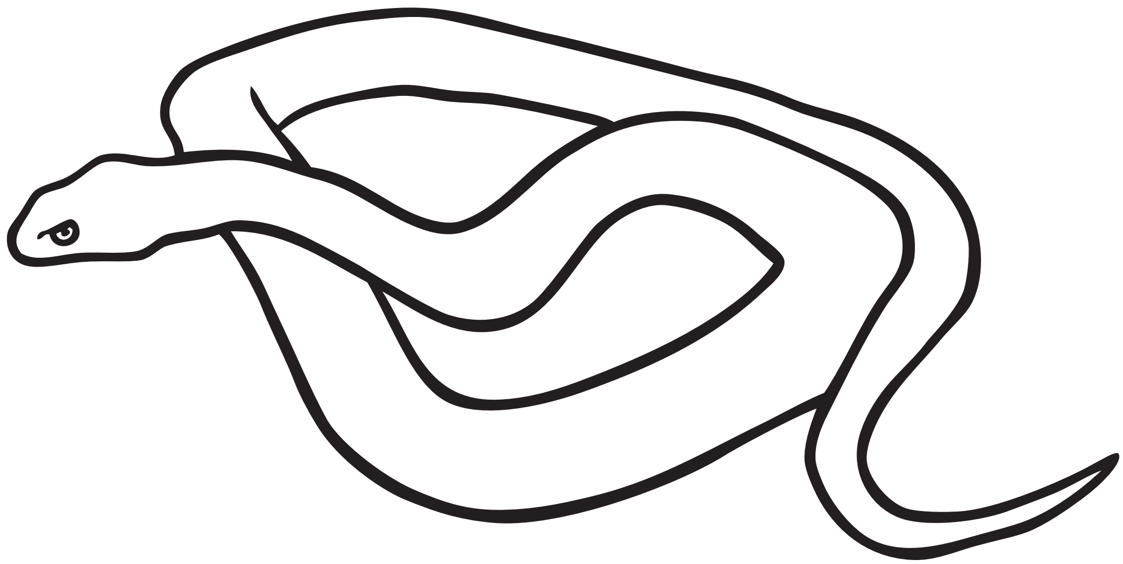
wrap-up/formative assessment

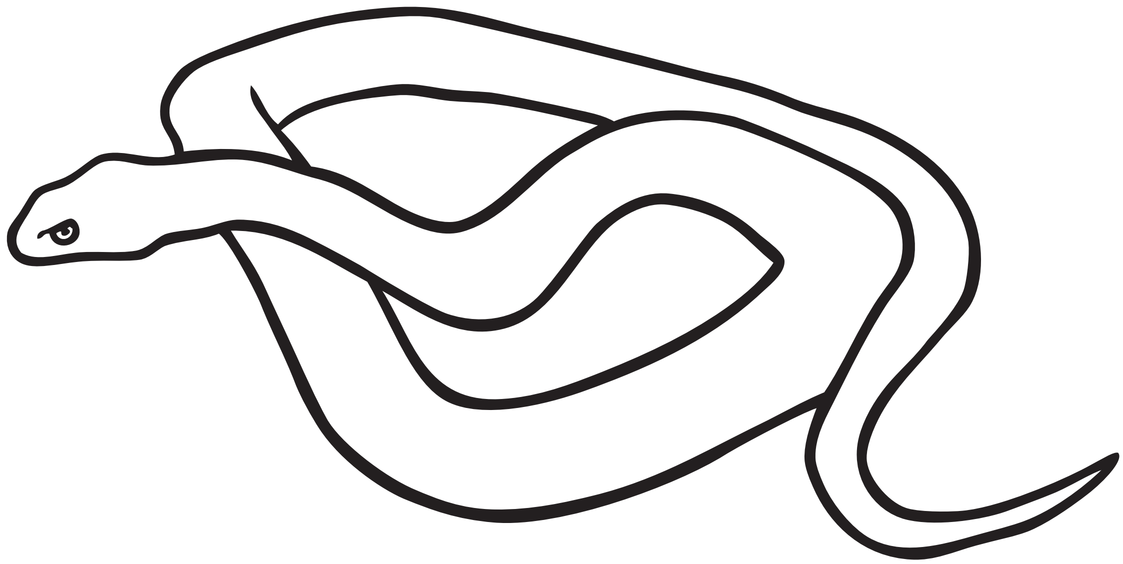
Provide students with one extra animal template to repeat this activity in an area in or around their home for one or more family members to find it. Have students write a short paragraph about the steps they took to do the activity at home and how it worked with the family member(s).











activity 3.3 : finding the right place at the right time—staying comfortable when you are cold-blooded

estimated time 30–40 minutes

objective

Students will be able to
1. Maintain a temperature range on a thermometer in an outdoor setting.
2. Explain how air temperature is an external cue that affects the behavior of cold-blooded animals.
3. Complete a data table using data collected.
4. Give a group presentation based on the results of data collection.

teacher preparation

This is an outdoor activity. Depending on the outside air temperature, it is possible that some groups may not be able to achieve a comfortable body temperature for their animal and that some groups may be able to maintain a comfortable body temperature for their animal at one location for the entire ten minutes. Such situations would provide good comparison/discussion points among groups.

Activity 3.3 Data Table should be copied for students to complete and attached to a page in their science notebooks.

Prepare the *Animal Temperature Cards* by making enough copies so each group of 3 or 4 students has one. Laminating the cards is suggested. A *Fahrenheit/Celsius Comparison Chart* is available (Appendix F) for teachers who choose to use it to help students make air temperature connections based on these city/month Fahrenheit and Celsius comparisons.

materials

Science notebooks
Pencils
Thermometers (1 per group)
Watch or stopwatch (1 per group)
Animal Temperature Cards (one card for each group of 3 or 4 students)
Fahrenheit/Celsius Comparison Chart (Appendix F)
Copies of *Activity 3.3 Data Table*

procedure

1. Have students prepare their science notebook headings and take and record outside air temperature.
   Q. How do you suppose it would feel if your body temperature always matched the air temperature of this classroom?
   A. Answers may vary. Comfortable, since the classroom has heat in the winter and air conditioning/open windows in the spring and summer.
   Q. What about at recess? How would having your body always match the air temperature in the schoolyard change the way you spent your recess time?
   A. It might be difficult to find ways to get really warmed up in the winter and ways to become really cooled down on very hot days. It could take too much time away from recess activities.

2. Explain to students that the body temperature of amphibians and reptiles become the same as the air around them. Therefore, amphibians and reptiles must always seek places within specific temperature ranges in order to survive.

3. Have students work in groups of three to four. Distribute one *Animal Temperature Card*, *Activity 3.3 Data Table*, a thermometer (hereinafter referred to as their animal), and a stop watch to each group. Inform students that it is the mission of each group to find ways to keep the "body temperature" of the animal (thermometer) within a comfortable range as indicated on their card for that animal. You will call time in ten minutes. During that time, each group should:
   - try as many different strategies as necessary to keep their animal at a comfortable body temperature
   - try each strategy for one minute
   - record 1) a brief description of each strategy (in a space under a rock; on the seat of a swing; under a bush; etc.); 2) the temperature reached for each strategy after one minute

4. Prompt students, if necessary, to try different strategies. Remind students that they need to try each strategy for one minute and that they may try as many strategies as they wish within the ten minutes. Four to five strategies would be reasonable considering student discussion and movement from one area to another.

5. Groups should complete the *Data Table* as they try different strategies. Groups should also record:
   a. The temperature of their animal (thermometer) when they first get the thermometer.
   b. The temperature of their animal (thermometer) after one minute at each location.
   c. The methods used to regulate their animal's temperature.

6. Have each group prepare a short class presentation that includes:
   - The name of the animal and its normal temperature range necessary for survival
   - A description of each location used
   - The temperature of the animal before and after one minute at each location
   - The strategy used at each location and how and why the group decided on each strategy
   - Which strategies worked better than others and why
   - What real-life strategies might their animal have used on a day similar to the day of the activity and in response to the external cue of temperature?
   - How the group members think they would spend their day if they were their animal living in their schoolyard in July with an air temperature of 26° Celsius, September with an air temperature of 19° Celsius and December with an air temperature of 1° Celsius

7. Have groups assigned the same animal compare results with each other.
   Q. How did data gathered by groups with the same animals differ? Why would there be differences?
   A. Answers will vary. Different methods/strategies were used. Timing, decision making, recording, etc., didn't work well.
   Q. How do animals that are not cold-blooded respond to an external cue of air temperature reaching 1.06 degrees Celsius?
   A. Hibernate (thirteen-lined ground squirrel), migrate, insulate, lay eggs and die off (mayflies, spiders, io moths).

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

Originally by Dr. Janice Greene, Missouri State University
Adapted by Melanie Carden-Jessen, Missouri Department of Conservation, 2000
Changed substantially for this activity, 2008

Activity 3.3—Data Table

Name of Group ____

Name of Animal ______________________________ Temperature Range for Survival ______________

Locations (Brief description of each location)	Strategy (Where and how the animal was placed in the location)	Beginning temperature (Taken at each new location)	Temperature after 1 minute	Did the strategy work? Why or why not?
Location 1 Description:				
Location 2 Description:				
Location 3 Description:				
Location 4 Description:				
Location 5 Description:				
Location 6 Description:				
Location 7 Description:				

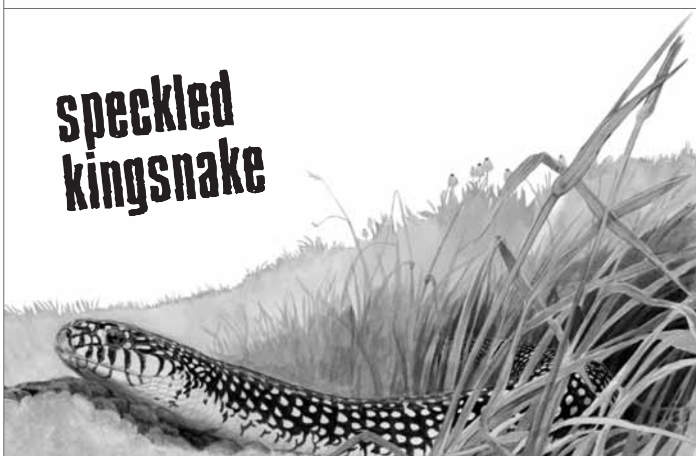
eastern collared lizard

25–34 degrees Celsius

spotted salamander

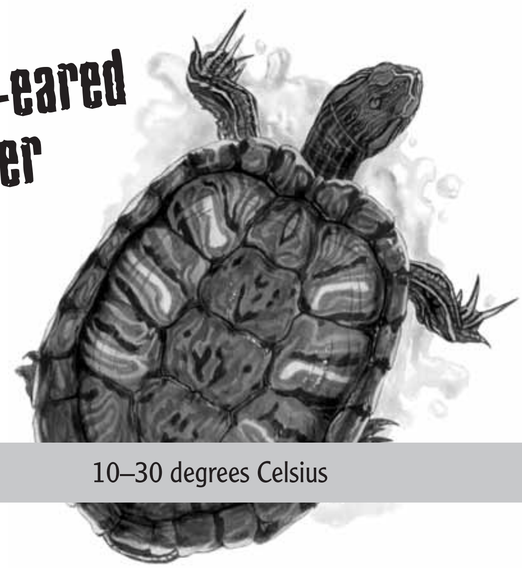
4–21 degrees Celsius

speckled kingsnake



14–30 degrees Celsius

red-eared slider



10–30 degrees Celsius

activity 3.4 : specialized structure game

estimated time 20–30 minutes

objectives

Students will be able to

1. Identify specialized structures of plants and describe how they help plants survive within pond, forest and prairie ecosystems.
2. Identify specialized structures and senses and describe how they help animals survive within pond, forest and prairie ecosystems.
3. Recognize internal cues (e.g., hunger) and external cues (e.g., changes in the environment) that cause organisms to behave in certain ways (e.g., hunting, migration, hibernation).
4. Predict which plant or animal will be able to survive in a specific ecosystem based on its special structures or behaviors.

teacher preparation

This activity may be done indoors or outdoors. It is intended to serve as a culminating activity for Lesson 3. However, it may be used throughout the rest of the Unit as a solid review of these concepts. It would also work well as a quick game to play with students when short spans of time are available. A *Specialized Structure Game Key* is provided.

Copy and cut out the cards provided. Laminate, if possible, for extended use.

materials

Activity 3.4 Structures, Organisms and Cues Game Cards
Activity 3.4 Specialized Structure Game Key
Flip chart/white board and markers

procedure

1. Have students work alone or in teams of two to four depending on time.

2. Keep score visible to students on a flip chart or white board.

3. Have one team choose a card from the *Structures, Organisms and Cues Game Cards*.

   If the card drawn is an organism, the team must supply the following when asked by the teacher:
   a. Identify the organism as a plant or an animal.
   b. Name one specialized structure for that organism.
   c. Explain how that specialized structure helps that organism survive.
   d. Predict the ecosystem in which that organism would most likely be found (pond/forest/prairie).

   If the card drawn is a specialized structure, the team must supply the following when asked by the teacher:
   a. Identify the specialized structure.
   b. Name an organism that would have that specialized structure.
   c. Explain how the specialized structure helps that organism to survive.
   d. Predict the ecosystem in which that organism and specialized structure would most likely be found (pond/forest/prairie).

   If the card drawn is a cue card, the team must supply the following when asked by the teacher:
   a. Identify whether the cue on the card is an internal cue or an external cue.
   b. Name one organism that would experience/react to the cue.
   c. Describe one possible behavior the organism might have in response to the cue.
   d. Predict the ecosystem in which an organism would experience such a cue.

4. Teams earn one point for each correct part of the answer.

5. Teams unable to score all possible points may use a "life line" and ask someone from another team for help. However, points for correct responses would be shared by both teams—one-half point to each team.

6. Continue playing until all teams have had an opportunity to draw a card or cards. Total the scores to decide the winning team.

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

long toes	strong legs and webbed feet
long, sharp beak	long tongues and beaks
gills	waxy, slimy coating
camouflage	ruffled feathers

strong roots	fluffy texture
floating, thread-like roots	prickly, sticky outer layer
strong front paws	soft footpads
wing-like shape	keen sense of sight

keen sense of smell	specially shaped beaks
keen sense of hearing	four-chambered stomach
loose folds of skin	sharp talons
sharp teeth	huge eyes

deep roots	bark
thorns	long, large claws
tree	duckweed
bullsnake	great blue heron

tadpole	arrowhead
fish	hummingbird
frog	seed
cattail	bobcat

owl	fox squirrel
rabbit	deer
mouse	song birds
vole	coyote

flying squirrel	gopher
big bluestem	roses
little bluestem	badger
blazing star	sudden sound

long periods of dry, hot weather	sudden movement
shorter, cooler days	longer, warmer days
fear	thirst
hunger	

Organism/ Animal	Specialized Structure(s)	How structure helps it survive	Ecosystem
Badger	Long, large claws	Help dig burrows/defend itself	Prairie
Bobcat	Sharp teeth Keen sense of smell/keen sense of hearing/soft footpads Camouflage	Rip and tear food Find and sneak up on animals to eat Blend in and hide from danger Blend in well enough to sneak up on animals to eat	Forest
Bullsnake	Camouflage	Blend in and hide from danger Blend in well enough to sneak up on animals to eat	Prairie
Coyote	Keen sense of smell/keen sense of sight/keen sense of hearing Soft footpads Sharp teeth	Help find food to eat Able to sneak up on animals to eat Tear and rip food	Prairie
Deer	Four-chambered stomach Keen sense of hearing Sharp teeth	Digest grasses Hear danger coming Crunch through tough acorns	Forest
Fish	Gills	Breath under water	Pond
Flying squirrel	Loose folds of skin	Acts like a parachute as it glides from tree to tree	Forest
Frog	Strong legs/webbed feet Camouflage	Jumping/swimming to escape danger Blend in and hide from danger	Pond
Gopher	Strong front paws Loose folds of skin	Tunnel underground to safety Tunnel underground to find food Turn a somersault in their tunnel to escape	Forest/Prairie
Great Blue Heron	Long toes Long, sharp beak	Walk in pond without sinking into the mud Help catch animals to eat	Pond
Hummingbird	Long tongues and beaks/ specially shaped beaks	Able to sip nectar deep within flowers	Prairie
Mouse	Keen sense of hearing	Hear danger coming	Forest
Owl	Sharp talons Huge eyes/keen sense of hearing Camouflage Ruffled feathers	Grabbing and gripping animals to eat Find animals to eat Blend in and hide from danger Blend in well enough to sneak up on animals to eat Silent flight—sneak up on animals to eat	Forest
Rabbit	Camouflage Keen sense of hearing	Blend in and hide from danger Hear danger coming	Forest
Song birds	Specially shaped beaks	Crack open seeds/eat different kinds of food	Forest/Prairie
Fox squirrel	Sharp teeth Keen sense of smell Keen sense of hearing	Crunch through tough acorns Find buried acorns Hear danger coming	Forest/Prairie
Tadpole	Gills	Breath under water	Pond
Vole	Strong front paws	Tunnel underground for safety Tunnel underground to find roots and leaves to eat	Forest/Prairie

Organism/ Plant	Specialized Structure(s)	How structure helps it survive	Ecosystem
Arrowhead	Slimy, waxy coating	Keep plant from drying out when water levels drop	Pond
Big bluestem	Strong roots Deep roots	Anchor plants against strong winds Reach water and nutrients and protect plants during dry weather	Prairie
Blackberry bush	Thorns	Keep animals away/stop animals from eating plant	Forest/Prairie
Blazing star	Strong roots Deep roots	Anchor plants against strong winds Reach water and nutrients and protect plants during dry weather	Prairie
Cattail	Slimy, waxy coating	Keep plant from drying out when water levels drop	Pond
Duckweed	Floating, threadlike roots	Allow plant to survive by floating on the surface of the water	Pond
Little bluestem	Strong roots Deep roots	Anchor plants against strong winds Reach water and nutrients and protect plants during dry weather	Prairie
Roses	Thorns	Keep animals away/stop animals from eating plant	Prairie
Seed	Fluffy texture Wing-like parts Prickly, sticky surfaces	Float through air Spin in air and help plant seed in the ground Hitch ride on the fur of animals and on people's clothing	Forest/Prairie
Tree	Strong roots Bark	Keep tree from falling over/provide tree with air, water and nutrients found in the soil Protect tree from injury and insects	Forest

Cue	Internal/ External	Response	Organism Responding	Ecosystem
Shorter, cooler days	External	Stop flow of nutrients to leaves and stems Hibernation Migration Store food Eat more to insulate bodies with extra layers of fat Mate, eat more food to lay eggs and die	Trees and other plants Certain frogs/Snakes/ Lizards/13-Lined Ground Squirrels/ Turtles/Salamanders Hummingbirds/Ducks/Geese Squirrels/Mice/Badgers Squirrels/Mice/Badgers Spiders/Certain insects	Pond/Forest/Prairie
Longer, warmer days	External	Migrate back Wake up from hibernation Seek mates and lay eggs Insects hatch Nutrients begin to flow Bloom early	Hummingbirds/Ducks/Geese Certain frogs/Snakes/ Lizards/13-Lined Ground Squirrels/ Turtles/Salamanders Birds/Insects/Salamanders/Frogs Trees and other plants Small understory trees and plants (dogwoods & mayapples)	Pond/Forest/Prairie
Long periods of dry, hot weather	External	Seek water Send roots deeper in ground Roots hold water like a sponge	Animals Trees and other plants Big & little bluestem, blazing star	Forest/Prairie Forest/Prairie Prairie
Sudden movement	External	Run, swim or fly away Hide Remain still Prepare to defend themselves	Animal answers may vary. (Rabbits tend to freeze in place when they detect sudden movement.)	Pond/Forest/Prairie
Sudden sound	External	Run, swim or fly away Hide Remain still Prepare to defend themselves	Animal answers may vary. (Rabbits tend to freeze in place when they detect sudden movement.)	Pond/Forest/Prairie
Hunger	Internal	Hunt for food Forage for food	Animal answers may vary.	Pond/Forest/Prairie
Thirst	Internal	Seek water	Animal answers may vary.	Forest/Prairie
Fear	Internal	Run, swim or fly away Hide Remain still Prepare to defend themselves	Animal answers may vary. (Rabbits tend to freeze in place when they detect sudden movement.)	Pond/Forest/Prairie

optional activity 3.a : mdc video segments

1. *Flying Squirrels* (15:46 minutes)
   They jump, climb and glide but little is known about these cute creatures of the night. We'll examine the question: Do flying squirrels really fly?

2. *Butterfly Migration* (16:13 minutes)
   We'll follow the movement of various animals as they travel on their annual migration. It's wildlife on the move without borders.

3. *Songbird Migration* (6:37 minutes)
   See how the work of this bird crew plays a role in finding out what's best for our forests.

4. *Waterfowl Migration* (5:47 minutes)
   Take to the skies and see how aerial waterfowl surveys benefit both wetland managers and waterfowl hunters.

optional activity 3.b : bird migration—human style

estimated time 40–50 minutes

objectives

Students will be able to
1. Demonstrate use of a compass and coordinates to follow a "migration route" through the schoolyard.
2. Describe some of the basic needs of migratory birds.

teacher preparation

This is an outdoor activity. Preparation for this activity requires helping students become comfortable using a compass, following headings (also referred to as coordinates), calculating number of paces, etc., as demonstrated during the required *Nature Unleashed* training with a MDC education consultant. A good resource is David Sobel's book, *Mapmaking With Children*. Sobel provides excellent worksheets to help students determine paces (see Worksheet #1 and #2 on pages 143 and 144 of his book). Sobel also provides a good fourth grade classroom project described on pages 134–136 blending mapmaking with the novel, *Ronia, the Robber's Daughter* (1985).

This activity requires students to follow sets of instructions (headings and paces or numbers of steps) "to migrate" to up to five locations (migratory areas for food and rest) around the schoolyard and to follow instructions for writing/sketching in their science notebooks at each location.

Set up for the migration paths is required before the class session begins. Any number of sets of migration paths can be created. Some session migration path sets could be planned and created by students for each other as they become more proficient at the exercise.

Students should work in small groups as compass supplies allow. More than one migration path may be set up by having headings for each path written on specific colored paper (Ex: Migration Path 1—red paper; Migration Path 2—blue paper, etc.). Lettered beads and string are optional and may be used as items to be retrieved—one from each food/rest stop along the path. Five beads should provide each students with a word related to the activity (Ex: birds; foods; homes; space; water; geese; ducks, etc.) Students may then string up the retrieved and unscrambled word(s) and use them as a bookmark for their students books, bracelets, key rings, etc.

materials

Science notebooks
Pencils
Thermometers
Compasses
Migration Heading Cards (one or more color sets)
Containers set out at specific coordinates around the schoolyard (matching *Migration Heading Card* colors, if necessary)
Lettered beads (optional)
String, yarn, ribbon, jute, etc. (optional)

procedure

1. Have students prepare their science notebook headings and take and record outside air temperature.

2. If there are a large number of students, set up heading/coordinate cards in different colors that match different sequences of travel through the course. Line students up at one or more starting locations.

3. Explain to students that they represent small flocks of migrating birds that must stop to rest at very specific locations. Students must follow the instructions on the card drawn at each resting or feeding spot, and complete the entire course in order to survive.

4. Instruct students to work together to ensure the survival of their flock.

5. One student from each flock should draw a red, blue or green *Migration Heading Card* (colors will vary or may not be used at all according to the specific course set up) that contains a heading and a distance in feet, yards, an average number of paces or steps that the flock must follow in order to reach their first rest stop along their migration route. (See sample cards included in this activity.)

6. Once the flock reaches the first rest stop, another student should reach into the container of *Migration Heading Cards* with the same color as their first card (if applicable), follow the directions listed below the *Migration Heading Card* line, take a bead or other object (if applicable) and follow the heading at the top of the card to reach the next stop.

7. Students should continue this way this way making certain to take cards of the same color as their first card (if applicable), following all science notebook writing/sketching instructions and following headings to the remaining rest and food stops.

8. If students arrive back too quickly, check their science notebooks to see if they hit all the stops and followed the instructions. If they missed any stops or failed to complete any science notebook writing/sketching activities, they may be considered unsuccessful at surviving their migration due to lack of food, rest and water. If beads were to be picked up at each station, it can be determined where a flock may have missed their stop(s) if they have too few beads or if the beads do not spell the correct word(s).

9. Once all flocks have completed their migration, have students share their migration experiences and science notebook writing/sketching entries. If beads were used at stations, this would be a good time to pass around string, jute or yarn for students to string their migration words together to form a bookmark for their science notebooks, bracelets, etc.

Wrap-Up/Formative Assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

migration heading card 1

Heading degrees _______

At a distance of ________

migration heading card 4

Heading degrees _______

At a distance of ________

While resting here, describe in your science notebook an organism you passed along the way.

migration heading card 2

Heading degrees _______

At a distance of ________

While resting here, write in your science notebook about:

1) Today's weather
2) How it makes you feel
3) How it might affect a migrating bird

migration heading card 5

Heading degrees _______

At a distance of ________

Hungry? Look around and list in your science notebook any organisms you see eating or possibly looking for food.

migration heading card 3

Heading degrees _______

At a distance of ________

While resting here:

1) Close your eyes and count the sounds you hear.
2) Describe some of them in your science notebook.

migration heading card 6

Heading degrees _______

At a distance of ________

Congratulations! You have survived your migration!

1) Put away your compass.
2) Read over your science notebook entries.
3) In your science notebook, sketch something you saw while you were "migrating."

optional activity 3.c : winter "rap"

Use this short "rap" song to reinforce what hibernate, insulate, terminate and migrate mean. Repeat several times as needed.

words	action
Some hibernate. (Group repeats with action.)	(Tilt head to side, place hands together under cheek, close eyes—as if sleeping.)
Some insulate. (Group repeats with action.)	(Arms at sides, elbows bent—as if putting on weight.)
Some terminate. (Group repeats with action.)	(Cross arms over chest—as if "dead.")
Some migrate. (Group repeats with action.)	(Hook thumbs under arms and flap elbows—as if flapping wings and flying.)

Repeat several times after the "-ate" terms are explained and understood.

optional activity 3.d : leaves for survival

estimated time 30 minutes in classroom; 30 minutes in schoolyard

objective
Students will make observations to identify leaf structures that enable plants to survive in the schoolyard environment.

materials
Round-head brass fasteners
Scissors
Copies of *Wheel 1* and *Wheel 2* (preferably on cardstock)

background information
Plants have adaptations that help them to survive and grow in different environments. Plants of the prairie live in an exposed setting where direct sun and high temperatures create a dry environment. Adaptations which help plants to conserve water include leaves which are very small, narrow, fuzzy or waxy. Some plants have leaves which turn, twist or droop to avoid the sun during the hottest part of the day. Prairie plants also have deep root systems to obtain water. Flexible stems help plants to withstand high wind and snowy conditions found in the prairie.

In contrast, plants which grow in a forest environment may have larger, wider leaves which help to collect light in more shaded conditions. Leaves may be thinner and lighter so that a plant can hold more leaves. Leaves which are smooth can shed rainwater before damaging mold can develop on the leaf. Plants adapted for shade may have a spread leaf arrangement, such as a radiating or alternating pattern, so that the leaves do not over-shade each other. Leaves which are deciduous protect the plant from freezing and also from breaking under the weight of winter snow and ice.

Plants adapted for pond environments may have flexible stems and leaves which float on the surface of the water. Plants in all environments may have adaptations which protect from being eaten by insects and other animals. These adaptations include thorns, tough leaves and saps or oils which would be distasteful to animals.

procedure
1. Have the students brainstorm a list of environmental conditions which might affect the ability of plants to grow and survive. Write down some of these conditions on the board. (Refer to the outline below as an aid for discussion.)

Environmental conditions affecting plants:

1) Air
   a. Wind
   b. Temperature
      i. High heat
      ii. Cold/freezing
2) Water
   a. Dryness
   b. Wetness
3) Light
   a. Shade
   b. Sun
4) Animals (consumers)

2. Have the students compare and contrast how these conditions differ within forest, prairie and pond ecosystems. Ask them to think about how plants might be adapted for these environmental conditions; what special features they might have for survival. Explain that although flowers and seeds can have special features for pollination, and dispersal, this activity will focus on adaptations of leaves for specific environmental conditions. Use information from Table 1 to provide examples of how plant leaves may be adapted for specific environmental conditions.

Table 1

Leaf adaptations	How it helps the plant	Environmental conditions
Large leaves	Gathers light	Shade
Fuzzy leaves	Conserves water (also protects from freezing)	Hot and dry Also cold and freezing
Long, narrow leaves	Conserves water	Hot and dry
Tiny leaves	Conserves water	Hot and dry
Waxy and shiny leaves	Conserves water (also protects from freezing)	Hot and dry Also cold and freezing
Smooth leaves	Sheds water and prevents molding	Moist and shade
Thick leaves	Conserves water	Hot and dry
Leaves twist or droop	Conserves water	Hot and dry
Leaves spread in circle	Gathers light	Shade
Loses leaves in winter	Protects from freezing	Cold and freezing
Floating leaves	Gathers light	Deeper water
Spines or prickles	Protects from being eaten	Any
Flexible leaves and stems	Prevents breaking	Windy environments

3. Hand out the copies of *Wheel 1* and *Wheel 2*. Have them cut out *Wheel 1* and attach it at the center point of *Wheel 2* with the round-head brass fastener.The wheel can be used to select a leaf type, displaying the function of that adaptation for specific environmental conditions.

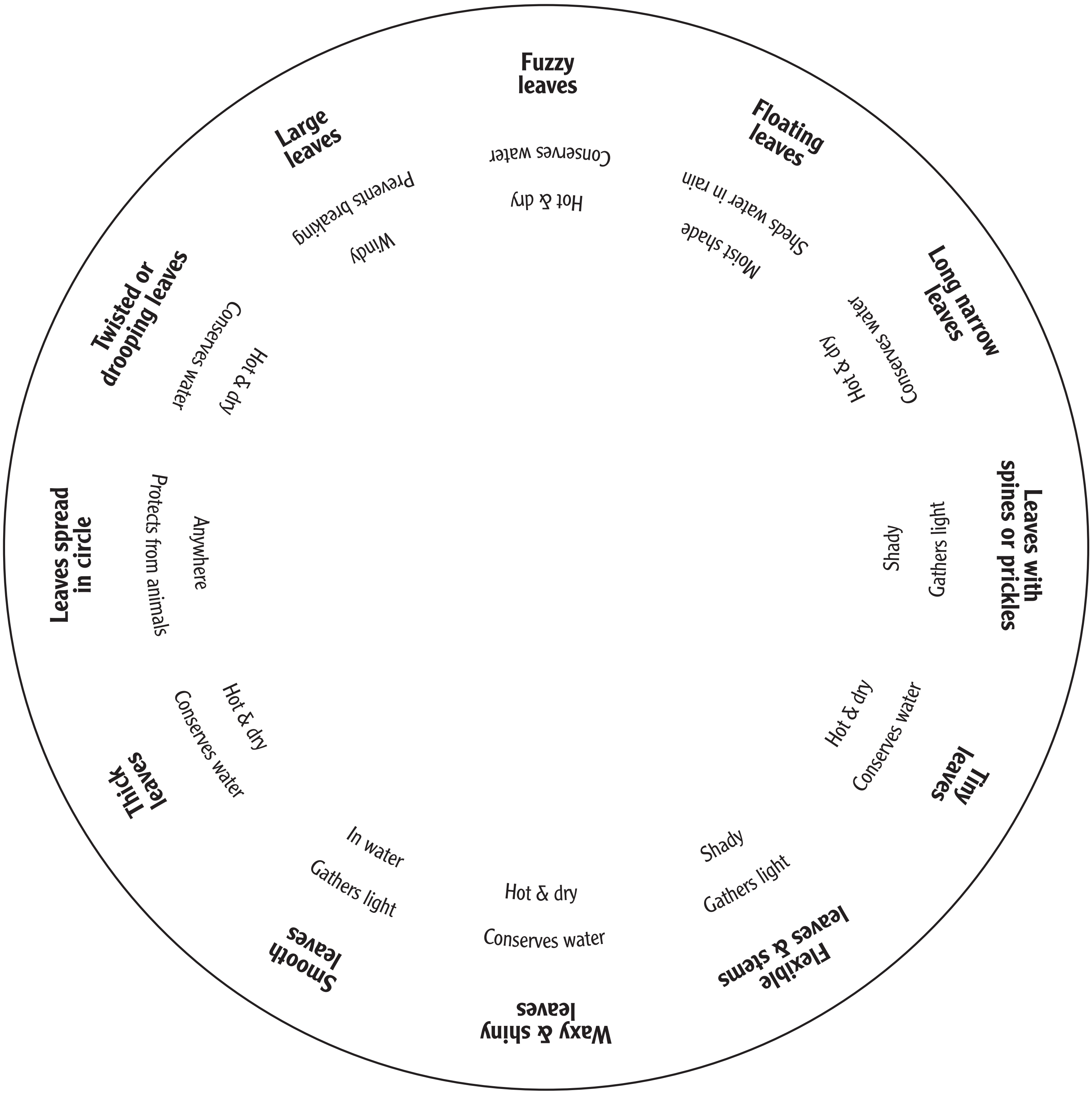
4. Demonstrate using the leaf adaptation wheel. Show the students that when they direct the arrow of the wheel towards a leaf type, how that adaptation helps the plant, and the environmental conditions where this adaptation is needed, will be displayed in the opening of the wheel.

5. Prepare students to go outdoors. Establish the boundaries, time limitation and signal to reconvene. Provide advice about safety concerns such as poison ivy (if present) and stinging insects. Explain that their task is to search the schoolyard for leaves which have the adaptations described on the "Dial-O-Leaf." Their objective is to find as many different kinds of leaf adaptations as they are able.

6. Return to the classroom. Review and discuss with the students. How many different types of leaf adaptations could be located in the schoolyard? What was the most common type of adaptation? (The students may discover that plant adaptations for cold and freezing environments are similar to those for hot and dry environments. This is particularly evident in evergreen trees and shrubs.) Were any other plant or leaf adaptations discovered which were not on the wheel? What were they? What can be determined about the schoolyard environment by understanding plant adaptations? How would the activity be different in other types of ecosystems?

7. Conclude the activity by restating that plants have many adaptations which help them to survive and grow in different environments.

Adapted with permission from David Bruns, Missouri Department of Conservation Education Consultant


Fuzzy leaves
Conserves water
Hot & dry
Floating leaves
Sheds water in rain
Moist shade
Long narrow leaves
Conserves water
Hot & dry
Leaves with spines or prickles
Gathers light
Shady
Tiny leaves
Conserves water
Hot & dry
Flexible leaves & stems
Gathers light
Shady
Waxy & shiny leaves
Conserves water
Hot & dry
Smooth leaves
Gathers light
In water
Thick leaves
Conserves water
Hot & dry
Leaves spread in circle
Protects from animals
Anywhere
Twisted or drooping leaves
Conserves water
Hot & dry
Large leaves
Prevents breaking
Windy


LEAF TYPE
ADAPTED FOR:
ENVIRONMENTAL CONDITION
FUNCTION:
(HOW IT HELPS THE PLANT)

so, what do you know?—lesson 3

1. What helps plants and animals live in their specific ecosystem?

________________________________ ________________________________

2. Place the letter of the specialized structure on the line next to the plant or animal that has it.

_________ snapping turtle	a. above-water leaves bring oxygen to roots
_________ fish	b. gills
_________ duckweed	c. long toes
_________ arrowhead	d. great big jaws
_________ great blue heron	e. thread-like roots that float in water

3. The plants and animals listed in #2 above survive in which ecosystem?

a. forest b. pond c. prairie

4. Place the letter of the specialized structure on the line next to the plant or animal that has it.

_________ badger	a. bright pink color
_________ blackberries	b. roots 8 feet deep
_________ round-winged katydid	c. keen sense of smell, hearing and sight
_________ bullsnake	d. thorns
_________ little bluestem	e. large claws
_________ coyote	f. color and markings that blend in with its ecosystem

5. The plants and animals listed in #4 above survive in which ecosystem?

a. forest b. pond c. prairie

6. Place the letter of the specialized structure on the line next to the plant or animal that has it.

_________ bobcats	a. trunks support branches
_________ owls	b. loose folds of skin stretch out to glide
_________ flying squirrels	c. soft foot pads and dappled fur
_________ snakes	d. venom glands
_________ trees	e. huge eyes and sharp talons

7. The plants and animals listed in #6 above survive in which ecosystem?

a. forest b. pond c. prairie

8. How does camouflage help animals survive?

9. What is an animal doing if it is sleeping through the winter?

10. What internal cue causes an animal to search for water?

so, what do you know?—lesson 3

answer key

1. What helps plants and animals live in their specific ecosystem? (1 point)

specialized structures

2. Place the letter of the specialized structure on the line next to the plant or animal that has it. (1 point each, 5 points total)

d	snapping turtle	a. above-water leaves bring oxygen to roots
b	fish	b. gills
e	duckweed	c. long toes
a	arrowhead	d. great big jaws
c	great blue heron	e. thread-like roots that float in water

3. The plants and animals listed in #2 above survive in which ecosystem? (1 point)

answer — b. pond

4. Place the letter of the specialized structure on the line next to the plant or animal that has it. (1 point each, 6 points total)

e	badger	a. bright pink color
d	blackberries	b. roots 8 feet deep
a	round-winged katydid	c. keen sense of smell, hearing and sight
f	bullsnake	d. thorns
b	little bluestem	e. large claws
c	coyote	f. color and markings that blend in with its ecosystem

5. The plants and animals listed in #4 above survive in which ecosystem? (1 point)

answer — c. prairie

6. Place the letter of the specialized structure on the line next to the plant or animal that has it. (1 point each, 5 points total)

c	bobcats	a. trunks support branches
e	owls	b. loose folds of skin stretch out to glide
b	flying squirrels	c. soft foot pads and dappled fur
d	snakes	d. venom glands
a	trees	e. huge eyes and sharp talons

7. The plants and animals listed in #6 above survive in which ecosystem? (1 point)

answer — a. forest

8. How does camouflage help animals survive? (2 points)

answer — It helps the animal blend into its surroundings whether it is hunting for food or hiding. [Other sentences that convey the same meaning are acceptable.]

9. What is an animal doing if it is sleeping through the winter? (1 point)

answer — Hibernating

10. What internal cue causes an animal to search for water? (1 point)

answer —Thirst

lesson 4: chain of foods

estimated time
1½–2 hours

science GLEs
EC.2.A.3.a. Identify sunlight as the primary source of energy plants use to produce their own food
EC.2.A.3.b. Classify populations of organisms as producers or consumers by the role they serve in the ecosystem
EC.2.A.3.c. Sequence the flow of energy through a food chain beginning with the sun
EC.2.A.3.d. Predict the possible effects of removing an organism from a food chain
ME.2.C.3.a. Recognize the sun is the primary source of light and food energy on earth
LO.1.E.5.b. Distinguish between plants (which use sunlight to make their own food) and animals (which must consume energy-rich food)

vocabulary
Food chains
Producers
Consumers
Nocturnal

lesson objectives
1. Identify the primary source of energy plants use to produce their own food.
2. Explain the difference between a producer and a consumer.
3. Classify populations of organisms as producers or consumers by the role they serve in the ecosystem.
4. Sequence the flow of energy through a food chain beginning with the sun.
5. Predict the possible effects of removing a population of organisms from a food chain.

essential questions for the lesson
1. Where do organisms get their energy?
2. Where do you get your energy?
3. What is the relationship between the sun and living organisms?
4. Why is it important to have strong food chains in (healthy) ecosystems?

teacher notes
Students should have read Chapter 4, "Chain of Foods," on pages 18–23 of their student books prior to engaging in these activities.

outline of answers to objectives
See following page.

essential activities
Activity 4.1: Basic Food Chain Paper Links
Activity 4.2: Food Chains
Activity 4.3: Schoolyard Ecosystem Food Chains

optional activities
Optional Activity 4.A: MDC video segments
Optional Activity 4.B: Owl Pellet Dissection Practice
Optional Activity 4.C: Owl Pellets—The Real Deal
Optional Activity 4.D: Beaks, Seeds and Places To Eat

summary
Plants and animals need and use the energy of the sun in different ways. Plants are producers because they use sunlight directly for energy to make their own food. Animals are consumers because they get their food and energy by eating plants and other animals. Energy from the sun is passed up through all food chains—as the producers (plants) are eaten by the consumers (animals). When a population in a food chain is eliminated, the rest of the food chain is affected.

outline of answers to objectives—lesson 4

1. Identify the primary source of energy plants use to produce their own food. (page 18)
   a. The sun

2. Explain the difference between a producer and a consumer. (page 19)
   a. Producers are organisms that make their own food. Plants are producers. Each plant acts as its own food factory using energy from the sun to create or "cook up" its "energy recipe." Carbon dioxide from the air and minerals from the soil and water are used by plants in this "recipe", but sunlight is the key ingredient.
   b. Consumers are organisms that eat other organisms to get the energy they need to survive. Animals eat other organisms so they are consumers. A portion of the energy from the sun is passed from the plant to an animal and from that animal to another animal.

3. Classify populations of organisms as producers or consumers by the role they serve in the ecosystem. (pages 19–23)
   a. Pond ecosystem
      i. Producers—examples include cattails, arrowhead plants, algae
      ii. Consumers—examples include tadpoles, great blue herons, water fleas, predacious diving beetles, largemouth bass, fishing spiders
   b. Forest ecosystem
      i. Producers—example includes hickory trees
      ii. Consumers—squirrels, owls, pileated woodpeckers, Io moth caterpillars, sowbugs, ovenbirds, bobcats, flying squirrels
   c. Prairie ecosystem
      i. Producers—grasses
      ii. Consumers—rabbits, coyotes, mice, voles, snakes, hawks, grasshopper sparrows, leaf beetles, grassland crayfish, northern crawfish frogs, speckled kingsnake

   * NOTE: Additional producers and consumers are included on the posters—Missouri Pond Life; Forests: Layers of Leaves; Prairie: Life Among the Grasses. The back of each poster provides this information.

4. Sequence the flow of energy through a food chain beginning with the sun. (pages 19–23)
   a. Pond ecosystem examples
      i. Sun ➲algae ➲tadpole ➲fish ➲great blue heron
      ii. Sun ➲algae ➲water flea ➲predacious diving beetle
   b. Forest ecosystem examples
      i. Sun ➲hickory tree (nut) ➲squirrel ➲great horned owl
      ii. Sun ➲leaves ➲sowbug ➲ovenbird
   c. Prairie ecosystem examples
      i. Sun ➲grass (seed) ➲rabbit ➲coyote
      ii. Sun ➲decaying plants ➲leaf beetle ➲grassland crayfish ➲northern crawfish frog

5. Predict the possible effects of removing a population of organisms from a food chain.
   a. When populations of organisms disappear from communities, food chains break down and the entire ecosystem is weakened.
   b. Pond example—If all frogs in the pond become sick and die, fish and other frog-eating animals in and around the pond would have less food to eat.
   c. Prairie example—If prairie grasses disappeared, populations of mice and voles would decrease because they would have less of their main food source to eat. Populations of snakes that get energy from the mice and voles they eat would decrease. Hawks would have fewer mice, voles, and snakes to eat and feed their young.

activity 4.1 : basic food chain paper links

estimated time 30 minutes

objectives

Students will be able to
1. Identify the primary source of energy plants use to produce their own food.
2. Explain the difference between a producer and consumer.
3. Sequence the flow of energy through a food chain beginning with the sun.

teacher preparation

Student should have read Chapter 4, "Chain of Foods," on pages 18–23 of their student books prior to engaging in these activities.

This activity will serve as a review for students who have studied food chains in a lower grade as well as a basic introduction to the concept of food chains.

Paper strips (*Activity 4.1 Food Chain Components*) should be photocopied, cut out and available for students along with Scotch tape. If possible, pages should be photocopied on colored paper.

For example:

—yellow paper for strips SUN pictures.
—green paper for strips with the word PRODUCER and various producer pictures.
—blue paper for strips with the word PLANT CONSUMER and various pictures of animals that eat plants.
—brown paper for strips with the word ANIMAL CONSUMER and various pictures of animals that eat other animals.

materials

Colored strips (as noted above)
Scotch tape
Student books
Flip chart/white board and markers

procedure

1. Review the concept and basic components of a food chain.
   Q. When we talk about a food chain, what do we mean?
   A. Answers may vary. Food chains pass energy from the sun up through producers and through consumers that eat producers. Plants make their own food by using energy from the sun, and animals get their energy by eating plants and other animals.
   Q. How are people part of food chains?
   A. People get energy by eating plants and animals.

2. Have students work in groups of three to four. Instruct them to think about the most recent meal they have eaten and how one or more parts of their meal can be traced back to the sun.
   Q. What did you have for breakfast/lunch/snack/dinner?
   A. Answers will vary. Choose one item from one student's meal and work the food chain links from the sun to the student. For example, if a student ate a hamburger with ketchup and pickles on a bun and drank a container of milk, write the food chain links on the board and talk through each link as shown in brackets:

   Sun ➲ Grass ➲ Cow ➲ Student

   [The sun provided energy to the grass to produce its own food. Energy from the grass was passed along to the cow when the cow ate/consumed it. Energy from the cow was passed along to the student when the student ate/consumed the cow (in the form of a hamburger).]

   Sun ➲ Tomato ➲ Student

   [The sun provided energy to the tomato (plant) to produce its own food. Energy from the tomato was passed along to the student when the student ate/consumed it (in the form of ketchup).]

   Sun ➲ Pickle ➲ Student

[The sun provided energy to the pickle (plant) to produce its own food. Energy from the pickle was passed along to the student when the student ate/consumed it.)]

Sun➲Wheat➲Student

[The sun provided energy to the wheat (plant) to produce its own food. Energy from the wheat was passed along to the student when the student ate/consumed it (in the form of flour baked into a bun).]

Sun➲Grass➲Cow➲Student

[The sun provided energy to the grass to produce its own food. Energy from the grass was passed along to the cow when the cow ate/consumed it. Energy from the cow was passed along to the student when the student drank/consumed the milk.]

3. Have students look at the food chains on the board:
   Q. Which items in these meals are producers? What makes them producers?
   A. The grass, tomato (in the form of ketchup), pickle and wheat (in the form of a bun) are producers because they are plants that get their energy to make their own food directly from the sun.
   Q. What are the cow and the student?
   A. The cow and the student are consumers.
   Q. Why are they called consumers?
   A. Consumers eat or consume other organisms to get energy. The cow consumed the grass to get energy, and the student consumed the tomato, the pickle, the wheat (in the form of a bun) and the cow (in the form of a hamburger).

4. Have students work in groups to create one set of food chain links for a composite of their most recent meal. Instruct them to be prepared to present their food chains to the class in such a way that each group member explains one or more links, depending on the length of the chain(s). Instruct students to follow the pattern demonstrated above and list each set of links and explain each chain, link by link, backwards from the student to the sun. Students should put a "P" above the producers and a "C" above the consumers in their chains.
   For example, students will discuss what each of them recently ate and decide on one group of meal items to use. (Ex: One student ate a peanut butter and jelly sandwich and Oreo cookies. Another student ate a hamburger with French fries. A third student ate a hot dog with mustard and relish and had Jell-o* for dessert. Students could choose to do a set of food chain links for a "composite" student who ate a peanut butter and jelly sandwich, French fries and Jell-o for lunch.)

   ** Items such as Jell-o might give students difficulty. Ask them what they think the main ingredient in Jell-o is besides water—sugar. Sugar comes from sugar cane which is a plant that produces its own food by using energy from the sun. Work students through similar thought processes with other food items with main ingredients not easily identified.*

5. Have students look at the food chains in their student books on the bottom of pages 19, 21 and 23 for the pond, forest and prairie ecosystems. Beginning with the sun, have students recite each link in each food chain with you. For example, the food chain on the bottom of page 19 for the pond ecosystem shows: Sun➲algae➲water flea➲predacious dividing beetle. The sun gave energy to the algae (a producer) which it used to make its own food. When the algae was eaten by the water flea (a consumer), energy was passed to the water flea. When the water flea was eaten by the predacious diving beetle (a consumer), energy was passed to the predacious diving beetle.
   Q. How could this chain be made shorter or longer?
   A. It could have been a shorter food chain if the water flea had eaten the algae and died because the pond water dried up. It could have been longer if a green frog (a consumer) had come along and eaten the predacious diving beetle *and then* a northern water snake (a consumer) had come along and eaten the green frog.
   Q. How else could this food chain have been different?
   A. Answers will vary. The water flea could have been eaten by a blue-fronted dancer dragonfly nymph (a consumer) that could have been eaten by a bluegill fish (a consumer).
   Q. How would you describe the forest food chain on the bottom of page 21 of your books?
   A. Sun➲decaying leaves➲sowbug➲ovenbird:
      - The sun gave energy to the leaves (producers) when they were still living which the leaves used to make their own food. When the decaying leaves were eaten by the sowbug (a consumer), energy that was still contained in the decaying leaves was passed to the sowbug. When the sowbug was eaten by the ovenbird (a consumer), energy was passed to the ovenbird.
      - This could have been shortened if the sowbug (after eating the decaying leaves) had died from being stepped on by a deer walking through the woods.

- This could have been longer if a Texas ratsnake (a consumer) had slithered along and eaten the ovenbird *and* a great horned owl (a consumer) swept down and grabbed and ate the Texas ratsnake.

Q. How would you describe the prairie food chain on the bottom of page 23 in your books?

A. Sun ➲ decaying plants ➲ leaf beetle ➲ grassland crayfish ➲ northern crawfish frog

- The sun gave energy to the decaying plants (producers) when they were still living which the plants used to make their own food. When the decaying plants were eaten by the leaf beetle (a consumer), energy that was still contained in the decaying plants was passed to the leaf beetle. When the leaf beetle was eaten by the grassland crayfish (a consumer), energy was passed to the grassland crayfish. When the grassland crayfish was eaten by the northern crawfish frog (a consumer), energy from the grassland crayfish was passed along to the northern crawfish frog.
- This food chain could have been shorter if a badger (a consumer) had come along and eaten the northern crawfish frog before it had a chance to eat the grassland crayfish.

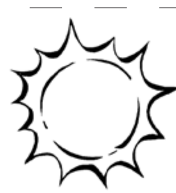
6. Using the paper chain cut-outs and Scotch tape, have students make their own simple food chains. Students should choose a sun strip, a producer strip, a plant consumer strip and an animal consumer strip. The link a student decides to use as the first link should be looped over and taped one end over the other (like a bracelet). The second link chosen by the student should be slipped through the first link, looped over and taped one end over the other (the beginning of a chain). Students should continue adding links to their food chains.

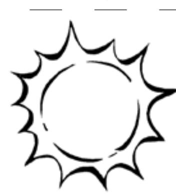
7. Have students share their links checking to see that the simple connections are possible ones and that every chain begins with the sun and moves to a producer and then consumers. Have students use the same repeated phrases as used for the first food chain they created that included humans.

8. Discuss what might happen to their chains if one paper link were torn apart and removed. Discuss what might happen if the organisms in their food chains were removed from an ecosystem.

Wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

Adapted with permission from Linda Chorice, Missouri Department of Conservation Springfield Conservation Nature Center





Producer 

Producer 

Producer 

Producer 

Producer 

Producer 

Producer 

Producer 

Producer 

Plant
Consumer

Plant
Consumer

Plant
Consumer

Plant
Consumer

Plant
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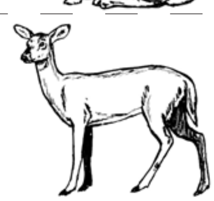
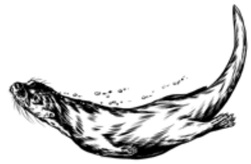
Consumer



Animal
Consumer

Animal
Consumer



Animal
Consumer

Animal
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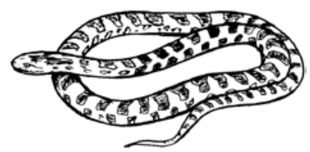
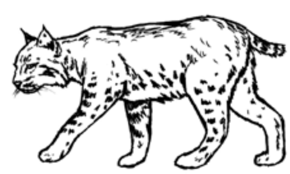


Animal
Consumer

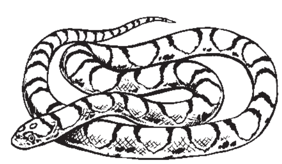
Animal
Consumer

Animal
Consumer

Animal
Consumer



Animal
Consumer



activity 4.2 : food chains

estimated time 30 minutes

objectives

Students will be able to

1. Identify the primary source of energy plants use to produce their own food.
2. Explain the difference between a producer and consumer.
3. Sequence the flow of energy through a food chain beginning with the sun.
4. Classify populations of organisms as producers or consumers by the role they serve in the ecosystem.
5. Predict the possible effects of removing a population from a food chain.

teacher preparation

This activity will work best in a large, open area such as the schoolyard or ball field.

It is recommended to:

- make two or three copies of the *Food Chain Cards*.
- laminate the *Food Chain Cards*.
- punch two holes on either side of the top of each card.
- lace yarn through the holes and tie the ends together. Yarn should be long enough to go easily over the heads of students and hang loosely enough around their necks to allow them easy access to the information on the cards.
- separate the Producer Cards from the Consumer Cards.

Extra sets of cards will allow for classes with more than 20 students, will allow teachers to increase the number of food chains based on the number of Producer Cards included in each session, and will allow students to create different food chains in each session. Place any extra cards aside.

Brackets indicate "top" consumers that are not included in these cards. For the purposes of this game, consumers with bracketed information should be the last consumers in any of these food chains.

Basic sets of cards should include:

Number of students	Sun card	Producer cards	Consumer cards
20	1	8–10	15
25	1	8–15	15–20
30	1	12–20	20–25

materials

Science notebooks
Pencils
Thermometers
Student Food Chain Cards (laminated and prepared as suggested above)
Food Chain Key
8–10 balls of yarn

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.

2. Sort *Food Chain Cards* (Producers/Consumers) and count out the number of each required for one session. Be sure to include the Sun card when the cards are randomly handed out. Place the balls of yarn in the center of the open area.

3. Shuffle Producer Cards and shuffle Consumer Cards. Distribute cards randomly and instruct students to read their cards carefully. Remind them that they will need to know 1) what plant or animal they are, 2) whether they are a producer or a consumer, and 3) how they get their energy (ex: make their own using the sun; consume a plant; consume an animal).

4. Instruct students to place the cards loosely around their necks in order to free their hands and to keep the information close to them.

5. After reading the information on their cards, ask students with Producer Cards to stand to your right.

6. Ask students with Consumer Cards to stand to your left.
   Q. Who is left alone?
   A. The student with the Sun card should be left standing alone, because the sun is neither a producer nor a consumer.

7. Provide a ball of yarn to the student with the Sun card. Address the student with the Sun card *[in a dramatic, fun voice]* and provide him/her with instructions similar to: "You are the sun, and all our chains will begin with you. None of our producers or consumers can survive without you, so you must be very careful not to drop your end of the yarn because it connects you with each food chain. Are you up to the task of representing the sun?"

8. Connect producers to the sun:
   - Choose one student with a producer card (from those to your right) and have that producer introduce him/herself to the group and explain why he/she is a producer. (Ex: I am algae and I am a producer because I make my own food using energy from the sun.)
   - Hand the loose end of a ball of yarn to the sun and hand the ball of yarn to the producer unwinding enough yarn to allow about two feet of space between them.
   - Refer back to the group of producers and choose another producer and repeat the above process using a new ball of yarn for each producer. Continue until all producers are connected to the sun with a piece of yarn. Producers should not be connected in any way to each other.

   Q. If these producers get their energy directly from the sun, what would get its energy directly from a producer?
   A. A consumer would get its energy directly from a producer.

9. Connect consumers to producers:
   - Ask students with consumer cards (those to your left) to raise their hand if they think they could be connected to one of the producers connected to the sun. As you choose students with raised hands, have each consumer introduce him/herself to the group and explain why he/she is a consumer. (Ex: I am a grasshopper and I am a consumer because I get my energy by eating or consuming grasses and leaves; or I am a coyote and I eat or consume rabbits, voles, grasshoppers, robins, young deer and insects but I also consume fruits and berries; or I am a deer and I eat or consume acorns, leaves, fruits and berries, wildflowers and grasses.) Have students double check what they eat to be sure a proper link in each food chain is formed. Students representing consumers that eat both plants and animals may step up as long as there are student producers available that match up with what is listed on their cards.
   - Have each consumer stand next to a producer they consume. Have the producer continue to hold onto the strand of yarn while he/she unwinds and passes the ball of yarn to the consumer. Enough yarn should be unwound to allow about two feet of space between them. Continue until all producers are connected to the sun on one side and a consumer on the other. Producers should continue to hold onto the piece of yarn.
   - Any consumers who eat or consume only producers left unlinked to a food chain should stand over to one side.

10. Connect consumers to consumers:
   - Ask remaining students with consumer cards to join a food chain where they think they belong (next to a consumer that their cards tells them they consume). Have each new consumer introduce him/herself to the group and explain why he/she is a consumer and why he/she believes he/she should be linked to that particular food chain. (Ex: I am a spider and I am a consumer because I get my energy by eating or consuming insects; or I am a coyote and I eat or consume rabbits; or I am a Texas ratsnake and I eat or consume woodland voles.)
   - Have students unwind the ball of yarn as it is passed to the new consumer. Enough yarn should be unwound to allow about two feet of space between them.The sun and all producers and consumers should continue to hold onto the piece of yarn.
   - Any consumers who eat or consume only consumers left unlinked to a food chain should join the other unconnected consumers over to the side.

11. Look at all these food chains you've created. Congratulations! You are organisms getting the energy you need either directly from the sun or by consuming producers or other consumers. Wait a minute! (Refer to the unlinked consumers.)

Q. What happened to these consumers?

A. They were not able to find the right food to eat.

Q. But we have all this food in all these chains. Why couldn't they find what they needed?

A. Other consumers ate their food; the animals that eat both producers and consumers had more choices; etc.

Q. What might happen to these consumers?

A. They might be hungry for a while until they find more food; they might starve and die; they might move away from their community to find food somewhere else; etc.

Q. I wonder if there are any places we might include them in our food chains.

A. Elicit suggestions from students and ultimately lead them to have each unlinked consumer read what they eat and try to find a place along a food chain for them to fit. Have the last consumer holding the ball of yarn unwind enough yarn to allow for any additional "links" to be inserted.

Some possible examples:

A chain that has:	sun ➲ algae ➲ tadpole ➲ water snake
could become:	sun ➲ algae ➲ tadpole ➲ water snake ➲ **Texas ratsnake**
A chain that has:	sun ➲ leaves ➲ insects ➲ robin ➲ Texas ratsnake
could become:	sun ➲ leaves ➲ insects ➲ **dragonfly** ➲ robin ➲ Texas ratsnake

12. Have students include as many as possible. Referring to any remaining consumers:

Q. What shall we do with these unlinked consumers? What would happen in nature to a consumer that was not able to find food?

A. Consumers unable to find food would eventually starve and die.

Q. What happens to the bodies of consumers that die?

A. Their bodies break down and eventually become part of the soil.

Q. If these consumers become part of the soil, where could they possibly be placed within our food chains?

A. The dead consumers could become part of the soil used by the producers.

13. Have any unlinked students stand around the producers (but not become part of a chain) because now they have become part of the soil that will provide nutrients to the producers.

14. Have each chain discuss its parts (ex: I'm a coyote which is a consumer that got its energy by eating a rabbit; I'm a rabbit which is a consumer that got its energy by eating grasses; I'm grass which is a producer that is able to make its own food by using energy from the sun. *[In a big booming voice]* I am the sun, and all food chains begin with me!) This repetition (and the repetition above as students initially link up) will reinforce the concept and will help capture students who may not have grasped the concept and/or did not understand how to use the cards.

15. Discuss whether or not any of these food chains would be found in a pond, a forest or a prairie ecosystem. Answers will vary. Quite often, animals move from one ecosystem to another. A Texas ratsnake may be found in a forest ecosystem, but it also seeks water at ponds; a deer may be associated with a forest ecosystem, but it might also forage on grasses and wildflowers in a prairie; etc.

16. Addressing all the food chains:

Q. What role do all the producers here play in their ecosystems?

A. Producers use energy from the sun to produce their own food which makes the plants/producers grow.

Q. What role do all the consumers here play in their ecosystems?

A. Consumers eat producers and other consumers in order to get energy.

Q. What would a possible effect be on a food chain if an entire link were missing?

A. A consumer or several consumers would not have that producer or consumer to eat.

17. To see how that might look, ask the grasses to release their piece of yarn.

Q. What just happened and what might happen?

A. A producer is gone, and the consumer that was connected to that producer will have to find something else to eat, and the consumers after the first consumer might have to find something else to eat.

Q. Raise your hand if you just "lost a meal." Would you starve?

A. Not unless all producers they eat in their ecosystem were gone, and they couldn't find the food they needed. If possible, they might go somewhere else for food.

Q. What might happen to a consumer that eats only one type of food and that food disappears?

A. Answers will vary. That consumer could starve or attempt to eat something else or move away, if possible, to where it could find more of its food.

18. Have the grasses rejoin their food chain by grasping the strand of yarn.

Q. Looking at all these food chains, is there one consumer we don't really need?

A. Answers will vary. Essentially, all consumers, even those that students may not like (snakes, voles, etc.) are all important parts of food chains and play a part in keeping a balance among populations. (Ex: Remove mice/voles = less food/energy for snakes.)

19. Think about what you've read about pond, forest and prairie ecosystems.

Q. Which ecosystem (pond, forest or prairie) might be the most difficult one for consumers to find other sources of food?

A. Certain pond ecosystem consumers, such as fish, certain aquatic insects, etc. would not be able to move away from one pond to another to find food.

wrap-up/formative assessment

In their science notebooks, instruct students to create written or illustrated food chains that include either their breakfast, lunch or last night's dinner.

Sun

Acorns

Eaten by deer

producer

Algae

Eaten by tadpoles, pond snails

producer

Aquatic plants

Eaten by pond snails

producer

Fruits & berries

Eaten by deer, woodland voles, box turtles, coyotes, rabbits, robins

producer

Grasses

Eaten by grasshoppers, deer, insects, rabbits

producer

Leaves

Eaten by grasshoppers, deer, insects, woodland voles, box turtles, rabbits

producer

Seeds

Eaten by woodland voles, robins

producer

Wildflowers

producer

Eaten by insects, rabbits, deer

Deer

consumer

Eats acorns, grasses, fruits & berries, wildflowers, leaves

Eaten by coyotes

Grasshopper

consumer

Eats grasses, leaves

Eaten by robins, spiders, coyotes

Insects

consumer

Eats leaves, grasses, wildflowers

Eaten by robins, dragonflies, box turtles, green frogs, spiders

Pond snail

Eats algae, aquatic plants

Eaten by green frogs

CONSUMER

Rabbit

Eats grasses, wildflowers, leaves, fruits & berries

Eaten by black rat snakes, coyotes

CONSUMER

Tadpole

Eats algae

Eaten by water snakes

CONSUMER

Woodland vole

Eats leaves, seeds, fruits & berries

Eaten by coyotes, Texas ratsnakes

CONSUMER

Texas ratsnake

Eats rabbits, woodland voles, robins, rabbits

[**Eaten by** other snakes, owls, hawks]

CONSUMER

Box turtle

Eats leaves, fruits & berries, insects

[**Eaten by** skunks, raccoons, badgers]

CONSUMER

Coyote

Eats rabbits, woodland voles, robins, grasshoppers, fruits & berries, young deer

[Young coyotes **Eaten by** owls]

CONSUMER

Dragonfly

Eats insects, dragonflies

Eaten by robins, green frogs, dragonflies

CONSUMER

Green frog

Eats insects, spiders, pond snails, dragonflies

Eaten by water snakes

CONSUMER

Robin

Eats seeds, fruits & berries, spiders, dragonflies, insects, grasshoppers

Eaten by black rat snakes, coyotes

CONSUMER

Spider

Eats insects, grasshoppers

Eaten by robins, green frogs

CONSUMER

Water snake

Eats green frogs, tadpoles

[**Eaten by** great blue herons, raccoons]

CONSUMER

Organism	Producer or Consumer	Eats (Gets energy)	Eaten by	Possible ecosystem
PRODUCERS				
Acorns	Producer	Energy from Sun	Deer	Forest, near ponds
Algae	Producer	Energy from Sun	Tadpoles Pond snails	Pond
Aquatic plants	Producer	Energy from Sun	Pond snails	Pond
Fruits & berries	Producers	Energy from Sun	Deer Woodland voles Box turtles Coyotes Rabbits Robins	Forest, prairie, near ponds
Grasses	Producer	Energy from Sun	Grasshoppers Deer Insects Rabbits	Forest, prairie, near ponds
Leaves	Producer	Energy from Sun	Grasshoppers Deer Insects Woodland voles Box turtles Rabbits	Forest, near ponds/prairies
Seeds	Producer	Energy from Sun	Woodland voles Robins	Forest, prairie, near ponds
Wildflowers	Producer	Energy from Sun	Insects Rabbits Deer	Forest, prairie, near ponds

Organism	Producer or Consumer	Eats (Gets energy)	Eaten by	Possible ecosystem
CONSUMERS—HERBIVORES				
Deer	Consumer	Grasses Fruits & berries Wildflowers Leaves Acorns	Coyotes	Forest, near prairies/ponds
Grasshopper	Consumer	Grasses, leaves	Robins Spiders Coyotes	Forest, prairie, near ponds
Insects	Consumer	Leaves Grasses Wildflowers	Robins Dragonflies Box turtles Green frogs Spiders	Forest, prairie, around ponds
Pond snail	Consumer	Algae Aquatic plants	Green frogs	Pond
Rabbit	Consumer	Grasses Wildflowers Leaves Fruits & berries	Texas ratsnakes Coyotes	Forest, near prairies and ponds
Tadpole	Consumer	Algae	Water snakes	Pond
Woodland vole	Consumer	Leaves Seeds Fruits & berries	Texas ratsnakes Coyotes	Forest

Organism	Producer or Consumer	Eats (Gets energy)	Eaten by	Possible ecosystem
CONSUMERS—CARNIVORES/OMNIVORES				
Texas ratsnake	Consumer	Rabbits Woodland voles Robins	[Other snakes, owls, hawks]	Forest, near ponds/prairies
Box turtle	Consumer	Leaves Fruits & berries Insects	[Skunks, raccoons, badgers]	Forest, prairie, near ponds
Coyote	Consumer	Rabbits Woodland voles Fruits & berries Robins Grasshoppers Young deer	[Young coyotes eaten by owls]	Forest, near ponds/prairies
Dragonfly	Consumer	Insects Dragonflies	Robins Green frogs Dragonflies	Pond, near forests/prairies
Green frog	Consumer	Insects Spiders Pond snails Dragonflies	Water snakes	Pond
Robin	Consumer	Seeds Fruits & berries Insects Grasshoppers Spiders Dragonflies	Texas ratsnakes Coyotes	Forest, near ponds/prairies
Spider	Consumer	Insects Grasshoppers	Robins Green frogs	Forest, prairie, near ponds
Water snake	Consumer	Green frogs Tadpoles	[Great blue heron, raccoons]	In and around ponds

activity 4.3 : schoolyard ecosystem food chains

estimated time 30 minutes

objectives
Students will be able to
1. Identify the primary source of energy plants use to produce their own food.
2. Explain the difference between a producer and consumer.
3. Sequence the flow of energy through a schoolyard food chain beginning with the sun.
4. Classify populations of organisms as producers or consumers by the role they serve in the schoolyard ecosystem.
5. Predict the possible effects of removing a population of organisms from a food chain.

teacher preparation
This activity should be conducted outside in the schoolyard ecosystem. Take a brief, preliminary walk around the area to check for producers and consumers in case students need prompts during the activity.

Students will need their science notebooks to add any new organisms to their *Big Chart: Schoolyard Ecosystem.*

materials
Science notebooks
Pencils
Thermometers
Big Chart: Schoolyard Ecosystem

procedure
1. Have students complete their science notebook headings and take and record outside air temperature.

2. Have students spend a few minutes moving slowly through and observing their schoolyard ecosystem. Have them look at any organism they see and decide whether it is a producer or a consumer.

3. Instruct students to add any new plants or animals observed during this activity to their *Big Chart: Schoolyard Ecosystem* "Organism" column. Instruct students to make an X or check mark to indicate whether each one was a plant or an animal. Instruct students to place an X or a check mark for each of their schoolyard ecosystem organisms to indicate whether each was a producer or consumer.

4. After students have spent at least 10–15 minutes observing and recording schoolyard organisms, have them note using an X or a check mark on the *Big Chart* whether each schoolyard organism is a producer or a consumer.

5. Ask for volunteers or call on students to share an example of a producer and a consumer from their list. Continue until everyone has shared something. Discuss any inaccuracies. Discuss why students may have observed any new organisms today.

6. Have students create at least three schoolyard food chains from their lists in their science notebooks. Have them share these food chains with the class.
   Q. Where did every one of your food chains begin regardless of the producers and consumers you included?
   A. Energy from the sun.
   Q. What role were the plants playing?
   A. Producers using energy from the sun to make their own food.
   Q. What role were all the animals playing?
   A. Consumers getting energy by eating producers or other consumers.
   Q. What might happen if all the producers suddenly disappeared from this ecosystem?
   A. Answers will vary. Consumers would have to find producers somewhere else, if possible.

wrap-up/formative assessment
Have students indicate whether or not pond, forest and prairie organisms on their *Big Charts* are producers or consumers by placing an X or a check mark under the "Producer" or "Consumer" columns in their *Big Charts*.

optional activity 4.a : mdc video segments

Video segments included on *Nature Unleashed* DVD

1. *Owls* (4:49 minutes)—They've gotten a new lease on life...now see how these owls are performing for others.

2. *American Burying Beetles* (5:24 minutes)—Once found on the prairies of Missouri, this endangered beetle has some very unique characteristics.

optional activity 4.b : owl pellet dissection practice

estimated time
30–40 minutes

objectives
Students will be able to
1. Sort and categorize simulated owl pellet components.

teacher preparation
NOTE: In the last few years, vendors have not been able to provide owl pellets. There is speculation that the low number of owl pellets reflects a drop in wild owl populations.

If students are familiar with dissection techniques, skip this practice section and move directly to *Optional Activity 4.C*.

This activity is designed to familiarize students with dissection and sorting techniques in preparation for dissection of actual owl pellets. Students will ultimately investigate owl pellets, which are the result of an owl's specialized stomach muscles. Owls have no teeth and are unable to break and chew food into pieces small enough to pass through their bodies. Depending on what an owl has eaten, fur, feathers and bones are left in its stomach after all the meat has been digested. Special stomach muscles squeeze the fur or feathers tightly around the bones forming a pellet.

These practice pellets are not intended for human consumption. Students will be instructed to place the dissected parts out in their bird feeding area. ***WARNING:*** *Replace peanut butter with soft bread pieces when students with peanut allergies are involved.*

These practice owl pellets must be assembled at least one hour in advance of the activity, but should not require too much time or materials. Only small amounts of the suggested owl pellet recipe items are needed and intended to be items easily available at home or possibly in the school kitchen. A small amount of seed is required, but seed suggested below should be available from seed used for bird feeding activities.

To create practice owl pellets:

1. Mix together the italicized ingredients listed under Materials below. Coconut flakes should comprise the bulk of the pellet. Use the least amount of peanut butter (or soft bread pieces) possible to hold the flakes and other items together.
2. Use a tablespoon or medium-sized melon scoop to separate the mixture into enough pellets to supply one pellet for every two students.
3. Pull out one length of wax paper (approximately 4 inches wide), tear off, fold in half and tear along fold. Repeat until there are enough squares for each pellet.
4. Place one scoop of pellet mixture on a wax paper square and roll into a tight ball.
5. Use the palm of your hand to roll and slightly flatten each ball.
6. Wrap each pellet tightly in the wax paper square.
7. Place pellets in a freezer for at least thirty minutes to allow them to chill enough to hold their shape.
8. Remove pellets from freezer and use immediately.

materials
Materials to make practice owl pellets

Wax paper (approximately 4-inch squares; one square per pellet)
Tablespoon or medium-sized melon scoop
Peanut butter (as needed; approximately ½ cup)
Coconut flakes (approximately 1 cup)
Small bird seed (niger or millet) (approximately ¼ cup)
Sunflower seeds (approximately ¼ cup)
Pretzel sticks broken (approximately) into thirds (¼ cup)

Materials for students
Science notebooks
Pencils
Wooden coffee stirrers and/or toothpicks
Paper plates
Paper towels
Practice owl pellets (one for every two students)
Practice Owl Pellet Worksheet (one per each pair of students)

procedure

Q. What were some of the specialized structures mentioned in Chapter 3 for owls?
A. Ruffled feathers; talons; beaks; huge eyes; ear openings next to the eyes; special stomach muscles that create pellets of undigested animal parts.
Q. What role would an owl play in a food chain?
A. Consumer because it eats other animals and does not use the energy of the sun directly to make its own food.
Q. I wonder why owls are usually considered top consumers of a food chain.
A. Owls eat other animals but are usually not hunted and eaten by other animals because they have specialized structures that make them hard to hear (ruffled flight feathers), hard to see (camouflage), large eyes to see well at night, strong feathers to fly off quickly and high into trees, etc.

1. Explain to students that they are going to solve the mystery of what an owl ate. Owl pellets from the outside do not provide too much information, but on the inside, their secrets and mysteries are revealed.

2. Provide each pair of students with an *Practice Owl Pellet Worksheet*, paper plate, paper towels, wooden coffee stirrers and/or toothpicks and one pellet in its wax paper wrapper.

3. Instruct students to unwrap their pellet carefully and place it on the paper plate. Using the stirrers and toothpicks, have students separate the pellet into smaller pieces.

4. Instruct students to use the key on the worksheet to sort out their pellet parts on the wax paper, then label and sketch each pellet part on *Practice Owl Pellet Worksheet*.

5. Instruct students to use the bottom or back of their worksheet to create a graph to illustrate their data.
   Q. How many animals were in your practice owl pellet? What bones gave you the best clue as to what your owl ate?
   A. The number of skulls found, because skulls are a good indication of the number of animals eaten. An animal would have two hip bones. Dividing the total number of hip bones by two would also be a good clue.

6. Discuss other animal "parts" students discovered in their pellets. These could be vertebra, toe or finger bones, pieces of broken ribs, etc.

7. Instruct students to roll their pellets tightly back up in the wax paper in order to transport them to a place of their choice near their bird feeding area. Suggested places would include directly squashed into the bark of a tree; mashed into a pine cone; on a tray or platform feeder, etc.

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

Name ____

Teammate Name ______________________________________

Key
Coconut flakes = Fur
Sunflower seed = Skull
Small bird seed = Small miscellaneous bones
Pretzel stick = Hip bone

Sketch the pellet parts in the squares provided:

Pellet content 1: ______________________________ **Number:** ________________	**Pellet content 2:** ______________________________ **Number:** ________________
Pellet content 3: ______________________________ **Number:** ________________	**Pellet content 4:** ______________________________ **Number:** ________________

optional activity 4.c : owl pellets—the real deal

estimated time 30–40 minutes

objectives

Students will be able to
1. Sort and organize the contents of an owl pellet.
2. Explain the relationship between what an owl eats and the contents of its owl pellet.
3. Sequence the flow of energy through a food chain beginning with the sun.
4. Predict the possible effects of removing a population of organisms from a food chain.

teacher preparation

Order owl pellets well in advance of this activity. Owl pellets are disinfected and professionally treated.

NOTE: In the last few years, vendors have not been able to provide owl pellets. There is speculation that the low number of owl pellets reflects a drop in wild owl populations.

materials

Science notebooks
Pencils
Owl pellets (one for every two students)
Wooden coffee stirrers and/or toothpicks
Paper plates
Owl Pellet Worksheet (one per student)
Construction paper (black or other dark color) (optional)
Glue (optional with construction paper)

procedure

1. Explain that in this activity students will dissect real owl pellets. These pellets have been specially treated and disinfected.

2. Review the methods students used in *Activity 4.3* to dissect a practice owl pellet. Instruct them to approach the real owl pellet in the same slow, careful manner when opening, breaking apart and sorting the pellet contents.

3. Have teams prepare their science notebook headings and record what they predict they will find inside their pellet.

4. Instruct students to
   a. Separate bones from fur.
   b. Use the key to sort bones and transfer to correct box on *Owl Pellet Worksheet.*
   c. Record the number of bones in each group on *Owl Pellet Worksheet.*

   Q. How many animals were in your owl's pellet? What bones gave you the best clue as to what your owl ate?
   A. The number of skulls found, because skulls are a good indication of the number of animals eaten.

5. Discuss numbers of other bones students discovered in their pellets.

   Q. Besides counting skulls, what would be another way to decide on the number of animals eaten?
   A. Counting lower jaw bones (2/animal); counting hip bones (2/animal); counting upper leg, shoulder or lower leg bones (2/animal). Upper and lower leg bones and shoulder bones may be fragmented and more difficult to identify.

6. Owls usually cough up two pellets every day. Instruct each team to decide the number of animals eaten by their owl and to use that number to provide the following information about their owl:
   a. Number of animals eaten in one day.
   b. Number of animals (potentially) eaten in a week.
   c. Number of animals (potentially) eaten in a month.
   d. Number of animals (potentially) eaten in a year.

7. Go around the room and have teams state the number of animals found in their pellets.

   Q. Based on the number of the animals in all of your pellets, answer the following:

   a. Average number of animals eaten in one day.
   b. Number of animals (potentially) eaten in a week.
   c. Number of animals (potentially) eaten in a month.
   d. Number of animals (potentially) eaten in a year.

   Q. How did pellet contents differ among class pellets?

   A. More of certain bones than others. Some had larger bones. Some had small bones and broken or no signs of skulls, etc.

   Q. Why would there be differences?

   A. Different owls produced these pellets. Owls living in different areas might have more birds or more mice/voles.

   Q. Based on the total number of animals eaten in a year, what effect do you think owls have on a Missouri forest ecosystem?

   A. Owls control populations of mice and other rodents. Owls help balance populations of mice, voles and other animals. Without owls, there would be greater numbers of mice and other rodents.

   Q. If a population of owls was greatly reduced or entirely removed from a forest ecosystem, what would be some possible effects on the ecosystem?

   A. Answers may vary. Rodent populations would increase. More producers (plants, seeds, etc.) would be eaten by the rodents reducing the amount of producers available for other consumers. Other animals that eat rodents would have lots of food. Too many rodents might cause diseases in rodent populations that could spread to other animals, etc.

extension activity

1. Have teams use their bone charts and their pellet bones to reconstruct a skeleton of one animal and glue it onto the construction paper. Were all bones available? If not, why?

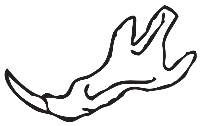
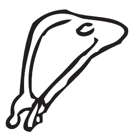
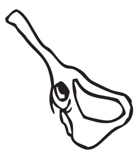
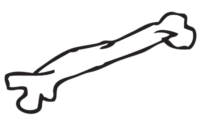
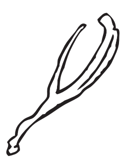
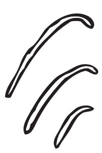
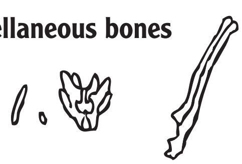
2. Have teams share their reconstructed skeletons with the class.

wrap-up/formative assessment

Have students create possible food chains that could have led up to their owl based on pellet contents. Have them label food chain organisms as producers or consumers. Check for correct inclusion of the sun.

Name ____

Teammate Name ____________________________________

Skull 	
Jaw 	
Shoulder blade 	
Hip 	
Upper leg 	
Lower leg 	
Ribs 	
Back bones 	
Extra/miscellaneous bones 	

optional activity 4.d : beaks, seeds and places to eat

estimated time 30–40 minutes

objectives

Students will be able to

1. Explain how birds are able to eat both plants and animals without the use of specialized tooth structures.

teacher preparation

This is an outdoor activity and is relevant to the ongoing, daily bird feeder observations and data collection by students.

Have students check that bird feeders are full at least a half-hour prior to the activity to allow birds time to return to the feeders after students have filled them.

Ideally, students would observe and collect data on bird beaks and feeding behaviors for 10–15 minutes two to four times each day for several days at several different locations. If one class period is all that is available, instruct students to observe and record data for several short lengths of time (depending on the length of the class period) with brief rest periods in between. A rest period would be very short (three to five minutes) and could involve students standing up quietly to stretch their legs and moving slowly to another (predetermined) observation position for the next round of observations.

materials

Science notebooks
Pencils
Thermometers
Binoculars (optional)
Bird field guides
Watch/Stop watch (optional)
Thermometer

procedure

1. Explain to students that they will be collecting very specific data on the way birds eat at feeders. If they work in groups, each group should decide how they will record this information (Ex: chart with name of bird/number of times that type of bird ate a specific seed/beak description of that bird/eating method/preferred seed; chart with type of seeds/names of birds eating each seed [or peanut butter]/shapes of seeds/shapes of bird beaks/number of times each type of bird visited a particular seed; etc.)

2. Instruct students to move quietly and slowly to their observation spots (predetermined by you or decided upon by the students) and to have their science notebook*s* and pencils ready to record data.

3. When data from all observation sessions has been recorded, instruct students to work in their groups to compile and organize their data and prepare a class presentation. Presentations should address the following:
   a. Number of specific types of birds that ate only one type of seed.
   b. Beak shape(s) of observed bird(s); how they differed; how they were similar.
   c. Comparison sketches of beaks and seeds (use field guides, if necessary).
   d. Conclusion as to why certain types of birds prefer certain foods.

   Q. Why would cardinals, chickadees and tufted titmice all eat black oil sunflower seeds?
   A. Black oil sunflower seeds are a good source of energy.These birds have similar shaped beaks that allow them to crack the sunflower seed shells.
   Q. How often did a certain type of bird remain at a feeder, or how often did a certain bird (or even the same bird) take a seed to another spot, eat it and return for another one?
   A. Answers will vary, but chickadees and titmice do this often.
   Q. Were there birds that ate insects, seeds and insects, only peanut butter, etc.?
   A. Answers will vary, but if nuthatches and woodpeckers were observed, they could be interested in the peanut butter/suet. Answers will also vary depending on the time of year and the availability of natural food and insects.

Q. What might this tell us about these birds?

A. They are all responding to internal hunger cues while responding to external weather cues (taking shelter under the top of a feeder while feeding from it), to potential danger cues (grabbing a seed and flying to a higher branch of a tree to eat it), etc.

Q. Why were there birds that only ate seed that had fallen to the ground?

A. Answers will vary depending on the time of year. Some birds found in Missouri only in the winter include white-throated sparrows, fox sparrows and dark-eyed juncos. These birds tend to feed on the ground. Mourning doves are found in Missouri all year and are often observed feeding on the ground. All of these birds utilize areas under brush piles and bushes as places to find seed. The brush piles offer shelter and protection from predators and weather. Students should look closely to record the type of seed these ground-feeding birds prefer.

Q. Are there other body structures besides beaks that determine where a bird might prefer to eat? Are bird feet specialized structures that influence where they feed?

A. Woodpeckers do have very special toe arrangements that allow them to grip the sides of objects. Woodpeckers also have specialized tail feathers that provide support for woodpeckers when they are moving about on a vertical object such as a tree trunk.

4. Based on all presentations, discuss with class what beak shapes were most common and why.

5. Have students sketch in their science notebook*s* the beaks of birds observed. Have them write a short description of a meal they might be able to eat if they had one of those beaks rather than a human mouth with teeth (Ex: walnuts without using a nutcracker to get out the seed; giant insects; an uncut watermelon; etc.).

so, what do you know?—lesson 4

1. Where do plants get the energy they need to produce their food?

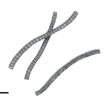
   a. Animal b. Plant c. Sun d. Water

2. Plants produce their own food. So they are called:

   a. Consumers b. Decomposers c. Populations d. Producers

3. What is the difference between producers and consumers?

4. Identify which organisms are consumers by placing the letter "C" in the line next to the picture. For producers, place the letter "P" on the line. (C=consumer, P=producer)

______ 
Algae

______ 
Squirrel

______ 
Woodpecker

______ 
Prairie grass

______ 
Leaf beetle

______ 
Crayfish

______ 
Tadpole

______ 
Tree

______ 
Rabbit

______ 
Coneflower

______ 
Bluegill

______ 
Owl

5. Make a food chain using the pictures below. Put a number 1 by the first thing, number 2 by the second thing and number 3 by the third thing in this food chain.


Mayapple


Sun


Deer

6. Use words or pictures and words to make a pond ecosystem food chain with four links.

7. A food chain is pictured below. What could happen if all of the leaf beetles died from disease?


Sun Decaying leaves Leaf beetle Grassland crayfish Crawfish frog

so, what do you know?—lesson 4

answer key

1. Where do plants get the energy they need to produce their food? (1 point)

   answer— c. Sun

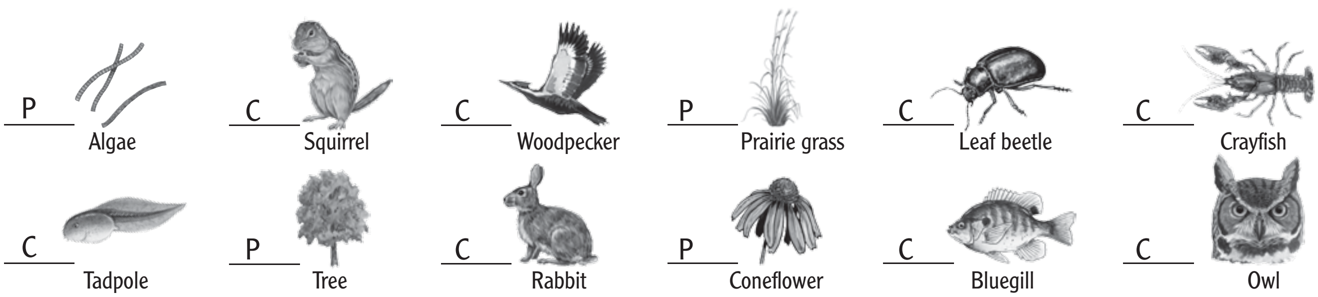
2. Plants produce their own food. So they are called: (1 point)

   answer— d. Producers

3. What is the difference between producers and consumers? (2 points for answers that convey the same meaning as the answer provided below)

   Producers use the energy from the sun to produce their own food.—*AND*—Consumers eat plants or other animals to get the food and energy they need.They can't produce their own energy.

4. Identify which organisms are consumers by placing the letter "C" in the line next to the picture. For producers, place the letter "P" on the line. (C=consumer, P=producer) (1 point for each correct answer, max. 12 points)

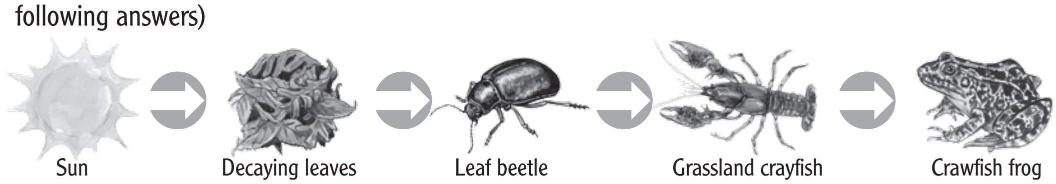


5. Make a food chain using the pictures below. Put a number 1 by the first thing, number 2 by the second thing and number 3 by the third thing in this food chain. (1 point)

6. Use words or pictures and words to make a pond ecosystem food chain with four links. (4 points)

   answer —Any food chain found in a pond ecosystem is acceptable as long as it has: sun, plant, herbivore or omnivore and omnivore or carnivore.

7. A food chain is pictured below. What could happen if all of the leaf beetles died from disease? (4 points for any one of the following answers)



possible answers

The crayfish would have less food to eat; Some crayfish might die because they didn't have enough food to eat; There may not be any animals to eat the decaying plants; The frogs might not have enough crayfish to eat; or other plausible answer.

lesson 5: you eat what?!

estimated time
2½–3 hours

science GLEs
EC.2.A.4.a. Classify populations of organisms as producers, consumers, or decomposers by the role they serve in the ecosystem
EC.2.A.4.b. Differentiate between the three types of consumers (herbivore, carnivore, omnivore)

vocabulary
Herbivore
Carnivore
Omnivore
Decomposer
Scavenger

lesson objectives
1. Explain how herbivores, carnivores and omnivores are different.
2. Categorize consumers by what they eat.
3. Define the role of decomposers in the ecosystem.
4. Classify organisms as producers, consumers or decomposers by the role they play in pond, forest and prairie ecosystems.
5. Explain how the teeth on an animal's skull can help identify the type of consumer it is.

essential questions for the lesson
1. How do you know if a consumer is an herbivore, carnivore or omnivore?
2. What type of "vore" are you?
3. Why are decomposers and scavengers important in ecosystems?

teacher notes
Students should have read Chapter 5, "You Eat What?!," on pages 24–27 of their student books prior to engaging in these activities. *Ecosystem Cards* should be prepared in advance.

All *Ecosystem Cards* will be used together in Lesson 6. In Lesson 5, the *Pond Ecosystem Cards* are used in *Activity 5.1*, the *Forest Ecosystem Cards* are used in *Activity 5.2* and the *Prairie Ecosystem Cards* are used in *Activity 5.3*. For these individual activities, the Human card should be removed and set aside. All three Human cards will be used in the culminating ecosystems activity in Lesson 6.

It is recommended to:

- Copy and laminate the *Pond Ecosystem Cards/Forest Ecosystem Cards/Prairie Ecosystem Cards*.
- Punch two holes on either side of the top of each card.
- Lace yarn through the holes and tie the ends together. Yarn should be long enough to go easily over the heads of students and hang loosely enough around their necks to allow them easy access to the information on the cards.
- Separate the cards into the three ecosystems: *Pond Ecosystem Cards/Forest Ecosystem Cards/ Prairie Ecosystem Cards*.

In reality, many animals often move from one ecosystem to another. To demonstrate this for students and to increase the number of predator/prey relationships when using the *Ecosystem Cards*, the animals listed below may be found in more than one set of *Ecosystem Cards*.

However, the environment description on the *Ecosystem Cards* will only describe the primary ecosystem for each of these "cross-over" animals (based on the three posters in Chapter 2 of the student book). On the teacher *Ecosystem Card Keys*, primary ecosystems for all organisms will be underlined and noted in bold letters. Ecosystems other than an animal's primary ecosystem will be shown within brackets.

Badger — Pond, [Forest], <u>**Prairie**</u>
Bobcat — Pond, <u>**Forest**</u>, [Prairie]
Great horned owl — Pond, <u>**Forest**</u>, [Prairie]
Green darner dragonfly — <u>**Pond**</u>, Forest, [Prairie]
Human — <u>**Pond**</u>, <u>**Forest**</u>, <u>**Prairie**</u>
Pileated woodpecker — Pond, <u>**Forest**</u>, [Prairie]
White-tailed deer — [Pond], <u>**Forest**</u>, [Prairie]

outline of answers to objectives

See following page.

essential activities

Activity 5.1: Are There Any "Free" Pond Lunches?
Activity 5.2: Are There Any "Free" Forest Lunches?
Activity 5.3: Are There Any "Free" Prairie Lunches?
Activity 5.4: Schoolyard Ecosystem Investigation

optional activities

Optional Activity 5.A: Animal Teeth—It's All About the Food
Optional Activity 5.B: Life on the Forest Floor
Optional Activity 5.C: Worms in School

summary

Animals are classified by the type of food they eat. Plant eaters are herbivores, and meat eaters are carnivores. Animals that eat both plants and meat are omnivores.

Herbivores and carnivores can be identified by looking at their teeth. Decomposers are organisms that eat dead plants and animals. They digest and break down dead organisms into tiny nutrients, which are then returned to the soil. Scavengers also clean up dead and decaying organisms.

outline of answers to objectives—lesson 5

1. Explain how herbivores, carnivores and omnivores are different. (pages 24–26)
   a. Herbivores are animals that eat only plants.
   b. Carnivores are animals that eat only meat. They hunt other animals for food.
   c. Omnivores are animals that eat both plants and animals.

2. Categorize consumers by what they eat. (pages 24–27)
   a. Herbivores
      i. Pond ecosystems: water fleas, snails, tadpoles, beavers
      ii. Forest ecosystems: deer, fox squirrels, woodland voles, spicebush swallowtail caterpillars and butterflies
      iii. Prairie ecosystems: gophers, regal fritillary caterpillars and butterflies, leaf beetles
   b. Carnivores
      i. Pond ecosystems: dragonfly nymph, fish, northern water snake
      ii. Forest ecosystems: bobcats, great horned owls, gray tree frogs, centipedes, rough green snakes, hawks
      iii. Prairie ecosystems: hawks, crawfish frogs, skinks, spiders, prairie mound ants, badgers, snakes
   c. Omnivores
      i. Pond ecosystems: muskrat, northern crayfish, raccoons, channel catfish
      ii. Forest ecosystems: turkey, three-toed box turtles, skunks
      iii. Prairie ecosystems: bobolinks, prairie-chicken adults, prairie mole crickets, grasshopper sparrows

3. Define the role of decomposers in the ecosystem. (page 27)
   a. They eat and break down scat (animal waste, feces) and dead organisms (plants and animals) into tiny nutrients.
   b. Examples:
      i. Pond ecosystems: northern crayfish, insects, bacteria and fungi
      ii. Forest ecosystems: sowbugs, carpenter ants, termites, beetles, fungi and bacteria
      iii. Prairie ecosystems: sowbugs, carpenter ants, termites, beetles, fungi and bacteria

      Note: Scavengers are not decomposers, but they are very important in keeping an ecosystem clean by feeding on dead and decaying organisms. Earthworms and vultures are examples.

4. Classify organisms as producers, consumers or decomposers by the role they play in prairie, forest and pond ecosystems. See *Activity 5.2: Are There Any "Free" Forest Lunches?* and *Activity 5.3: Are There Any "Free" Prairie Lunches?*

5. Explain how the teeth on an animal's skull can help identify the type of consumer it is. (page 26)
   a. Herbivores: large, sharp front teeth that help them snip off grasses and leaves; grinding teeth in the back of the mouth that help crush seeds and tough plant parts.
   b. Carnivores: large flat teeth line the sides of the mouth for grinding up meat and bones; long, sharp pointed teeth on either side of sharp front teeth that grip and tear up meat.
   c. Omnivores: some have teeth like herbivores and carnivores. Others like robins and turkeys have no teeth; instead they have beaks that help them capture insects and eat seeds and fruits

activity 5.1 : are there any "free" pond lunches?

estimated time 30–40 minutes

objectives

Students will be able to
1. Categorize consumers by what they eat.
2. Explain how herbivores, carnivores and omnivores are different.
3. Define the roles of decomposers in an ecosystem.
4. Classify decomposers and scavengers by the role they play in pond ecosystems.

teacher preparation

Students should have read Chapter 5, "You Eat What?!," on pages 24–27 of their student books prior to engaging in this activity. This is an outdoor activity and will require a large, open area. *Pond Ecosystem Cards* will be used to demonstrate how herbivores, carnivores and omnivores differ, not only in what they eat, but also in the variety and availability of food sources.

Use only the *Pond Ecosystem Cards* for this activity, but *REMOVE THE HUMAN CARD*.

The purpose of this activity is to reinforce each objective as well as give students an opportunity to explore food chains related specifically to a pond ecosystem. Graphic organizers (data table and graph) should be copied in advance unless students are instructed to create these directly in their science notebooks.

NOTE: For quick teacher reference, each *Pond Ecosystem Card* is marked with a single bar on the lower right corner.

materials

Science notebooks
Pencils
Thermometers
Flip chart or small white board and markers
Pond Ecosystem Cards (with Human card removed)
Pond Ecosystem Cards Teacher Key
Activity 5.1 Data Table/Bar Graph copies

procedure

1. Have students complete the heading in their science notebooks and take and record the outside air temperature.

2. Place the balls of yarn in the center of the open area. Shuffle and distribute one *Pond Ecosystem Card* randomly to each student. Make certain that a student receives the Sun card.

3. After students have read their cards carefully, indicate a place where all the herbivores should stand together, where all the carnivores should stand together, and where all the omnivores should stand together. Have students in the "vore" groups check each other's cards to be sure everyone is sorted out correctly. Students with producer cards and the Sun card should remain apart from the "vore" groups.

4. Address the entire class:
   Q. Based on the organism on your card, raise your hand if you are a consumer.
   A. All but the producers and the sun should raise their hands.
   Q. Raise your hand if you're a type of consumer called an herbivore.
   A. Check for accuracy.
   Q. Raise your hand if you're a type of consumer called a carnivore.
   A. Check for accuracy.
   Q. Raise your hand if you're a type of consumer called an omnivore.
   A. Check for accuracy.

5. Any consumers here who have not raised their hand yet?
   Q. What type of consumers are you?
   A. Decomposers and scavengers.
   Q. What is the difference between decomposers and scavengers?
   A. Decomposers are special organisms (bacteria, fungi) that eat and break down scat, and dead plants and animals into tiny parts. Scavengers (northern crayfish, common snapping turtles, etc.) seek out and eat dead and decaying organisms.

6. Bring the student with the Sun card to the center of the open area near the balls of yarn and remind him/her of the important role he/she is about to play.

7. Address the entire class:
   Q. Which organisms should be connected directly to the Sun?
   A. Producers.

8. Have producers raise their hands, and choose one producer at a time to step forward. While the Sun is holding the end of a ball of yarn and unwinding it and handing it to the producer, ask:
   Q. What organism are you?
   A. Algae, duckweed, arrowhead, etc.
   Q. What role do you play in an ecosystem?
   A. Producer.
   Q. Why do you think you should connect to this food chain here?
   A. I get energy to make my own food directly from the sun.
   Q. In what ecosystem would you commonly be found?
   A. Pond.

9. Continue linking producers to the Sun until they are either all linked *OR* until the Sun has used all the available balls of yarn. Have any unlinked producers stand over to the side.
   Q. What might happen to a producer that does not receive enough sun, water, nutrients, etc.?
   A. It might die.
   Q. What happens to producers that die?
   A. They begin to break down or decompose and eventually become part of the soil.

10. Indicate a place off to the side of the group as the place for unlinked/decomposing organisms. Ask students to give the place a name. The name could be funny/clever/etc. but should relate to decomposition (Ex: Decomp Hill; Soil Will Be Us; Break Down Dump).

    Throughout this entire activity, send any students incorrectly attempting to link to a food chain (based on the information on their cards) to the decomposition area.

11. Repeat the process with consumers. Ask the consumers (who could be linked to one of the available producers linked to the Sun) to raise their hands. Choose students randomly, have them stand next to a producer they would consume and ask each one:
    Q. What organism are you?
    A. Answers will vary but should include animals only.
    Q. What kind of consumer are you?
    A. Answers will vary but should include herbivores, omnivores, scavengers and decomposers only.
    Q. What role do you play in an ecosystem?
    A. Answers will vary. Depending on the specific organism, answers should include:
    - Consumers eat producers and other consumers and help to pass energy up through a food chain.
    - Herbivores eat producers and help to pass energy up through the food chain.
    - Omnivores eat producers and other consumers and help to pass energy up through the food chain.
    - Scavengers seek out and eat dead and decaying organisms and help to keep an ecosystem clean.
    - Decomposers eat and break down scat and dead and decaying plants and animals into tiny parts.

Q. Why do you think you should connect to this food chain here?

A. Answers will vary but should be based on information on their cards. (Ex: Because I am a consumer/herbivore/omnivore that consumes [names the particular plant to which they will connect] for energy; Because I am a scavenger/decomposer and I consume dead and decaying plants. This plant is dead and decaying.)

12. Have students unwind the ball of yarn as it is passed to the consumer. Enough yarn should be unwound to allow about two feet of space between them. The sun and all producers and consumers should continue to hold onto the piece of yarn.

13. Address any organisms remaining in the herbivore group:

Q. What has happened to these herbivores?

A. There are no producers left for them to eat.

Q. What could happen to them?

A. These herbivores would either starve or move away (if possible) to find producers somewhere else.

Q. Where should we place them now?

A. In the decomposition area!

14. If a decomposer has linked to a producer (which is possible):

Q. What is happening to a food chain that includes the sun, a producer and a decomposer?

A. The producer has died, and the decomposer is breaking it down into tiny parts.

Q. Would it be the end of a food chain if a decomposer linked up with a decaying plant?

A. Not necessarily. If a northern crayfish (considered a decomposer and a scavenger) linked with a "decaying" producer, there are other consumers that could still consume (link up with) the northern crayfish.

15. Continue the process with the remaining consumers. Ask students who think they could link with one of the food chains to raise their hands. Choose students randomly and repeat the questions for each student as they step up to their chosen chain and unwind and pass along the ball of yarn.

Q. What organism are you?

A. Answers will vary but should include animals, scavengers and decomposers only.

Q. What kind of consumer are you?

A. Answers will vary but should include carnivores, omnivores, scavengers and decomposers only.

Q. What role do you play in an ecosystem?

A. Answers will vary. Depending on the specific organism, answers should include:

- Consumers eat producers and other consumers and help to pass energy up through a food chain.
- Carnivores eat other consumers and help to pass energy up through the food chain.
- Omnivores eat producers and other consumers and help to pass energy up through the food chain.
- Scavengers seek out and eat dead and decaying organisms and help to keep an ecosystem clean.
- Decomposers eat and break down scat and dead and decaying plants and animals into tiny parts.

Q. Why do you think you should connect to this food chain here?

A. Answers will vary but should be based on information on their cards. (Ex: Because I am a consumer/carnivore /omnivore that consumes [names the particular animal to which they will connect] for energy; Because I am a scavenger/decomposer and I consume dead and decaying animals. This animal is dead and decaying.)

16. Repeat the process, asking for students to step up as part of the next link in one of the food chains. Students from this point on should be carnivores, omnivores, scavengers or decomposers only but must reference the information on their card to prove that they would eat the organism to which they plan to link.

Continue until all students are linked to a food chain or unlinked students/consumers have no place to connect. Send unlinked students to the decomposition area.

17. Use a flip chart or small white board to capture the following information for all food chains. Have students use the data table provided to organize the information.
    Q. How many producers?
    Q. How many herbivores?
    Q. How many carnivores?
    Q. How many omnivores?
    Q. How many decomposers and scavengers?
    Q. How many decomposing organisms left at the decomposition area?

    Q. Who or what is going to clean up all those decomposing organisms?
    A. Other decomposers (bacteria, northern crayfish, etc.) and scavengers (northern crayfish, common snapping turtles, etc.).

18. Have students roll up the balls of yarn and place them in the center of the open area. Collect and redistribute the cards randomly. **Instruct students to create new food chains on their own for their pond ecosystem.** This could create something close to chaos as students read their cards, find the Sun, question each other and attempt to link with a food chain. Students who think they cannot connect into any of the chains should move to the decomposition area.

19. Quickly review and discuss each component of each food chain. (If students are confident in their understanding of the concepts, have them attempt these food chain reviews in "speed talk.") Send any students linked incorrectly to the decomposition area, and randomly select a student already in the decomposition area and see if he/she can connect somewhere in one of the chains without jeopardizing a student already in place.

20. Record the number of each type of organism linked somewhere in the food chains and include those numbers as a second set on the flip chart/white board. Have students record this data in their *Data Tables*.

21. Using data from their *Data Tables*, have students work in groups to use the graph provided to create a bar graph.

22. Have students look at their graph to answer the following:
    Q. Which type of organism had the highest number?
    Q. Which type of organism had the lowest number?
    Q. What did you notice about the numbers of these organisms?
    A. Answers will vary. There are more producers. There are more omnivores than herbivores or carnivores. There are many decomposing organisms, etc.
    Q. How would you explain this?
    A. Answers will vary. As long as there is sunlight, air, water, nutrients, space and temperature, producers will grow. Omnivores have more choices and are able to eat a larger variety of food. Basically, there really are no free lunches, and even omnivores sometimes have difficulty finding food. However, there were always students "decomposing" and returning nutrients back into the soil.

23. Have students revisit their *Big Chart: Pond Ecosystem* and place an X or a check mark indicating whether each organism listed is an herbivore, carnivore, omnivore, decomposer or scavenger.

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

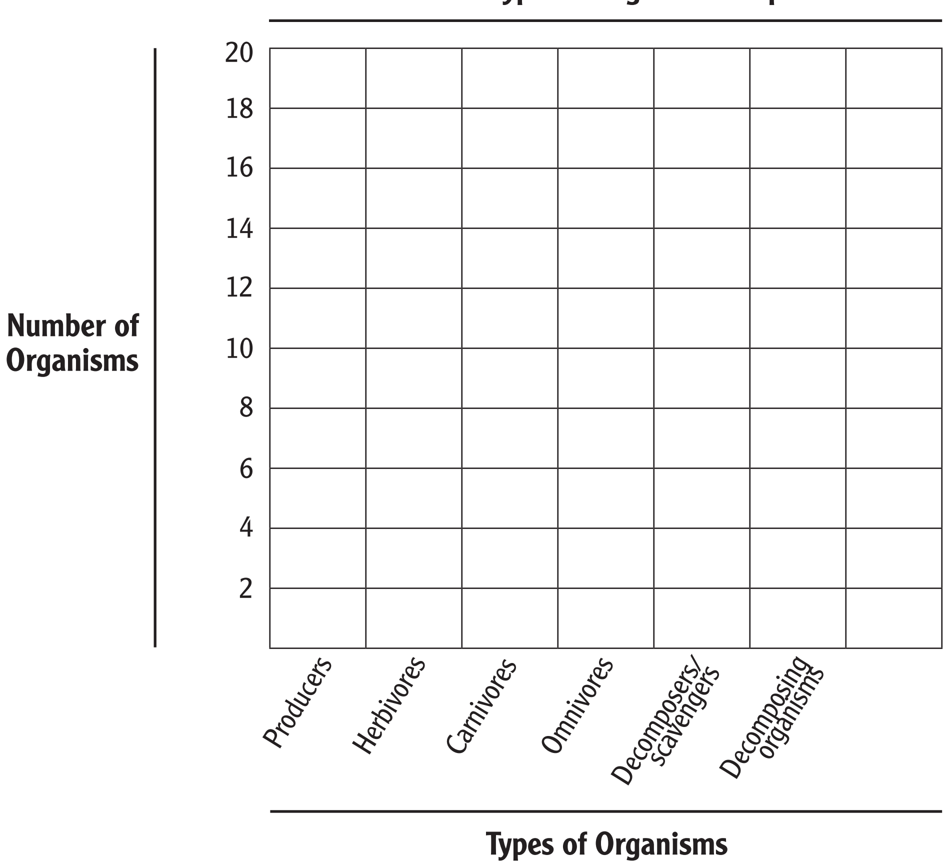
pond ecosystem data table

Kinds of organisms	Number of organisms in 1st set of pond food chains	Number of organisms in 2nd set of pond food chains	Total
Producers			
Herbivores			
Carnivores			
Omnivores			
Decomposers & scavengers			
Decomposing organisms			

pond ecosystem graph

Complete a bar graph below using the information from the Total column in your data table.

Numbers of different types of organisms in pond food chains



algae

what it eats: Produces its own food using energy from the sun

what eats it: Giant floater mussels, yellow drake mayflies, northern crayfish, bluegill fish, water fleas, green frog tadpoles, pond snails, red-eared slider turtles, fathead minnows

environment: Free floating in the water, attaching to rocks, plants and other surfaces

bluegill fish

what it eats: Water striders, blue-fronted dancer damselflies, yellow drake mayflies, northern crayfish, fathead minnows, algae

what eats it: Largemouth bass, great blue herons, northern water snakes, humans

environment: Among plants near shore of an enclosed deep body of water

black willow tree

what it eats: Produces its own food using energy from the sun

what eats it: **Leaves eaten by**—white-tailed deer; **Roots and stems eaten by**—muskrats

environment: Low, wet areas along the water in full sun

cattail

what it eats: Produces its own food using energy from the sun

what eats it: Muskrats

environment: Banks and shallow areas of an enclosed body of fresh water

blue-fronted dancer damselfly

what it eats: **Adults eat**—water fleas; **Nymphs eat**—predacious diving beetles

what eats it: **Adults eaten by**—mallard ducks, green darner dragonflies; **Nymphs eaten by**—bluegill fish, predacious diving beetles, green frogs, red-eared slider turtles, yellow drake mayflies, fathead minnows

environment: In and near enclosed bodies of fresh water

channel catfish

what it eats: **Living and dead**—fishing spiders, fathead minnows, northern crayfish, duckweed

what eats it: Common snapping turtles, humans

environment: Near the bottom of small, deep bodies of water

common carp

what it eats: **Living and dead**—fishing spiders, coontails, duckweed

what eats it: Humans, largemouth bass, great blue herons

environment: In deeper pools of water around submerged logs

coontail

what it eats: Produces its own food using energy from the sun

what eats it: Mallard ducks, red-eared slider turtles, common snapping turtles, common carp, northern crayfish

environment: In small body of clear-to-murky water up to 20 feet deep

common sedge

what it eats: Produces its own food using energy from the sun

what eats it: **Seeds eaten by**—mallard ducks

environment: Banks of small, deep bodies of water

duckweed

what it eats: Produces its own food using energy from the sun

what eats it: Mallard ducks, common carp, red-eared slider turtles, northern crayfish, channel catfish

environment: Floats on surface of small, deep bodies of water

common snapping turtle

what it eats: **Living and dead**—aquatic plants, channel catfish, northern crayfish, green frogs, coontails

what eats it: **Eggs and young eaten by**—raccoons, northern water snakes

environment: In an enclosed body of water with muddy bottoms, submerged logs and plenty of vegetation

fathead minnow

what it eats: Algae, green darner dragonflies, blue-fronted dancer damselflies

what eats it: Largemouth bass, bluegill fish, channel catfish, northern water snakes, great blue herons, green frogs, raccoons

environment: In a small area of water surrounded by land

fishing spider

what it eats: Water striders, predacious diving beetles

what eats it: Green frogs, channel catfish, largemouth bass, common carp

environment: Among plants on or near the bank of an enclosed body of fresh water

green darner dragonfly

what it eats: **Adults eat**—blue-fronted dancer damselflies, yellow drake mayflies; **Nymphs eat**—predacious diving beetles, green frog tadpoles

what eats it: **Adults eaten by**—green frogs; **Nymphs eaten by**—largemouth bass, predacious diving beetles, green frogs, red-eared slider turtles, northern harrier hawks, yellow garden spiders, fathead minnows

environment: **Adults**—near a small, deep body of water; **Nymphs**—in the water

giant floater mussel

what it eats: Algae, water fleas

what eats it: Muskrats, raccoons, red-eared slider turtles, great blue herons

environment: Bottom of a small, deep body of water

green frog

what it eats: **Adults eat**—blue-fronted dancer damselflies, green darner dragonflies, yellow drake mayflies, water striders, fishing spiders, predacious diving beetles, northern crayfish, fathead minnows, pond snails; **Tadpoles eat**—algae

what eats it: Northern water snakes, common snapping turtles, largemouth bass, great blue herons, raccoons, muskrats, humans; **Tadpoles eaten by**—green darner dragonfly nymphs, predacious diving beetles

environment: In algae and among aquatic plants

great blue heron

what it eats: Bluegill fish, common carp, fathead minnows, young largemouth bass, green frogs, northern water snakes, red-eared slider turtles, giant floater mussels, pond snails, northern crayfish

what eats it: Raccoons

environment: Near bodies of water

human

what it eats: Blackberries, bluegill fish, bobwhite quail, channel catfish, common carp, fox squirrels, green frogs, hickory nuts, largemouth bass, mallard ducks, muskrats, raccoons, white-tailed deer, wild turkeys, northern crayfish

what eats it: None

environment: Found in more than one ecosystem

largemouth bass

what it eats: Bluegill fish, common carp, channel catfish, fathead minnows, northern crayfish, green frogs, water fleas, green darner dragonflies, fishing spiders, predacious diving beetles

what eats it: Humans, great blue herons, raccoons, northern water snakes

environment: In warm, clear water

northern crayfish

what it eats: Algae; **Decaying—**yellow water lilies, coontail, duckweed

what eats it: Channel catfish, largemouth bass, bluegill fish, red-eared slider turtles, common snapping turtles, green frogs, northern water snakes, great blue herons, mallard ducks, raccoons, muskrats, humans

environment: Bodies of open and enclosed water

mallard duck

what it eats: Duckweed, coontail, water primrose, common sedge, pin oak trees, water striders, yellow drake mayflies, blue-fronted dancer damselflies, pond snails, predacious diving beetles, northern crayfish

what eats it: Humans, raccoons

environment: In and around enclosed bodies of fresh water

northern water snake

what it eats: Largemouth bass, bluegill fish, fathead minnows, northern crayfish, green frogs, common snapping turtles

what eats it: Great blue herons, raccoons, red-eared slider turtles

environment: In a small, deep body of water

muskrat

what it eats: Yellow water lilies, black willow trees, cattails, giant floater mussels, northern crayfish, green frogs

what eats it: Humans

environment: In and around enclosed bodies of water

pin oak tree

what it eats: Produces its own food using energy from the sun

what eats it: **Acorns eaten by**—mallard ducks, raccoons, white-tailed deer; **Leaves and twigs eaten by**—white-tailed deer

environment: Near enclosed and open bodies of water

pond snail

what it eats: Algae

what eats it: Common carp, green frogs, red-eared slider turtles, great blue herons, mallard ducks

environment: In water surrounded by land

red-eared slider turtle

what it eats: Water striders, pond snails, northern crayfish, giant floater mussels, duckweed, coontail, algae; Nymphs of green darner dragonflies, yellow drake mayflies and blue-fronted dancer damselflies

what eats it: Raccoons, great blue herons; **Eggs and young eaten by**—northern water snakes

environment: In and around an area of water surrounded by land

predacious diving beetle

what it eats: Nymphs of green darner dragonflies, blue-fronted dancer damselflies and yellow drake mayflies; Green frog tadpoles

what eats it: Predacious diving beetles, fishing spiders, largemouth bass, green frogs, mallard ducks; **Eaten by nymphs of**—green darner dragonflies and blue-fronted dancer damselflies

environment: Body of water surrounded by land

water flea

what it eats: Algae, water fleas

what eats it: Water fleas, water striders, blue-fronted dancer damselflies, yellow drake mayflies, giant floater mussels, young largemouth bass

environment: Body of water

raccoon

what it eats: Pin oak trees, northern crayfish, northern water snakes, fathead minnows, largemouth bass, green frogs, giant floater mussels, mallard ducks, common snapping turtles, red-eared slider turtles, great blue herons

what eats it: Humans

environment: Areas near enclosed bodies of water

water primrose

what it eats: Produces its own food using energy from the sun

what eats it: **Seeds eaten by**—white-tailed deer, mallard ducks

environment: In an area of water surrounded by land

water strider

what it eats: Water fleas

what eats it: Green frogs, bluegill fish, fishing spiders, red-eared slider turtles, mallard ducks

environment: Surface of a small area of water surrounded by land

yellow drake mayfly

what it eats: **Adults**—do not eat; **Nymphs eat**—water fleas, blue-fronted dancer damselfly nymphs, algae

what eats it: **Adults eaten by**—mallard ducks, green frogs, green darner dragonflies; **Nymphs eaten by**—bluegill fish, predacious diving beetles, green frogs, red-eared slider turtles

environment: In and near the water

white-tailed deer

what it eats: White oak trees,Virginia creeper vines, mayapples, mosses, shelf mushrooms, flowering dogwood trees, sassafras trees, hickory trees, blue violets, redcedar trees, red maple trees, pin oak trees, black willow trees, little bluestem, big bluestem, switch grass, Indian grass, sideoats grama grass, prairie blazing star, purple coneflowers, gaura, compass plants, blackberries, water primrose

what eats it: Humans, bobcats

environment: Wooded areas

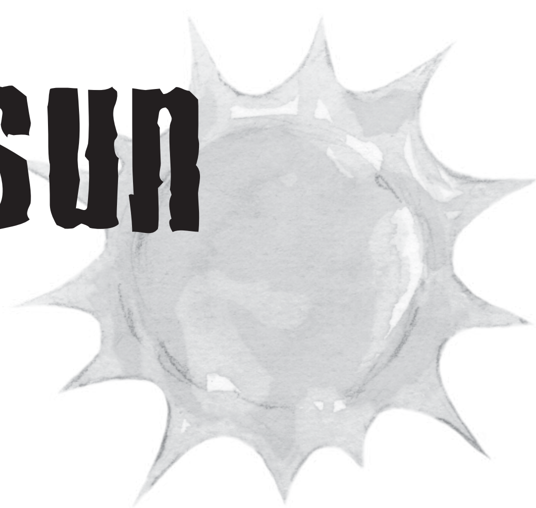
yellow water lily

what it eats: Produces its own food using energy from the sun

what eats it: Muskrats, northern crayfish

environment: Enclosed bodies of fresh water

sun



Organism	Key
algae **what it eats:** Produces its own food using energy from the sun **what eats it:** Giant floater mussels, yellow drake mayflies, northern crayfish, bluegill fish, water fleas, green frog tadpoles, pond snails, red-eared slider turtles, fathead minnows **environment:** Free floating in the water, attaching to rocks, plants and other surfaces	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
black willow tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Leaves eaten by**—white-tailed deer; **Roots and stems eaten by**—muskrats **environment:** Low, wet areas along the water in full sun	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
blue-fronted dancer damselfly **what it eats:** **Adults eat**—water fleas; **Nymphs eat**—predacious diving beetles **what eats it:** **Adults eaten by**—mallard ducks, green darner dragonflies; **Nymphs eaten by**—bluegill fish, predacious diving beetles, green frogs, red-eared slider turtles, yellow drake mayflies, fathead minnows **environment:** In and near enclosed bodies of fresh water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
bluegill fish **what it eats:** Water striders, blue-fronted dancer damselflies, yellow drake mayflies, northern crayfish, fathead minnows, algae **what eats it:** Largemouth bass, great blue herons, northern water snakes, humans **environment:** Among plants near shore of an enclosed deep body of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
cattail **what it eats:** Produces its own food using energy from the sun **what eats it:** Muskrats **environment:** Banks and shallow areas of an enclosed body of fresh water	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
channel catfish **what it eats:** **Living and dead**—fishing spiders, fathead minnows, northern crayfish, duckweed **what eats it:** Common snapping turtles, humans **environment:** Near the bottom of small, deep bodies of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, **Scavenger** **Prey**, **Predator**
common carp **what it eats:** **Living and dead**—fishing spiders, coontails, duckweed **what eats it:** Humans, largemouth bass, great blue herons **environment:** In deeper pools of water around submerged logs	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
common sedge **what it eats:** Produces its own food using energy from the sun **what eats it:** **Seeds eaten by**—mallard ducks **environment:** Banks of small, deep bodies of water	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
common snapping turtle **what it eats:** **Living and dead**—aquatic plants, channel catfish, northern crayfish, green frogs, coontails **what eats it:** **Eggs and young eaten by**—raccoons, northern water snakes **environment:** In an enclosed body of water with muddy bottoms, submerged logs and plenty of vegetation	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, **Scavenger** **Prey**, **Predator**
coontail **what it eats:** Produces its own food using energy from the sun **what eats it:** Mallard ducks, red-eared slider turtles, common snapping turtles, common carp, northern crayfish **environment:** In small body of clear-to-murky water up to 20 feet deep	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
duckweed **what it eats:** Produces its own food using energy from the sun **what eats it:** Mallard ducks, common carp, red-eared slider turtles, northern crayfish, channel catfish **environment:** Floats on surface of small, deep bodies of water	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
fathead minnow **what it eats:** Algae, green darner dragonflies, blue-fronted dancer damselflies **what eats it:** Largemouth bass, bluegill fish, channel catfish, northern water snakes, great blue herons, green frogs, raccoons **environment:** In a small area of water surrounded by land	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
fishing spider **what it eats:** Water striders, predacious diving beetles **what eats it:** Green frogs, channel catfish, largemouth bass, common carp **environment:** Among plants on or near the bank of an enclosed body of fresh water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
giant floater mussel **what it eats:** Algae, water fleas **what eats it:** Muskrats, raccoons, red-eared slider turtles, great blue herons **environment:** Bottom of a small, deep body of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
great blue heron **what it eats:** Bluegill fish, common carp, fathead minnows, young largemouth bass, green frogs, northern water snakes, red-eared slider turtles, giant floater mussels, pond snails, northern crayfish **what eats it:** Raccoons **environment:** Near bodies of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
green darner dragonfly **what it eats:** **Adults eat**—blue-fronted dancer damselflies, yellow drake mayflies; **Nymphs eat**—predacious diving beetles, green frog tadpoles **what eats it:** **Adults eaten by**—green frogs; **Nymphs eaten by**—largemouth bass, predacious diving beetles, green frogs, red-eared slider turtles, northern harrier hawks, yellow garden spiders, fathead minnows **environment:** **Adults**—near a small, deep body of water; **Nymphs**—in the water	**Pond**, Forest, [Prairie] Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
green frog **what it eats:** **Adults eat**—blue-fronted dancer damselflies, green darner dragonflies, yellow drake mayflies, water striders, fishing spiders, predacious diving beetles, northern crayfish, fathead minnows, pond snails; **Tadpoles eat**—algae **what eats it:** Northern water snakes, common snapping turtles, largemouth bass, great blue herons, raccoons, muskrats, humans; **Tadpoles eaten by**—green darner dragonfly nymphs, predacious diving beetles **environment:** In algae and among aquatic plants	**Pond**, Forest, Prairie Producer, **Consumer** **Herbivore** (as tadpole), Omnivore, **Carnivore** (as adult), Decomposer, Scavenger **Prey**, **Predator**
human **what it eats:** Blackberries, bluegill fish, bobwhite quail, channel catfish, common carp, fox squirrels, green frogs, hickory nuts, largemouth bass, mallard ducks, muskrats, raccoons, white-tailed deer, wild turkeys, northern crayfish **what eats it:** None **environment:** Found in more than one ecosystem	**Pond**, **Forest**, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger Prey, **Predator**
largemouth bass **what it eats:** Bluegill fish, common carp, channel catfish, fathead minnows, northern crayfish, green frogs, water fleas, green darner dragonflies, fishing spiders, predacious diving beetles **what eats it:** Humans, great blue herons, raccoons, northern water snakes **environment:** In warm, clear water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
mallard duck **what it eats:** Duckweed, coontail, water primrose, common sedge, pin oak trees, water striders, yellow drake mayflies, blue-fronted dancer damselflies, pond snails, predacious diving beetles, northern crayfish **what eats it:** Humans, raccoons **environment:** In and around enclosed bodies of fresh water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
muskrat **what it eats:** Yellow water lilies, black willow trees, cattails, giant floater mussels, northern crayfish, green frogs **what eats it:** Humans **environment:** In and around enclosed bodies of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
northern crayfish **what it eats:** Algae; **Decaying—**yellow water lilies, coontail, duckweed **what eats it:** Channel catfish, largemouth bass, bluegill fish, red-eared slider turtles, common snapping turtles, green frogs, northern water snakes, great blue herons, mallard ducks, raccoons, muskrats, humans **environment:** Bodies of open and enclosed water	**Pond**, Forest, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, **Scavenger** **Prey**, Predator
northern water snake **what it eats:** Largemouth bass, bluegill fish, fathead minnows, northern crayfish, green frogs, common snapping turtles **what eats it:** Great blue herons, raccoons, red-eared slider turtles **environment:** In a small, deep body of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
pin oak tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Acorns eaten by—**mallard ducks, raccoons, white-tailed deer; **Leaves and twigs eaten by—**white-tailed deer **environment:** Near enclosed and open bodies of water	**Pond**, [Forest], Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
pond snail **what it eats:** Algae **what eats it:** Common carp, green frogs, red-eared slider turtles, great blue herons, mallard ducks **environment:** In water surrounded by land	**<u>Pond</u>**, Forest, Prairie Producer, **<u>Consumer</u>** **<u>Herbivore</u>**, Omnivore, Carnivore, Decomposer, Scavenger **<u>Prey</u>**, Predator
predacious diving beetle **what it eats:** Nymphs of green darner dragonflies, blue-fronted dancer damselflies and yellow drake mayflies; Green frog tadpoles **what eats it:** Predacious diving beetles, fishing spiders, largemouth bass, green frogs, mallard ducks; **Eaten by nymphs of**—green darner dragonflies and blue-fronted dancer damselflies **environment:** Body of water surrounded by land	**<u>Pond</u>**, Forest, Prairie Producer, **<u>Consumer</u>** Herbivore, Omnivore, **<u>Carnivore</u>**, Decomposer, Scavenger **<u>Prey</u>**, **<u>Predator</u>**
raccoon **what it eats:** Pin oak trees, northern crayfish, northern water snakes, fathead minnows, largemouth bass, green frogs, giant floater mussels, mallard ducks, common snapping turtles, red-eared slider turtles, great blue herons **what eats it:** Humans **environment:** Areas near enclosed bodies of water	**<u>Pond</u>**, Forest, Prairie Producer, **<u>Consumer</u>** Herbivore, **<u>Omnivore</u>**, Carnivore, Decomposer, Scavenger **<u>Prey</u>**, **<u>Predator</u>**
red-eared slider turtle **what it eats:** Water striders, pond snails, northern crayfish, giant floater mussels, duckweed, coontail, algae; Nymphs of green darner dragonflies, yellow drake mayflies and blue-fronted dancer damselflies **what eats it:** Raccoons, great blue herons; **Eggs and young eaten by**—northern water snakes **environment:** In and around an area of water surrounded by land	**<u>Pond</u>**, Forest, Prairie Producer, **<u>Consumer</u>** Herbivore, **<u>Omnivore</u>**, Carnivore, Decomposer, Scavenger **<u>Prey</u>**, **<u>Predator</u>**
water flea **what it eats:** Algae, water fleas **what eats it:** Water fleas, water striders, blue-fronted dancer damselflies, yellow drake mayflies, giant floater mussels, young largemouth bass **environment:** Body of water	**<u>Pond</u>**, Forest, Prairie Producer, **<u>Consumer</u>** Herbivore, **<u>Omnivore</u>**, Carnivore, Decomposer, Scavenger **<u>Prey</u>**, **<u>Predator</u>**

Organism	Key
water primrose **what it eats:** Produces its own food using energy from the sun **what eats it:** **Seeds eaten by**—white-tailed deer, mallard ducks **environment:** In an area of water surrounded by land	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
water strider **what it eats:** Water fleas **what eats it:** Green frogs, bluegill fish, fishing spiders, red-eared slider turtles, mallard ducks **environment:** Surface of a small area of water surrounded by land	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
white-tailed deer **what it eats:** White oak trees, Virginia creeper vines, mayapples, mosses, shelf mushrooms, flowering dogwood trees, sassafras trees, hickory trees, blue violets, redcedar trees, red maple trees, pin oak trees, black willow trees, little bluestem, big bluestem, switch grass, Indian grass, sideoats grama grass, prairie blazing star, purple coneflowers, gaura, compass plants, blackberries, water primrose **what eats it:** Humans, bobcats **environment:** Wooded areas	[Pond], **Forest**, [Prairie] Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
yellow drake mayfly **what it eats:** **Adults**—do not eat; **Nymphs eat**—water fleas, blue-fronted dancer damselfly nymphs, algae **what eats it:** **Adults eaten by**—mallard ducks, green frogs, green darner dragonflies; **Nymphs eaten by**—bluegill fish, predacious diving beetles, green frogs, red-eared slider turtles **environment:** In and near the water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
yellow water lily **what it eats:** Produces its own food using energy from the sun **what eats it:** Muskrats, northern crayfish **environment:** Enclosed bodies of fresh water	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

activity 5.2 : are there any "free" forest lunches?

estimated time 30–40 minutes

objectives

Students will be able to

1. Categorize consumers by what they eat.
2. Explain how herbivores, carnivores and omnivores are different.
3. Define the roles of decomposers in an ecosystem.
4. Classify decomposers and scavengers by the role they play in forest ecosystems.
5. Explain how an animal's teeth can help identify the kind of consumer it is.

teacher preparation

This is an outdoor activity and will require a large, open area. *Forest Ecosystem Cards* will be used to demonstrate how herbivores, carnivores and omnivores differ, not only in what they eat and the specialized tooth structures that help them eat, but also in the variety and availability of food sources.

Use only the *Forest Ecosystem Cards* for this activity, but *REMOVE THE HUMAN CARD.* The purpose of this activity is to reinforce each objective as well as give students an opportunity to explore food chains related specifically to a forest ecosystem.

NOTE: For quick teacher reference, each *Forest Ecosystem Card* is marked with two bars on the lower right corner.

materials

Science notebooks
Pencils
Thermometers
Flip chart or small white board and markers
*Forest Ecosystem Card*s (with Human card removed)
Forest Ecosystem Cards Teacher Key
Activity 5.2 Data Table/Bar Graph copies

procedure

1. Have students complete the heading in their science notebooks and take and record the outside air temperature.

2. Place the balls of yarn in the center of the open area. Shuffle and distribute one *Forest Ecosystem Card* randomly to each student. Make certain that a student has the Sun card.

3. After students have read their cards carefully, indicate a place where all the herbivores should stand together, where all the carnivores should stand together, and where all the omnivores should stand together. Have students in the "vore" groups check each other's cards to be sure everyone is sorted out correctly. Students with producer cards and the Sun card should remain apart from the "vore" groups.

4. Address the entire class:
   Q. Based on the organism on your card, raise your hand if you are a consumer.
   A. All but the producers and the sun should raise their hands.
   Q. What specialized structures do you have to help you consume/eat other organisms?
   A. Answers may vary, but students should note that each group of "vores" has different kinds of teeth.

5. Address the herbivores:
   Q. What kind of teeth do you have and why?
   A. Herbivores have snipping and grinding teeth because these teeth help them snip off and chew up plants.

6. Address the carnivores:

Q. What kind of teeth do you have and why?

A. Carnivores have sharp front teeth for gripping and tearing plus grinding teeth plus two sharp, pointed teeth on the sides of the front teeth for gripping and tearing. All of these teeth help carnivores grab, tear up and grind down the flesh and bones of animals.

7. Address the omnivores:

Q. What kind of teeth do you have and why?

A. Omnivores have teeth similar to both herbivores and carnivores because they eat plants and animals and need to grip, tear and grind both tough plants and the flesh and bones of animals.

8. Address the class:

Q. What about omnivores like white-breasted nuthatches and wild turkeys? What kind of specialized structure do they have to help them capture insects and eat seeds and fruit?

A. Omnivores like white-breasted nuthatches and wild turkeys have no teeth at all. Instead they have beaks that help them capture insects and eat seeds and fruits. Great horned owls are carnivores. They do not have teeth but use their sharp beaks for tearing apart their food.

9. Address the producers and the sun, by asking this "trick" question:

Q. Those of you left here, what kind of teeth do you have?

A. Producers do not eat other organisms, and therefore, have no tooth structures. Producers get energy directly from the sun to make their own food. The sun is the source of all energy and is not an organism.

10. Address the remaining consumers (scavengers and decomposers):

Q. What type of consumers are you?

A. Decomposers and scavengers.

Q. What is the difference between decomposers and scavengers?

A. Decomposers are special organisms (bacteria, fungi) that eat and break down scat, and dead plants and animals into tiny parts. Scavengers (earthworms, sowbugs, etc.) seek out and eat dead and decaying organisms.

11. Bring the student with the Sun card to the center of the open area near the balls of yarn and remind him/her of the important role he/she is about to play.

12. Address the entire class:

Q. Which organisms should be connected directly to the Sun?

A. Producers.

13. Have producers raise their hands, and choose one producer at a time to step forward. While the Sun is holding the end of a ball of yarn and unwinding it and handing it to the producer, ask:

Q. What organism are you?

A. Blue violet, moss, mayapple, etc.

Q. What role do you play in an ecosystem?

A. Producer.

Q. Why do you think you should connect to this food chain here?

A. I get energy to make my own food directly from the sun.

Q. In what ecosystem would you commonly be found?

A. Forest.

14. Continue linking producers to the Sun until they are either all linked *OR* until the Sun has used all the available balls of yarn. Have any unlinked producers stand over to the side.

Q. What might happen to a producer that does not receive enough sun, water, nutrients, etc.?

A. It might die.

Q. What happens to producers that die?

A. They begin to break down or decompose and eventually become part of the soil.

15. Indicate a place off to the side of the group as the place for unlinked/decomposing organisms. Ask students to give the place a name. The name could be funny/clever/etc. but should relate to decomposition (Ex: Decomp Hill; Soil Will Be Us; Break Down Dump).

Throughout this entire activity, send any students incorrectly attempting to link to a food chain (based on the information on their cards) to the decomposition area.

16. Repeat the process with consumers. Ask the consumers (who could be linked to one of the available producers linked to the Sun) to raise their hands. Choose students randomly and have them stand next to a producer they would consume. Ask each one:
    Q. What organism are you?
    A. Answers will vary but should include animals only.
    Q. What kind of consumer are you?
    A. Answers will vary but should include herbivores, omnivores, scavengers and decomposers only.
    Q. What role do you play in an ecosystem?
    A. Answers will vary. Depending on the specific organism, answers should include:
    - Consumers eat producers and other consumers and help to pass energy up through a food chain.
    - Herbivores eat producers and help to pass energy up through the food chain.
    - Omnivores eat producers and other consumers and help to pass energy up through the food chain.
    - Scavengers seek out and eat dead and decaying organisms and help to keep an ecosystem clean.
    - Decomposers eat and break down scat and dead and decaying plants and animals into tiny parts.

    Q. Why do you think you should connect to this food chain here?
    A. Answers will vary but should be based on information on their cards. (Ex: Because I am a consumer/herbivore/omnivore that consumes [names the particular plant to which they will connect] for energy; Because I am a scavenger/decomposer and I consume dead and decaying plants.This plant is dead and decaying.)

17. Have students unwind the ball of yarn as it is passed to the consumer. Enough yarn should be unwound to allow about two feet of space between them.The sun and all producers and consumers should continue to hold onto the piece of yarn.

18. Address any organisms remaining in the herbivore group:
    Q. What has happened to these herbivores?
    A. There are no producers left for them to eat.
    Q. What could happen to them?
    A. These herbivores would either starve or move away (if possible) to find producers somewhere else.
    Q. Where should we place them now?
    A. In the decomposition area!

19. If a decomposer has linked to a producer (which is possible):
    Q. What is happening to a food chain that includes the sun, a producer, and a decomposer?
    A. The producer has died, and the decomposer is breaking it down into tiny parts.
    Q. Would it be the end of a food chain if a decomposer linked up with a decaying plant?
    A. Not necessarily. If a sowbug (considered a decomposer and a scavenger) linked with a "decaying" producer, there are other consumers that could still consume (link up with) the sowbug.

20. Continue the process with the remaining consumers. Ask students who think they could link with one of the food chains to raise their hands. Choose students randomly and repeat the questions for each student as they step up to their chosen chain and unwind and pass along the ball of yarn.
    Q. What organism are you?
    A. Answers will vary but should include animals, scavengers and decomposers only.
    Q. What kind of consumer are you?
    A. Answers will vary but should include carnivores, omnivores, scavengers and decomposers only.
    Q. What role do you play in an ecosystem?
    A. Answers will vary. Depending on the specific organism, answers should include:
    - Consumers eat producers and other consumers and help to pass energy up through a food chain.
    - Carnivores eat other consumers and help to pass energy up through the food chain.
    - Omnivores eat producers and other consumers and help to pass energy up through the food chain.
    - Scavengers seek out and eat dead and decaying organisms and help to keep an ecosystem clean.
    - Decomposers eat and break down scat and dead and decaying plants and animals into tiny parts.

    Q. Why do you think you should connect to this food chain here?

A. Answers will vary but should be based on information on their cards. (Ex: Because I am a consumer/carnivore /omnivore that consumes (names the particular animal to which they will connect) for energy; Because I am a scavenger/decomposer and I consume dead and decaying animals. This animal is dead and decaying.)

21. Repeat the process, asking for students to step up as part of the next link in one of the food chains. Students from this point on should be carnivores, omnivores, scavengers or decomposers only but must reference the information on their card to prove that they would eat the organism to which they plan to link.

Continue until all students are linked to a food chain or unlinked students/consumers have no place to connect. Send unlinked students to the decomposition area.

22. Use a flip chart or small white board to capture the following information for all food chains. Have students use the data table provided to organize the information.
Q. How many producers?
Q. How many herbivores?
Q. How many carnivores?
Q. How many omnivores?
Q. How many decomposers and scavengers?
Q. How many decomposing organisms left at the decomposition area?

Q. Who or what is going to clean up all those decomposing organisms?
A. Other decomposers (fungi and bacteria) and scavengers (earthworms, sowbugs, etc.).

23. Have students roll up the balls of yarn and place them in the center of the open area. Collect and redistribute the cards randomly. **Instruct students to create new food chains on their own for their forest ecosystem.** This could create something close to chaos as students read their cards, find the Sun, question each other and attempt to link with a food chain. Students who think they cannot connect into any of the chains should move to the decomposition area.

24. Quickly review and discuss each component of each food chain. (If students are confident in their understanding of the concepts, have them attempt these food chain reviews in "speed talk.") Send any students linked incorrectly to the decomposition area, and randomly select a student already in the decomposition area and see if he/she can connect somewhere in one of the chains without jeopardizing a student already in place.

25. Record the number of each type of organism linked somewhere in the food chains and include those numbers as a second set on the flip chart/white board. Have students record this data in their *Data Tables*.

26. Using data from their *Data Tables*, have students work in groups to use the graph provided to create a bar graph.

27. Have students at their graph to answer the following:
Q. Which type of organism had the highest number?
Q. Which type of organism had the lowest number?
Q. What did you notice about the numbers of these organisms?
A. Answers will vary. There are more producers. There are more omnivores than herbivores or carnivores. There are many decomposing organisms, etc.
Q. How would you explain this?
A. Answers will vary. As long as there is sunlight, air, water, nutrients, space and temperature, producers will grow. Omnivores have more choices and are able to eat a larger variety of food. Basically, there really are no free lunches, and even omnivores sometimes have difficulty finding food. However, there were always students "decomposing" and returning nutrients back into the soil.

28. Have students revisit their *Big Chart: Forest Ecosystem* and place an X or a check mark indicating whether each organism listed is an herbivore, carnivore, omnivore, decomposer or scavenger.

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

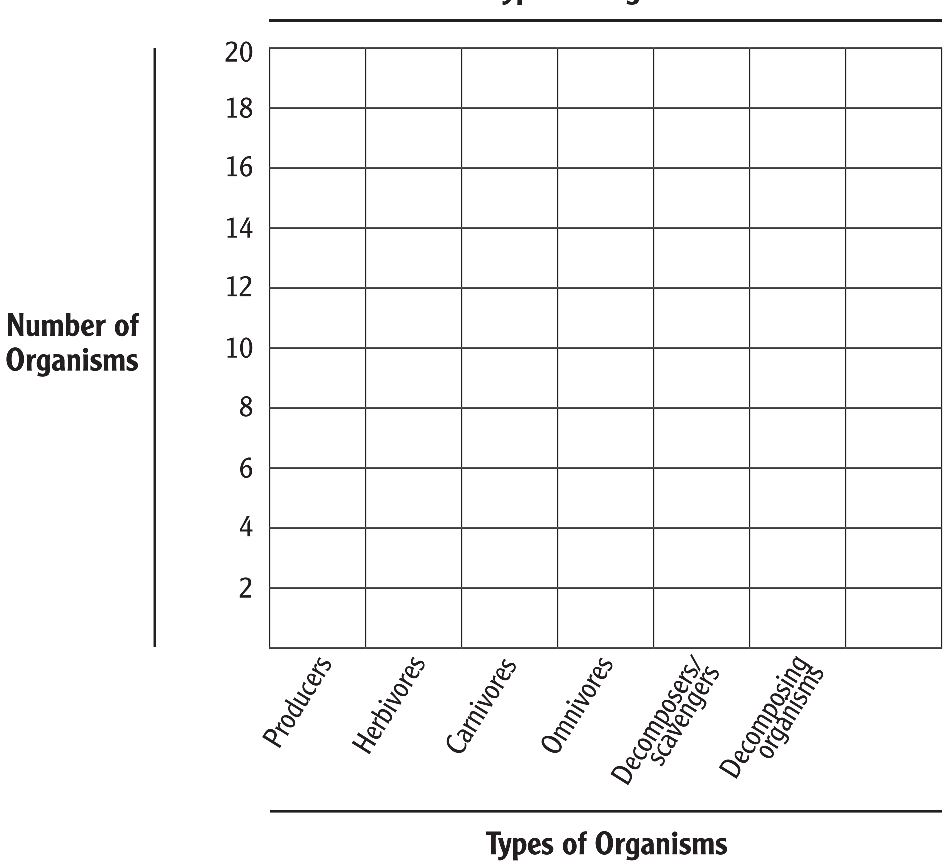
forest ecosystem data table

Kinds of organisms	Number of organisms in 1st set of forest food chains	Number of organisms in 2nd set of forest food chains	Total
Producers			
Herbivores			
Carnivores			
Omnivores			
Decomposers & scavengers			
Decomposing organisms			

forest ecosystem graph

Complete a bar graph below using the information from the Total column in your data table.

Numbers of different types of organisms in forest food chains



badger

what it eats: Thirteen-lined ground squirrels, northern crawfish frogs, ornate box turtles, three-toed box turtles, plains pocket gophers

what eats it: Young eaten by coyotes

environment: Grasslands

carpenter ant

what it eats: **Living and dead**—termites and sowbugs

what eats it: Pileated woodpeckers, ovenbirds, centipedes, gray tree frogs; **Tiny pieces of dead and decaying carpenter ants eaten by**—earthworms

environment: Dead trees and logs

blue violet

what it eats: Produces its own food using energy from the sun

what eats it: Three-toed box turtles, io moths, woodland voles, white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs

environment: In an area with many trees

centipede

what it eats: Sowbugs, centipedes, termites, carpenter ants

what eats it: Centipedes, tiger salamanders, ovenbirds

environment: Land with many trees

bobcat

what it eats: White-tailed deer, ovenbirds, wild turkeys, Texas ratsnakes

what eats it: **Young eaten by**—Great horned owls, coyotes

environment: Bottomland with lots of trees

earthworm

what it eats: **Tiny pieces of dead and decaying**—hickory trees, blue violets, mayapples, flowering dogwood trees, sassafras trees, redcedar trees, red maple trees, Virginia creeper vines, white oak trees, sowbugs, carpenter ants and termites

what eats it: Ovenbirds, three-toed box turtles, tiger salamanders

environment: In areas with lots of trees and other plants

flowering dogwood tree

what it eats: Produces its own food using energy from the sun

what eats it: **Fruit eaten by**—fox squirrels, white-tailed deer, wild turkeys, white-breasted nuthatches; **Seeds eaten by**—carpenter ants; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites

environment: Under larger trees

great horned owl

what it eats: Fox squirrels, bobcats, thirteen-lined ground squirrels, spotted skunks, woodland voles, northern harrier hawks, ovenbirds, white-breasted nuthatches, wild turkeys,Texas ratsnakes, speckled kingsnakes

what eats it: Texas ratsnakes

environment: Areas with many trees

fox squirrel

what it eats: Virginia creeper vines, flowering dogwood trees, white oak trees, hickory trees, red maple trees

what eats it: Great horned owls,Texas ratsnakes, humans

environment: Cavities of oak, hickory and other hardwood trees

hickory tree

what it eats: Produces its own food using energy from the sun

what eats it: **Nuts eaten by**—humans, wild turkeys; **Nuts and buds eaten by**—fox squirrels, white-tailed deer; **Leaves eaten by**—walking sticks, white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites

environment: In an area with many trees

gray treefrog

what it eats: Walking sticks, termites, carpenter ants

what eats it: Texas ratsnakes

environment: Areas with many trees

human

what it eats: Blackberries, bluegill fish, bobwhite quail, channel catfish, common carp, fox squirrels, green frogs, hickory nuts, largemouth bass, mallard ducks, muskrats, raccoons, white-tailed deer, wild turkeys, northern crayfish

what eats it: None

environment: Found in more than one ecosystem

io moth

what it eats: **Adults**—do not feed; **Larva eat leaves of**—blue violets, sassafras trees, oak trees

what eats it: Pileated woodpeckers, white-breasted nuthatches, rough green snakes

environment: Land with many trees

ovenbird

what it eats: Earthworms, centipedes, sowbugs, carpenter ants, termites

what eats it: Great horned owls, bobcats, Texas ratsnakes

environment: In an area with many trees

mayapple

what it eats: Produces its own food using energy from the sun

what eats it: **Fruit eaten by**—three-toed box turtles, wild turkeys, woodland voles; **Fruit and leaves eaten by**—white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs

environment: Areas with many trees

pileated woodpecker

what it eats: Virginia creeper vines, walking sticks, carpenter ants, io moths, spicebush swallowtail butterflies, termites, white oak trees, redcedar trees, blackberries

what eats it: Texas ratsnakes

environment: Areas with many trees

moss

what it eats: Produces its own food using energy from the sun

what eats it: White-tailed deer

environment: In shaded areas under trees

red maple tree

what it eats: Produces its own food using energy from the sun

what eats it: **Seeds eaten by**—white-breasted nuthatches, wild turkeys, fox squirrels, woodland voles; **Leaves eaten by**—white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—shelf mushrooms, termites

environment: In areas with many trees

redcedar tree

what it eats: Produces its own food using energy from the sun

what eats it: **Berries eaten by**—white-tailed deer, pileated woodpeckers, white-breasted nuthatches; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites

environment: Areas with lots of trees

shelf mushroom

what it eats: **Dead and decaying**—white oak trees, hickory trees, red maple trees

what eats it: White-tailed deer

environment: In areas with many trees

rough green snake

what it eats: Spicebush swallowtail butterflies, io moths, termites, walking sticks

what eats it: Texas ratsnakes

environment: Areas with many trees

sowbug

what it eats: **Dead and decaying**—hickory trees, blue violets, white oak trees, sassafras trees, redcedar trees, red maple trees,Virginia creeper vines, mayapples, flowering dogwood trees

what eats it: Centipedes, tiger salamanders, ovenbirds, wild turkeys, carpenter ants; **Tiny pieces of dead and decayed sowbugs eaten by**—earthworms

environment: In damp areas with many trees under logs and rocks

sassafras tree

what it eats: Produces its own food using energy from the sun

what eats it: **Fruit eaten by**—white-tailed deer, white-breasted nuthatches; **Leaves eaten by**—io moths, spicebush swallowtail butterflies, white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites

environment: Areas with lots of trees

spicebush swallowtail butterfly

what it eats: Sassafras trees

what eats it: Pileated woodpeckers, rough green snakes

environment: Areas with lots of trees

termite

what it eats: **Dead and decaying wood from**—flowering dogwood trees, hickory trees, red maple trees, redcedar trees, sassafras trees, white oak trees

what eats it: Gray tree frogs, pileated woodpeckers, white-breasted nuthatches, ovenbirds, carpenter ants, centipedes, rough green snakes; **Tiny pieces of dead and decayed termites eaten by**—earthworms

environment: Where there are many trees

tiger salamander

what it eats: Earthworms, centipedes, sowbugs

what eats it: Texas ratsnakes, great horned owls, wild turkeys

environment: Where there are many trees

texas ratsnake

what it eats: Gray treefrogs, rough green snakes, tiger salamanders, ovenbirds, white-breasted nuthatches, fox squirrels; **Eggs and nestlings of**—pileated woodpeckers, ovenbirds, white-breasted nuthatches, great horned owls

what eats it: Great horned owls, bobcats

environment: In an area with many trees

virginia creeper vine

what it eats: Produces its own food using energy from the sun

what eats it: **Berries eaten by**—white-breasted nuthatches, pileated woodpeckers, fox squirrels; **Leaves eaten by**—white-tailed deer, wild turkeys; **Dead leaves eaten by**—earthworms, sowbugs

environment: Areas with trees

three-toed box turtle

what it eats: Blue violets, mayapples, earthworms

what eats it: Badgers

environment: In areas with many trees

walking stick

what it eats: White oak trees, hickory trees

what eats it: Wild turkeys, pileated woodpeckers, white-breasted nuthatches, rough green snakes, gray treefrogs

environment: Areas with many trees

white oak tree

what it eats: Produces its own food using energy from the sun

what eats it: **Leaves eaten by**—walking sticks; **Dead leaves eaten by**—earthworms, sowbugs; **Acorns eaten by**—fox squirrels, wild turkeys, pileated woodpeckers; **Acorns and leaves eaten by**—white-tailed deer; **Dead wood eaten by**—shelf mushrooms, termites

environment: Land where many trees grow

wild turkey

what it eats: Walking sticks, sowbugs, tiger salamanders, mayapples, red maple trees, white oak trees, hickory trees, flowering dogwood trees, Virginia creeper vines

what eats it: Humans, great horned owls, bobcats

environment: In an area with many trees

white-breasted nuthatch

what it eats: Termites, walking sticks, io moths, red maple trees, redcedar trees, flowering dogwood trees, sassafras trees, virginia creeper vines

what eats it: Great horned owls,Texas ratsnakes

environment: Areas with many trees

woodland vole

what it eats: Mayapples, blue violets, red maple trees

what eats it: Great horned owls

environment: In an area with many trees

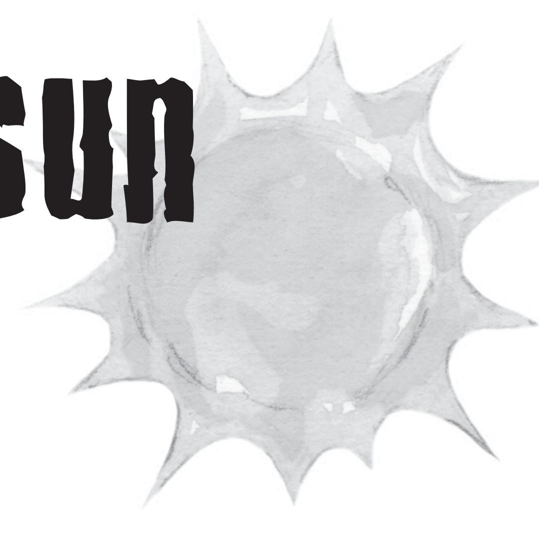
white-tailed deer

what it eats: White oak trees,Virginia creeper vines, mayapples, mosses, shelf mushrooms, flowering dogwood trees, sassafras trees, hickory trees, blue violets, redcedar trees, red maple trees, pin oak trees, black willow trees, little bluestem, big bluestem, switch grass, Indian grass, sideoats grama grass, prairie blazing star, purple coneflowers, gaura, compass plants, blackberries, water primrose

what eats it: Humans, bobcats

environment: Wooded areas

sun



Organism	Key
badger **what it eats:** Thirteen-lined ground squirrels, northern crawfish frogs, ornate box turtles, three-toed box turtles, plains pocket gophers **what eats it:** Young eaten by coyotes **environment:** Grasslands	Pond, [Forest], **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
blue violet **what it eats:** Produces its own food using energy from the sun **what eats it:** Three-toed box turtles, io moths, woodland voles, white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs **environment:** In an area with many trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
bobcat **what it eats:** White-tailed deer, ovenbirds, wild turkeys,Texas ratsnakes **what eats it:** **Young eaten by**—Great horned owls, coyotes **environment:** Bottomland with lots of trees	Pond, **Forest**, [Prairie] Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
carpenter ant **what it eats:** **Living and dead**—termites and sowbugs **what eats it:** Pileated woodpeckers, ovenbirds, centipedes, gray tree frogs; **Tiny pieces of dead and decaying carpenter ants eaten by**—earthworms **environment:** Dead trees and logs	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, **Decomposer**, **Scavenger** **Prey**, **Predator**
centipede **what it eats:** Sowbugs, centipedes, termites, carpenter ants **what eats it:** Centipedes, tiger salamanders, ovenbirds **environment:** Land with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
earthworm **what it eats:** **Tiny pieces of dead and decaying**—hickory trees, blue violets, mayapples, flowering dogwood trees, sassafras trees, redcedar trees, red maple trees, Virginia creeper vines, white oak trees, sowbugs, carpenter ants and termites **what eats it:** Ovenbirds, three-toed box turtles, tiger salamanders **environment:** In areas with lots of trees and other plants	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, Carnivore, **Decomposer**, **Scavenger** **Prey**, Predator
flowering dogwood tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Fruit eaten by**—fox squirrels, white-tailed deer, wild turkeys, white-breasted nuthatches; **Seeds eaten by**—carpenter ants; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites **environment:** Under larger trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
fox squirrel **what it eats:** Virginia creeper vines, flowering dogwood trees, white oak trees, hickory trees, red maple trees **what eats it:** Great horned owls, Texas ratsnakes, humans **environment:** Cavities of oak, hickory and other hardwood trees	Pond, **Forest**, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
gray treefrog **what it eats:** Walking sticks, termites, carpenter ants **what eats it:** Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
great horned owl **what it eats:** Fox squirrels, bobcats, thirteen-lined ground squirrels, spotted skunks, woodland voles, northern harrier hawks, ovenbirds, white-breasted nuthatches, wild turkeys, Texas ratsnakes, speckled kingsnakes **what eats it:** Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, [Prairie] Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
hickory tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Nuts eaten by**—humans, wild turkeys; **Nuts and buds eaten by**—fox squirrels, white-tailed deer; **Leaves eaten by**—walking sticks, white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites **environment:** In an area with many trees	Pond, **<u>Forest</u>**, Prairie **<u>Producer</u>**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
human **what it eats:** Blackberries, bluegill fish, bobwhite quail, channel catfish, common carp, fox squirrels, green frogs, hickory nuts, largemouth bass, mallard ducks, muskrats, raccoons, white-tailed deer, wild turkeys, northern crayfish **what eats it:** None **environment:** Found in more than one ecosystem	**<u>Pond</u>**, **<u>Forest</u>**, **<u>Prairie</u>** Producer, **<u>Consumer</u>** Herbivore, **<u>Omnivore</u>**, Carnivore, Decomposer, Scavenger Prey, **<u>Predator</u>**
io moth **what it eats:** **Adults**—do not feed; **Larva eat leaves of**—blue violets, sassafras trees, oak trees **what eats it:** Pileated woodpeckers, white-breasted nuthatches, rough green snakes **environment:** Land with many trees	Pond, **<u>Forest</u>**, Prairie Producer, **<u>Consumer</u>** **<u>Herbivore</u>**, Omnivore, Carnivore, Decomposer, Scavenger **<u>Prey</u>**, Predator
mayapple **what it eats:** Produces its own food using energy from the sun **what eats it:** **Fruit eaten by**—three-toed box turtles, wild turkeys, woodland voles; **Fruit and leaves eaten by**—white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs **environment:** Areas with many trees	Pond, **<u>Forest</u>**, Prairie **<u>Producer</u>**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
moss **what it eats:** Produces its own food using energy from the sun **what eats it:** White-tailed deer **environment:** In shaded areas under trees	Pond, **<u>Forest</u>**, Prairie **<u>Producer</u>**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
ovenbird **what it eats:** Earthworms, centipedes, sowbugs, carpenter ants, termites **what eats it:** Great horned owls, bobcats,Texas ratsnakes **environment:** In an area with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
pileated woodpecker **what it eats:** Virginia creeper vines, walking sticks, carpenter ants, io moths, spicebush swallowtail butterflies, termites, white oak trees, redcedar trees, blackberries **what eats it:** Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, [Prairie] Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
red maple tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Seeds eaten by**—white-breasted nuthatches, wild turkeys, fox squirrels, woodland voles; **Leaves eaten by**—white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—shelf mushrooms, termites **environment:** In areas with many trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
redcedar tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Berries eaten by**—white-tailed deer, pileated woodpeckers, white-breasted nuthatches; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites **environment:** Areas with lots of trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
rough green snake **what it eats:** Spicebush swallowtail butterflies, io moths, termites, walking sticks **what eats it:** Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
sassafras tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Fruit eaten by**—white-tailed deer, white-breasted nuthatches; **Leaves eaten by**—io moths, spicebush swallowtail butterflies, white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites **environment:** Areas with lots of trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
shelf mushroom **what it eats:** **Dead and decaying**—white oak trees, hickory trees, red maple trees **what eats it:** White-tailed deer **environment:** In areas with many trees	Pond, **Forest**, Prairie Producer, Consumer **[Fungi belong to an entirely different category of organisms.]** Herbivore, Omnivore, Carnivore, **Decomposer**, Scavenger Prey, Predator
sowbug **what it eats:** **Dead and decaying**—hickory trees, blue violets, white oak trees, sassafras trees, redcedar trees, red maple trees, Virginia creeper vines, mayapples, flowering dogwood trees **what eats it:** Centipedes, tiger salamanders, ovenbirds, wild turkeys, carpenter ants; **Tiny pieces of dead and decayed sowbugs eaten by**—earthworms **environment:** In damp areas with many trees under logs and rocks	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, Carnivore, **Decomposer**, **Scavenger** **Prey**, Predator
spicebush swallowtail butterfly **what it eats:** Sassafras trees **what eats it:** Pileated woodpeckers, rough green snakes **environment:** Areas with lots of trees	Pond, **Forest**, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
termite **what it eats:** **Dead and decaying wood from**—flowering dogwood trees, hickory trees, red maple trees, redcedar trees, sassafras trees, white oak trees **what eats it:** Gray tree frogs, pileated woodpeckers, white-breasted nuthatches, ovenbirds, carpenter ants, centipedes, rough green snakes; **Tiny pieces of dead and decayed termites eaten by**—earthworms **environment:** Where there are many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, Carnivore, **Decomposer**, Scavenger **Prey**, Predator

Organism	Key
texas ratsnake **what it eats:** Gray treefrogs, rough green snakes, tiger salamanders, ovenbirds, white-breasted nuthatches, fox squirrels; **Eggs and nestlings of**—pileated woodpeckers, ovenbirds, white-breasted nuthatches, great horned owls **what eats it:** Great horned owls, bobcats **environment:** In an area with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
three-toed box turtle **what it eats:** Blue violets, mayapples, earthworms **what eats it:** Badgers **environment:** In areas with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
tiger salamander **what it eats:** Earthworms, centipedes, sowbugs **what eats it:** Texas ratsnakes, great horned owls, wild turkeys **environment:** Where there are many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
virginia creeper vine **what it eats:** Produces its own food using energy from the sun **what eats it:** **Berries eaten by**—white-breasted nuthatches, pileated woodpeckers, fox squirrels; **Leaves eaten by**—white-tailed deer, wild turkeys; **Dead leaves eaten by**—earthworms, sowbugs **environment:** Areas with trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
walking stick **what it eats:** White oak trees, hickory trees **what eats it:** Wild turkeys, pileated woodpeckers, white-breasted nuthatches, rough green snakes, gray treefrogs **environment:** Areas with many trees	Pond, **Forest**, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator

Organism	Key
white oak tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Leaves eaten by**—walking sticks; **Dead leaves eaten by**—earthworms, sowbugs; **Acorns eaten by**—fox squirrels, wild turkeys, pileated woodpeckers; **Acorns and leaves eaten by**—white-tailed deer; **Dead wood eaten by**—shelf mushrooms, termites **environment:** Land where many trees grow	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
white-breasted nuthatch **what it eats:** Termites, walking sticks, io moths, red maple trees, redcedar trees, flowering dogwood trees, sassafras trees, virginia creeper vines **what eats it:** Great horned owls,Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
white-tailed deer **what it eats:** White oak trees,Virginia creeper vines, mayapples, mosses, shelf mushrooms, flowering dogwood trees, sassafras trees, hickory trees, blue violets, redcedar trees, red maple trees, pin oak trees, black willow trees, little bluestem, big bluestem, switch grass, Indian grass, sideoats grama grass, prairie blazing star, purple coneflowers, gaura, compass plants, blackberries, water primrose **what eats it:** Humans, bobcats **environment:** Wooded areas	[Pond], **Forest**, [Prairie] Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
wild turkey **what it eats:** Walking sticks, sowbugs, tiger salamanders, mayapples, red maple trees, white oak trees, hickory trees, flowering dogwood trees, Virginia creeper vines **what eats it:** Humans, great horned owls, bobcats **environment:** In an area with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
woodland vole **what it eats:** Mayapples, blue violets, red maple trees **what eats it:** Great horned owls **environment:** In an area with many trees	Pond, **Forest**, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator

activity 5.3 : are there any "free" prairie lunches?

estimated time 30–40 minutes

objectives

Students will be able to
1. Categorize consumers by what they eat.
2. Explain how herbivores, carnivores and omnivores are different.
3. Define the roles of decomposers in an ecosystem.
4. Classify decomposers and scavengers by the role they play in prairie ecosystems.
5. Explain how an animal's teeth can help identify the kind of consumer it is.

teacher preparation

This is an outdoor activity and will require a large, open area. *Prairie Ecosystem Cards* will be used to demonstrate how herbivores, carnivores and omnivores differ, not only in what they eat and the specialized tooth structures that help them eat, but also in the variety and availability of food sources.

Use only the *Prairie Ecosystem Cards* for this session, but *REMOVE THE HUMAN CARD.* This purpose of this activity is to reinforce each objective as well as give students an opportunity to explore food chains related specifically to a prairie ecosystem.

NOTE: For quick teacher reference, each *Prairie Ecosystem Card* is marked with three bars on the lower right corner.

materials

Science notebooks
Pencils
Thermometers
Flip chart or small white board and markers
*Prairie Ecosystem Card*s (with Human card removed)
Prairie Ecosystem Cards Teacher Key
Activity 5.3 Data Table/Bar Graph copies

procedure

1. Have students complete the heading in their science notebooks and take and record the outside air temperature.

2. Place the balls of yarn in the center of the open area. Shuffle and distribute one *Prairie Ecosystem Card* randomly to each student. Make certain that a student has the Sun card.

3. After students have read their cards carefully, indicate a place where all the herbivores should stand together, where all the carnivores should stand together, and where all the omnivores should stand together. Have students in the "vore" groups check each other's cards to be sure everyone is sorted out correctly. Students with producer cards and the Sun card should remain apart from the "vore" groups.

[Numbers 4 through 8 below repeat the procedure in *Activity 5.2* regarding teeth as specialized structures, but this activity deals with prairie animals specifically. Repeat numbers 4 through 8 with emphasis on prairie consumers for students who would benefit from reinforcement or review the concept in a prairie context briefly for students who have grasped the concept after completing *Activity 5.1*.]

4. Addressing the entire class:
   Q. Based on the organism on your card, raise your hand if you are a consumer.
   A. All but the producers and the sun should raise their hands.
   Q. What specialized structures do you have to help you consume/eat other organisms?
   A. Answers may vary, but students should note that each group of "vores" has different kinds of teeth.

5. Address the herbivores:
   Q. What kind of teeth do you have and why?
   A. Herbivores have snipping and grinding teeth because these teeth help them snip off and chew up plants.

6. Address the carnivores:
   Q. What kind of teeth do you have and why?
   A. Carnivores have sharp front teeth for gripping and tearing plus grinding teeth plus two sharp, pointed teeth on the sides of the front teeth for gripping and tearing. All of these teeth help carnivores grab, tear up and grind down the flesh and bones of animals.

7. Address the omnivores:
   Q. What kind of teeth do you have and why?
   A. Omnivores have teeth similar to both herbivores and carnivores because they eat plants and animals and need to grip, tear and grind both tough plants and the flesh and bones of animals.

8. Address the class:
   Q. What about omnivores like bobolinks and grasshopper sparrows? What kind of specialized structure do they have to help them capture insects and eat seeds and fruit?
   A. Omnivores like bobolinks and grasshopper sparrows have no teeth at all. Instead they have beaks that help them capture insects and eat seeds and fruits. Great horned owls and northern harrier hawks are carnivores. They do not have teeth but they do use their sharp beaks for tearing apart their food.

9. Address the producers and the sun and ask this "trick" question:
   Q. Those of you left here, what kind of teeth do you have?
   A. Producers do not eat other organisms, and therefore, have no tooth structures. Producers get energy directly from the sun to make their own food. The sun is the source of all energy and is not an organism.

10. Address the remaining consumers (scavengers and decomposers):
    Q. What type of consumers are you?
    A. Decomposers and scavengers.
    Q. What is the difference between decomposers and scavengers?
    A. Decomposers are special organisms (bacteria, fungi) that eat and break down scat, and dead plants and animals into tiny parts. Scavengers (earthworms, vultures, grassland crayfish, etc.) seek out and eat dead and decaying organisms.

11. Bring the student with the Sun card to the center of the open area near the balls of yarn and remind him/her of the important role he/she is about to play.

12. Address the entire class:
    Q. Which organisms should be connected directly to the Sun?
    A. Producers.

13. Have producers raise their hands, and choose one producer at a time to step forward. While the Sun is holding the end of a ball of yarn and unwinding it and handing it to the producer, ask:
    Q. What organism are you?
    A. Big bluestem, prairie blazing star, Indian grass, etc.
    Q. What role do you play in an ecosystem?
    A. Producer.
    Q. Why do you think you should connect to this food chain here?
    A. I get energy to make my own food directly from the sun.
    Q. In what ecosystem would you commonly be found?
    A. Prairie.

14. Continue linking producers to the Sun until they are either all linked *OR* until the Sun has used all the available balls of yarn. Have any unlinked producers stand over to the side.
   Q. What might happen to a producer that does not receive enough sun, water, nutrients, etc.?
   A. It might die.
   Q. What happens to producers that die?
   A. They begin to break down or decompose and eventually become part of the soil.

15. Indicate a place off to the side of the group as the place for unlinked/decomposing organisms. Ask students to give the place a name. The name could be funny/clever/etc. but should relate to decomposition (Ex: Decomp Hill; Soil Will Be Us; Break Down Dump).

   Throughout this entire activity, send any students incorrectly (based on the information on their cards) attempting to link to a food chain to the decomposition area.

16. Repeat the process with consumers. Ask the consumers (who could be linked to one of the available producers linked to the Sun) to raise their hands. Choose students randomly and have them stand next to a producer they would consume. Ask each one:
   Q. What organism are you?
   A. Answers will vary but should include animals only.
   Q. What kind of consumer are you?
   A. Answers will vary but should include herbivores, omnivores, scavengers and decomposers only.
   Q. What role do you play in an ecosystem?
   A. Answers will vary. Depending on the specific organism, answers should include:
   - Consumers eat producers and other consumers and help to pass energy up through a food chain.
   - Herbivores eat producers and help to pass energy up through the food chain.
   - Omnivores eat producers and other consumers and help to pass energy up through the food chain.
   - Scavengers seek out and eat dead and decaying organisms and help to keep an ecosystem clean.
   - Decomposers eat and break down scat and dead and decaying plants and animals into tiny parts.

   Q. Why do you think you should connect to this food chain here?
   A. Answers will vary but should be based on information on their cards. (Ex: Because I am a consumer/herbivore/omnivore that consumes [names the particular plant to which they will connect] for energy; Because I am a scavenger/decomposer and I consume dead and decaying plants. This plant is dead and decaying.)

17. Have students unwind the ball of yarn as it is passed to the consumer. Enough yarn should be unwound to allow about two feet of space between them. The sun and all producers and consumers should continue to hold onto the piece of yarn.

18. Addressing any organisms remaining in the herbivore group:
   Q. What has happened to these herbivores?
   A. There are no producers left for them to eat.
   Q. What could happen to them?
   A. These herbivores would either starve or move away (if possible) to find producers somewhere else.
   Q. Where should we place them now?
   A. In the decomposition area!

19. If a decomposer has linked to a producer (which is possible):
   Q. What happens to a food chain that includes the sun, a producer, and a decomposer?
   A. The producer has died, and the decomposer is breaking it down into tiny parts which would be the "end" of that particular food chain.
   Q. Would it be the end of a food chain here if decomposer or scavenger had linked up with a decaying plant?
   A. Not necessarily. If a grassland crayfish (considered a decomposer and scavenger) linked with a "decaying" producer, there are carnivores that could still consume (link up with) the grassland crayfish.

20. Continue the process with the remaining consumers. Ask students who think they could link with one of the food chains to raise their hands. Choose students randomly and repeat the questions for each student as they step up to their chosen chain and unwind and pass along the ball of yarn.

    Q. What organism are you?

    A. Answers will vary but should include animals, scavengers and decomposers only.

    Q. What kind of consumer are you?

    A. Answers will vary but should include carnivores, omnivores, scavengers and decomposers only.

    Q. What role do you play in an ecosystem?

    A. Answers will vary. Depending on the specific organism, answers should include:
    - Consumers eat producers and other consumers and help to pass energy up through a food chain.
    - Carnivores eat other consumers and help to pass energy up through the food chain.
    - Omnivores eat producers and other consumers and help to pass energy up through the food chain.
    - Scavengers seek out and eat dead and decaying organisms and help to keep an ecosystem clean.
    - Decomposers eat and break down scat and dead and decaying plants and animals into tiny parts.

    Q. Why do you think you should connect to this food chain here?

    A. Answers will vary but should be based on information on their cards. (Ex: Because I am a consumer/carnivore /omnivore that consumes [names the particular animal to which they will connect] for energy; Because I am a scavenger/decomposer and I consume dead and decaying animals. This animal is dead and decaying.)

21. Repeat the process, asking for students to step up as part of the next link in one of the food chains. Students from this point on should be carnivores, omnivores, scavengers or decomposers only but must prove by referencing the information on their card that they would eat the organism to which they plan to link.

    Continue until all students are linked to a food chain or unlinked students/consumers have no place to connect. Send unlinked students to the decomposition area.

22. Use a flip chart or small white board to capture the following information for all food chains. Have students use the data table provided to organize the information.

    Q. How many producers?

    Q. How many herbivores?

    Q. How many carnivores?

    Q. How many omnivores?

    Q. How many decomposers and scavengers?

    Q. How many decomposing organisms left at the decomposition area?

    Q. Who or what is going to clean up all those decomposing organisms?

    A. Other decomposers (fungi and bacteria) and scavengers (insects, earthworms, grassland crayfish, etc.).

23. Have students roll up the balls of yarn and place them in the center of the open area. Collect and redistribute the cards randomly. Instruct students to create new food chains on their own for their prairie ecosystem. This could create something close to chaos as students read their cards, find the Sun, question each other and attempt to link with a food chain. Students who think they cannot connect into any of the chains should move to the decomposition area.

24. Quickly review and discuss each component of each food chain. (If students are confident in their understanding of the concepts, have them attempt these food chain reviews in "speed talk.") Send any students linked incorrectly to the decomposition area, and randomly select a student already in the decomposition area and see if he/she can connect somewhere in one of the chains without jeopardizing a student already in place.

25. Record the number of each type of organism linked somewhere in the food chains and include those numbers as a second set on the flip chart/white board. Have students record this data in their *Data Tables*.

26. Using data from their *Data Tables*, have students work in groups to use the graph provided to create a bar graph.

27. Have students look at their graphs to answer the following:
   Q. Which type of organism had the highest number?
   Q. Which type of organism had the lowest number?
   Q. What did you notice about the numbers of these organisms?
   A. Answers will vary. There are more producers. There are more omnivores than herbivores or carnivores. There are many decomposing organisms, etc.
   Q. How would you explain this?
   A. Answers will vary. As long as there is sunlight, air, water, nutrients, space and temperature, producers will grow. Omnivores have more choices and are able to eat a larger variety of food. Basically, there really are no free lunches, and even omnivores sometimes have difficulty finding food. However, there were always students "decomposing" and returning nutrients back into the soil.

28. Have students revisit their *Big Chart: Prairie Ecosystem* and place an X or a check mark indicating whether each organism listed is an herbivore, carnivore, omnivore, decomposer or scavenger.

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

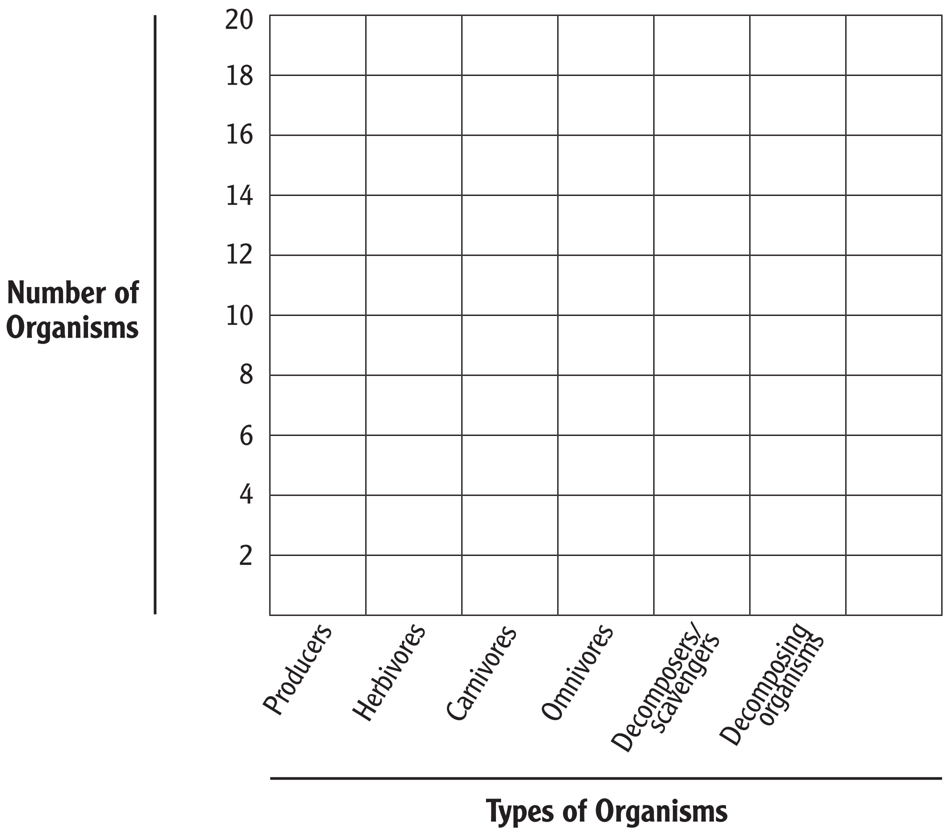
prairie ecosystem data table

Kinds of organisms	Number of organisms in 1st set of prairie food chains	Number of organisms in 2nd set of prairie food chains	Total
Producers			
Herbivores			
Carnivores			
Omnivores			
Decomposers & scavengers			
Decomposing organisms			

prairie ecosystem graph

Complete a bar graph below using the information from the Total column in your data table.

Numbers of different types of organisms in prairie food chains



badger

what it eats: Thirteen-lined ground squirrels, northern crawfish frogs, ornate box turtles, three-toed box turtles, plains pocket gophers

what eats it: **Young eaten by**—coyotes

environment: Large areas of flat or rolling grassland

bobcat

what it eats: White-tailed deer, ovenbirds, wild turkeys, Texas ratsnakes

what eats it: **Young eaten by**—Great horned owls, coyotes

environment: Areas with many trees

big bluestem

what it eats: Produces its own food using energy from the sun

what eats it: Thirteen-lined ground squirrels, bobolinks, grasshopper sparrows, upland sandpipers, bobwhite quail, greater prairie-chickens, plains pocket gophers, leaf beetles, prairie voles, grassland crayfish, white-tailed deer

environment: Large area of flat or rolling grassland

bobolink

what it eats: Regal fritillary butterflies, yellow garden spiders, leaf beetles, round-winged katydids, blackberries, compass plants, big bluestem, little bluestem, purple coneflowers, sideoats grama grass, switch grass, Indian grass

what eats it: Northern harrier hawks, bullsnakes

environment: Large area of flat or rolling grassland

blackberries

what it eats: Produces its own food using energy from the sun

what eats it: Bobolinks, pileated woodpeckers, coyotes, plains pocket gophers, prairie voles, white-tailed deer, ornate box turtles, spotted skunks, humans

environment: Land covered with grasses and flowers

bobwhite quail

what it eats: Prairie mound ants, compass plants, big bluestem, little bluestem, sideoats grama grass, switch grass, Indian grass

what eats it: Coyotes, northern harrier hawks, bullsnakes, humans

environment: Area with tall grass

bullsnake

what it eats: Prairie voles, great plains skinks, thirteen-lined ground squirrels, plains pocket gophers, greater prairie-chickens, bobolinks, bobwhite quail, grasshopper sparrows, upland sandpipers

what eats it: Northern harrier hawks, coyotes

environment: A wide area of land with tall grasses

compass plant

what it eats: Produces its own food using energy from the sun

what eats it: Upland sandpipers, bobolinks, grasshopper sparrows, bobwhite quail, prairie voles, leaf beetles, regal fritillary butterflies, white-tailed deer, thirteen-lined ground squirrels

environment: Open grassland

coyote

what it eats: **Living and dead**—round-winged katydids, bullsnakes, speckled kingsnakes, ornate box turtles, bobcats, thirteen-lined ground squirrels, badgers, prairie voles, greater prairie-chickens, bobwhite quail, upland sandpipers; Blackberries

what eats it: Northern harrier hawks, badgers

environment: Wide area of tall grasses

gaura

what it eats: Produces its own food using energy from the sun

what eats it: Prairie voles, white-tailed deer, honeybees, regal fritillary butterflies

environment: Land covered with grasses and flowers

grasshopper sparrow

what it eats: Yellow garden spiders, regal fritillary butterflies, honeybees, leaf beetles, round-winged katydids, prairie mound ants, compass plants, big bluestem, little bluestem, sideoats grama grass, switch grass, Indian grass, purple coneflowers

what eats it: Northern harrier hawks, bullsnakes, speckled kingsnakes

environment: Area with grasses and forbs

grassland crayfish

what it eats: **Living and dead**—leaf beetles, prairie mound ants, big bluestem, little bluestem, switch grass, Indian grass, sideoats grama grass

what eats it: Northern crawfish frogs

environment: Land covered with grasses and flowers

great horned owl

what it eats: Fox squirrels, bobcats, thirteen-lined ground squirrels, spotted skunks, woodland voles, northern harrier hawks, ovenbirds, white-breasted nuthatches, wild turkeys,Texas ratsnakes, speckled kingsnakes

what eats it: Texas ratsnakes

environment: Areas with many trees

green darner dragonfly

what it eats: **Adults eat**—blue-fronted dancer damselflies, yellow drake mayflies; **Nymphs eat**—predacious diving beetles, green frog tadpoles

what eats it: **Adults eaten by**—green frogs; **Nymphs eaten by**—largemouth bass, predacious diving beetles, green frogs, red-eared slider turtles, northern harrier hawks, yellow garden spiders

environment: Near small, deep bodies of water

great plains skink

what it eats: Yellow garden spiders, round-winged katydids, prairie mound ants, leaf beetles

what eats it: Bullsnakes, speckled kingsnakes, northern harrier hawks

environment: Land covered with grasses and wildflowers

honeybee

what it eats: **Nectar from**—gaura, prairie blazing star, purple coneflowers

what eats it: Grasshopper sparrows, yellow garden spiders, prairie mound ants

environment: Land covered with grasses and flowers

greater prairie-chicken

what it eats: Prairie mound ants, big bluestem, little bluestem, switch grass, Indian grass, sideoats grama grass

what eats it: Bullsnakes, speckled kingsnakes, coyotes

environment: Land covered with grasses and flowers

human

what it eats: Blackberries, bluegill fish, bobwhite quail, channel catfish, common carp, fox squirrels, green frogs, hickory nuts, largemouth bass, mallard ducks, muskrats, raccoons, white-tailed deer, wild turkeys, northern crayfish

what eats it: None

environment: Found in many ecosystems

indian grass

what it eats: Produces its own food using energy from the sun

what eats it: White-tailed deer, leaf beetles, upland sandpipers, bobolinks, bobwhite quail, grasshopper sparrows, greater prairie-chickens, thirteen-lined ground squirrels, prairie voles, grassland crayfish, plains pocket gophers, round-winged katydids

environment: Large area with grasses and forbs

northern crawfish frog

what it eats: Yellow garden spiders, grassland crayfish, prairie mound ants

what eats it: Badgers

environment: Land covered with grasses and flowers

leaf beetle

what it eats: Compass plants, purple coneflowers, big bluestem, little bluestem, Indian grass, switch grass, sideoats grama grass

what eats it: Bobolinks, grasshopper sparrows, great plains skinks, thirteen-lined ground squirrel, grassland crayfish, upland sandpipers, prairie mound ants, ornate box turtles

environment: Large area of flat or rolling grassland

northern harrier hawk

what it eats: Prairie voles, plains pocket gophers, speckled kingsnakes, bullsnakes, great plains skinks, young coyotes, green darner dragonflies, bobolinks, grasshopper sparrows, bobwhite quail

what eats it: Great horned owls

environment: A wide area of land with tall grasses

little bluestem

what it eats: Produces its own food using energy from the sun

what eats it: Thirteen-lined ground squirrels, bobolinks, bobwhite quail, greater prairie-chickens, upland sandpipers, grasshopper sparrows, plains pocket gophers, leaf beetles, prairie voles, white-tailed deer, grassland crayfish

environment: Land covered with grasses and flowers

ornate box turtle

what it eats: Leaf beetles, regal fritillary butterflies, blackberries

what eats it: Coyotes, badgers

environment: Land with grasses and forbs

pileated woodpecker

what it eats: Virginia creeper vines, walking sticks, carpenter ants, io moths, spicebush swallowtail butterflies, termites, white oak trees, redcedar trees, blackberries

what eats it: Texas ratsnakes

environment: Areas with many trees

prairie mound ant

what it eats: **Dead**—Leaf beetles, honeybees, round-winged katydids, regal fritillary butterflies

what eats it: Great plains skinks, bobwhite quail, grasshopper sparrows, upland sandpipers, greater prairie-chickens, yellow garden spiders, northern crayfish frogs, grassland crayfish, spotted skunks, thirteen-lined ground squirrels

environment: Land covered with grasses and flowers

plains pocket gopher

what it eats: Blackberries, big bluestem, little bluestem, Indian grass, switch grass, sideoats grama grass

what eats it: Badgers, spotted skunks, northern harrier hawks, bullsnakes

environment: A large area of flat or rolling grassland

prairie vole

what it eats: Prairie blazing star, purple coneflowers, gaura, big bluestem, little bluestem, Indian grass, compass plant, sideoats grama grass, switch grass, blackberries

what eats it: Coyotes, bullsnakes, speckled kingsnakes, northern harrier hawks, spotted skunks

environment: A wide area of land with tall grasses and wildflowers

prairie blazing star

what it eats: Produces its own food using energy from the sun

what eats it: Regal fritillary butterflies, honeybees, thirteen-lined ground squirrels, prairie voles, white-tailed deer

environment: A wide area with grasses and forbs

purple coneflower

what it eats: Produces its own food using energy from the sun

what eats it: Honeybees, regal fritillary butterflies, grasshopper sparrows, bobolinks, leaf beetles, prairie voles, thirteen-lined ground squirrels, white-tailed deer

environment: Large area of land covered with grasses and flowers

regal fritillary butterfly

what it eats: Prairie blazing star, compass plants, gaura, purple coneflowers

what eats it: Bobolinks, grassland sparrows, prairie mound ants, yellow garden spiders, ornate box turtles, thirteen-lined ground squirrels

environment: A wide area of land with tall grasses and flowers

speckled kingsnake

what it eats: Prairie voles, great plains skinks, greater prairie-chicken eggs, grasshopper sparrows, upland sandpipers

what eats it: Northern harrier hawks, coyotes, great horned owls

environment: Areas with grasses and forbs

round-winged katydid (pink form)

what it eats: Indian grass, switch grass, sideoats grama grass

what eats it: Bobolinks, grasshopper sparrows, great plains skinks, coyotes, yellow garden spiders, prairie mound ants, thirteen-lined ground squirrels

environment: Area with grasses and forbs

spotted skunk

what it eats: **Living and dead**—prairie voles, plains pocket gophers, prairie mound ants; Blackberries

what eats it: Great horned owls

environment: Land covered with grasses and flowers

sideoats grama grass

what it eats: Produces its own food using energy from the sun

what eats it: Thirteen-lined ground squirrels, bobwhite quail, greater prairie-chickens, bobolinks, upland sandpipers, grasshopper sparrows, prairie voles, grassland crayfish, plains pocket gophers, leaf beetles, round-winged katydids, white-tailed deer

environment: A wide area of land with tall grasses and flowers

switch grass

what it eats: Produces its own food using energy from the sun

what eats it: Thirteen-lined ground squirrels, white-tailed deer, round-winged katydids, prairie voles, bobwhite quail, greater prairie-chickens, upland sandpipers, bobolinks, grassland sparrows, plains pocket gophers, grassland crayfish, leaf beetles

environment: Land covered with grasses and flowers

thirteen-lined ground squirrel

what it eats: Regal fritillary butterflies, round-winged katydids, leaf beetles, prairie mound ants, big bluestem, little bluestem, Indian grass, switch grass, sideoats grama grass, prairie blazing star, purple coneflowers, compass plants

what eats it: Coyotes, badgers, great horned owls, bullsnakes

environment: Area with grasses and forbs

white-tailed deer

what it eats: White oak trees, Virginia creeper vines, mayapples, mosses, shelf mushrooms, flowering dogwood trees, sassafras trees, hickory trees, blue violets, redcedar trees, red maple trees, pin oak trees, black willow trees, little bluestem, big bluestem, switch grass, Indian grass, sideoats grama grass, prairie blazing star, purple coneflowers, gaura, compass plants, blackberries, water primrose

what eats it: Humans, bobcats

environment: Areas with many trees

upland sandpiper

what it eats: Big bluestem, little bluestem, sideoats grama grass, switch grass, Indian grass, compass plants, prairie mound ants, leaf beetles

what eats it: Bullsnakes, speckled kingsnakes, coyotes

environment: Land covered with grasses and flowers

yellow garden spider

what it eats: Regal fritillary butterflies, green darner dragonflies, prairie mound ants, honeybees, round-winged katydids

what eats it: Bobolinks, grasshopper sparrows, great plains skinks, northern crawfish frogs

environment: Land covered with grasses and flowers

sun

Organism	Key
badger **what it eats:** Thirteen-lined ground squirrels, northern crawfish frogs, ornate box turtles, three-toed box turtles, plains pocket gophers **what eats it:** **Young eaten by**—coyotes **environment:** Large areas of flat or rolling grassland	Pond, [Forest], **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
big bluestem **what it eats:** Produces its own food using energy from the sun **what eats it:** Thirteen-lined ground squirrels, bobolinks, grasshopper sparrows, upland sandpipers, bobwhite quail, greater prairie-chickens, plains pocket gophers, leaf beetles, prairie voles, grassland crayfish, white-tailed deer **environment:** Large area of flat or rolling grassland	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
blackberries **what it eats:** Produces its own food using energy from the sun **what eats it:** Bobolinks, pileated woodpeckers, coyotes, plains pocket gophers, prairie voles, white-tailed deer, ornate box turtles, spotted skunks, humans **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
bobcat **what it eats:** White-tailed deer, ovenbirds, wild turkeys,Texas ratsnakes **what eats it:** **Young eaten by**—Great horned owls, coyotes **environment:** Areas with many trees	Pond, **Forest**, [Prairie] Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
bobolink **what it eats:** Regal fritillary butterflies, yellow garden spiders, leaf beetles, round-winged katydids, blackberries, compass plants, big bluestem, little bluestem, purple coneflowers, sideoats grama grass, switch grass, Indian grass **what eats it:** Northern harrier hawks, bullsnakes **environment:** Large area of flat or rolling grassland	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
bobwhite quail **what it eats:** Prairie mound ants, compass plants, big bluestem, little bluestem, sideoats grama grass, switch grass, Indian grass **what eats it:** Coyotes, northern harrier hawks, bullsnakes, humans **environment:** Area with tall grass	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
bullsnake **what it eats:** Prairie voles, great plains skinks, thirteen-lined ground squirrels, plains pocket gophers, greater prairie-chickens, bobolinks, bobwhite quail, grasshopper sparrows, upland sandpipers **what eats it:** Northern harrier hawks, coyotes **environment:** A wide area of land with tall grasses	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
compass plant **what it eats:** Produces its own food using energy from the sun **what eats it:** Upland sandpipers, bobolinks, grasshopper sparrows, bobwhite quail, prairie voles, leaf beetles, regal fritillary butterflies, white-tailed deer, thirteen-lined ground squirrels **environment:** Open grassland	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
coyote **what it eats:** **Living and dead**—round-winged katydids, bullsnakes, speckled kingsnakes, ornate box turtles, bobcats, thirteen-lined ground squirrels, badgers, prairie voles, greater prairie-chickens, bobwhite quail, upland sandpipers; Blackberries **what eats it:** Northern harrier hawks, badgers **environment:** Wide area of tall grasses	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, **Scavenger** **Prey**, **Predator**
gaura **what it eats:** Produces its own food using energy from the sun **what eats it:** Prairie voles, white-tailed deer, honeybees, regal fritillary butterflies **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
grasshopper sparrow **what it eats:** Yellow garden spiders, regal fritillary butterflies, honeybees, leaf beetles, round-winged katydids, prairie mound ants, compass plants, big bluestem, little bluestem, sideoats grama grass, switch grass, Indian grass, purple coneflowers **what eats it:** Northern harrier hawks, bullsnakes, speckled kingsnakes **environment:** Area with grasses and forbs	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
grassland crayfish **what it eats:** **Living and dead**—leaf beetles, prairie mound ants, big bluestem, little bluestem, switch grass, Indian grass, sideoats grama grass **what eats it:** Northern crawfish frogs **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, **Decomposer**, **Scavenger** **Prey**, **Predator**
great horned owl **what it eats:** Fox squirrels, bobcats, thirteen-lined ground squirrels, spotted skunks, woodland voles, northern harrier hawks, ovenbirds, white-breasted nuthatches, wild turkeys,Texas ratsnakes, speckled kingsnakes **what eats it:** Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, [Prairie] Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
great plains skink **what it eats:** Yellow garden spiders, round-winged katydids, prairie mound ants, leaf beetles **what eats it:** Bullsnakes, speckled kingsnakes, northern harrier hawks **environment:** Land covered with grasses and wildflowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
greater prairie-chicken **what it eats:** Prairie mound ants, big bluestem, little bluestem, switch grass, Indian grass, sideoats grama grass **what eats it:** Bullsnakes, speckled kingsnakes, coyotes **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
green darner dragonfly **what it eats:** **Adults eat**—blue-fronted dancer damselflies, yellow drake mayflies; **Nymphs eat**—predacious diving beetles, green frog tadpoles **what eats it:** **Adults eaten by**—green frogs; **Nymphs eaten by**—largemouth bass, predacious diving beetles, green frogs, red-eared slider turtles, northern harrier hawks, yellow garden spiders **environment:** Near small, deep bodies of water	**Pond**, Forest, [Prairie] Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
honeybee **what it eats:** **Nectar from**—gaura, prairie blazing star, purple coneflowers **what eats it:** Grasshopper sparrows, yellow garden spiders, prairie mound ants **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
human **what it eats:** Blackberries, bluegill fish, bobwhite quail, channel catfish, common carp, fox squirrels, green frogs, hickory nuts, largemouth bass, mallard ducks, muskrats, raccoons, white-tailed deer, wild turkeys, northern crayfish **what eats it:** None **environment:** Found in many ecosystems	**Pond**, **Forest**, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger Prey, **Predator**
indian grass **what it eats:** Produces its own food using energy from the sun **what eats it:** White-tailed deer, leaf beetles, upland sandpipers, bobolinks, bobwhite quail, grasshopper sparrows, greater prairie-chickens, thirteen-lined ground squirrels, prairie voles, grassland crayfish, plains pocket gophers, round-winged katydids **environment:** Large area with grasses and forbs	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
leaf beetle **what it eats:** Compass plants, purple coneflowers, big bluestem, little bluestem, Indian grass, switch grass, sideoats grama grass **what eats it:** Bobolinks, grasshopper sparrows, great plains skinks, thirteen-lined ground squirrel, grassland crayfish, upland sandpipers, prairie mound ants, ornate box turtles **environment:** Large area of flat or rolling grassland	Pond, Forest, **Prairie** Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
little bluestem **what it eats:** Produces its own food using energy from the sun **what eats it:** Thirteen-lined ground squirrels, bobolinks, bobwhite quail, greater prairie-chickens, upland sandpipers, grasshopper sparrows, plains pocket gophers, leaf beetles, prairie voles, white-tailed deer, grassland crayfish **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
northern crawfish frog **what it eats:** Yellow garden spiders, grassland crayfish, prairie mound ants **what eats it:** Badgers **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
northern harrier hawk **what it eats:** Prairie voles, plains pocket gophers, speckled kingsnakes, bullsnakes, great plains skinks, young coyotes, green darner dragonflies, bobolinks, grasshopper sparrows, bobwhite quail **what eats it:** Great horned owls **environment:** A wide area of land with tall grasses	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
ornate box turtle **what it eats:** Leaf beetles, regal fritillary butterflies, blackberries **what eats it:** Coyotes, badgers **environment:** Land with grasses and forbs	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
pileated woodpecker **what it eats:** Virginia creeper vines, walking sticks, carpenter ants, io moths, spicebush swallowtail butterflies, termites, white oak trees, redcedar trees, blackberries **what eats it:** Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, [Prairie] Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
plains pocket gopher **what it eats:** Blackberries, big bluestem, little bluestem, Indian grass, switch grass, sideoats grama grass **what eats it:** Badgers, spotted skunks, northern harrier hawks, bullsnakes **environment:** A large area of flat or rolling grassland	Pond, Forest, **Prairie** Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
prairie blazing star **what it eats:** Produces its own food using energy from the sun **what eats it:** Regal fritillary butterflies, honeybees, thirteen-lined ground squirrels, prairie voles, white-tailed deer **environment:** A wide area with grasses and forbs	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
prairie mound ant **what it eats:** **Dead**—Leaf beetles, honeybees, round-winged katydids, regal fritillary butterflies **what eats it:** Great plains skinks, bobwhite quail, grasshopper sparrows, upland sandpipers, greater prairie-chickens, yellow garden spiders, northern crayfish frogs, grassland crayfish, spotted skunks, thirteen-lined ground squirrels **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, Carnivore, **Decomposer**, **Scavenger** **Prey**, **Predator**
prairie vole **what it eats:** Prairie blazing star, purple coneflowers, gaura, big bluestem, little bluestem, Indian grass, compass plant, sideoats grama grass, switch grass, blackberries **what eats it:** Coyotes, bullsnakes, speckled kingsnakes, northern harrier hawks, spotted skunks **environment:** A wide area of land with tall grasses and wildflowers	Pond, Forest, **Prairie** Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator

Organism	Key
purple coneflower **what it eats:** Produces its own food using energy from the sun **what eats it:** Honeybees, regal fritillary butterflies, grasshopper sparrows, bobolinks, leaf beetles, prairie voles, thirteen-lined ground squirrels, white-tailed deer **environment:** Large area of land covered with grasses and flowers	Pond, Forest, **<u>Prairie</u>** **<u>Producer</u>**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
regal fritillary butterfly **what it eats:** Prairie blazing star, compass plants, gaura, purple coneflowers **what eats it:** Bobolinks, grassland sparrows, prairie mound ants, yellow garden spiders, ornate box turtles, thirteen-lined ground squirrels **environment:** A wide area of land with tall grasses and flowers	Pond, Forest, **<u>Prairie</u>** Producer, **<u>Consumer</u>** **<u>Herbivore</u>**, Omnivore, Carnivore, Decomposer, Scavenger **<u>Prey</u>**, Predator
round-winged katydid (pink form) **what it eats:** Indian grass, switch grass, sideoats grama grass **what eats it:** Bobolinks, grasshopper sparrows, great plains skinks, coyotes, yellow garden spiders, prairie mound ants, thirteen-lined ground squirrels **environment:** Area with grasses and forbs	Pond, Forest, **<u>Prairie</u>** Producer, **<u>Consumer</u>** **<u>Herbivore</u>**, Omnivore, Carnivore, Decomposer, Scavenger **<u>Prey</u>**, Predator
sideoats grama grass **what it eats:** Produces its own food using energy from the sun **what eats it:** Thirteen-lined ground squirrels, bobwhite quail, greater prairie-chickens, bobolinks, upland sandpipers, grasshopper sparrows, prairie voles, grassland crayfish, plains pocket gophers, leaf beetles, round-winged katydids, white-tailed deer **environment:** A wide area of land with tall grasses and flowers	Pond, Forest, **<u>Prairie</u>** **<u>Producer</u>**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
speckled kingsnake **what it eats:** Prairie voles, great plains skinks, greater prairie-chicken eggs, grasshopper sparrows, upland sandpipers **what eats it:** Northern harrier hawks, coyotes, great horned owls **environment:** Areas with grasses and forbs	Pond, Forest, **<u>Prairie</u>** Producer, **<u>Consumer</u>** Herbivore, Omnivore, **<u>Carnivore</u>**, Decomposer, Scavenger **<u>Prey</u>**, **<u>Predator</u>**

Organism	Key
spotted skunk **what it eats:** **Living and dead**—prairie voles, plains pocket gophers, prairie mound ants; Blackberries **what eats it:** Great horned owls **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, **Scavenger** **Prey**, **Predator**
switch grass **what it eats:** Produces its own food using energy from the sun **what eats it:** Thirteen-lined ground squirrels, white-tailed deer, round-winged katydids, prairie voles, bobwhite quail, greater prairie-chickens, upland sandpipers, bobolinks, grassland sparrows, plains pocket gophers, grassland crayfish, leaf beetles **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
thirteen-lined ground squirrel **what it eats:** Regal fritillary butterflies, round-winged katydids, leaf beetles, prairie mound ants, big bluestem, little bluestem, Indian grass, switch grass, sideoats grama grass, prairie blazing star, purple coneflowers, compass plants **what eats it:** Coyotes, badgers, great horned owls, bullsnakes **environment:** Area with grasses and forbs	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
upland sandpiper **what it eats:** Big bluestem, little bluestem, sideoats grama grass, switch grass, Indian grass, compass plants, prairie mound ants, leaf beetles **what eats it:** Bullsnakes, speckled kingsnakes, coyotes **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
white-tailed deer **what it eats:** White oak trees,Virginia creeper vines, mayapples, mosses, shelf mushrooms, flowering dogwood trees, sassafras trees, hickory trees, blue violets, redcedar trees, red maple trees, pin oak trees, black willow trees, little bluestem, big bluestem, switch grass, Indian grass, sideoats grama grass, prairie blazing star, purple coneflowers, gaura, compass plants, blackberries, water primrose **what eats it:** Humans, bobcats **environment:** Areas with many trees	[Pond], **Forest**, [Prairie] Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
yellow garden spider **what it eats:** Regal fritillary butterflies, green darner dragonflies, prairie mound ants, honeybees, round-winged katydids **what eats it:** Bobolinks, grasshopper sparrows, great plains skinks, northern crawfish frogs **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

activity 5.4 : schoolyard ecosystem investigation

estimated time 30–40 minutes

objectives

Students will be able to
1. Identify producers, consumers (herbivores, carnivores and omnivores), decomposers and scavengers in their schoolyard.
2. Explain the role producers, consumers, decomposers and scavengers play in their schoolyard ecosystem.
3. Give a group presentation on schoolyard observations.

teacher preparation

This is an outdoor activity. Take a brief walk around the schoolyard and note where you find examples of producers, consumers, scavengers and decomposers. During the course of the activity, if students are unsure and/or unable to find examples, refer to your notes and provide subtle prompts for students to discover examples.

This activity is designed to allow students to continue to explore their schoolyard ecosystem as they have been doing during this unit. However, this activity will allow students to observe the organisms living and interacting there more closely.

materials

Science notebooks
Pencils
Thermometers
Heavy string or rope looped in a circle *OR* wire hangers stretched into circle-like shapes (*OR* hula hoops if available)
Hand lenses or loupes
Small collection boxes with or without magnification on the lid
Field guides

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.

2. Explain to students that they will use their science notebooks to record, organize and present in any way they choose (either alone or in groups) data from their schoolyard ecosystem—at a distance (a big picture) and up close. Distance observation of the big picture should be done while sitting or standing in one place and quietly watching the organisms around them at a distance. Birds and squirrels at the bird feeders would fall into this category as would trees, plants and animals within their field of vision and animals moving through or seeds blowing by their field of vision. This could also include watching a butterfly land on their arm and observing it with a hand lens.

3. For the up-close investigation, show students the materials they may use: certain number of viewing boxes per student/group; heavy string or wire hangers; hand lenses or loupes. Demonstrate how these things should be used for the up-close observations.
   a. Viewing boxes are for temporary storage and viewing of organisms found within the area of the hula hoop or wire hanger and small enough for the organism to fit comfortably inside the box with the lid in place.
   b. Heavy string or wire hangers are to be placed somewhere in the schoolyard ecosystem (according to boundaries and guidelines set by teacher) in such a way that they define a small area within their edges. Students are to spend time observing as many organisms and interactions within the area of the string or the wire hanger and record all observations in their science notebooks. If used, hula hoops may be placed flat on the ground over a grassy spot, over an area worn down by foot traffic, at a corner of a building, over the area below a fence, or they may be placed up against the base of a tree, hung from a branch of a tree so that the hoop is up against the tree trunk, placed on a large log, etc. to observe a more vertical surface.
   c. Hand lenses or loupes should be handled carefully and used to magnify organisms students wish to observe without disturbing the organisms.

4. Move around the schoolyard and ask questions to encourage students/groups to look more closely, draw conclusions, decide to move, use a field guide to identify their organisms, consider ways to compare and contrast hula hoop-sized areas, etc. (Ex: organisms observed within the hanger set down on the flower garden compared to organisms observed within the hanger set down on the sidewalk or an area of grass worn down due to foot traffic, people cutting across a lawn instead of walking around the edge on the sidewalk, etc.). Check that students have engaged in both the big picture and the up-close observations.

5. Have students enter any new organisms from both types of observation on their *Big Chart: Schoolyard Ecosystem* in their science notebooks and check off the appropriate boxes: animal or plant; producer or consumer; herbivore, carnivore, omnivore, decomposer or scavenger.

6. Have students/groups work on organizing their data and preparing their presentations. Presentations should include (for both the broad and the up-close observations):
   a. Number and type of organisms.
   b. Where these organisms were observed.
   c. Interactions observed between or among organisms.
   d. Roles these organisms play in the schoolyard ecosystem.
   e. Reasons behind locations chosen.
   f. Comparison/contrast between different locations and possible explanation for differences/similarities.
   g. Two interactions they observed that were unexpected and surprised them.
   h. One or more questions they have about something(s) they observed.
   i. One or more things they would like to investigate further based on their observations.
   j. Which form of observation (big picture or up-close) provided the most data.
   k. Which form of observation would they like to do again and why.

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

optional activity 5.a :
animal teeth—it's all about the food

estimated time 30 minutes

objectives

Students will be able to

1. Explain how the teeth on an animal's skull can help identify the type of consumer it is.
2. Identify mammal skulls as belonging to an herbivore, carnivore or omnivore.

teacher preparation

This activity may be done indoors or outdoors. Have *Worksheet 5.A: It's All About the Food* photocopied for each student. Groups of two to three students should work together and record the information on individual worksheets to be included in their science notebooks. Students will need their student books to reference the three skull illustrations on page 26.

materials

Pencils
Thermometers (if outdoors)
Class copies of *Worksheet 5.A: It's All About the Food*
Student books
Flip chart/whiteboard and markers

procedure

1. Have students work in small groups. Instruct students to open their student books to page 26 in Chapter 5 and study and discuss the three skulls illustrated there. Have students note at least two specialized tooth structures on each of the three animal skulls and discuss how these tooth structures might help these animals.

2. Have groups share their information. Compile their answers on a flip chart, white board, etc.

3. Student answers may vary but should include:
   a. The white-tailed deer has sharp front teeth on its lower jaw that help it snip off grasses and leaves; wide, flatter teeth in the back of the mouth that help crush seeds and tough plant parts; no front teeth on its upper jaw.
   b. The bobcat has sharp front teeth that grip and tear up meat; large, flat teeth that line the sides of its mouth for grinding up meat and bones; long, sharp, pointed teeth on either side of sharp front teeth, also for gripping and tearing meat.
   c. The raccoon has some teeth like herbivores and carnivores: sharp, front teeth for gripping and tearing meat and snipping off plants; sharp, pointed teeth on either side of sharp front teeth for gripping and tearing meat; flat teeth that line the sides of a raccoon's mouth that help crush seeds and tough plant parts.

4. What conclusions might be drawn from the information on the flip chart/white board?

5. Answers may vary but should include:
   a. Herbivores have snipping and grinding teeth because these teeth help them chew up plants.
   b. Carnivores have sharp front teeth for gripping and tearing plus flat grinding teeth plus two sharp, pointed teeth on the sides of the front teeth for gripping and tearing, and all of these teeth help carnivores grab, tear up and grind down meat (or the flesh and bones of animals).
   c. Omnivores have teeth similar to both herbivores and carnivores because they eat plants and animals and need to grip, tear and grind both tough plants and meat.

6. Distribute *Worksheet 5.A: It's All About the Food* to each student. Instruct them to look carefully at the side view of each skull, especially the teeth, discuss other characteristics of the skull, and from the list at the bottom of the chart, choose which skull belongs to which animal and decide whether that animal is an herbivore, a carnivore or an omnivore. Answers should be written on the worksheet.

7. Have groups take turns picking skulls and sharing their discussions, answer choices and reasons for choosing those answers with the class.

Name ______________________________

Group Member Names ____

Animal ____________________

Type of eater ________________

Animal ____________

Type of eater ________________

Animal ____________________

Type of eater ________________

Animal ________________

Type of eater ________________

Animal ____________________

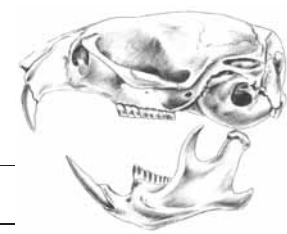
Type of eater ________________

Animal ____________________

Type of eater ________________

Animal ____________________

Type of eater ________________



Animal __________________

Type of eater ______________

Animal ____________________

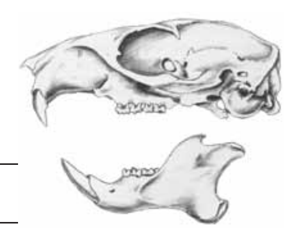
Type of eater ________________

Animal __________________

Type of eater ________________

Animal ____________________

Type of eater ______________



Animal ____________________

Type of eater ________________

Animal ____________________

Type of eater ______________

choices

Badger	Fox squirrel	Thirteen-lined ground squirrel
Beaver	Muskrat	White-tailed deer
Bobcat	Raccoon	Woodland vole
Coyote	Prairie vole	
Flying squirrel	Spotted skunk	

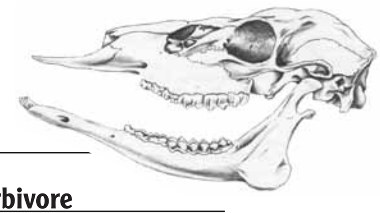
Charles W. Schwartz artwork

Name ____

Group Member Names ____

Animal Beaver

Type of eater Herbivore

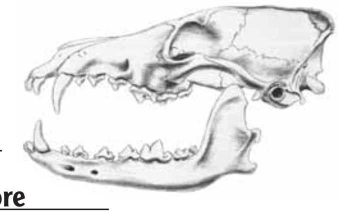


Animal Deer

Type of eater Herbivore

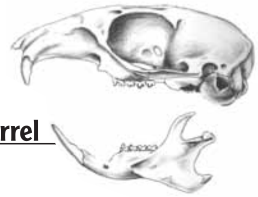
Animal Bobcat

Type of eater Carnivore



Animal Coyote

Type of eater Omnivore



Animal Thirteen-lined ground squirrel

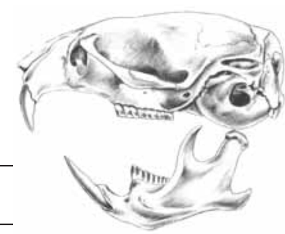
Type of eater Omnivore

Animal Woodland vole

Type of eater Herbivore

Animal Flying squirrel

Type of eater Omnivore

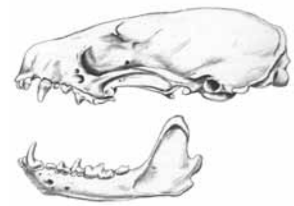


Animal Prairie vole

Type of eater Omnivore

Animal Muskrat

Type of eater Omnivore

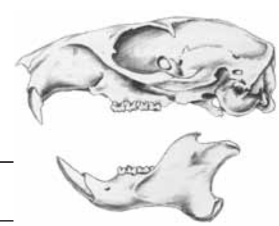


Animal Spotted skunk

Type of eater Omnivore

Animal Badger

Type of eater Carnivore



Animal Fox squirrel

Type of eater Herbivore

Animal Raccoon

Type of eater Omnivore

choices

Badger	Fox squirrel	Thirteen-lined ground squirrel
Beaver	Muskrat	White-tailed deer
Bobcat	Raccoon	Woodland vole
Coyote	Prairie vole	
Flying squirrel	Spotted skunk	

Charles W. Schwartz artwork

optional activity 5.b : life on the forest floor

estimated time 30–45 minutes

objectives

1. Students understand the importance of woody debris in habitat areas.
2. Students understand that insects and decomposers are important forms of wildlife.
3. Students use observation skills and tools to discover animals they might not normally see.

description

Students explore decaying woody plants to find evidence of wildlife and plants that live in the decomposing material on the forest floor. Students use magnifiers to see this evidence, then examine and explain the importance of such decaying matter in the cycle of renewal of the habitat area.

teacher preparation

Collect about 1 cubic foot of decaying woody debris from a forest area with decomposing stumps and branches (the more lichen and moss the better). Store in a plastic bag in a dark, cool place until ready for use. Return this material to the habitat area when finished with the activity. If gathering woody debris from another habitat area, take care not to inadvertently introduce exotic species (such as ivy or bindweed) into your habitat area.

materials

Science notebooks
Pencils
Magnifiers
Decaying log, leaves, branches, etc.
Life on the Forest Floor poster

procedure

1. Go to natural habitat area and find a forested area with trees and shrubs. Ask students "What wildlife might live in the forest floor?" State that, "There are thousands, even millions of wildlife that live in the woody debris and forest duff in this natural area."

2. Look for leaves and branches that have fallen to the ground over the seasons as part of their life cycle (deciduous, evergreen). Tell students that this is called forest duff and woody debris. Forest duff is the leafy, woody mulch that makes up the top layer of soil. Touch and feel forest duff. How does it feel? (moist, spongy, cool, soft, etc.)

3. Look for evidence of woody debris that has begun to decay, especially stumps, logs or other large material. Ask, "What do you observe?" (wood is breaking apart, moss and lichen are growing on it, plants grow on it)

4. Form students into groups of three to four. Pass out magnifiers and distribute pieces of woody debris. Have students share woody debris and observations with each other.

5. Ask students to look for evidence or actual sightings of tiny wildlife and plants in the woody debris. Have them use magnifiers to find and locate microscopic organisms. Help students locate and recognize tiny microorganisms, as well as fungal roots, egg masses, etc.

6. Science notebooks: Draw and record information about an animal or plant seen living in the woody debris (lichens, moss, decomposers, insects, roots, seeds, etc.). Ask students to label as possible (animal/plant, name, parts).

7. Share findings and discuss, "What are we observing in the woody debris? (micro organisms and the process of breaking down large matter into small) How does woody debris fit into the 'cycle of renewal' in our habitat area? (decomposition, decomposers) Why is woody debris important? What does it turn into? (humus, soil nutrients) How? (decomposition) What would happen if woody debris did not decompose?" (there would be a mountain of woody debris, plants couldn't grow)

8. Conclude, "One handful of forest duff can contain millions of organisms important for plant growth. It is amazing to think so much new plant growth in the forests begins in woody debris."

Developed by Heidi Bohan/Starflower Foundation
(adapted with permission from the Washington Native Plant Society/Starflower Foundation)

optional activity 5.c : worms in school

estimated time Bin set-up time: 15 minutes; Activity on-going

objective

Students will be able to
1. Explain the role of decomposers in an ecosystem.

teacher preparation

- *Eisenia foetida*, commonly called redworms, are best suited for bins. As surface dwellers, they process large amounts of organic material in their natural habitats of manure, compost piles and decaying leaves. They reproduce quickly and love to eat a variety of kitchen wastes.
- Worms have no eyes, but are extremely sensitive to light which they "see" via special skin cells located at the head and tail end of their body.
- Worms have no lungs to breathe with as we do. Their moist skin allows them to "breathe" oxygen into their body and release carbon dioxide from inside their body into the surrounding bedding.
- Worms, in nature, will usually live and die within the same year. Worms in a worm bin may live up to five years.
- An earthworm can move a stone that is fifty times its own weight.
- A mature redworm (four to six weeks old) can mate and produce two to three cocoons per week. Two to five baby worms can hatch from each cocoon in only three weeks.
- A single worm has both male and female reproductive organs, but it still takes two worms to reproduce.

Wonder Worm Bins

When food scraps are thrown into the garbage, a valuable resource is lost. Composting with worms or vermicomposting provides an alternative method for disposing of kitchen waste. Maintaining a worm bin is fun, educational and will reduce household waste while providing you with a source of natural nutrients for your plants.

Worm Bin Recipe

- 1 dark plastic storage bin (10–14 gallons) with a snug-fitting lid (such as a Rubbermaid Roughtote). Choose size according to food waste produced. Rule of thumb: One square foot of surface space is needed for each pound of food waste produced per week.

- Newspaper or shredded paper
- Jug or bucket of water
- 1 handful of garden soil
- 1 pound of redworms
- Food waste

1. Drill small holes on lid and along top 2–4 inches of bin to allow for good aeration.
2. Make bedding by ripping newspapers into 1-inch strips. Put the paper in the container.
3. Mix water into newspaper until bedding is thoroughly moistened. There should be no standing water in bottom of container.
4. Mix in soil. Fluff bedding.
5. Spread worms over top of bedding.
6. Bury food waste. Cover bin and place in a location where the temperature will remain 55–77 degrees Fahrenheit.

worm bins FAQ

What kind of food can I put in the worm bin?

Worms will eat most anything. A list of their favorites is given below. Feed your worms a good variety of produce scraps to keep an even chemical balance in the soil, which keeps them healthy. Mostly fruit or tomato waste could make the soil too acidic.

Apples	Cabbage	Cucumbers	Onion peels	Pizza crust
Apple cores	Cake	Egg shells*	Orange peels	Potato peels
Baked beans	Carrots	Grapefruit peels	Pancakes	Tea leaves
Banana peels	Cereal	Lettuce	Pears	Tomatoes
Biscuits	Coffee grounds	Oatmeal	Pineapple rind	

**good source of calcium carbonate, necessary for worm reproduction*

How much do worms eat?
Redworms eat almost half of their body weight each day. If you start with a pound of worms, you can feed them 3–5 pounds a week. Don't worry about the worms when you go on vacation for a couple of weeks. The worms will eat the bedding when no food waste is available.

Will there be odors and bugs?
A properly maintained bin should not give off any offensive odors. Avoid adding meat scraps, and always completely bury all food waste in the bin. Burying fruit waste will prevent fruit flies from being attracted to the worm bin. Air is necessary for the worms and other microorganisms to work effectively. Without air you may develop anaerobic conditions which will allow gas producing microorganisms to thrive. To avoid fruit flies, freeze food waste before adding to the bin.

Will I need to add more bedding?
Add bedding every 3–5 weeks or when there is not enough bedding material to completely bury the food waste. Other suitable sources for bedding are shredded office paper or shredded corrugated cardboard.

When and how can I use the vermicompost?
The redworms will work most productively when they live in 55–77 degrees Fahrenheit, are fed, kept moist and minimally disturbed. Given these conditions you will have compost available within a few months. The worm castings (or vermicompost) are very rich in nutrients for plants. You may work the vermicompost into garden soil, add a spoonful periodically to indoor plant soil, or water plants with compost tea.

What is the best way to harvest the vermicompost?
The easiest method is the "Divide and Dump" technique. You simply remove about two-thirds of your vermicompost, worms and all, and dump directly onto your garden. Add fresh bedding to the vermicompost that is still in the box. There will be enough worms and cocoons remaining to repopulate the worm bin.

You can let the worms do the sorting for you by putting the vermicompost and worms to one side of the worm bin. Then add new bedding to the empty side. Bury your food waste in the new bedding only. The worms will move over to the new bedding in search of food. After two to three months the vermicompost can be harvested. You can continue this back and forth method to simplify your harvest of future vermicompost.

Another method is to dump and hand sort the worms from the vermicompost. First dump your worm bin out onto a large sheet of plastic. Make several cone-shaped piles. When the light is very bright the worms will quickly move into the center of each pile. After about five minutes, you will not be able to see the worms. Gently remove the outer surface of each pile, exposing the worms to the light and sending them deeper into the pile. Following this process you will eventually end up with a container of vermicompost and a mass of pure worms. It's a good idea to have fresh bedding made up before getting started with this method so you can refill your empty bin and add the worms as you sort.

Where can I get redworms?
Flowerfield Enterprises
10332 Shaver Rd.
Kalamazoo, MI 49002
(616) 327-0108
www.wormwoman.com

Other suppliers via:
www.wormdigest.org

Also check your local bait shop for redworms. Don't be surprised if they don't know them as redworms. They are also commonly called red wigglers, red hybrids or manure worms. If you are successful in finding redworms in your bait store, you may find them to be more expensive than ordering from a grower. Growers sell by the pound (approximately 800 to 1,000 worms), where bait shops usually sell by the dozen.

For additional information on using worms in your classroom: *Worms Eat My Garbage* (book)

Created by Melanie Carden-Jessen, Missouri Department of Conservation

so, what do you know?—lesson 5

1. What do herbivores eat?

2. What do carnivores eat?

3. What do omnivores eat?

4. Using the information you have learned in this unit, circle all of the categories you fit in.

   Producer Consumer Herbivore Carnivore Omnivore

5. What role do decomposers play in an ecosystem?

6. For each living thing, place an X in the column or columns that apply. Some living things fit under more than one category.

	Producer	Consumer	Herbivore	Carnivore	Omnivore	Decomposer	Pond ecosystem	Forest ecosystem	Prairie ecosystem
Blackberries									
Bobcat									
Bobwhite quail									
Cattail									
Duckweed									
Green darner dragonfly									
Largemouth bass									
Little bluestem									
Mayapple									
Pond snail									
Red-eared slider turtle									
Regal fritillary butterfly									
Round-winged katydid									
Shelf mushroom									
Sowbug									
Termite									
White oak tree									

so, what do you know?—lesson 5

answer key

1. What do herbivores eat? (1 point)

   answer Plants

2. What do carnivores eat? (1 point)

   answer Animals

3. What do omnivores eat? (1 point)

   answer Plants and animals

4. Using the information you have learned in this unit, circle all of the categories you fit in. (2 points)

   Producer Consumer Herbivore Carnivore Omnivore

   answer should include Consumer *AND* herbivore or omnivore

5. What role do decomposers play in an ecosystem? (2 points)

   answer —Decomposers eat and break down scat, or animal droppings, and dead plants and animals into tiny pieces.
   OR Other answers that convey the same meaning.

6. For each living thing, place an X in the column or columns that apply. Some living things fit under more than one category. (1 point for each X in the correct row and column; max. 40 points)

	Producer	Consumer	Herbivore	Carnivore	Omnivore	Decomposer	Pond ecosystem	Forest ecosystem	Prairie ecosystem
Blackberries	X								X
Bobcat		X		X				X	[X]
Bobwhite quail		X			X				X
Cattail	X						X		
Duckweed	X						X		
Green darner dragonfly		X		X			X		[X]
Largemouth bass		X		X			X		
Little bluestem	X								X
Mayapple	X							X	
Pond snail		X	X				X		
Red-eared slider turtle		X			X		X		
Regal fritillary butterfly		X	X						X
Round-winged katydid		X	X						X
Shelf mushroom						X		X	
Sowbug		X				X		X	
Termite		X				X		X	
White oak tree	X							X	

lesson 6: you want flies with that?

estimated time
1½–2 hours

science GLEs
EC.2.A.3.d. Predict the possible effects of removing an organism from a food chain
EC.2.A.4.c. Categorize organisms as predator or prey in a given ecosystem

vocabulary
Predators
Prey

lesson objectives
1. Define predator and prey.
2. Categorize organisms as predator and/or prey in a given ecosystem.
3. Identify the roles of predators and prey in an ecosystem.
4. Explain why predators and prey are important to energy flow in a food chain.
5. Predict the possible effects of removing an organism from a food chain.
6. Give examples of how humans as predators affect an ecosystem.

essential questions for the lesson
1. How can an organism be both predator and prey?
2. Why is it important to have both predators and prey in an ecosystem?
3. What role do humans as consumers play in an ecosystem?

teacher notes
Students should have read Chapter 6, "You Want Flies With That?," on pages 28–31, in their student books prior to engaging in these activities.

Activity 6.3 uses all three sets of *Ecosystem Cards* at one time. A comprehensive alphabetized key is included as Appendix I.

outline of answers to objectives
See following page.

essential activities
Activity 6.1: Predators and Prey in the Food Chain
Activity 6.2: Predators—They're Part of the Picture
Activity 6.3: Humans—At the Top

optional activities
Optional Activity 6.A: Hike Through the Regulations

summary
Predators hunt other animals for food. A prey animal is a predator's food, but there are animals that are both predators and prey. The speckled kingsnake on pages 28 and 29 in the student book is an example of an animal that is a predator when hunting the prairie vole for food but is also prey when hunted by the hawk. People who catch fish and hunt deer and turkey for food play the role of predator in an ecosystem.

Why do some people think of predators as fearsome and frightening animals and think of prey animals as gentle and cute?

outline of answers to objectives—lesson 6

1. Define predator and prey. (pages 28, 29)
   a. Predators are animals that hunt other animals.
      1) All carnivores are predators.
      2) Some carnivores are also prey.
   b. Prey are animals that are hunted by other animals.
      1) All herbivores are prey.
      2) Some carnivores are also prey

2. Categorize organisms as predator and/or prey in a given ecosystem. (page 29)
   a. Pond examples
      1) Tadpole is prey for a fish (a predator), which is prey for a great blue heron.
      2) Insect is prey for a water strider (a predator), which is prey for a fishing spider (a predator), which is prey for a green frog (a predator), which is prey for a northern water snake (predator). [An example from the pond poster]
   b. Forest examples
      1) Insects are prey to a carpenter ant (a predator), which is prey for a spider (a predator), which is prey for a rough green snake (a predator), which is prey for larger snakes (predators).
      2) Fox squirrel is prey to a great horned owl (a predator). [An example from the forest poster]
   c. Prairie examples
      1) An insect is prey for a prairie bird (a predator), which is prey for a hawk (a predator).
      2) A prairie vole is prey for a speckled kingsnake (a predator), which is prey to a hawk (a predator).
      3) A bobolink is prey to a speckled kingsnake (a predator), which is prey for a northern harrier (a predator). [An example from the prairie poster]

3. Identify the roles of predators and prey in an ecosystem. See *Activity 6.1: Predators and Prey in the Food Chain.*

4. Explain why predators and prey are important to energy flow in a food chain. See *Activity 6.2: Predators—They're Part of the Picture* (page 30)
   a. Prey pass energy to predators up through the food chain.
   b. A balance between predators and prey is important to help control animal populations, keep food chains strong and ecosystems healthy and balanced.

5. Predict the possible effects of removing an organism from a food chain. See *Activity 6.1: Predators and Prey in the Food Chain.*

6. Give examples of how humans as predators affect an ecosystem. (pages 30, 31)
   a. Humans are consumers at the top of many food chains.
   b. Some humans are herbivores (vegetarians), but most humans are omnivores.
   c. In the predator role, humans help control animal populations and keep ecosystems healthy and balanced.
      1) Insects are prey for bluegills (predators), which are prey for humans (predators).
      2) Junebug grubs are prey for turkeys (predators), which are prey for humans (predators).
      3) Deer (an herbivore) are prey for humans (predator).
      4) People who hunt and trap raccoons reduce the threat of distemper and help keep the raccoon populations healthy and balanced.

activity 6.1 : predators and prey in the food chain

estimated time 30 minutes

objectives

Students will be able to

1. Define predator and prey.
2. Categorize organisms as predator and/or prey in a given ecosystem.
3. Explain why predators and prey are important to the energy flow in a food chain.
4. Identify the roles of predators and prey in an ecosystem.
5. Predict the possible effects of removing an organism from a food chain.

teacher preparation

Students should have read Chapter 6, "You Want Flies With That?," on pages 28–31, in their student books prior to engaging in these activities.

This is an outdoor activity and will require a large, open area. This activity will require individual use of all three sets of *Ecosystem Cards* **with the decomposer and scavenger cards separated out**. Choose or have students choose which set of *Ecosystem Cards* they would like to use first.

This activity will introduce the concept of organisms as predators and/or prey and will incorporate this concept into the food chain for the first time. Repeat the activity for the other two ecosystems during the same or future class sessions. Repeating the activity with each of the three sets of *Ecosystem Cards* will reinforce the concept as well as reinforce student understanding of which organisms belong in which ecosystem (necessary for MAP test preparation). Understanding this will be very important when all three sets of cards are combined and used in the culminating *Activity 6.3* which will draw upon and pull together all of these concepts.

NOTE: At this point, many students may have grasped the concepts of food chains and have demonstrated a high level of understanding and of competency during Lesson 5 activities. From this point on, all activities involving the creation of student food chains will omit detailed procedures (such as those provided in Activities 5.1, 5.2 *and* 5.3*) for the creation and assessment of food chains, and students will be instructed to work together independently from the teacher to create and to assess food chains. These changes might create a bit of chaos at first, but if students do understand the concepts and the process, it could also help to change things up and increase student interest and fun.*

Also at this point, the use of yarn is optional. When yarn is not used, students should be instructed to stand in straight, clear rows or chains that radiate from the sun.

[However, if students would benefit from reinforcement of basic food chain concepts and detailed procedures, refer to and follow the procedures listed in Lesson 5 (*Activity 5.1* for the pond ecosystem; *Activity 5.2* the forest ecosystem; *Activity 5.3* for the prairie ecosystem) eliminating references to decomposers and scavengers. Have students continue to link together with the balls of yarn, if necessary.]

materials

Science notebooks
Pencils
Thermometers
Pond Ecosystem Cards/Forest Ecosystem Cards/Prairie Ecosystem Cards (with decomposers and scavengers separated out)
Big Charts
10–15 balls of yarn (optional)

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.

2. Shuffle and distribute the chosen set of *Ecosystem Cards* randomly to students.

3. Instruct students to read their cards carefully and to work together to create as many food chains as possible, incorporating as many organisms as possible into each chain. Prompt them with procedures used in Lesson 5 when necessary. Students should stand in clear, straight rows radiating from the sun.

4. Once as many students as possible are linked into chains, have organisms in each chain state what organism they represent and have unlinked students assess each chain. Incorrectly linked organisms should step aside, and any of the formerly unlinked students may replace them when possible.
   Q. Which ecosystem do we have here?
   A. Answers will vary depending on the set of cards chosen (pond, forest, prairie).
   NOTE: The pond ecosystem is used as the example here.

5. When the food chains are assessed and accurate:
   a. Ask all the producers to please raise their hands. Check for accuracy, acknowledge their hands and allow them to put them down.
   b. Ask all the consumers to please raise their hands. Check for accuracy, acknowledge their hands and allow them to put them down.
   c. Ask all predators to please raise their right hand and keep them up.
   d. Ask all prey animals to please raise their left hand and keep them up. Have students check each other for accuracy.
   Q. Why are some of you holding both hands up?
   A. They are predators because they hunted and ate another animal/consumer, but they became prey when they were hunted and eaten by another consumer. Consumers at the end of each chain should not have their left hands raised because they have not been eaten.
   Q. What is the difference between a predator and a prey?
   A. Prey is defined as an animal that is hunted by another animal. Predator is defined as an animal that hunts and eats other animals.

6. Refer to one chain. [For example:]

   Sun ➲ algae ➲ tadpole ➲ fishing spider ➲ green frog ➲ northern water snake ➲ great blue heron

   Q. Trick question: When would algae be considered a predator or prey?
   A. NEVER! Algae is a producer/plant that does not hunt or eat anything. Instead it gets its energy directly from the sun.
   Q. What is the tadpole and why?
   A. Although the tadpole may move about in search of food (algae), it doesn't hunt or eat other animals.The tadpole is an herbivore, and it gets its energy from the algae which received its energy from the sun.
   Q. What happened to this tadpole?
   A. It was eaten by the fishing spider.
   Q. If it were hunted and eaten, how would we describe the roles this tadpole played in this pond ecosystem?
   A. The tadpole played the roles of consumer, herbivore and prey.
   Q. What roles did the fishing spider play in the ecosystem?
   A. The fishing spider played the role of consumer and carnivore, but it also played the role of predator because it hunted and ate its prey, the tadpole. As a predator, it helped pass energy up through the food chain.
   Q. What came next in this food chain and what role(s) did it play in this pond ecosystem?
   A. The green frog is next. It hunted and ate the fishing spider. It played the roles of consumer, carnivore (because it eats animals only) and a predator (because it hunted and ate the fishing spider.) As a predator, it helped pass energy up through the food chain.
   Q. Hold on! We just said the fishing spider was a predator. If the green frog hunted and ate the fishing spider, what does that make the fishing spider?
   A. Prey.The fishing spider played the role of predator when it hunted and ate the tadpole, but it also played the role of prey when it was hunted and eaten by the predator green frog. Now the fishing spider roles include consumer, carnivore, predator and prey, and it helped to pass energy up through the food chain.
   Q. Now we have the green frog eaten by the northern water snake. What roles did they play?
   A. The northern water snake is the predator because it hunted and ate the green frog, and the green frog was a predator when it ate the fishing spider but has now become the prey. The green frog plays the role of consumer, carnivore, predator and prey. The northern water snake plays the role of consumer, carnivore and predator. As predators, both the green frog and the northern water snake helped to pass energy up through the food chain.

Q. This northern water snake had a green frog meal, but what has now happened to the snake?

A. The northern water snake was a predator when it hunted and ate the green frog, but now it is a prey animal because the great blue heron hunted and ate it. The great blue heron is a predator. The northern water snake roles were consumer, carnivore, predator and prey. The great blue heron roles were consumer, carnivore and predator. As predators, both the northern water snake and the great blue heron helped to pass energy up through the food chain.

7. To reinforce the predator/prey concept and relationships, have each chain *chant* the relationship between each link beginning with the top (or last) consumer in each chain. For example:

   Great blue heron: I am the predator heron that ate the prey snake
   Northern water snake: that was prey to the heron but predator to the frog…
   Green frog: that was prey to the snake but predator to the spider…
   Fishing spider: that was prey to the frog but predator to the tadpole…
   Tadpole: that was prey to the spider but only ate the algae…
   Algae: that produced its own food with energy from the sun…
   Sun: I am the sun that started it all!

8. Discuss with students how predators could be removed from a food chain (disease; flooding; over hunting/fishing or illegal hunting/fishing, etc.)

9. Move through at least three food chains and remove one or more predators from each one.

   Q. What might happen to each food chain if these predators were to disappear?

   A. Prey/herbivore populations would have fewer predators and would thrive and increase in number. Increased numbers in populations of herbivores might eat so many plants that the herbivores eventually have difficulty finding enough food, and their population numbers could be affected.

10. Repeat this exercise by having all the animals that would never be predators (herbivores) raise their hands and remove them from the food chain. Discuss how this might affect an ecosystem.

11. Collect the *Ecosystem Cards* and continue with the other two ecosystems *OR* use two future class sessions to repeat this activity for the two remaining ecosystems.

wrap-up/formative assessment

In their pond, forest and prairie *Big Charts*, have students place an X or a check mark under either the "Prey" or "Predator" column or both columns for each animal organism listed.

Have students revisit their *Big Chart: Schoolyard Ecosystem* to place an X or a check mark under the "Prey" or "Predator" columns for their schoolyard animal organisms.

activity 6.2 : predators—they're part of the picture

estimated time 30 minutes

objectives

Students will be able to

1. Explain why predators and prey are important to energy flow in a food chain.

teacher preparation

This activity addresses common misconceptions about predators: they're all fearsome, dangerous, ruthless, etc. It also addresses common misconceptions about prey animals that may also be predators: they're innocent, cute, not dangerous at all, etc.

Prepare three columns on the second page of a flip chart or on a section of white board with the headings: "Predators," "Predator Adjectives" and "Predator Verbs." Flip over and prepare the first page of the flip chart or prepare another area on the white board away from the first three columns with two columns labeled: "Prey Animals" and "Prey Adjectives."

materials

Science notebooks
Big Charts
Pencils
Flip chart/white board
Markers

procedure

1. Instruct students to prepare two pages in their science notebooks with the columns and headings as described above.

2. Ask students to name some common Missouri pond, forest or prairie prey animals (Ex: rabbits, white-breasted nuthatches, mallard ducks). List these on the flip chart/white board under the "Prey Animals" heading. Instruct students to list them in their science notebooks under the appropriate heading.
   Q. In which ecosystem would each of these animals most likely be found?
   A. Answers will vary. Have students refer to their three ecosystem *Big Charts*, if necessary.
   Q. How do you know these are prey animals?
   A. All of the listed animals should be animals that are hunted and eaten by other animals.

3. Ask students to suggest adjectives to describe these animals (Ex: soft, innocent, quiet, feathery, cute) and add these to the flip chart/white board under the "Prey Adjectives" column. Students should list these in their science notebooks.

4. Have students work in small groups to add any other adjectives/prey animals. Instruct students to describe any five listed prey animals using the adjectives on the list *OR* assign an equal number of prey animals to each group. Have each group share their descriptions with the class (Ex: quiet rabbit, tiny, soft white-breasted nuthatch, gentle mallard).

5. Referring to the second flip chart page, have students name predators that would be found in a Missouri pond, forest and prairie ecosystem. (Ex: bobcats, Texas ratsnake, coyotes, yellow garden spider, largemouth bass, predaceous diving beetle) List these on the second page of the flip chart/white board under the heading "Predators." Students should list these in their science notebooks.
   Q. In which ecosystem would each of these animals most likely be found?
   A. Answers will vary. Have students refer to their three ecosystem *Big Charts*, if necessary.
   Q. How do you know these are predators?
   A. All of the listed animals should be animals that hunt and eat other animals.

6. Have students suggest adjectives that describe predators (in general) (ex: fearsome, deadly, ferocious, dangerous, sneaky, vicious, terrifying, frightening, evil) and verbs that describe how predators eat their prey (ex: devour, rip apart, tear apart, shred). List these under the appropriate columns on the second flip chart page/white board. Students should list these in their science notebooks under the appropriate headings.

7. Have students work in small groups to add any adjectives/predators. Instruct students to describe any five listed predator animals using the adjectives and verbs on the list *OR* assign an equal number of predator animals to each group. Have each group share their descriptions with the class (Ex: evil coyote, sneaky Texas ratsnake, terrifying fishing spider).

8. Have students turn to the back of their science notebooks and identify and describe the animal (flying squirrel) illustrated there (Ex: cute, funny, acrobatic, cuddly, soft and furry, quiet).
   Q. What kind of consumer is a flying squirrel?
   A. Flying squirrels are omnivores.
   Q. If flying squirrels are omnivores, that means they eat producers *AND* other consumers. If they eat other consumers, what does that mean?
   A. It means they are predators.

9. Using adjectives and verbs from the predator columns, ask students to create sentences to describe the flying squirrel (Ex: The deadly flying squirrel tore apart the acorn. The ferocious flying squirrel crept up behind the baby bird in its nest and ripped it apart with its sharp teeth.).

10. Refer to the prey animal list. Point to each animal and circle it if students decide it is an omnivore. Have students work in groups to create descriptions of omnivores by combining each omnivore with a predator adjective (Ex: evil salamander, ferocious greater prairie-chicken, sneaky grasshopper sparrow).

11. As groups share their descriptions, discuss each one.
   Q. Just how fearsome is a salamander? How evil is a grasshopper sparrow? How terrifying is a flying squirrel? Which is more terrifying: a pileated woodpecker eating a termite or a greater prairie-chicken eating a prairie mound ant? Which is sneakier: a coyote creeping up on a rabbit or a grasshopper sparrow hunting a grasshopper?
   A. Answers will vary. Any predator might seem terrifying to someone watching it hunt and eat its prey, but some of those prey animals that are omnivores probably seemed just as terrifying when they hunted and ate their prey.

12. Sum up the activity by reminding students that predators are some of the most misunderstood animals in the world. Predators aren't necessarily mean and vicious. They are just trying to survive like all other animals, and hunting other animals to eat takes care of one of their basic needs—the need for food. Often predators are hunted by other animals and become the prey. Prey may appear cute, quiet, innocent, etc., but many prey animals are also predators.

13. [Assign for homework or] have students work in small groups to use the adjectives and verbs from the "Predator Adjectives" and "Predator Verb" lists to create full sentences to describe each listed predator from the "Predators" list and each circled omnivore on the "Prey Animals" list [or a certain number of the listed predators/omnivores]. Encourage students to be accurate about what the predators are eating but to be creative and to have fun. (Ex: The sneaky coyote tore apart the baby turkey. The evil and deadly grasshopper sparrow ripped the innocent grasshopper to shreds. The terrifying yellow garden spider sucked the life out of the trapped dragonfly that had just gorged itself on an unsuspecting butterfly.)

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

Used and adapted with permission from Linda Chorice at the Missouri Department of Conservation Springfield Conservation Nature Center.

activity 6.3 : humans—at the top

estimated time 30 minutes

objectives

Students will be able to
1. Sequence the flow of energy through pond, forest and prairie food chains beginning with the sun.
2. Explain the roles humans play in pond, forest and prairie ecosystem food chains.
3. Give examples of how humans as predators affect pond, forest and prairie ecosystems.

teacher preparation

This is an outdoor activity and will require a large, open area. This activity will require the use of all three sets of *Ecosystem Cards* used in Lesson 5 including the three Human cards and the decomposer and scavenger cards. Only one Sun card will be needed. This activity functions as a culminating activity for all concepts and information captured by students in their three *Big Charts* (i.e., organisms, producers, consumers, herbivores, carnivores, omnivores, decomposers, scavengers, predators and prey) as well as the concepts of humans as part of pond, forest and prairie ecosystem food chains and of humans as predators in those food chains.

Students will represent the organism on their card and determine their roles in a food chain by referring to and interpreting all the information provided on their cards. Each food chain should reflect one of the three ecosystems, and students should be able to identify whether they are linked within a pond, forest or prairie ecosystem food chain.

Prepare cards ahead of time. The number of producer cards used will determine the number of food chains created. The chart below is provided as *an example* of ways to combine the three sets of *Ecosystem Cards* to allow for at least six food chains. The Sun card must be included, and at least one Human card and two or more of the "cross-over" organisms (badger, bobcat, great horned owl, green darner dragonfly, pileated woodpecker and white-tailed deer) plus the decomposers/scavengers should be included as consumers.

Number of students	Sun	Pond ecosystem		Forest ecosystem		Prairie ecosystem	
		Producers	Consumers	Producers	Consumers	Producers	Consumers
30	1	3	7	3	7	2	7
25	1	2	6	3	6	2	6
20	1	2	4	2	4	2	5

* Suggestion: If more than one class has adopted the *Nature Unleashed* unit, combine all the classes and increase the number of *Ecosystem Cards* used to increase the number of food chains, increase the length of food chains *OR* create several separate sets of food chains by adding one or more Sun cards.

This activity brings all the concepts and ecosystems together as well as introduces humans into the picture and challenges students to incorporate all their acquired knowledge into the links of each and every food chain. Lesson 5 and Lesson 6 (*Activity 6.1*) provided students with ample opportunities to create food chains using individual ecosystems. Therefore, it is suggested in this activity that students be given the opportunity to work together to create these all-inclusive food chains independent of the teacher.

materials

Science notebooks
Pencils
Thermometers
Pond, Forest and Prairie Ecosystem Cards (including Human cards)
Ecosystem Cards Comprehensive Key (Appendix I)
6–8 balls of yarn (optional)

procedure

1. Have students complete the heading in their science notebooks and take and record the outside air temperature.

2. If used, place the balls of yarn in the center of the open area. Shuffle the prepared *Ecosystem Cards* and distribute one card to each student. Make certain that the Sun card is included as well as enough Human and "cross-over" organism cards (badger, bobcat, great horned owl, green darner dragonfly, pileated woodpecker and white-tailed deer).

3. The cards indicate exactly what organisms the students are to represent and what organisms they eat. Students representing plants will have cards that provide information that helps them deduce that they are producers. Instruct students to read their cards very carefully because all three ecosystems (pond, forest and prairie) organisms are mixed in together, and they will be sent to the decomposition area if they link up incorrectly in a chain.

4. Indicate a place off to the side of the group as the place for unlinked/decomposing organisms. Ask students to give the place a name. **Throughout this entire activity, send any students incorrectly (based on the information on their cards) linked to a food chain to the decomposition area.**

5. Address any questions students may have about the words on their cards but be careful not to provide key information regarding whether or not they are producers, herbivores, carnivores, omnivores, predators, etc.

6. Instruct students to work together to create as many food chains as possible, incorporating as many organisms as possible into each chain. Prompt them with procedures used in Lesson 5 and in *Activity 6.1* when necessary. Students should stand in clear, straight rows radiating from the sun.

7. Once as many students as possible are linked into chains, have organisms in each chain state what organism they represent and have unlinked students assess each chain. Incorrectly linked organisms should step aside, and any of the formerly unlinked students may replace them when possible.

8. When the food chains are briefly assessed and accurate, ask all the producers to move their hands side to side over their heads (as if they were plants swaying in the breeze). Have students check each other for accuracy.
   Q. Why do you think you are producers?
   A. [These students] have cards that show they are plants, and plants use the energy directly from the sun to make their own food.

   Have producers stop moving their hands.

9. Ask all the consumers to "take a knee" (get down on one knee). Have students check each other for accuracy.
   Q. What does it mean to be a consumer?
   A. Consumers are organisms that must eat other organisms in order to get energy to survive.

   Have students return to a standing position.

10. Ask all students who are organisms that eat only plants to clap their hands. Have students check each other for accuracy.
   Q. If you eat only plants, what kind of consumers are you?
   A. Herbivores!

   Have students stop clapping their hands.

11. Ask all students who are organisms that eat only meat to roar.
   Q. If you eat only meat, what kind of consumers are you?
   A. Carnivores!

   Have students stop roaring.

12. Ask all students who are organisms that eat both plants and meat to clap their hands like herbivores, roar like carnivores *AND* jump up and down. Have students check each other for accuracy.
   Q. If you eat both plants and meat, what kind of consumers are you?
   A. Omnivores!

   Have students stand quietly.

13. Address the class:
    Q. Which organisms have been standing quietly this whole time?
    A. Answers may vary. Decomposers and scavengers may not have participated with the other consumers, and unlinked students have been in the decomposition area. The student with the Sun card has been standing quietly, but he/she is not an organism.

14. Have all decomposers and scavengers in the food chain as well as students in the decomposition area say, "Mmmmmmmmmmmm good!"

15. One time all together: Have students continue doing their motion or sound as you add each group. Everyone should be doing something at the same time by the end:
    a. Producers, sway your hands in the breeze over your heads.
    b. Herbivores, clap your hands.
    c. Carnivores, roar.
    d. Omnivores, clap your hands, roar and jump up and down.
    e. Decomposers and scavengers, say, "Mmmmmmmmmmmmmm good!"

16. Have students return to standing quietly in their food chains.

17. Address the class:
    a. Ask all predators to please raise their right hand and keep them up. Have students check each other for accuracy.
    b. Ask all prey animals to please raise their left hand and keep them up. Have students check each other for accuracy.
    Q. What role has each of you been playing in your food chains?
    A. Answers will vary. Prey animals have provided energy to the predators who have consumed them. Predators have gained energy from their prey to survive. Predators and prey have helped to move energy up through food chains. A balance between predators and prey is important to help control animal populations, keep food chains strong and ecosystems healthy and balanced.
    Q. Why do some of you have both hands up?
    A. These animals are both predator and prey. They are predators when hunting for food and prey animals when something hunts them.
    c. Have all predators and prey high five each other and put their hands down.

18. Address the class:
    Q. Where are the humans in these food chains?
    A. Have the humans raise their hands.
    Q. What roles are you playing in your food chains?
    A. Answers may vary. Humans would be consumers, omnivores and predators. Humans would move energy up through a food chain.
    Q. How has each student holding a human card played the role of predator?
    A. Answers may vary but could include:

    A student with a Human card:

Linked to	Could have been linked because...
A white-tailed deer	He/she was a deer hunter.
A bluegill fish	He/she was fishing, caught bluegill and ate them for dinner.
A wild turkey	He/she was a turkey hunter.
A green frog	He/she had been gigging for frogs the night before and was serving frog legs for dinner.
A raccoon	He/she trapped a raccoon to eat the raccoon meat and to sell its pelt at an auction.

Q. Humans act like predators when they hunt. What might happen if humans stopped hunting white-tailed deer in Missouri?

A. Answers will vary. When people hunt white-tailed deer in Missouri, they help control the population of white-tailed deer and help keep the ecosystems healthy and balanced. Too many large populations of white-tailed deer can cause serious damage to farmers' crops, wildflower gardens, the understory plants in forests, etc. An overabundance of white-tailed deer in urban areas often result in deer-vehicle accidents.

Q. Where are all the human organisms located in these food chains?

A. They are all the last ones in a food chain.

Q. Why are they last?

A. Humans are at the top of food chains because they are not prey to any predators. They are the top predators and top consumers.

19. Address the class:

Q. Look over each organism linked in your food chain. Based on the kinds of organisms, in which ecosystem would your food chain most likely be found: a pond ecosystem; a forest ecosystem; or a prairie ecosystem?

A. Answers will vary based on the organisms in each food chain. Have students check each other for accuracy.

20. [Similar to the end of *Activity 6.1*] To reinforce all the concepts and relationships and to bring the activity to a "rousing" conclusion: In each food chain, have each link ***chant its relationship*** with the link next to it beginning with the top (or last) consumer in each chain ***while doing the motion assigned to each earlier in the activity (carnivores should roar before and after they chant their relationship)***. When each chain has "performed," they should stand quietly while the next food chain takes their turn. For example:

Human: [*Jumping up and down and clapping hands=omnivore*] I am a human and I am predator that hunted and ate the wild turkey.

Wild turkey: [*Jumping up and down and clapping hands=omnivore*] I am the wild turkey that was prey to the human but was predator to the tiger salamander.

Tiger salamander: [*ROAR!*] I am the tiger salamander that was prey to the wild turkey but was predator to the sowbug. [*ROAR!*]

Sowbug: [*Mmmmmmmmmmm good!=decomposer/scavenger*] I am the sowbug that was prey to the tiger salamander while eating the decaying leaves of the mayapple. [*Mmmmmmmmmmm good!*]

Mayapple: [*Moving hands back and forth over his/her head.*] I am the mayapple that produced its own food with energy from the sun.

Sun: I am the sun that started it all!

ENTIRE FOOD CHAIN: We are found in a forest ecosystem!

21. Continue until each food chain has completed its "performance." Have all food chain components give the organisms in the decomposition area a round of applause for "breaking down" and returning nutrients to the soil.

Wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

optional activity 6.a : hike through the regulations

teacher preparation

1. Use Internet (*www.mdc.mo.gov/hunt/*) for a virtual hike through the deer, turkey and/or fishing regulations or have paper copies for students, which are available at all Missouri Department of Conservation offices and vendors of fishing and hunting permits.

2. Familiarize yourself with the contents of the regulation booklets or Web site.

3. Choose key items you think are important for students to know and/or to be able to find. (Ex: hunting/fishing seasons; limits; lengths; Share the Harvest information; hunting safety guidelines, etc.)

procedure

1. Name an item you want students to find.

2. The first student/group of students to find an item should raise their hands, tell what page the item is on, how they found it, and read the item to the class.

3. Continue this way through one or all of the regulation booklets.

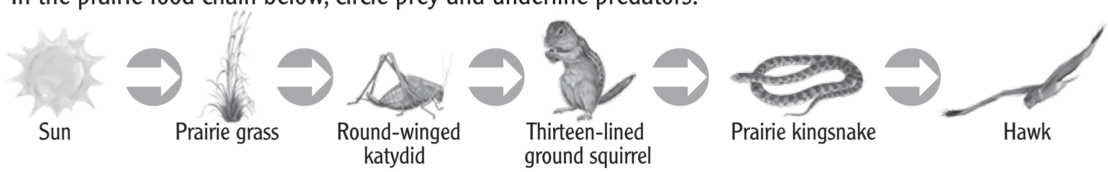
4. Award points to students/groups as they discover an item correctly and provide accurate information.

so, what do you know?—lesson 6

1. What is the definition of predator?
   a. Animal that is hunted by other animals.
   b. Animal that hunts for other animals.
   c. Animal that hunts for plants.
   d. Animal that produces its own food.

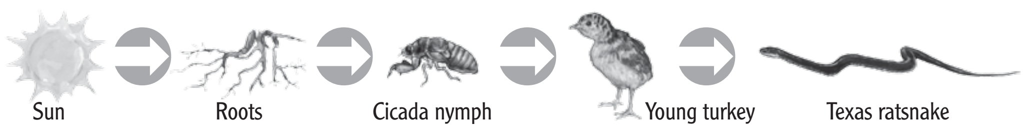
2. What is the definition of prey?
   a. Animal that is hunted by other animals.
   b. Animal that hunts for other animals.
   c. Animal that hunts for plants.
   d. Animal that produces its own food.

3. In the prairie food chain below, circle prey and underline predators.

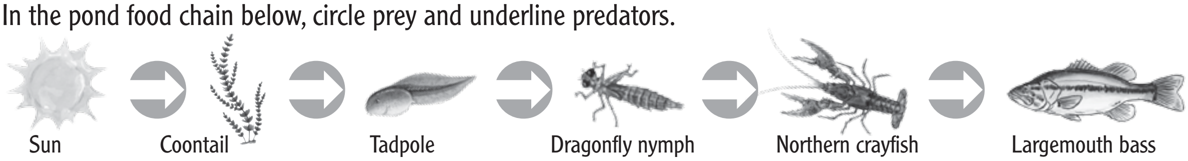


4. In the prairie food chain above, predict what might happen if the ground squirrel population disappears.

5. In the forest food chain below, circle prey and underline predators.



6. In the pond food chain below, circle prey and underline predators.



7. In the pond food chain pictured above, predict what might happen if the crayfish population disappears.

8. What role do predators and prey fill in any food chain?
   a. They are decomposers in an ecosystem.
   b. They produce energy from the sun.
   c. They are the clean-up crew in an ecosystem
   d. They pass energy up through the food chain.

9. Some humans are vegetarians (herbivores) but most are omnivores. Some humans hunt for food. List one example where humans as predators have had a positive impact on an ecosystem.

10. Why do predators hunt?

so, what do you know?—lesson 6

answer key

1. What is the definition of predator? (1 point)
   answer —b. Animal that hunts for other animals.

2. What is the definition of prey? (1 point)
   answer —a. Animal that is hunted by other animals.

3. In the prairie food chain below, circle prey and underline predators. (1 point each; maximum 6 points)
   answer —Prey: katydid, thirteen-lined ground squirrel, kingsnake; Predators: thirteen-lined ground squirrel, kingsnake, hawk

4. In the prairie food chain above, predict what might happen if the ground squirrel population disappears.
   possible answers (4 points for any one of the answers below)
   - The katydid population might increase a lot because no ground squirrels are eating them.
   - The prairie kingsnake population might decrease because there are no ground squirrels to eat. With a decreased population of snakes, the hawk population could find it harder to get enough food to eat.
   - Or other plausible answer

5. In the forest food chain below, circle prey and underline predators. (1 point each; maximum 4 points)
   answer —Prey: cicada, turkey; Predators: turkey, snake

6. In the pond food chain below, circle prey and underline predators. (1 point each; maximum 6 points)
   answer —Prey: tadpole, dragonfly nymph, crayfish; Predators: dragonfly, crayfish, bass

7. In the pond food chain pictured above, predict what might happen if the crayfish population disappears.
   possible answers (2 points for any one of the answers below)
   - The dragon nymph population might increase and eat more tadpoles. This could decrease the tadpole population.
   - The bass may not have enough food to eat which means the bass population could decrease.
   - Or other plausible answer

8. What role do predators and prey fill in any food chain? (1 point)
   answer —d. They pass energy up through the food chain.

9. Some humans are vegetarians (herbivores) but most are omnivores. Some humans hunt for food. List one example where humans as predators have had a positive impact on an ecosystem. (2 points)
   possible answers
   - Humans who hunt deer help reduce the deer population. This can help reduce the number of deer involved in car accidents.
   - People who hunt or trap raccoons help keep the raccoon population healthy and balanced. When there are too many raccoons in an area, they can get distemper, which is a serious disease that spreads quickly.
   - Other examples may be acceptable.

10. Why do predators hunt? (1 point) **answer** —To survive; for food to survive

lesson 7: it all makes sense

estimated time
1½–2 hours

science GLEs
EC.1.A.4.a. Identify the ways a specific organism may interact with other organisms or with the environment (e.g., pollination, shelter, seed dispersal, camouflage, ~~migration, hibernation,~~ defensive mechanism)

vocabulary
Pollinators
Disperse
Digestive tract
Defense mechanisms

lesson objectives
1. Explain why organisms need to interact with other organisms and their environment.
2. Identify ways specific organisms interact with other organisms and the environment, such as seed dispersal, pollination, camouflage and defense mechanisms.
3. List human interactions with their environments.
4. Explain how these human interactions may affect the environment and the organisms in the environment/ecosystem.

essential questions for the lesson
1. Why do organisms interact with each other and the environment?
2. How do organisms, including humans, interact with other organisms and their environment?

teacher notes
Students should have read Chapter 7, "It All Makes Sense," pages 32–35 in their student books prior to engaging in these activities.

outline of answers to objectives
See following page.

essential activities
Activity 7.1: What's the Big Deal About Interaction?
Activity 7.2: Bird Interaction—Survival! Survival! Survival!
Activity 7.3: Human Interactions

optional activities
Optional Activity 7.A: Oh, Deer! (Project WILD)

Note: For teachers who have completed a Project WILD workshop, the activity titled *Oh, Deer!* has an excellent extension activity involving several populations of animals in one area and their interactions as predator and/or prey.

summary
Organisms interact with other organisms and the environment by seed dispersal, pollination, camouflage and defense mechanisms. A decrease in prey populations can cause a decrease in predator populations. A decrease in predator populations can cause an increase in prey populations. Different organisms survive in a given environment because they have special structures or behaviors. Humans are part of the picture, too.

outline of answers to objectives—lesson 7

1. Explain why organisms need to interact with other organisms and their environment. (page 32)
   a. Organisms need to interact with other organisms and their environment to survive.

2. Identify ways specific organisms interact with other organisms and the environment, such as seed dispersal, pollination, camouflage and defense mechanisms. (pages 32–35)
   a. Pollination—Examples
      1) Plants depend upon bees, butterflies and other insect pollinators to transfer pollen from one flower to the next. Pollination is necessary for the plants to develop fruits and seeds, which eventually grow into new plants. These plants will be food for omnivores and herbivores.
      2) Bumble bees gather nectar for food from prairie coneflowers. Each coneflower benefits because bees leave behind bits of pollen that they have collected in their pollen baskets from other coneflowers.
   b. Shelter—Examples
      1) Frogs and toads lay eggs in pond water and when the eggs hatch, the young find safety and food among the pond plants.
      2) Dragonflies lay eggs on stems of pond plants and when the eggs hatch, the young find safety and food among the pond plants.
      3) Some animals living in forests and prairies find shelter and food among the roots, leaves and flowers of plants and trees.
      4) Animals use plants as places to nest and raise their young. Quail use prairies with both brushy areas and woodland edges to nest and raise their young and survive harsh winters.
      5) Prairie racerunners may use rocks for shelter.
      6) Big brown bats use hollow trees, deep rock crevices, buildings, caves and other places to roost and hibernate.
      7) Fallen leaves from trees and other plants blanket the forest floor and create a layer of safety and warmth for other plants and small animals.
      8) Thick clumps of prairie grass make perfect shelters, nesting spots and travel lanes for rodents, birds and snakes.
   c. Seed dispersal—Many plants depend on the wind or animals to move or disperse their seed. Examples:
      1) Seeds with wing-like parts spin down from the trees.
      2) Seeds with soft, fuzzy coverings are light enough to float away on the breeze.
      3) Seeds with sticky or prickly surfaces cling to animal fur and hitch a ride until they fall off or are scratched off. Where they land is where they can germinate and grow.
      4) Some plant seeds must be eaten and pass through an animal's digestive tract before they will grow. Migrating waxwings eat cedar seeds. When the seeds pass through the digestive system, they are dropped along the waxwings' migration route, where many will grow.
   d. Camouflage—Examples:
      1) Newborn deer have white spots on their brown fur that allow the fawns to blend into their forest surroundings.
      2) Thirteen-lined ground squirrels, greater prairie-chickens, ornate box turtles and bullsnakes are prairie animals with stripes, spots and bands of light and dark colors that help them blend into their prairie environment.
   e. Defense mechanisms—Examples:
      1) Venomous snakes and spiders use venom to protect themselves and to make their live food hold still.
      2) Skunks, daddy longlegs and certain snakes and insects have glands that give off such foul smells that other animals leave them alone.
      3) Specialized feet, tails and body shapes allow animals to run, jump and climb to escape other animals or to capture them.
      4) Speed is the greatest defense mechanism prairie racerunners have to escape predators. Their long stripes help keep predators wondering which way the speedy lizard is racing.
   f. Predator and prey interaction
      1) Balance is the key to healthy ecosystems.
         a) Ecosystems may become unbalanced when populations of plants or animals become too large or too small as a result of droughts, floods or diseases.
         b) Balanced populations depend on an environment having enough food for all the animals as well as the right number of animals to eat the food.

2) When population numbers change, the balance between predator and prey changes.
   a) If bobcat populations suddenly became smaller, there would be fewer predators to eat rabbits. In a short time the rabbit population would increase and consume too many plants. With fewer plants, eventually rabbits and other plant consumers would not have the food they need to survive.

g. Other interactions—Examples
   1) A hungry animal will forage for plants or hunt for other animals for food.
   2) Prairie racerunners use flat rocks to warm up or cool down.
   3) Herbivores and omnivores depend on plants for food.
   4) Decomposers are essential to all animals and plants. They clean up scat and dead plants and animals by breaking them down and returning them back to the soil as nutrients. Examples:
      a) Forest: sowbugs, carpenter ants, termites, beetles, fungi and bacteria
      b) Prairie: microorganisms (organisms too small to be seen without a microscope)

3. Identify examples where human activities caused beneficial or harmful changes to the ecosystem. See *Activity 7.3: Human Interactions*.
   a. When humans dig up large numbers of wildflowers from a prairie they are removing essential pieces of the prairie ecosystems. Rabbits, butterflies, birds and other herbivores that depend on the forbs for food and shelter may have more difficulty surviving. This in turn means that bobcats, coyotes, hawks and other predators that depend on those herbivores for food are affected.
   b. Taking fish smaller than the legal length limit reduces the number of fish old enough to reproduce.
   c. Riding an ATV through forests can damage plants and homes of burrowing or ground-nesting animals.
   d. Dumping trash, or littering, is ugly. It can also be a health hazard for humans and other animals.

activity 7.1 : what's the big deal about interaction?

estimated time 30 minutes

objectives
Students will be able to
1. Explain why organisms need to interact with other organisms and their environment.
2. Identify ways specific organisms interact with other organisms and the environment, such as seed dispersal, pollination, camouflage and defense mechanisms.

teacher preparation
Students should have read Chapter 7, "It All Makes Sense," pages 32–35 in their student books prior to engaging in these activities.

This is an outdoor activity. Take a brief walk around the schoolyard and note where you find examples of organisms interacting with each other and with the non-living things in the schoolyard (hunting; being hunted; sunning; moving from flower to flower; waiting by a flower to eat animals coming to the flower; birds eating birdseed from the students' feeders or eating insects; etc.). During the course of the activity, if students are unsure and/or unable to find examples, refer to your notes and provide subtle prompts for students to discover examples.

materials

Science notebooks	Hand lenses/loupes	Field guides (optional)
Pencils	Thermometers	

procedure
1. Have students complete their science notebook headings and take and record outside air temperature.

2. Have students work individually to list in their science notebooks the "organisms" that live in their own homes. For example:
   a. humans (parents; sisters; brothers; uncles; grandmother; etc.)
   b. pets (dogs; cats; parakeets; etc.)
   c. plants (Mom's kitchen herbs over the sink; plants in the windows; etc.)
   d. pests (flies; mice; spiders; mosquitoes; etc.)

   Q. How do the organisms you have listed interact with each other?
   a. Parents provide food, water, shelter, space to children.
   b. Children provide pets with food, water, shelter and space.
   c. Humans provide plants with water, nutrients and light.
   d. Plants give off oxygen and provide air to the humans and pets.
   e. Humans try to get rid of pests, such as mosquitoes and flies, because they can be very annoying and could possibly carry disease and harm the other organisms in the home.
   f. Pests (mosquitoes) use the humans as food or take advantage of humans because they make food available (crumbs, fruit left out, etc. for flies and mice).

   Q. What purpose do all these interactions serve?
   A. It's all about survival. Even these interactions occurring every day at home serve to help each organism find or receive what it needs to survive.

3. Instruct students to spend time observing their schoolyard ecosystem and record interactions they see occurring between organisms. Students may use hand lenses or loupes for close-up observations. Instruct students to watch especially for examples of interactions involving seed dispersal, pollination, camouflage, predator/prey and defense mechanisms.

4. Discuss the interactions observed and ask students how each interaction was somehow connected to at least one organism using another to survive.

wrap-up/formative assessment
See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

activity 7.2 : bird interaction— survival! survival! survival!

estimated time 30–40 minutes

objectives

Students will be able to
1. Explain why birds need to interact with other organisms and their environment.
2. Identify ways specific birds interact with other organisms and the environment, such as seed dispersal, camouflage and defense mechanisms.

teacher preparation

Bird feeders should have been filled at least fifteen minutes to one-half hour before the activity.

This is an outdoor activity. Take a brief walk around the schoolyard and note bird activity and behavior. During the course of the activity, if students are unsure and/or unable to find examples of bird activity and behavior, refer to your notes and provide subtle prompts for students to discover examples.

Activity 7.2 incorporates many of the concepts from prior lessons and will focus on the bird feeders and on the birds using them that students have been studying throughout the unit. Time allowed for students to observe bird behavior should be determined by student interest level and ability to remain focused and on-task.

materials

Science notebooks
Pencils
Thermometers
Field guides (optional)
Binoculars (optional)

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.

2. Instruct students to quietly observe their bird feeders and record bird activity, behavior and interactions:
   a. Birds interacting with other birds. Why?
   b. Birds interacting with plants. Why?
   c. Birds interacting with non-living things in the schoolyard ecosystem or in their immediate environment. Why?
   d. Bird behavior observed that is a reaction to internal and/or external cues. How could you tell?

3. Have students share and discuss their observations. Challenge them to draw conclusions as to why birds were observed doing certain activities:
   a. Were birds competing for food at the feeders and displaying aggressive behavior to other birds to scare them away? Were those other birds reacting to an internal cue of fear and flew away as a defense mechanism?
   b. Were birds at plants because they were eating parts of the plants, were they hunting insects that were on/in the plants, or were they just resting on the plants?
   c. Were birds at the fountain/bird bath/pond because they were reacting to external cues of hot temperatures or internal cues of thirst, or were they eating insects/plants in or near the water?
   d. Were there birds that were more camouflaged than others? Describe their behavior compared to the brightly colored, very visible birds. Were there differences/similarities?
   e. Were birds engaged in any form of seed dispersal? Were there birds eating seed that had been tossed about and dropped from the feeders by other birds? That's one form of dispersal. Were other birds taking one seed at a time from the feeder and flying off somewhere else to eat it? Why?

Q. All of these behaviors and interactions observed provided what for these birds?

A. Some form of safety, shelter, food, water and space, which means these birds were interacting in order to survive.

Q. Were there any birds observed doing anything that would not have been a survival technique?

A. Answers will vary, but everything should point to survival including birds that were resting or sleeping.

wrap-up/formative assessment

Have students write a brief paragraph describing one internal or external cue they experienced personally, how they reacted to that cue, and why or why not was their reaction helpful to their survival. (Ex: fear—ran away—wasn't bitten by a mean dog or wasn't beaten up by a neighborhood bully; hunger—ate a snack—didn't starve; extreme cold—put on gloves, heavier coat and hat—was able to continue shoveling the driveway so parents could drive to the store for food; etc.)

activity 7.3 : human interactions

estimated time 20–30 minutes

objectives

Students will be able to
1. List human interactions with their environments.
2. Explain how these human interactions may effect the environment and the organisms in the environment/ecosystem.

teacher preparation

This is an outdoor activity. Take a brief walk around the schoolyard and note where you find examples of human interactions with the schoolyard ecosystem. During the course of the activity, if students are unsure and/or unable to find examples, refer to your notes and provide subtle prompts for students to discover examples.

This activity will involve simple, introductory discussions based on the pictures on page 35 of the student book. Students will use the schoolyard ecosystem for examples of human interactions. The terms "harmful effects" and "beneficial effects" are not officially introduced until Chapter 8. However, this simple brainstorming activity does not necessarily require introducing those terms here. Lists generated by students in this activity will be tied in closely with *Activity 8.1,* and the terms "harmful effects" and "beneficial effects" will be introduced there.

If students should focus on harmful effects caused by human interactions, allow them to do so. Capture the information on the flip chart. *Activity 8.1* will balance the harmful effects of human interactions with beneficial effects of human interactions.

materials

Science notebooks
Pencils
Thermometers
Student books

procedure

1. Have students complete their science notebook headings and take and record outside air temperature.

2. Have students work in groups to come up with a list of ways humans interact with environments and the possible effects these interactions have on those environments. Record students' list items on a flip chart for later use in *Activity 8.1*. Ex: People litter; write graffiti; poach deer, turkeys, fish, etc.; dig up wildflowers; drive ATVs through streams and off trails in forests; plant flowers; feed birds; etc.

3. Instruct students to read the information on page 35 of their student book and to look carefully at the pictures on that page. Have them share any effects they see on the page not already on the flip chart list.
   Q. What are possible effects caused by the interactions on your list?
   A. Answers will vary but could include:
      a. Human digging up wildflowers—When humans remove parts of the ecosystem that other animals/organisms depend on for survival, they affect the organisms that depend directly on the wildflowers for food and shelter and they affect the organisms that depend on other organisms for food.
      b. Human riding an ATV through a stream/forest—ATVs can cause damage to plants and to the homes of organisms. ATVs can cause damage to organisms that live in the streams.
      c. Humans leaving trash and litter—Litter and trash make a place look ugly. Litter is ugly and can cause health hazards for humans and other organisms.
      d. Humans might take more fish/wrong size fish than is allowed by the regulations—Taking too many fish reduces the fish population. Taking fish smaller than the legal length limit reduces the number of fish old enough to reproduce.

4. Instruct students to take note of some effects they see in their schoolyard ecosystem that are the result of human interactions (ex: trash, bird feeders torn down, people wearing down grass or walking through flower gardens to take a short cut).

5. Have students share these so that they may be recorded on the flip chart for inclusion in *Activity 8.1*.

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

so, what do you know?—lesson 7

1. Why do organisms need to interact with other organisms and their environment?

2. When bees and butterflies go from one flower to the next they are interacting with other living things. What is this type of interaction called?

   a. Pollination
   b. Predation
   c. Defense mechanism
   d. Preying on flowers

3. What is one way prairie racerunners interact with flat rocks?

   a. They use them to raise their young.
   b. They use them as raceways.
   c. They use them to warm up or cool down.
   d. They use them to kill their prey.

4. Where can forest animals find shelter?

5. Why is it important to maintain predator/prey balance in an ecosystem?

6. Predict what might happen to the coyote population in the following scenario.

   In the prairie ecosystem, coyotes rely on rabbits and other small mammals for food. The spring and summer months have been very, very wet. So wet, in fact, that about 50% of the young rabbit population has drowned.

so, what do you know?—lesson 7

answer key

1. Why do organisms need to interact with other organisms and their environment? (1 point)

   answer —To survive

2. When bees and butterflies go from one flower to the next they are interacting with other living things. What is this type of interaction called? (1 point)

   answer —a. Pollination

3. What is one way prairie racerunners interact with flat rocks? (1 point)

   answer —c. They use them to warm up or cool down.

4. Where can forest animals find shelter? (2 points for any one of the answers provided)

   possible answers
   - Among the roots, leaves and flowers of plants
   - Among the fallen leaves, sticks, rocks, etc., on the forest floor
   - Other answers may be acceptable

5. Why is it important to maintain predator/prey balance in an ecosystem? (2 points)

   answer
   - Predator/prey balance is key to healthy ecosystems.
   - Or other similarly-worded content

6. Predict what might happen to the coyote population in the following scenario.

   In the prairie ecosystem, coyotes rely on rabbits and other small mammals for food. The spring and summer months have been very, very wet. So wet, in fact, that about 50% of the young rabbit population has drowned.

   possible answers (4 points for one plausible answer)
   - The coyote population may not have enough food to eat; therefore, the coyote population may decrease.
   - The coyote population may eat more of other types of animals in order to survive. This could impact other predators that depend on those animals for food.
   - Or other plausible answers.

lesson 8 : humans are organisms, too

estimated time
30–40 minutes

science GLEs
EC.1.D.4.a. Identify examples in Missouri where human activity has had a beneficial or harmful effect on other organisms (e.g., feeding birds, littering vs. picking up trash, hunting/conservation of species, paving/restoring greenspace)

vocabulary
Beneficial effect
Harmful effect

lesson objectives
1. Explain how humans are just one of the organisms interacting with plants and animals in Missouri.
2. Identify examples in Missouri where human activity has had a beneficial or harmful effect on other organisms.

essential questions for the lesson
1. How are we part of ecosystems?
2. How can human activities help or harm an ecosystem?

teacher notes
Students should have read Chapter 8, "Humans Are Organisms, Too," on pages 36–38 in their student books prior to engaging in this lesson.

This lesson brings together all concepts in the book. Discussions on human interactions (both harmful and beneficial) are continued from *Activity 7.3* and reinforce the concept that human organisms and populations are a part of ecosystems, too.

Background information—A native species is a plant or animal that occurs naturally in a certain area. A native Missouri plant or animal originated in Missouri. A native Missouri plant or animal was not introduced into Missouri and existed within the state borders prior to the arrival of settlers. Because a native plant or animal evolves in an area over time, it typically co-evolves with other species that serve to keep its population in check through predation, competition or disease. Non-native species (exotic species or alien species) are ones that have been introduced or moved by human activities to an area where they do not naturally occur. A non-native species is not necessarily harmful, and in fact, some non-native species are beneficial (apple trees and honeybees). However, when a non-native species overruns or out-competes native species in natural communities or ecosystems and causes ecological or economic problems, it is called an invasive species.

outline of answers to objectives
See following page.

essential activities
Activity 8.1: Humans Interactions Continued

optional activities
Optional Activity 8.A: Can They Live Here?
Optional Activity 8.B: Interactive Web
Optional Activity 8.C: MDC Video Segments
Optional Activity 8.D: What Is Going On In Your Neighborhood?
Optional Activity 8.E: Conservation Programs

summary
A human is an organism living with other human organisms to form populations of humans. Human populations living among other populations of organisms become part of a community. Add the non-living things, such as sunlight, water, temperature, soil, landforms and air, and humans become part of an ecosystem. Humans have opportunities to keep ecosystems healthy and balanced. Humans also have the power to make choices and decisions that could unbalance ecosystems forever.

outline of answers to objectives—lesson 8

1. Explain how humans are just one of the organisms interacting with plants and animals in Missouri. (page 36)
   a. A human is an organism living with other human organisms to form populations of humans. Human populations living among other populations of organisms become part of a community. Add the non-living things, such as sunlight, water, temperature, soil, landforms and air, and humans become part of an ecosystem.
   b. Humans are part of food chains. They are consumers, and energy is passed along to them through the producers and consumers they eat.
      1) Most humans are omnivores.
      2) Some humans are vegetarians (herbivores).
      3) Some humans farm and hunt for food.
      4) Some humans depend on supermarkets for their vegetables and meat.
   c. It may seem as if modern Missourians do not interact as closely with plants and animals as they did in the past, but any human activity affects other organisms.

2. Identify examples in Missouri where human activity has had a beneficial or harmful effect on other organisms. (pages 36–38)
   a. Beneficial effects—Examples
      1) Humans build and maintain healthy pond ecosystems.
      2) People work together to bring parks and hiking trails back into their cities. These green spaces provide habitat for native trees and other plants and attract birds, butterflies, rabbits, foxes and many other organisms necessary for healthy ecosystems.
      3) Hunting and fishing are ways for humans to interact with their environment just as other predators do. Missourians who follow the rules and regulations set by the Department of Conservation help to manage and balance wildlife populations.
      4) Hiking, bird watching, butterfly watching, mushroom hunting and outdoor photography are other ways humans interact with organisms.
      5) People who put out bird feeders, bird baths, and bird houses provide food, water and shelter for Missouri birds.
      6) Careful harvesting removes mature trees for use as lumber and paper. Harvesting also provides space and more sunlight on the forest floor for the next generation of trees as well as healthy habitat for other forest organisms.
      7) Many people are careful not to harm other organisms when they are exploring and discovering nature.
      8) People join organizations and groups to help Missouri's ecosystems. They also plant native plants and call in to report poachers.
         a) ForestKeepers—Volunteers adopt sections of forest and keep records of the forest's health.
         b) Adopt-A-Trail—Interested hikers, bikers, and motorcyclists who want to have safe and enjoyable trails, adopt sections of conservation area trails and monitor them.
         c) Missouri Stream Team—Volunteer groups adopt sections of Missouri rivers, streams and creeks. They test the quality of the water and clean up litter.
         d) Operation Game Thief—People can call in and report poachers.
         e) Grow Native—Planting native plants not only benefits wildlife, but the plants can be enjoyable for the gardener.
   b. Harmful effects—Examples
      1) When people carve their initials on the bark of a tree, carving leaves the tree's trunk open to disease and insects.
      2) People who hike, ride ATVs, bicycles or horses off marked trails through streams, forests and prairies can damage these ecosystems.
      3) Some people litter, and litter is not only harmful to organisms and their environment, it is also ugly.

activity 8.1 : human interactions continued

estimated time 30–40 minutes

objective
Students will be able to
1. Explain how humans are just one of the organisms interacting with plants and animals in Missouri.
2. Identify examples in Missouri where human activity has had a beneficial or harmful effect on other organisms.

teacher preparation
This activity will tie in closely with the lists generated by students in *Activity 7.3* and will balance out the harmful effects with beneficial effects of human interactions.

This is an outdoor activity. Take a brief walk around the schoolyard and note where you find examples of harmful and beneficial effects of human interactions. During the course of the activity, if students are unsure and/or unable to find examples, refer to your notes and provide subtle prompts for students to discover examples.

materials
Science notebooks
Pencils
Thermometers
Flip chart/white board with lists generated in *Activity 7.3*
Class copies of *Writing Prompt Scoring Guide* (Appendix C)

procedure
1. Have students complete their science notebook headings and take and record outside air temperature.
   Q. How are humans part of an ecosystem?
   a. A human is an organism living with other human organisms to form populations of humans. Human populations living among other populations of organisms become part of a community. Add the non-living things, such as sunlight, water, temperature, soil, landforms and air, and humans become part of an ecosystem.
   b. Humans are part of food chains. They are consumers, and energy is passed along to them through the producers and consumers they eat.
      1) Most humans are naturally omnivores.
      2) Some humans are vegetarians (herbivores).
      3) Some humans farm and hunt for food.
      4) Some humans depend on supermarkets for their vegetables and meat.
      5) Humans have teeth similar to omnivores. Most humans choose to be omnivores. Some humans choose to be herbivores (vegetarians).
   c. It may seem as if modern Missourians do not interact as closely with plants and animals as they did in the past, but any human activity affects other organisms.

2. Have the flip chart/white board available with the lists generated during *Activity 7.3*.

3. Instruct students to create two columns in their science notebooks and label the first column "Harmful Effects."
   Q. What does "harmful effect" mean?
   A. Harmful means something that injures or hurts. A harmful effect is the result or consequence of something causing injury or hurt.

4. Instruct students to label their second column "Beneficial Effects."
   Q. What does "beneficial effect" mean?
   A. Something beneficial is something that is good. A beneficial effect is the result or consequence of something good.

5. Moving through the flip chart list generated in *Activity 7.3*, have students indicate whether each item listed is a harmful effect or a beneficial effect. Instruct students to write these in the correct columns in their science notebooks.

6. Instruct students to move around their schoolyard ecosystem (within pre-determined parameters). Have students record the effects of human interactions found throughout their schoolyard ecosystem. Examples of these human interactions should be listed in their science notebooks under the "Harmful Effects" or the "Beneficial Effects" columns. (Ex: Harmful effects—worn down grass and gardens where students took shortcuts; Beneficial effects—native flower gardens)

7. Have students refer to Chapter 8 in their student books to find more examples of human interactions.
   Q. What other human interactions would you like to add to your lists? Are they harmful or beneficial effects of human interactions?
   A. Beneficial effects—Examples
      1. Humans build and maintain healthy pond ecosystems.
      2. People work together to bring parks and hiking trails back into their cities. These green spaces provide habitat for native trees and other plants and attract birds, butterflies, rabbits, foxes and many other organisms necessary for healthy ecosystems.
      3. Hunting and fishing are ways for humans to interact with their environment just as other predators do. Missourians who follow the rules and regulations set by the Department of Conservation help to manage and balance wildlife populations.
      4. Hiking, bird watching, butterfly watching, mushroom hunting and outdoor photography are other ways humans interact with organisms.
      5. People who put out bird feeders, bird baths and bird houses provide food, water and shelter for Missouri birds.
      6. People who plant native flowers and grasses provide food and shelter for birds, insects and many other animals.
      7. Careful harvesting (cutting down certain trees) removes mature trees for use as lumber and paper. Harvesting also provides space and more sunlight on the forest floor for the next generation of trees as well as healthy habitat for other forest organisms.
      8. Many people are careful not to harm other organisms when they are exploring and discovering nature.
      9. People join organizations and groups to help Missouri's ecosystems. They also plant native plants and call in to report poachers.
         (1) ForestKeepers—Volunteers adopt sections of forest and keep records of the forest's health.
         (2) Adopt-A-Trail—Interested hikers, bikers and motorcyclists who want to have safe and enjoyable trails adopt sections of conservation area trails and monitor them.
         (3) Missouri Stream Team—Volunteer groups adopt sections of Missouri rivers, streams and creeks. They test the quality of the water and clean up litter.
         (4) Operation Game Thief—People can call in anonymously and report poachers.
         (5) Grow Native—Planting native plants not only benefits wildlife, but the plants can be enjoyable for the gardener.

   Harmful effects—Examples
      1. When people carve their initials on the bark of a tree, carving leaves the tree's trunk open to disease and insects.
      2. People who hike, ride ATVs, bicycles or horses off marked trails through streams, forests and prairies can damage these ecosystems.
      3. Some people litter, and litter is not only harmful to organisms and their environment, it is also ugly.

wrap-up/formative assessment

After discussing the items on the lists, distribute *Writing Scoring Guide* to students. Ask students to re-read the summary box for Chapter 8 in their student book and write at least three paragraphs in their science notebooks describing how they feel about their role as a human organism in the schoolyard and what effects they feel their interactions have had on their schoolyard ecosystem.

optional activity 8.a : can they live here?

estimated time Several class sessions/homework

objectives

Students should be able to:

1. Research and describe the habitat needs for a specific selection of wildlife species. Evaluate the habitat quality of these species in their outdoor classroom or schoolyard.
2. Develop a management plan to improve the outdoor classroom/schoolyard wildlife habitat.
3. Present plans to the class using visual aids.
4. Select and implement a management plan.

teacher preparation

This activity is related to "Snips and Snags" in the November 2000 issue of *Outside In*. It can be found on the Web at: *www.mdc.mo.gov/kids/out-in/2000/04/4.htm*. Students research three of the basic needs of several animals to determine if they can be found in their outdoor classroom or schoolyard. Students then develop and carry out a management plan to attract desired animals. Check with your school administrator about this activity. You may need to get permission to implement the winning plan.

Make copies of the copy page or direct students to make a chart with the desired information in their science notebooks.

materials

Science notebooks
Pencils
Copy page 8.A—Can They Live Here?
Internet access
Wildlife reference materials

procedure

1. Have students read "Snips and Snag" in the November 2000 issue of *Outside In* at: *www.mdc.mo.gov/kids/out-in/2000/04/4.htm*.

2. Tell students that they are going to research the needs of five Missouri wildlife species (from a list of 15 species) and then inspect their outdoor classroom/schoolyard to determine if it provides what each animal needs for food, water and shelter.

3. Provide each student with a copy page. Divide the class into groups of three or four. Ask each group to select five animals from the list and add the names of these animals to their charts. Each student should record the information in their own chart. Review the kind of information that they need to record for each animal (needs for food, water and shelter).

4. Following their research, conduct an outdoor classroom inspection and have students record their findings in the last two columns of the chart.

5. Direct the students to continue working in their groups to develop a management strategy to attract missing animals. Plans should be feasible, as the winning team's plan may be implemented in the outdoor classroom/schoolyard.

6. Have teams present their management plans. Each presentation must include some type of visual aid (power point, diorama, poster, mural, cartoon strips, etc.).

7. After all teams have made their presentations, have students (or a panel of faculty and parents) vote for a management plan that could be implemented in your outdoor classroom/schoolyard.

8. Discuss the winning team's plan as a class and make any necessary modifications. Have the class implement the plan and monitor the area for signs of increased wildlife use.

1. Select five Missouri animals from the list that follows and record their names in the chart below or a chart you create in your science notebook.

Black-capped chickadee	Nuthatch	Salamander
Butterfly	Opossum	Shrew
Flying squirrel	Owl	Skunk
Fox or gray squirrel	Rabbit	Toad
Honeybee	Raccoon	Woodpecker

2. Research what each animal needs for food, water and shelter and note this information on the chart. When directed by your teacher, inspect your outdoor classroom/schoolyard to determine if each animal's needs are satisfied there. If not, suggest improvements to the outdoor classroom/schoolyard that would attract the selected animals.

	Results of library or internet research			**Outdoor classroom/schoolyard inspection**	
Name of animal	Food needs	Water needs	Shelter needs	Is there evidence that the animal lives here?	If not, what could be done to attract the animal?

3. Working in your group, develop a management strategy to attract the missing animals on your list. Present this strategy to the rest of your class using a visual aid (power point, diorama, poster, mural, cartoon strips, etc.). Be creative, but remember that your project must be feasible!

4. After all presentations, the class or invited guests will vote on the best management plan.

5. Implement the selected plan in your outdoor classroom/schoolyard if approved. Monitor the area for signs of new animal activity.

optional activity 8.b : interactive web

estimated time 30–40 minutes

objectives

Students will be able to

1. Explain how humans are just one of the organisms interacting with plants and animals in Missouri.
2. Explain that no matter how public or private land is used, living and non-living things are affected.
3. Identify examples in Missouri where human activity has had a beneficial or harmful effect on other organisms as well as on non-living things, such as water.

teacher preparation

This activity would work best outdoors, allowing for more space than the classroom.

In advance, have *Optional Activity 8.B Land Use Cards* copied, laminated (optional), cut and grouped in sets. The small letter on the bottom right corner of each card indicates the set to which a card belongs. Two or three sets may be needed depending on the number of students. Each student should have at least one card. Use complete sets when possible.

This activity is designed to introduce interactions among and issues arising from the diverse ways people use public and private land. People have many diverse reasons for using public land; yet there is only so much public land available for everyone to use. This often causes conflicts among different groups of people attempting to use the public areas at the same time. The bottom line is that no matter how public or private land is used, everything and everyone is affected in one way or another.

materials

Science notebooks
Pencils
Thermometers
Optional Activity 8.B Land Use Cards
Ball/skein of yarn

procedure

1. Have students prepare their science notebook headings and take and record outside air temperature.

2. Have the *Land Use Cards* arranged face down in a circle on the ground.

3. Have students stand behind one of the *Land Use Cards* on the ground and face in towards the center of the circle. (Students may be asked to hold two cards if necessary to get through two or more cycles.)

4. Instruct students to pick up and read the card before them. Check that students understand the information on their cards.
   Q. What is the source of all energy for living things?
   A. The sun.

5. Have the sun card holder step into the center of the circle and take one end of the yarn.

6. Explain that all students will eventually be handed a piece of yarn. If the yarn is dropped, the activity will not succeed. The sun has the responsibility of holding several pieces of yarn without dropping any of them.

7. Explain that the purpose of this activity is to think about the ways people use public and private land, about how people and other organisms interact with each other and with non-living things on public and private land, and about the effects of those interactions.
   Q. What organisms get energy from the sun to make their own food?
   A. Producers.

8. Instruct students to look at their card and raise their hand if they are a producer.

9. Hand the end of the yarn to the sun in the middle of the circle and extend it to one of the students with a producer card. Have the student tell the class which producer he or she is.

10. Ask students to raise their hands if they are a farmer who raises this type of producer. Extend the yarn on to one of these students.

11. Ask students to raise their hands if they are an animal raised on a farm. Extend the yarn from the farmer to a student with a farm animal card.

12. Continue by asking the following questions in this order, extending the yarn between students and having students state who or what they are:
    - A farmer who raises that farm animal
    - A game animal
    - A hunter who hunts that game animal
    - A part of a wetland OR wild inhabitant of a wetland OR an issue related to wetlands
    - A recreational user of wetlands
    - A conservation area (land for public use)
    - A recreational user of conservation areas (public lands)
    - An urban area user
    - An invasive species

13. Work back and forth across the circle to connect each inhabitant/user with yarn. Once the above list is connected, one chain is complete. Students holding yarn should continue to do so.

14. Return to the sun and repeat the same list of connections, again, connecting to different but appropriate students. Each chain in the web should begin with the sun and a producer and end with an invasive species. Continue until all students are connected. Be sure to return to the sun after each invasive species is connected.
    Q. Anyone want to describe what we have here?
    A. A giant web.

15. Remind students that the final and most important part of this activity will not work if any yarn is dropped. Explain that when certain students are instructed to give the yarn a gentle tug, it is very important that no one yanks the yarn out of anyone else's hand.

16. This is a giant web of different ways land is used.
    Q. Which land user, including animals, do you think creates the least harmful effects on the other parts of the web?
    A. Answers will vary and could include hunters, ATV riders, farmers, canoeists, etc.

17. Choose one user suggested by the students and instruct the student with that particular card to tug gently on their piece of yarn, pulling it towards him or herself several times. Instruct any other students who feel that tug to begin tugging just as gently. Instruct any other students who feel those tugs to begin tugging—until all students are tugging on the yarn.
    Q. What does this mean? How could that [first tugger's card] affect everything?
    A. Have students make real life connections when they answer.The conclusion that should be drawn is that all uses of land (or an ecosystem), no matter how large or small, eventually affect the other users and organisms on the land in some way.

18. Ask for another activity/animal/plant/farming practice/land use/etc., and repeat the tugging. Ask the same question.
    Q. Ask any student with a water quality card to raise their hand? How many tugs did it take before you felt the tug? How important is that?
    A. Water quality might not have been part of the first two or three tugs, but once it was involved and began tugging, it affected everything else. Water is one of the basic needs of all living things. If water quality is affected in a harmful way (by crop or golf course lawn fertilizer, farm animal waste, cattle in creeks, gravel mining, ATV riding through rivers and streams, littering, etc.), many living organisms will be affected.

19. If an invasive species had not been chosen to tug first, repeat the activity using one and discuss the results.

Q. Which activity/user caused everyone to feel the tugging more quickly and why?

A. Answer will vary.

Q. What does this mean to us here in our schoolyard ecosystem?

A. Answers will vary. Every human organism that uses the schoolyard in any way at all (short cut to a street; recess at school; playground use on weekends; staff parking; trash pick-up worker; etc.) and every organism living in/on/visiting the schoolyard has some effect (harmful or beneficial) on the rest of the schoolyard ecosystem.

20. Have students put the yarn down on the ground next to their cards and ask for a volunteer to roll it all up in a ball and volunteers to pick up the *Land Use Cards*.

wrap-up/formative assessment See *Wrap-Up/Formative Assessments* in the Teacher Notes section of the introductory material to choose a strategy that meets student needs.

Sun

producer Soy beans A	**farmer** On your land you grow and harvest soybeans. A
farm animals Cattle A	**farmer** On your land you raise cattle. A

game animals

Ducks

A

hunters

You enjoy hunting ducks.

A

wetland issues and inhabitants

Homeowner

A

wetland recreational users

Canoeist

A

conservation areas

Fountain Grove CA

A

recreational visitor

On conservation areas, you enjoy hiking.

A

urban area uses

Highway development

A

invasive species

Sericea lespedeza

A

producer Timber B	**farmer** On your land you grow and harvest timber. B
farm animals Dairy cows B	**farmer** On your land you raise dairy cows. B

game animals Wild turkeys B	**hunters** You enjoy hunting wild turkeys. B
wetland issues and inhabitants Water quality B	**wetland recreational users** Swimmers B

conservation areas Lost Pond CA B	**recreational visitor** On conservation areas, you enjoy camping. B
urban area uses Housing development B	**invasive species** Zebra mussels B

producer Warm season grasses C	**farmer** On your land you grow and harvest warm season grasses. C
farm animals Domestic turkeys C	**farmer** On your land you raise domestic turkeys. C

game animals

Deer

C

hunters

You enjoy hunting deer.

C

wetland issues and inhabitants

Smallmouth bass

C

wetland recreational users

Anglers

C

conservation areas Four Rivers CA C	**recreational visitor** On conservation areas, you enjoy horseback riding. C
urban area uses Schools C	**invasive species** Teasel C

producer Wheat D	**farmer** On your land you grow and harvest wheat. D
farm animals Pigs D	**farmer** On your land you raise pigs. D

game animals Mourning doves D	**hunters** You enjoy hunting mourning doves. D
wetland issues and inhabitants Riparian corridor D	**wetland recreational users** Gravel mining D

conservation areas Clifty Creek CA D	**recreational visitor** On conservation areas, you enjoy ATV riding. D
urban area uses Urban sprawl D	**invasive species** Bush honeysuckle D

optional activity 8.c : mdc video segments

1. *The Snakes' Tale* (20:00 minutes)—It's easy to learn tall tales about snakes, but the truth about how they live is just as intriguing. See how snakes mate, give birth and feed; how they protect themselves from danger; and how they sense the world around them.

2. *Massassauga Rattlesnake* (5:36 minutes)—Meet the Massassauga...but take special care when tracking THIS endangered species!

3. *Great Blue Herons* (4:26 minutes)—Take a good look at Missouri's largest, and probably most familiar, heron...the great blue. We'll visit colonies of great blues and examine their primitive-like qualities and see why their numbers are on the rise in Missouri.

4. *No MOre Trash* (5:33 minutes)—Litter and pollution...it's an ongoing problem. See what you can do to help out in the new campaign that's joining forces to fight back.

5. *Friends of the Forest* (5:00 minutes)—See what these volunteers are doing to ensure forests for the future.

optional activity 8.d : what is going on in your neighborhood?

Students tour their neighborhood and make a list of activities that are going on. Examples: construction of a sidewalk, road or home; house being torn down; people riding bikes, playing ball, or playing golf; people planting native plants; litter blowing across yards; bird houses being put up. Write about how these human activities affect the environment.

optional activity 8.e : conservation programs

Participate in a conservation program such as Conservation Frontiers, ForestKeepers, Stream Team or Adopt-A-Trail. For information about these programs, visit *www.MissouriConservation.org*.

so, what do you know?—lesson 8

1. Can humans make their own food directly from the sun? Explain why or why not.

2. Are humans organisms? Explain why or why not.

3. Humans are consumers. As consumers how do humans fit into food chains?

4. Any human activity affects other organisms and ecosystems. An activity can have a beneficial or a harmful effect. For each activity on the left place an X in the column for the correct effect.

Human activities	Beneficial effect	Harmful effect
Build ponds		
Build small brush piles for shelter		
Carve initials on tree trunk		
Dig up lots of flowers in a prairie		
Drop trash on ground		
Eat deer harvested legally		
Harvest trees carefully		
Hike or bike on a trail		
Join a stream team to help care for a stream		
Kill deer outside of deer season		
Make parks and hiking trails		
Obey fishing regulations		
Pick up litter		
Put gum and candy wrappers in a trash can		
Put out bird feeders		
Put up bird houses		
Ride ATVs through a stream or off a trail in the forest		
Ride horses in streams		

so, what do you know?—lesson 8

1. Can humans make their own food directly from the sun? Explain why or why not.

   answer —No *AND*
   - Humans are not producers. They are consumers. *OR*
   - Humans eat plants and animals because they cannot produce their own food. They are consumers. *OR*
   - Other sentences that convey the same meaning.

   scoring key — 2 points both components answered correctly; 1 point— No

2. Are humans organisms? Explain why or why not.

   answer —Yes *AND* Humans are living things that can grow and reproduce. Living things are organisms. *OR*
   Other sentences that convey the same meaning.

   scoring key — 4 points—both parts are correct; 2 points—either part is correct; 0 points—neither part is correct.

3. Humans are consumers. As consumers, how do humans fit into food chains?

   answer
   - Some humans are vegetarians (herbivores) because they only eat plants. Most humans are omnivores because they eat plants and animals. Because humans eat plants and animals, humans are part of many food chains.
   - *OR* Because humans are herbivores or omnivores, humans are part of many food chains.
   - Other sentences that convey the same meaning.

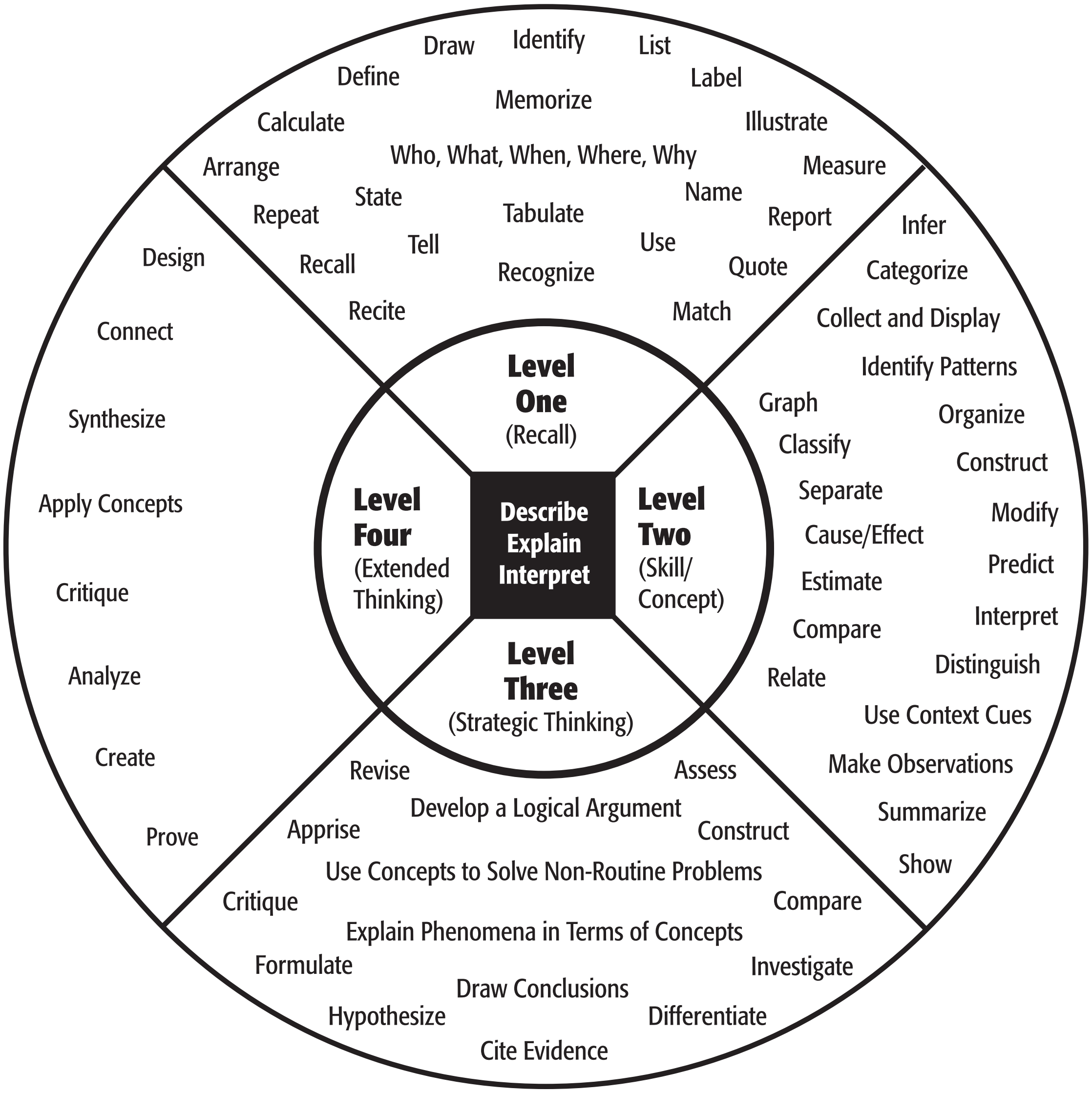
   scoring key — 4 points for one of the answers provided

4. Any human activity affects other organisms and ecosystems. An activity can have a beneficial or a harmful effect. For each activity on the left place an X in the column for the correct effect. (1 point for each X in the correct column; maximum of 18 points)

Human activities	Beneficial effect	Harmful effect
Build ponds	X	
Build small brush piles for shelter	X	
Carve initials on tree trunk		X
Dig up lots of flowers in a prairie		X
Drop trash on ground		X
Eat deer harvested legally	X	
Harvest trees carefully	X	
Hike or bike on a trail	X	
Join a stream team to help care for a stream	X	
Kill deer outside of deer season		X
Make parks and hiking trails	X	
Obey fishing regulations	X	
Pick up litter	X	
Put gum and candy wrappers in a trash can	X	
Put out bird feeders	X	
Put up bird houses	X	
Ride ATVs through a stream or off a trail in the forest		X
Ride horses in streams		X

appendices

appendix a : depth of knowledge chart



Level One Activities	Level Two Activities	Level Three Activities	Level Four Activities
Recall elements and details of story structure, such as sequence of events, character, plot and setting. Conduct basic mathematical calculations. Label locations on a map. Represent in words or diagrams a scientific concept or relationship. Perform routine procedures like measuring length or using punctuation marks correctly. Describe the features of a place or people.	Identify and summarize the major events in a narrative. Use context cues to identify the meaning of unfamiliar words. Solve routine multiple-step problems. Describe the cause/effect of a particular event. Identify patterns in events or behavior. Formulate a routine problem given data and conditions. Organize, represent and interpret data.	Support ideas with details and examples. Use voice appropriate to the purpose and audience. Identify research questions and design investigations for a scientific problem. Develop a scientific model for a complex situation. Determine the author's purpose and describe how it affects the interpretation of a reading selection. Apply a concept in other contexts.	Conduct a project that requires specifying a problem, designing and conducting an experiment, analyzing its data, and reporting results/ solutions. Apply mathematical model to illuminate a problem or situation. Analyze and synthesize information from multiple sources. Describe and illustrate how common themes are found across texts from different cultures. Design a mathematical model to inform and solve a practical or abstract situation.

Webb, Norman L. and others. "Web Alignment Tool" 24 July 2005. Wisconsin Center of Educational Research. University of Wisconsin-Madison. 2 Feb. 2006. <http://www.wcer.wisc.edu/WAT/index.aspx>.

ELEMENTARY PERFORMANCE EVENT TEMPLATE for 2007-2010 MAP

TYPICAL SEQUENCE OF COMPONENTS

Minimum Total Points = 16 (11 prompts) Maximum Total Points = 19 (14 prompts)

(N = necessary components *See standardized prompt and scoring guide All blank data tables are provided for student use)

SCENARIO

Ideally the template starts with the scenario of a novel investigation. The results can be initially presented in a table or as a combination of a table and pictorial. The purpose, the procedure, and the person or people performing the investigation should be clearly stated in the introduction.

Not all investigations will give the information in a table alone. Some investigations will give students pictures of objects to be measured (leaves, toy cars, etc.). Questions will then follow in a typical sequence described below.

	Performance Event COMPONENT	GLEs that may be addressed	NOTES	NO of ITEM PROMPTS	TOTAL POINT RANGE
N	**Measure (using manipulatives when appropriate)**	**IN.1.B5a**: Make qualitative observations using the five senses **IN.1.B5b**: Determine the appropriate tools and techniques to collect data **IN.1.B5c**: Use a variety of tools and equipment to gather data…. **IN.1.B5d**: Measure length to the nearest centimeter, mass to the nearest gram, volume to the nearest milliliter, temperature to the nearest degree Celsius, weight to the nearest Newton **IN.1.B5f**: Judge whether measurements and computation of quantities are reasonable	*Questions may ask students to determine the proper tools to perform certain investigations*	1	1-2
	Sort and count (using manipulatives when appropriate)	**IN.1.B5a**: Make qualitative observations using the five senses **IN.1.B5b**: Determine the appropriate tools and techniques to collect data **IN.1.B5e**: Compare amounts/measurements **IN.1.B5f**: Judge whether measurements and computation of quantities are reasonable		1	1-2

ELEMENTARY PERFORMANCE EVENT TEMPLATE for 2007-2010 MAP

	Performance Event COMPONENT	GLEs that may be addressed	NOTES	NO of ITEM PROMPTS	TOTAL POINT RANGE
N	**Record data in data table**	**IN.1.E5a**: Communicate the procedures and results of investigations and explanations through: …data tables….	*This may follow another investigation located later in the template.*	**1**	**2**
N	**Questions about data displayed in data table**	**IN.1.B5e**: Compare amounts/measurements **IN.1.B5f**: Judge whether measurements and computation of quantities are reasonable **IN.1.C5a**: Use quantitative and qualitative data as support for reasonable explanations **IN.1.C5b**: Use data as support for observed patterns and relationships, and to make predictions to be tested	*Students should be able to answer questions using data from the prompt or data table.*	**1-2**	**1-2 (1/item)**
N *	**Complete bar/single line graph** (title given, axes labeled with general description of independent and dependent variables)	**IN.1.E5a**: Communicate the procedures and results of investigations and explanations through …graphs….		**1**	**4**
N	**Questions about data displayed in bar/single line graph**	**IN.1.B5e**: Compare amounts/measurements **IN.1.C5a**: Use quantitative and qualitative data as support for reasonable explanations **IN.1.C5b**: Use data as support for observed patterns and relationships, and to make predictions to be tested **IN.1.D5a:** Evaluate the reasonableness of an explanation **IN.1.D5b:** Analyze whether evidence and scientific principles support proposed explanations	*Students should be able to answer the questions using either the table or the graph.*	**1-2**	**1-2 (1/item)**
N	**Questions about experimental design**	**IN.1.A5b**: Recognize the characteristics of a fair and unbiased test **IN.1.A5c**: Conduct a fair test to answer a question **IN.1.A5d**: Make suggestions for reasonable improvements or extensions of a fair test	*(Questions may be asked after the new scenario)*	**1-2**	**1-2 (1/item)**

ELEMENTARY PERFORMANCE EVENT TEMPLATE for 2007-2010 MAP

New scenario (same theme) with additional data (may be in form of new chart, graph, or illustration)

	Performance Event COMPONENT	GLEs that may be addressed	NOTES	NO of ITEM PROMPTS	TOTAL POINT RANGE
N	**Questions on data provided in prompt** *(not previously asked elsewhere in)*	**IN.1.B5e**: Compare amounts/measurements **IN.1.B5f**: Judge whether measurements and computation of quantities are reasonable **IN.1.C5a**: Use quantitative and qualitative data as support for reasonable explanations **IN.1.C5b**: Use data as support for observed patterns and relationships, and to make predictions to be tested **IN.1.D5a:** Evaluate the reasonableness of an explanation **IN.1.D5b:** Analyze whether evidence and scientific principles support proposed explanations		**1-2**	**1-2 (1/item)**
N	**Write a testable question related to the new scenario**	**IN.1.A5a**: Formulate testable questions…		**1**	**1**
N	**Write an explanation (hypothesis)**	**IN.1.A5a**: Formulate testable … explanations (hypotheses)		**1**	**1**
N	**Questions about experimental design** *(not previously asked)*	**IN.1.A5b**: Recognize the characteristics of a fair and unbiased test **IN.1.A5c**: Conduct a fair test to answer a question **IN.1.A5d**: Make suggestions for reasonable improvements or extensions of a fair test		**1-2**	**1-2 (1/item)**

ELEMENTARY PERFORMANCE EVENT TEMPLATE for 2007-2010 MAP

Generic Scoring Guide for Bar or Single Line Graphs, Grade 5

(10x10 grid provided with title given, axes labeled with general description of independent and dependent variables, with units if appropriate, spaces/lines provided for category labels)

Four Total Points:

First key element:
Bar graph: All categories to be graphed correctly labeled within bar spaces along horizontal graph
OR
Single-line graph: An appropriate number scale labeled along horizontal axis:
- numbers written on grid lines,
- numbers allow for plotting of all data,
- consistently scaled

Second key element:
All graphs: An appropriate number scale along vertical axis:
- numbers written on grid lines,
- numbers that allow all data to be plotted,
- consistently scaled

Third key element:
Bar graph: At least four bars correctly drawn (top line of each bar is well-defined)
Single-line graph: At least four points correctly plotted and connected by line

Fourth key element:
Bar graph: All five bars are correctly drawn (top line of each bar is well-defined)
Single-line graph: All five points correctly plotted and connected by line

Prompt reads:
Complete the bar graph below, using the information from the data table.
Be sure to do the following:
- **Finish labeling both axes with categories or a number scale.**
- **Draw bars to represent the data, but do not color or shade inside the bars.**

-or-

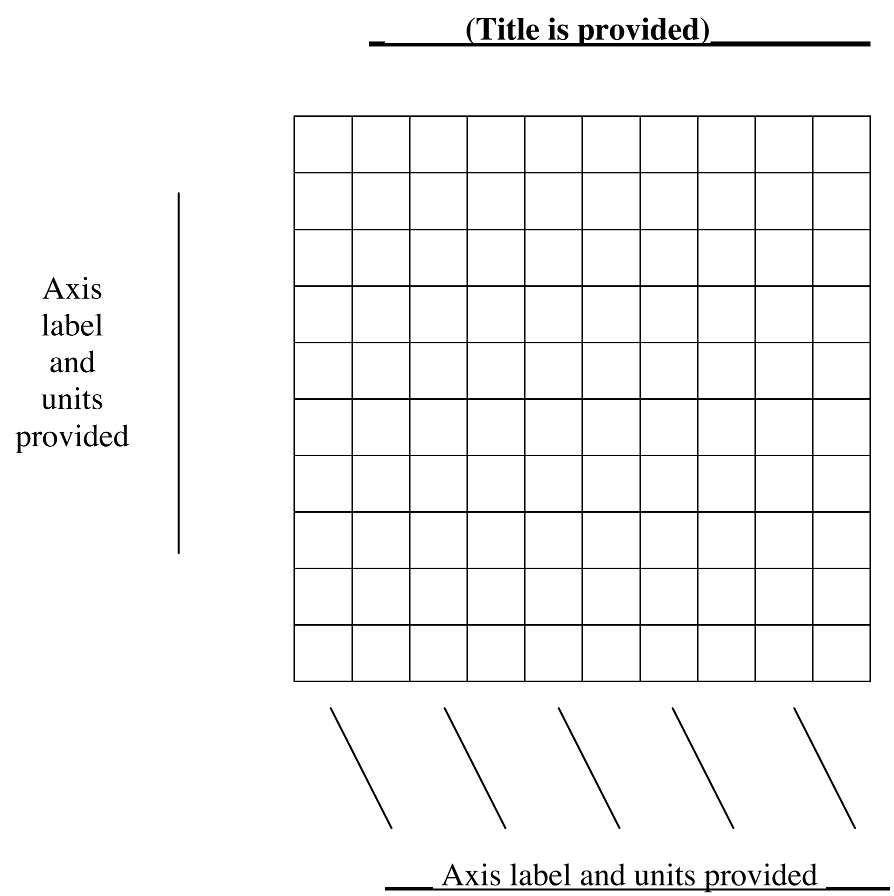
Complete a single line graph below, using the information from the data table.
Be sure to finish labeling both axes with a number scale.

ELEMENTARY PERFORMANCE EVENT TEMPLATE for 2007-2010 MAP

Complete the <u>bar</u> graph below using the information from the data table on page ____.

Be sure to do the following:

- **Finish labeling both axes with categories or a number scale.**
- **Draw bars to represent the data, but do <u>not</u> color or shade inside the bars.**

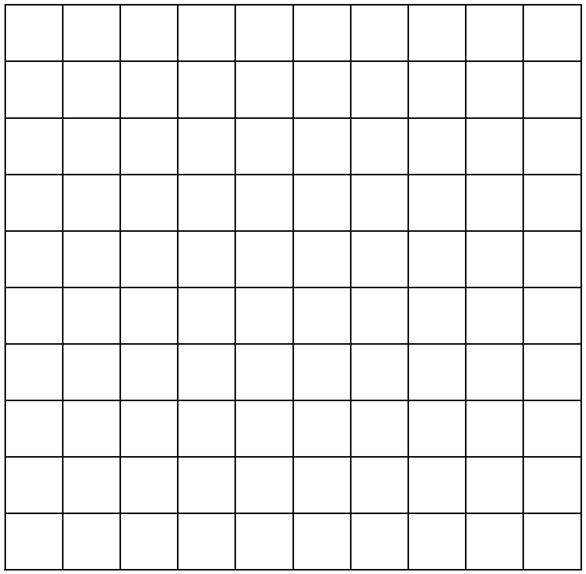


ELEMENTARY PERFORMANCE EVENT TEMPLATE for 2007-2010 MAP

Complete a <u>single line</u> graph below using the information from the data table on page ____.
Be sure to finish labeling both axes with a number scale.

______(Title is provided)__________

Axis label and units provided ____________



___ Axis label and units provided ____

appendix c : writing prompt scoring guide—grade 3*

4 points

The paper:

- Has an effective beginning, middle and end.
- Contains a clear controlling idea.
- Clearly addresses the topic and provides specific and relevant details/examples.
- Contains words that are specific, accurate and suited to the topic.
- Consistently uses complete sentences.
- Clearly shows an awareness of audience and purpose.
- Contains few errors in grammar/usage, punctuation, capitalization, and/or spelling.

3 points

The paper:

- Has a beginning, a middle and end.
- Contains a controlling idea.
- Addresses the topic and uses relevant details/examples.
- Contains some words that are specific, accurate and related to the topic.
- Generally uses complete sentences.
- Shows an awareness of audience and purpose.
- May contain errors in grammar/usage, punctuation, capitalization, and/or spelling that are not significantly distracting to the reader.

2 points

The paper:

- Has evidence of a beginning, a middle and an end.
- Contains a general sense of direction, but may lack focus.
- Generally addresses the topic, but may contain some details that are not relevant.
- Uses words that tend to be repetitive, imprecise and ordinary.
- Contains some incomplete sentences that may be distracting to the reader.
- Shows some awareness of audience and purpose.
- Contains errors in grammar/usage, punctuation, capitalization and/or spelling that may be distracting to the reader.

1 point

The paper:

- May lack evidence of a beginning, a middle and/or an end.
- Is difficult to follow and/or lacks focus.
- Attempts to address topic, but lacks development.
- Uses words that are consistently repetitive, dull and colorless.
- Includes incomplete sentences that are distracting to the reader.
- Shows little or no awareness of audience and purpose.
- Contains repeated errors in grammar/usage, punctuation, capitalization and/or spelling that may be distracting to the reader.

* As of 8/28/09, DESE's Web site indicates that the state writing scoring guide for grade 3 should be used for evaluating Grade 4 writing prompt items.

Credit: Missouri Department of Elementary and Secondary Education

appendix d : writer's and speaker's checklists

writer's checklist for paper

- My paper has a beginning, middle and end.
- My paper uses paragraphing appropriately.
- My paper flows smoothly from one idea to another.
- My paper uses precise and vivid language.
- My paper includes details and examples.
- My paper includes a variety of sentence structures.
- My paper includes correct grammar/usage, punctuation, capitalization and spelling.

speaker's checklist

- I give a clear viewpoint of the topic portrayed in nonfiction.
- My rate of speech is appropriate.
- My pace is appropriate.
- My enunciation is good.

appendix e : summary paragraph guidelines and scoring key

paragraph includes

Beginning (topic sentence); Middle (supporting details); and End (concluding sentence)

Topic sentence—a sentence that states the main idea of the paragraph
Supporting details—examples provided to describe, explain, or reinforce the main idea
Concluding sentence—closing/ending sentence; after all the details have been included in the body of the paragraph

scoring key

3 points—all three components are included and accurate
2 points—two of the three components are included and accurate
0 points—less than two accurate components

Credit: Missouri Department of Elementary and Secondary Education

appendix f : fahrenheit/celsius comparison chart

average temperatures in major missouri cities

In Fahrenheit													
	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**	**Yearly average**
Kansas City	25.7 F	31.2 F	42.7 F	54.5 F	64.1 F	72.2 F	78.5 F	76.1 F	67.5 F	56.6 F	43.1 F	30.4 F	53.6 F
St. Louis	29.3 F	33.9 F	45.1 F	56.7 F	66.1 F	75.4 F	79.8 F	77.6 F	70.2 F	58.4 F	46.2 F	33.9 F	56.1 F
Springfield	31.1 F	35.7 F	46.0 F	56.0 F	64.6 F	73.2 F	78.1 F	76.8 F	69.0 F	57.8 F	46.0 F	35.3 F	55.8 F
In Celsius													
	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**	**Yearly average**
Kansas City	-3.5 C	-.44 C	5.94 C	12.50 C	17.83 C	22.33 C	25.83 C	24.50 C	19.72 C	13.67 C	6.17 C	-0.89 C	12.00 C
St. Louis	-1.50 C	1.06 C	7.28 C	13.72 C	18.94 C	24.11 C	26.56 C	25.33 C	21.22 C	14.67 C	7.89 C	1.06 C	13.39 C
Springfield	-0.50 C	2.06 C	7.78 C	13.33 C	18.11 C	22.89 C	25.61 C	24.89 C	20.56 C	14.33 C	7.78 C	1.83 C	13.22 C

appendix g : planning a successful field trip*

* See *Nature Unleashed* Grant Guidelines for specific *Nature Unleashed* Field Trip Guidelines.

1. **Decide on a date.** A field trip requires advanced planning to select and reserve a site that will fit your objectives (and the criteria of the *Nature Unleashed* Grant, if applicable). Determine a date at least four months in advance. Be prepared with a Plan B in case of unexpected weather issues. Late spring and early fall provide the greatest variety of plant and animal life, and although cold weather poses challenges, ecosystems observed, explored and investigated during winter months provide ample opportunities to observe interactions among living and non-living things.

2. **Choose a location.** Students will need an area that allows for field investigations and observation of plants and wildlife in natural settings. Choose a location with an outdoor, natural area reflecting an ecosystem discussed in the *Nature Unleashed* student book.

3. **Arrange for transportation.** Contact the school district transportation division to secure busses for your desired date. Ask for an estimate of the cost for bus mileage and driver or vans and drivers or parent drivers. Be prepared to provide a map and be familiar with the location of and directions to your field trip site.

4. **Arrange for volunteers.** Recruiting enough adult volunteers is essential. Recruit parents, other teachers and aides for special needs students. Ask the school nurse or a parent with knowledge of first aid to attend. Be prepared with a Plan B in case of unexpected weather issues, and check with those you have recruited to assist as to their availability on a Plan B date.

5. **Provide details for appropriate attire.** Appropriate attire for weather and outdoor exploration considerations, especially footwear, should be emphasized. Tennis or sturdy hiking shoes (no flip-flops or open-toe shoes) are strongly recommended for nature walking, hiking over gravel or mulch, walking along a stream or pond, etc.

6. **Permission slips.** Use the permission form provided by the school or adapt the sample form provided in this Teacher Guide. Send permission slips home with students at least a month in advance of the field trip with a reminder two weeks prior to the trip. Make arrangements for students who do not receive permission to attend the trip. Include detailed information for parents regarding required items (i.e., clothing, insect repellent, sunscreen, lunch/beverage, etc.).

7. **Other considerations:**
    a. Provide your principal with details of your trip. Include a list of students who are attending and the location and purpose of the field trip. Include a list of students who are not attending and note where those students have been assigned during the school day. Include an invitation to observe or participate in the field trip.
    b. Bring a cooler for water and ice and paper cups. More than one cooler with ice may be needed for beverages and/or lunches.
    c. If students have been instructed to bring a sack lunch, request a few extra sack lunches from the cafeteria just in case students forget to bring theirs.

* NOTE: Schools that are approved for grant reimbursement for a *Nature Unleashed* field trip must plan and execute a *Nature Unleashed* field trip according to the guidelines provided in the Grant Guidelines and the Grant Application.

sample *nature unleashed* field trip permission slip

Dear Parent/Guardian,

Students in ________________________ (teacher's name) class are studying Missouri's ecosystems.

Date of field trip: ____________________________

Location of field trip: ____

Departure time from school: ___________________________

Return time to school: ________________________________

Activities will include: observation and recording of weather conditions; moving throughout the natural area; recording observations of living and non-living components within the natural area; collecting and recording data; etc.

Students should be dressed so that they are comfortable being outdoors all day. Please review and save the required items Checklist at the bottom of the page.

Students should bring a sack lunch OR lunches will be provided by the school cafeteria. Coolers will be provided for beverages and lunches brought by students. Students should have their names placed on any sack lunch/beverage brought by them.

Please complete and sign the permission slip below to indicate whether or not your child has or does not have permission to participate in this field trip. Arrangements at school will be made for students without permission to attend the trip.

Student Name: ____

Yes, my child may attend. ________ No, my child may not attend. ________

_______________________________________ ____________________________
Parent/Guardian printed name Phone Number

____
Parent/Guardian signature

---Please cut and save---

field trip checklist for parents and students

____ Clothing appropriate for school and for the weather that can get wet and dirty.
____ Shoes that can get wet and dirty but that allow for easy walking/hiking, such as tennis shoes. *Flip-flops/sandals are not acceptable.*
____ Sunscreen
____ Insect repellent
____ Lunch (labeled with name)
____ Beverage (labeled with name)

appendix h : assessments

The "Test" that begins on the following page should be used for both pre- and post-tests. The test should be administered prior to beginning the unit. Results of this "pre-test" should be used to inform instruction. When the test is administered as a summative assessment (post-test), teachers may administer the test as a whole at one time or administer it in smaller segments.

Additional questions have been provided in an "Assessment Item Bank" section. Level of difficulty of items varies. These questions are provided so teachers have more options for assessment throughout the unit and are to be used at teachers' discretion. An answer and scoring key is provided. All test items and assessment bank items are cross-referenced with lessons and GLEs.

test

Directions: Read each item carefully. Circle the letter of the best answer.

1. A beaver builds its home out of mud and sticks. In which ecosystem is it most likely found?

a. Forest
b. Pond
c. Prairie
d. All of the above

2. Which of the following is an example of camouflage?

a. Prairie racerunners use rocks as shelter or to warm up or cool down.
b. Big brown bats use hollow trees, deep rock crevices, buildings, caves and other places to roost.
c. Venomous snakes and spiders use venom to protect themselves and to make their live food hold still.
d. Newborn deer have white spots on their brown fur that allow them to blend into their forest surroundings.

3. What is the primary source of energy plants use to make food?

a. Nutrients
b. Soil
c. Sun
d. Water

4. A redbud is a shade-loving tree. In which ecosystem is it most likely found?

a. Forest
b. Pond
c. Prairie
d. All of the above

5. What external cues, or something outside the body, cause ducks to migrate?

a. Cooler temperatures and shorter days
b. High heat and dryness
c. Hot, humid and windy days
d. Sudden movement or sudden sound

6. Butterflies and bees visit one flower, then the next and the next, and so on. How are they interacting or living with the flowers?

a. Escaping
b. Hibernating
c. Migrating
d. Pollinating

7. An insect that is bright pink and is able to hide among blooming flowers is most likely able to survive in which environment?

a. Forest
b. Pond
c. Prairie
d. Stream

Directions: Read each item carefully. Follow the directions provided.

8. Describe the 6 basic needs of most plants.

9. Read the list of things below. Underline the <u>non-living</u> things.

Bluebird	Cloud	Frog	Rabbit	Tree
Building	Coneflower	Grass	Sun	Wind
Butterfly	Dirt	Human	Rock	Worm

10. Read the descriptions below. Place the name (community, ecosystem, organism, population) on the line by the description that is an example of what the word means.

__________________ 3 round-winged katydids, 2 hummingbirds, 3 big bluestem

__________________ small section of prairie that shows some living things and non-living things

__________________ 1 round-winged katydid

__________________ 3 round-winged katydids

11. Duckweed plants live in a watery environment. Which specialized structure helps them survive? Explain how it helps duckweed plants survive in their environment.

a. Large leaves
b. Thin stripes on leaves
c. Long strong roots
d. Thread-like roots

12. Which of the following must tadpoles have to survive in a watery environment? Explain how your selected answer helps tadpoles survive.

a. Ribs
b. Eyes
c. Gills
d. Mouth

13. How are producers and consumers different?

14. Show the flow of energy through a food chain using the things listed below. Use numbers and arrows to show the flow of energy.

15. How are herbivores, carnivores and omnivores different?

16. A snail is eaten by a crayfish and the crayfish is eaten by a bluegill and the bluegill is eaten by a green heron. Who are predators and who are prey in this scenario? List them under appropriate columns. An animal may be listed more than once.

Predators	Prey

17. In the food chain shown below, list which things fit in which category. Things may fit in more than one category.

Sun ➲ Coneflower ➲ Leaf beetle ➲ Grasshopper sparrow ➲ Bullsnake

Producer(s):
Consumers(s):
Decomposer(s):
Prey:
Predator(s):
Herbivore(s):
Omnivore(s):
Carnivore(s):

18. In the food chain shown below, predict what might happen if the entire population of bullsnakes died? List one possible effect.

Sun ➲ Coneflower ➲ Leaf beetle ➲ Grasshopper sparrow ➲ Bullsnake

19. For the list of actions below, put an X in the appropriate column to indicate which ones could have a beneficial or harmful effect on other organisms or an ecosystem.

Action	Beneficial effect	Harmful effect
Spilling gas on the ground when fueling up the lawn mower		
Dropping a gum wrapper on the ground		
Picking up trash on the school grounds		
Hunting and killing deer outside of deer hunting season		
Trapping nuisance otters		
Riding your bike on marked trails		
Recycling newspapers		
Setting up your tent in a no-camping area		

test with answers and scoring key

1. A beaver builds its home out of mud and sticks. In which ecosystem is it most likely found? (Lesson 2, EC.1.A.4.b.)

a. Forest
b. Pond
c. Prairie
d. All of the above

answer (1 point) — b. Pond

2. Which of the following is an example of camouflage? (Lesson 3, EC.1.A.4.a.)

a. Prairie racerunners use rocks as shelter or to warm up or cool down.
b. Big brown bats use hollow trees, deep rock crevices, buildings, caves and other places to roost.
c. Venomous snakes and spiders use venom to protect themselves and to make their live food hold still.
d. Newborn deer have white spots on their brown fur that allow them to blend into their forest surroundings.

answer (1 point) — d. Newborn deer have white spots on their brown fur that allow them to blend into their forest surroundings.

3. What is the primary source of energy plants use to make food? (Lesson 4, EC.2.A.3.a. and ME.2.C.3.a.)

a. Nutrients
b. Soil
c. Sun
d. Water

answer (1 point) — c. Sun

4. A redbud is a shade-loving tree. In which ecosystem is it most likely found? (Lesson 2, EC.1.A.4.b.)

a. Forest
b. Pond
c. Prairie
d. All of the above

answer (1 point) — a. Forest

5. What external cues, or something outside the body, cause ducks to migrate? (Lesson 3, EC.3.C.4.c.)

a. Cooler temperatures and shorter days
b. High heat and dryness
c. Hot, humid and windy days
d. Sudden movement or sudden sound

answer (1 point) — a. Cooler temperature and shorter days

6. Butterflies and bees visit one flower, then the next and the next, and so on. How are they interacting or living with the flowers? (Lesson 7, EC.1.A.4.a.)

a. Escaping
b. Hibernating
c. Migrating
d. Pollinating

answer (1 point) — d. Pollinating

7. An insect that is bright pink and is able to hide among blooming flowers is most likely able to survive in which environment? (Lesson 3, EC.3.C.4.d.)

a. Forest
b. Pond
c. Prairie
d. Stream

answer (1 point) — c. Prairie

8. Describe the 6 basic needs of most plants. (Lesson 1, LO.1.A.3.a.)

answer — should include air, water, light, nutrients, space and temperature.

scoring key

3 points— all 6 basic needs
2 points— 5 of 6 basic needs
1 point— 4 of 6 basic needs
0 points— less than 4 basic needs

9. Read the list of things below. Underline the non-living things. (Lesson 1, foundation for EC.1.A.6.a., EC.1.B.6.a. and EC.1.B.6.b.)

Bluebird	Cloud	Frog	Rabbit	Tree
Building	Coneflower	Grass	Sun	Wind
Butterfly	Dirt	Human	Rock	Worm

answer

Non-living things: building, cloud, dirt, sun, rock, wind
Living things: bluebird, butterfly, coneflower, frog, grass, human, rabbit, tree, worm

scoring key

1 point for every non-living thing underlined (6 points maximum number)

10. Read the descriptions below. Place the name (community, ecosystem, organism, population) on the line by the description that is an example of what the word means. (Lesson 1, foundation for EC.1.A.6.a., EC.1.B.6.a. and EC.1.B.6.b.)

answer

Community (3 round-winged katydids, 2 hummingbirds, 3 big bluestem)
Ecosystem (small section of prairie that shows some living things and non-living things)
Organism (1 round-winged katydid)
Population (3 round-winged katydids)

scoring key

4 points— all 4 pictures labeled correctly.
3 points— 3 of 4 pictures labeled correctly.
2 points— 2 of 4 pictures labeled correctly.
0 points— less than 2 pictures labeled correctly.

11. Duckweed plants live in a watery environment. Which specialized structure helps them survive? Explain how it helps duckweed plants survive in their environment. (Lesson 3, EC.3.C.4.a.)

a. Large leaves
b. Thin stripes on leaves
c. Long strong roots
d. Thread-like roots

answer

d.Thread-like roots
AND Duckweed plants are able to float on the surface of the water to get what they need to survive. *OR* Other sentences that convey the same meaning.

scoring key

2 points— both parts are correct
1 point— d.Thread-like roots is correct
0 points— other answers

12. Which of the following must tadpoles have to survive in a watery environment? Explain how your selected answer helps tadpoles survive. (Lesson 3, EC.3.C.4.b.)

a. Ribs
b. Eyes
c. Gills
d. Mouth

answer — c. Gills
AND Gills allow tadpoles to get oxygen from the water. (Other sentences that convey the same meaning are acceptable.)

scoring key

2 points— c. Gills *AND* Gills allow tadpoles to get oxygen from the water.
1 point— c. Gills
0 points— any other response

13. How are producers and consumers different? (Lesson 4, EC.2.A.3.b. and LO.1.E.5.b.)

answer and scoring key

2 points—Plants are producers because they can make their own food using energy from the sun. Animals are consumers because they must eat (consume) producers or other consumers for food (energy). Consumers cannot make their own food. *OR* Other sentences that convey the same meaning.

14. Show the flow of energy through a food chain using the things listed below. Use numbers and arrows to show the flow of energy. (Lesson 4, EC.2.A.3.c.)

answer (4 points—all four (4) components are included in the correct order)
1 Sun ➲ 2 Decaying plants ➲ 3 Sowbug ➲ 4 Ovenbird

15. How are herbivores, carnivores and omnivores different? (Lesson 5, EC.2.A.4.b.)

answer (2 points) — Herbivores only eat plants, carnivores only eat animals and omnivores eat both plants and animals. (Other sentences that convey the same meaning are acceptable.)

16. A snail is eaten by a crayfish and the crayfish is eaten by a bluegill and the bluegill is eaten by a green heron. Who are predators and who are prey in this scenario? List them under appropriate columns. An animal may be listed more than once. (Lesson 6, EC.2.A.4.c.)

Predators	Prey
Crayfish Bluegill Green heron	Snail Crayfish Bluegill

scoring key

1 point for each animal that is placed in the correct column (maximum of 6 points)

17. In the food chain shown below, list which things fit in which category. Things may fit in more than one category. (Lessons 5 & 6, EC.2.A.3.b., EC.2.A.4.a., EC.2.A.4.b., EC.2.A.4.c.)

Sun ➲ Coneflower ➲ Leaf beetle ➲ Grasshopper sparrow ➲ Bullsnake

answer (1 point each) (total points 12)

Producer(s): coneflower
Consumers(s): leaf beetle, grasshopper sparrow, bullsnake
Decomposer(s): none
Prey: leaf beetle, grasshopper sparrow
Predator(s): grasshopper sparrow, bullsnake
Herbivore(s): leaf beetle
Omnivore(s): grasshopper sparrow
Carnivore(s): bullsnake

18. In the food chain shown below, predict what might happen if the entire population of bullsnakes died? List one possible effect. (Lessons 4 & 5, EC.2.A.3.d.)

Sun ➲ Coneflower ➲ Leaf beetle ➲ Grasshopper sparrow ➲ Bullsnake

possible answers

- All of the living things in the food chain could be affected.
- The grasshopper sparrow population could increase without the bullsnakes eating them.
- The animals that eat the bullsnakes could be affected.
- Other populations eaten by the bullsnake could be affected.
  (Other answers could be acceptable.)

scoring key

2 points for 1 plausible answer

19. For the list of actions below, put an X in the appropriate column to indicate which ones could have a beneficial or harmful effect on other organisms or an ecosystem. (Lessons 6, 7 & 8, EC.1.D.4.a.)

Action	Beneficial effect	Harmful effect
Spilling gas on the ground when fueling up the lawn mower		X
Dropping a gum wrapper on the ground		X
Picking up trash on the school grounds	X	
Hunting and killing deer outside of deer hunting season		X
Trapping nuisance otters	X	
Riding your bike on marked trails	X	
Recycling newspapers	X	
Setting up your tent in a no-camping area		X

scoring key

1 point for each X in the correct column. 8 points max.

assessment item bank

** NOTE: Assessment items are grouped by lesson. Each item is cross-referenced with corresponding lesson(s) and GLE(s). When choosing items from the bank for assessment, check for alignment to Lesson # and the specific GLE. Not every targeted GLE has items in the assessment bank.*

LESSON 1

When living things in a community interact with each other and with the non-living things in their environment, what is it called?

a. Community
b. Ecosystem
c. Organism
d. Population

What is it called when two or more of the same organisms live together?

a. Community
b. Ecosystem
c. Organism
d. Population

Explain how organism, population, community and ecosystem are connected. You can use illustrations to support your answer.

LESSON 2

A cactus that needs a dry, hot location is most likely living in a:

a. Forest
b. Pond
c. Prairie
d. None of the above

A sun-loving coneflower that needs deep soil is most likely living in a:

a. Forest
b. Pond
c. Prairie
d. None of the above

Muskrats dig dens in soil near or in water. In which ecosystem are they most likely found?

a. Forest
b. Pond
c. Prairie
d. None of the above

Bobolinks build their nests among clump grasses and wildflowers. In which ecosystem are they most likely found?

a. Forest
b. Pond
c. Prairie
d. All of the above

LESSON 3

An animal is sleeping in a den or burrow through the winter. How is this animal interacting or living with its environment?

a. It is migrating.
b. It is hibernating.
c. It is going dormant.
d. It is defending its home.

Predict which plant or animal is best able to survive in a prairie.

a. A grass that needs full sun and has deep roots
b. A tree that keeps its leaves all year and has deep roots
c. An owl that has keen vision and nests in trees
d. An arrowhead plant with roots in mud

Predict which plant or animal is most likely able to survive in a forest.

a. A tree that loves the sun and hot, dry conditions
b. A bird that needs clump grasses for nesting and travel lanes
c. A frog that hides among water-loving plants to avoid predators
d. A plant that blooms in early spring before other taller plants leaf out

Identify one specialized structure of trees and describe how it helps trees survive in their environment.

Identify a specialized structure of prairie grasses that helps protect them during dry weather and describe one additional way this structure helps prairie grasses survive in their environment.

Bobcats have keen vision and other specialized structures for survival. What is another specialized structure of a bobcat, and how does it help bobcats survive?

What internal cue, or something inside the body, causes animals to hunt or forage for food?

What external cue, or something outside the body, might cause an animal to run away, fly away, swim off or stay still?

a. Cooler and warmer temperatures
b. Hot, humid and windy days
c. Strong winds and bright sunshine
d. Sudden movement or sound

What causes dormant plants to grow leaves and bloom?

LESSON 4

The food chain shown below is most likely found in which ecosystem?

Sun ➲ Big bluestem ➲ Bobolink ➲ Northern harrier hawk ➲ Bullsnake

a. Forest
b. Glade
c. Pond
d. Prairie

Using words or pictures and words, show (sequence) the flow of energy through a food chain with at least two animals. <u>You may not use plants or animals included on this test</u>.

Show the flow of energy through a food chain using the things listed below.

Snail   Sun   Green frog   Algae   Common snapping turtle

LESSONS 4 and 5

In the food chain below, label the producer(s), consumer(s) and decomposer(s). More than one label may apply to the plants and animals listed in the food chain.

Sun ➲ Decaying plants ➲ Carpenter ants ➲ Pileated woodpecker

LESSON 6

Can an animal be both prey and predator? Explain your answer.

LESSON 7

A bluegill lives in a pond. When it senses danger, what can provide shelter for the fish?

a. Aquatic plants
b. Other fish
c. Snapping turtles
d. Water temperature

assessment item bank with answers and scoring key

* *NOTE: Assessment items are grouped by lesson. Each item is cross-referenced with corresponding lesson(s) and GLE(s). When choosing items from the bank for assessment, check for alignment to Lesson # and the specific GLE. Not every targeted GLE has items in the assessment bank.*

LESSON 1

When living things in a community interact with each other and the with non-living things in their environment, what is it called? (Lesson 1, foundation for EC.1.A.6.a., EC.1.B.6.a. and EC.1.B.6.b.)

a. Community
b. Ecosystem
c. Organism
d. Population

answer (1 point) — b. Ecosystem

What is it called when two or more of the same organisms live together?
(Lesson 1, foundation for EC.1.A.6.a., EC.1.B.6.a. and EC.1.B.6.b.)

a. Community
b. Ecosystem
c. Organism
d. Population

answer (1 point) — d. Population

Explain how organism, population, community and ecosystem are connected. You can use illustrations to support your answer. (Lesson 1, foundation for EC.1.A.6.a., EC.1.B.6.a. and EC.1.B.6.b)

answer

Explanation:

- An organism is a single living thing.
- Two or more of the same organism living in the same area at the same time forms a population.
- Two or more populations of organisms living together in the same place at the same time forms a community.
- When a community of different populations of organisms are interacting with each other and with the non-living things an ecosystem is formed.

scoring key

4 points— All 4 components are correct.
3 points— 3 of the 4 components are correct.
2 points— 2 of the 4 components are correct.
0 points— Less than 2 of the 4 components are correct

LESSON 2

A cactus that needs a dry, hot location is most likely living in a: (Lesson 2, EC.1.A.4.b.)

a. Forest
b. Pond
c. Prairie
d. None of the above

answer (1 point) — d. None of the above

A sun-loving coneflower that needs deep soil is most likely living in a: (Lesson 2, EC.1.A.4.b.)

a. Forest
b. Pond
c. Prairie
d. None of the above

answer (1 point) — c. Prairie

Muskrats dig dens in soil near or in water. In which ecosystem are they most likely found? (Lesson 2, EC.1.A.4.b.)

a. Forest
b. Pond
c. Prairie
d. None of the above

answer (1 point) — b. Pond

Bobolinks build their nests among clump grasses and wildflowers. In which ecosystem are they most likely found? (Lesson 2, EC.1.A.4.b.)

a. Forest
b. Pond
c. Prairie
d. All of the above

answer (1 point) — c. Prairie

LESSON 3

An animal is sleeping in a den or burrow through the winter. How is this animal interacting or living with its environment? (Lesson 3, EC.1.A.4.a.)

a. It is migrating.
b. It is hibernating.
c. It is going dormant.
d. It is defending its home.

answer (1 point) — b. It is hibernating.

Predict which plant or animal is best able to survive in a prairie. (Lesson 3, EC.3.C.4.d.)

a. A grass that needs full sun and has deep roots
b. A tree that keeps its leaves all year and has deep roots
c. An owl that has keen vision and nests in trees
d. An arrowhead plant with roots in mud

answer (1 point) — a. A grass that needs full sun and has deep roots

Predict which plant or animal is most likely able to survive in a forest. (Lesson 3, EC.3.C.4.d.)

a. A tree that loves the sun and hot, dry conditions
b. A bird that needs clump grasses for nesting and travel lanes
c. A frog that hides among water-loving plants to avoid predators
d. A plant that blooms in early spring before other taller plants leaf out

answer (1 point) — d. A plant that blooms in early spring before other taller plants leaf out

Identify one specialized structure of trees and describe how it helps trees survive in their environment.
(Lesson 3, EC.3.C.4.a.)

answer — any one of the following:

- Bark: protects trees from insects and injury.
- Leaves: use energy from the sun to produce food for the tree.
- Roots: spread out far and grow deep in search of air, water and minerals.
- Trunk: supports branches and carries nutrients and water to and from the leaves.
- Other: appropriate responses that include a tree’s specialized structure and how it helps the tree survive

scoring key

2 points— Answer includes one specialized structure and how it helps trees survive in their environment.
1 point— Answer only includes one specialized structure but not how it helps trees survive in their environment.
0 points— No appropriate structures

Identify a specialized structure of prairie grasses that helps protect them during dry weather and describe one additional way this structure helps prairie grasses survive in their environment. (Lesson 3, EC.3.C.4.a.)

answer

Specialized structure—Long roots
AND
Grow deep down into the soil to reach water and nutrients *OR*
Grow deep to anchor the plants against strong winds
(Other sentences that convey the same meaning are acceptable.)

scoring key

2 points— specialized structure—long roots and one of the ways listed
1 point— specialized structure—long roots
0 points—no correct specialized structure

Bobcats have keen vision and other specialized structures for survival. What is another specialized structure of a bobcat, and how does it help bobcats survive? (Lesson 3, EC.3.C.4.b.)

answer— any one of the following

- Keen hearing: helps them hear prey or predators
- Soft foot pads: allow them to creep up quietly on prey or move silently
- Dappled-colored fur: allows them to blend into their surroundings so they can creep up on prey or hide
- Other appropriate responses that include a bobcat's specialized structure and how it helps the bobcat survive

scoring key

2 points— Answer must include a specialized structure and how it helps bobcats survive.
1 point— Specialized structure
0 points— No correct specialized structure

What internal cue, or something inside the body, causes animals to hunt or forage for food? (Lesson 3, EC.3.C.4.c.)

answer (1 point) — Hunger

What external cue, or something outside the body, might cause an animal to run away, fly away, swim off or stay still? (Lesson 3, EC.3.C.4.c.)

a. Cooler and warmer temperatures
b. Hot, humid and windy days
c. Strong winds and bright sunshine
d. Sudden movement or sound

answer (1 point) — d. Sudden movement or sound

What causes dormant plants to grow leaves and bloom? (Lesson 3, EC.3.C.4.c.)

answer (1 point) — Longer days and warmer temperatures

LESSON 4

The food chain shown below is most likely found in which ecosystem? (Lessons 4, EC.1.A.4.a.)

Sun ➲ Big bluestem ➲ Bobolink ➲ Northern harrier hawk ➲ Bullsnake

a. Forest
b. Glade
c. Pond
d. Prairie

answer (1 point) — d. Prairie

Using words or pictures and words, show (sequence) the flow of energy through a food chain with at least two animals. <u>You may not use plants or animals included on this test</u>. (Lesson 4, EC.2.A.3.c.)

answer
Any food chain except the ones used on this test is acceptable if it includes:
Sun first, plant second, herbivore/omnivore third and an omnivore/carnivore last

Show the flow of energy through a food chain using the things listed below. (Lesson 4, EC.2.A.3.c.)

Snail Sun Green frog Algae Common snapping turtle

answer (5 points—all five (5) components are included in the correct order)
Sun ➲ Algae ➲ Snail ➲ Green frog ➲ Common snapping turtle

LESSONS 4 and 5

In the food chain below, label the producer(s), consumer(s) and decomposer(s). More than one label may apply to the plants and animals listed in the food chain. (Lessons 4 & 5, EC.2.A.3.b., EC.2.A.4.a.)

Sun ➲ Decaying plants ➲ Carpenter ants ➲ Pileated woodpecker

answer
Decaying plants—producer
Carpenter ants—decomposer, consumer
Pileated woodpecker—consumer

scoring key
1 point for each correct response (maximum 4 points)

LESSON 6

Can an animal be both prey and predator? Explain your answer. (Lesson 6, EC.2.A.4.c.)

answer (2 points) —Yes
AND When an animal hunts and eats another animal it is a predator. When that predator is hunted and eaten by another predator, it becomes prey.
(Other sentences that convey the same meaning are acceptable.)

LESSON 7

A bluegill lives in a pond. When it senses danger, what can provide shelter for the fish? (Lesson 7, EC.1.A.4.a.)

a. Aquatic plants
b. Other fish
c. Snapping turtles
d. Water temperature

answer (1 point) — a. Aquatic plants

appendix i : ecosystem cards comprehensive key

Organism	Key
algae **what it eats:** Produces its own food using energy from the sun **what eats it:** Giant floater mussels, yellow drake mayflies, northern crayfish, bluegill fish, water fleas, green frog tadpoles, pond snails, red-eared slider turtles, fathead minnows **environment:** Free floating in the water, attaching to rocks, plants and other surfaces	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
badger **what it eats:** Thirteen-lined ground squirrels, northern crawfish frogs, ornate box turtles, three-toed box turtles, plains pocket gophers **what eats it:** Young eaten by coyotes **environment:** Grasslands	Pond, [Forest], **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
big bluestem **what it eats:** Produces its own food using energy from the sun **what eats it:** Thirteen-lined ground squirrels, bobolinks, grasshopper sparrows, upland sandpipers, bobwhite quail, greater prairie-chickens, plains pocket gophers, leaf beetles, prairie voles, grassland crayfish, white-tailed deer **environment:** Large area of flat or rolling grassland	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
blackberries **what it eats:** Produces its own food using energy from the sun **what eats it:** Bobolinks, pileated woodpeckers, coyotes, plains pocket gophers, prairie voles, white-tailed deer, ornate box turtles, spotted skunks, humans **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
black willow tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Leaves eaten by**—white-tailed deer; **Roots and stems eaten by**—muskrats **environment:** Low, wet areas along the water in full sun	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
blue violet **what it eats:** Produces its own food using energy from the sun **what eats it:** Three-toed box turtles, io moths, woodland voles, white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs **environment:** In an area with many trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
blue-fronted dancer damselfly **what it eats:** **Adults eat**—water fleas; **Nymphs eat**—predacious diving beetles **what eats it:** **Adults eaten by**—mallard ducks, green darner dragonflies; **Nymphs eaten by**—bluegill fish, predacious diving beetles, green frogs, red-eared slider turtles, yellow drake mayflies, fathead minnows **environment:** In and near enclosed bodies of fresh water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
bluegill fish **what it eats:** Water striders, blue-fronted dancer damselflies, yellow drake mayflies, northern crayfish, fathead minnows, algae **what eats it:** Largemouth bass, great blue herons, northern water snakes, humans **environment:** Among plants near shore of an enclosed deep body of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
bobcat **what it eats:** White-tailed deer, ovenbirds, wild turkeys,Texas ratsnakes **what eats it:** **Young eaten by**—Great horned owls, coyotes **environment:** Bottomland with lots of trees	Pond, **Forest**, [Prairie] Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
bobolink **what it eats:** Regal fritillary butterflies, yellow garden spiders, leaf beetles, round-winged katydids, blackberries, compass plants, big bluestem, little bluestem, purple coneflowers, sideoats grama grass, switch grass, Indian grass **what eats it:** Northern harrier hawks, bullsnakes **environment:** Large area of flat or rolling grassland	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
bobwhite quail **what it eats:** Prairie mound ants, compass plants, big bluestem, little bluestem, sideoats grama grass, switch grass, Indian grass **what eats it:** Coyotes, northern harrier hawks, bullsnakes, humans **environment:** Area with tall grass	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
bullsnake **what it eats:** Prairie voles, great plains skinks, thirteen-lined ground squirrels, plains pocket gophers, greater prairie-chickens, bobolinks, bobwhite quail, grasshopper sparrows, upland sandpipers **what eats it:** Northern harrier hawks, coyotes **environment:** A wide area of land with tall grasses	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
carpenter ant **what it eats:** **Living and dead**—termites and sowbugs **what eats it:** Pileated woodpeckers, ovenbirds, centipedes, gray tree frogs; **Tiny pieces of dead and decaying carpenter ants eaten by**—earthworms **environment:** Dead trees and logs	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, **Decomposer**, **Scavenger** **Prey**, **Predator**
cattail **what it eats:** Produces its own food using energy from the sun **what eats it:** Muskrats **environment:** Banks and shallow areas of an enclosed body of fresh water	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
centipede **what it eats:** Sowbugs, centipedes, termites, carpenter ants **what eats it:** Centipedes, tiger salamanders, ovenbirds **environment:** Land with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
channel catfish **what it eats:** **Living and dead**—fishing spiders, fathead minnows, northern crayfish, duckweed **what eats it:** Common snapping turtles, humans **environment:** Near the bottom of small, deep bodies of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, **Scavenger** **Prey**, **Predator**
common carp **what it eats:** **Living and dead**—fishing spiders, coontails, duckweed **what eats it:** Humans, largemouth bass, great blue herons **environment:** In deeper pools of water around submerged logs	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
common sedge **what it eats:** Produces its own food using energy from the sun **what eats it:** **Seeds eaten by**—mallard ducks **environment:** Banks of small, deep bodies of water	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
common snapping turtle **what it eats:** **Living and dead**—aquatic plants, channel catfish, northern crayfish, green frogs, coontails **what eats it:** **Eggs and young eaten by**—raccoons, northern water snakes **environment:** In an enclosed body of water with muddy bottoms, submerged logs and plenty of vegetation	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, **Scavenger** **Prey**, **Predator**

Organism	Key
compass plant **what it eats:** Produces its own food using energy from the sun **what eats it:** Upland sandpipers, bobolinks, grasshopper sparrows, bobwhite quail, prairie voles, leaf beetles, regal fritillary butterflies, white-tailed deer, thirteen-lined ground squirrels **environment:** Open grassland	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
coontail **what it eats:** Produces its own food using energy from the sun **what eats it:** Mallard ducks, red-eared slider turtles, common snapping turtles, common carp, northern crayfish **environment:** In small body of clear-to-murky water up to 20 feet deep	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
coyote **what it eats:** **Living and dead**—round-winged katydids, bullsnakes, speckled kingsnakes, ornate box turtles, bobcats, thirteen-lined ground squirrels, badgers, prairie voles, greater prairie-chickens, bobwhite quail, upland sandpipers; Blackberries **what eats it:** Northern harrier hawks, badgers **environment:** Wide area of tall grasses	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, **Scavenger** **Prey**, **Predator**
duckweed **what it eats:** Produces its own food using energy from the sun **what eats it:** Mallard ducks, common carp, red-eared slider turtles, northern crayfish, channel catfish **environment:** Floats on surface of small, deep bodies of water	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
earthworm **what it eats:** **Tiny pieces of dead and decaying**—hickory trees, blue violets, mayapples, flowering dogwood trees, sassafras trees, redcedar trees, red maple trees,Virginia creeper vines, white oak trees, sowbugs, carpenter ants and termites **what eats it:** Ovenbirds, three-toed box turtles, tiger salamanders **environment:** In areas with lots of trees and other plants	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, Carnivore, **Decomposer**, **Scavenger** **Prey**, Predator

Organism	Key
fathead minnow **what it eats:** Algae, green darner dragonflies, blue-fronted dancer damselflies **what eats it:** Largemouth bass, bluegill fish, channel catfish, northern water snakes, great blue herons, green frogs, raccoons **environment:** In a small area of water surrounded by land	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
fishing spider **what it eats:** Water striders, predacious diving beetles **what eats it:** Green frogs, channel catfish, largemouth bass, common carp **environment:** Among plants on or near the bank of an enclosed body of fresh water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
flowering dogwood tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Fruit eaten by**—fox squirrels, white-tailed deer, wild turkeys, white-breasted nuthatches; **Seeds eaten by**—carpenter ants; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites **environment:** Under larger trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
fox squirrel **what it eats:** Virginia creeper vines, flowering dogwood trees, white oak trees, hickory trees, red maple trees **what eats it:** Great horned owls,Texas ratsnakes, humans **environment:** Cavities of oak, hickory and other hardwood trees	Pond, **Forest**, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
gaura **what it eats:** Produces its own food using energy from the sun **what eats it:** Prairie voles, white-tailed deer, honeybees, regal fritillary butterflies **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
giant floater mussel **what it eats:** Algae, water fleas **what eats it:** Muskrats, raccoons, red-eared slider turtles, great blue herons **environment:** Bottom of a small, deep body of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
grasshopper sparrow **what it eats:** Yellow garden spiders, regal fritillary butterflies, honeybees, leaf beetles, round-winged katydids, prairie mound ants, compass plants, big bluestem, little bluestem, sideoats grama grass, switch grass, Indian grass, purple coneflowers **what eats it:** Northern harrier hawks, bullsnakes, speckled kingsnakes **environment:** Area with grasses and forbs	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
grassland crayfish **what it eats:** **Living and dead**—leaf beetles, prairie mound ants, big bluestem, little bluestem, switch grass, Indian grass, sideoats grama grass **what eats it:** Northern crawfish frogs **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, **Decomposer**, **Scavenger** **Prey**, **Predator**
gray treefrog **what it eats:** Walking sticks, termites, carpenter ants **what eats it:** Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
great blue heron **what it eats:** Bluegill fish, common carp, fathead minnows, young largemouth bass, green frogs, northern water snakes, red-eared slider turtles, giant floater mussels, pond snails, northern crayfish **what eats it:** Raccoons **environment:** Near bodies of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
great horned owl **what it eats:** Fox squirrels, bobcats, thirteen-lined ground squirrels, spotted skunks, woodland voles, northern harrier hawks, ovenbirds, white-breasted nuthatches, wild turkeys,Texas ratsnakes, speckled kingsnakes **what eats it:** Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, [Prairie] Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
great plains skink **what it eats:** Yellow garden spiders, round-winged katydids, prairie mound ants, leaf beetles **what eats it:** Bullsnakes, speckled kingsnakes, northern harrier hawks **environment:** Land covered with grasses and wildflowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
greater prairie-chicken **what it eats:** Prairie mound ants, big bluestem, little bluestem, switch grass, Indian grass, sideoats grama grass **what eats it:** Bullsnakes, speckled kingsnakes, coyotes **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
green darner dragonfly **what it eats:** **Adults eat**—blue-fronted dancer damselflies, yellow drake mayflies; **Nymphs eat**—predacious diving beetles, green frog tadpoles **what eats it:** **Adults eaten by**—green frogs; **Nymphs eaten by**—largemouth bass, predacious diving beetles, green frogs, red-eared slider turtles, northern harrier hawks, yellow garden spiders, fathead minnows **environment:** **Adults**—near a small, deep body of water; **Nymphs**—in the water	**Pond**, Forest, [Prairie] Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
green frog **what it eats:** **Adults eat**—blue-fronted dancer damselflies, green darner dragonflies, yellow drake mayflies, water striders, fishing spiders, predacious diving beetles, northern crayfish, fathead minnows, pond snails; **Tadpoles eat**—algae **what eats it:** Northern water snakes, common snapping turtles, largemouth bass, great blue herons, raccoons, muskrats, humans; **Tadpoles eaten by**—green darner dragonfly nymphs, predacious diving beetles **environment:** In algae and among aquatic plants	**Pond**, Forest, Prairie Producer, **Consumer** **Herbivore** (as tadpole), Omnivore, **Carnivore** (as adult), Decomposer, Scavenger **Prey**, **Predator**
hickory tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Nuts eaten by**—humans, wild turkeys; **Nuts and buds eaten by**—fox squirrels, white-tailed deer; **Leaves eaten by**—walking sticks, white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites **environment:** In an area with many trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
honeybee **what it eats:** **Nectar from**—gaura, prairie blazing star, purple coneflowers **what eats it:** Grasshopper sparrows, yellow garden spiders, prairie mound ants **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
human **what it eats:** Blackberries, bluegill fish, bobwhite quail, channel catfish, common carp, fox squirrels, green frogs, hickory nuts, largemouth bass, mallard ducks, muskrats, raccoons, white-tailed deer, wild turkeys, northern crayfish **what eats it:** None **environment:** Found in more than one ecosystem	**Pond**, **Forest**, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger Prey, **Predator**

Organism	Key
indian grass **what it eats:** Produces its own food using energy from the sun **what eats it:** White-tailed deer, leaf beetles, upland sandpipers, bobolinks, bobwhite quail, grasshopper sparrows, greater prairie-chickens, thirteen-lined ground squirrels, prairie voles, grassland crayfish, plains pocket gophers, round-winged katydids **environment:** Large area with grasses and forbs	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
io moth **what it eats:** **Adults**—do not feed; **Larva eat leaves of**—blue violets, sassafras trees, oak trees **what eats it:** Pileated woodpeckers, white-breasted nuthatches, rough green snakes **environment:** Land with many trees	Pond, **Forest**, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
largemouth bass **what it eats:** Bluegill fish, common carp, channel catfish, fathead minnows, northern crayfish, green frogs, water fleas, green darner dragonflies, fishing spiders, predacious diving beetles **what eats it:** Humans, great blue herons, raccoons, northern water snakes **environment:** In warm, clear water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
leaf beetle **what it eats:** Compass plants, purple coneflowers, big bluestem, little bluestem, Indian grass, switch grass, sideoats grama grass **what eats it:** Bobolinks, grasshopper sparrows, great plains skinks, thirteen-lined ground squirrel, grassland crayfish, upland sandpipers, prairie mound ants, ornate box turtles **environment:** Large area of flat or rolling grassland	Pond, Forest, **Prairie** Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
little bluestem **what it eats:** Produces its own food using energy from the sun **what eats it:** Thirteen-lined ground squirrels, bobolinks, bobwhite quail, greater prairie-chickens, upland sandpipers, grasshopper sparrows, plains pocket gophers, leaf beetles, prairie voles, white-tailed deer, grassland crayfish **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
mallard duck **what it eats:** Duckweed, coontail, water primrose, common sedge, pin oak trees, water striders, yellow drake mayflies, blue-fronted dancer damselflies, pond snails, predacious diving beetles, northern crayfish **what eats it:** Humans, raccoons **environment:** In and around enclosed bodies of fresh water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
mayapple **what it eats:** Produces its own food using energy from the sun **what eats it:** **Fruit eaten by**—three-toed box turtles, wild turkeys, woodland voles; **Fruit and leaves eaten by**—white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs **environment:** Areas with many trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
moss **what it eats:** Produces its own food using energy from the sun **what eats it:** White-tailed deer **environment:** In shaded areas under trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
muskrat **what it eats:** Yellow water lilies, black willow trees, cattails, giant floater mussels, northern crayfish, green frogs **what eats it:** Humans **environment:** In and around enclosed bodies of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
northern crawfish frog **what it eats:** Yellow garden spiders, grassland crayfish, prairie mound ants **what eats it:** Badgers **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
northern crayfish **what it eats:** Algae; **Decaying—**yellow water lilies, coontail, duckweed **what eats it:** Channel catfish, largemouth bass, bluegill fish, red-eared slider turtles, common snapping turtles, green frogs, northern water snakes, great blue herons, mallard ducks, raccoons, muskrats, humans **environment:** Bodies of open and enclosed water	**Pond**, Forest, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, **Scavenger** **Prey**, Predator
northern harrier hawk **what it eats:** Prairie voles, plains pocket gophers, speckled kingsnakes, bullsnakes, great plains skinks, young coyotes, green darner dragonflies, bobolinks, grasshopper sparrows, bobwhite quail **what eats it:** Great horned owls **environment:** A wide area of land with tall grasses	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
northern water snake **what it eats:** Largemouth bass, bluegill fish, fathead minnows, northern crayfish, green frogs, common snapping turtles **what eats it:** Great blue herons, raccoons, red-eared slider turtles **environment:** In a small, deep body of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
ornate box turtle **what it eats:** Leaf beetles, regal fritillary butterflies, blackberries **what eats it:** Coyotes, badgers **environment:** Land with grasses and forbs	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
ovenbird **what it eats:** Earthworms, centipedes, sowbugs, carpenter ants, termites **what eats it:** Great horned owls, bobcats,Texas ratsnakes **environment:** In an area with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
pileated woodpecker **what it eats:** Virginia creeper vines, walking sticks, carpenter ants, io moths, spicebush swallowtail butterflies, termites, white oak trees, redcedar trees, blackberries **what eats it:** Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, [Prairie] Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
pin oak tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Acorns eaten by**—mallard ducks, raccoons, white-tailed deer; **Leaves and twigs eaten by**—white-tailed deer **environment:** Near enclosed and open bodies of water	**Pond**, [Forest], Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
plains pocket gopher **what it eats:** Blackberries, big bluestem, little bluestem, Indian grass, switch grass, sideoats grama grass **what eats it:** Badgers, spotted skunks, northern harrier hawks, bullsnakes **environment:** A large area of flat or rolling grassland	Pond, Forest, **Prairie** Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
pond snail **what it eats:** Algae **what eats it:** Common carp, green frogs, red-eared slider turtles, great blue herons, mallard ducks **environment:** In water surrounded by land	**Pond**, Forest, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
prairie blazing star **what it eats:** Produces its own food using energy from the sun **what eats it:** Regal fritillary butterflies, honeybees, thirteen-lined ground squirrels, prairie voles, white-tailed deer **environment:** A wide area with grasses and forbs	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
prairie mound ant **what it eats:** **Dead**—Leaf beetles, honeybees, round-winged katydids, regal fritillary butterflies **what eats it:** Great plains skinks, bobwhite quail, grasshopper sparrows, upland sandpipers, greater prairie-chickens, yellow garden spiders, northern crayfish frogs, grassland crayfish, spotted skunks, thirteen-lined ground squirrels **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, Carnivore, **Decomposer**, **Scavenger** **Prey**, **Predator**
prairie vole **what it eats:** Prairie blazing star, purple coneflowers, gaura, big bluestem, little bluestem, Indian grass, compass plant, sideoats grama grass, switch grass, blackberries **what eats it:** Coyotes, bullsnakes, speckled kingsnakes, northern harrier hawks, spotted skunks **environment:** A wide area of land with tall grasses and wildflowers	Pond, Forest, **Prairie** Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
predacious diving beetle **what it eats:** Nymphs of green darner dragonflies, blue-fronted dancer damselflies and yellow drake mayflies; Green frog tadpoles **what eats it:** Predacious diving beetles, fishing spiders, largemouth bass, green frogs, mallard ducks; **Eaten by nymphs of**—green darner dragonflies and blue-fronted dancer damselflies **environment:** Body of water surrounded by land	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
purple coneflower **what it eats:** Produces its own food using energy from the sun **what eats it:** Honeybees, regal fritillary butterflies, grasshopper sparrows, bobolinks, leaf beetles, prairie voles, thirteen-lined ground squirrels, white-tailed deer **environment:** Large area of land covered with grasses and flowers	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
raccoon **what it eats:** Pin oak trees, northern crayfish, northern water snakes, fathead minnows, largemouth bass, green frogs, giant floater mussels, mallard ducks, common snapping turtles, red-eared slider turtles, great blue herons **what eats it:** Humans **environment:** Areas near enclosed bodies of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
redcedar tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Berries eaten by**—white-tailed deer, pileated woodpeckers, white-breasted nuthatches; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites **environment:** Areas with lots of trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
red-eared slider turtle **what it eats:** Water striders, pond snails, northern crayfish, giant floater mussels, duckweed, coontail, algae; Nymphs of green darner dragonflies, yellow drake mayflies and blue-fronted dancer damselflies **what eats it:** Raccoons, great blue herons; **Eggs and young eaten by**—northern water snakes **environment:** In and around an area of water surrounded by land	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
red maple tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Seeds eaten by**—white-breasted nuthatches, wild turkeys, fox squirrels, woodland voles; **Leaves eaten by**—white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—shelf mushrooms, termites **environment:** In areas with many trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
regal fritillary butterfly **what it eats:** Prairie blazing star, compass plants, gaura, purple coneflowers **what eats it:** Bobolinks, grassland sparrows, prairie mound ants, yellow garden spiders, ornate box turtles, thirteen-lined ground squirrels **environment:** A wide area of land with tall grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator

Organism	Key
rough green snake **what it eats:** Spicebush swallowtail butterflies, io moths, termites, walking sticks **what eats it:** Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
round-winged katydid (pink form) **what it eats:** Indian grass, switch grass, sideoats grama grass **what eats it:** Bobolinks, grasshopper sparrows, great plains skinks, coyotes, yellow garden spiders, prairie mound ants, thirteen-lined ground squirrels **environment:** Area with grasses and forbs	Pond, Forest, **Prairie** Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
sassafras tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Fruit eaten by**—white-tailed deer, white-breasted nuthatches; **Leaves eaten by**—io moths, spicebush swallowtail butterflies, white-tailed deer; **Dead leaves eaten by**—earthworms, sowbugs; **Dead wood eaten by**—termites **environment:** Areas with lots of trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
shelf mushroom **what it eats:** **Dead and decaying**—white oak trees, hickory trees, red maple trees **what eats it:** White-tailed deer **environment:** In areas with many trees	Pond, **Forest**, Prairie Producer, Consumer **[Fungi belong to an entirely different category of organisms.]** Herbivore, Omnivore, Carnivore, **Decomposer**, Scavenger Prey, Predator
sideoats grama grass **what it eats:** Produces its own food using energy from the sun **what eats it:** Thirteen-lined ground squirrels, bobwhite quail, greater prairie-chickens, bobolinks, upland sandpipers, grasshopper sparrows, prairie voles, grassland crayfish, plains pocket gophers, leaf beetles, round-winged katydids, white-tailed deer **environment:** A wide area of land with tall grasses and flowers	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
sowbug **what it eats:** **Dead and decaying**—hickory trees, blue violets, white oak trees, sassafras trees, redcedar trees, red maple trees, Virginia creeper vines, mayapples, flowering dogwood trees **what eats it:** Centipedes, tiger salamanders, ovenbirds, wild turkeys, carpenter ants; **Tiny pieces of dead and decaying sowbugs eaten by**—earthworms **environment:** In damp areas with many trees under logs and rocks	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, Carnivore, **Decomposer**, **Scavenger** **Prey**, Predator
speckled kingsnake **what it eats:** Prairie voles, great plains skinks, greater prairie-chicken eggs, grasshopper sparrows, upland sandpipers **what eats it:** Northern harrier hawks, coyotes, great horned owls **environment:** Areas with grasses and forbs	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
spicebush swallowtail butterfly **what it eats:** Sassafras trees **what eats it:** Pileated woodpeckers, rough green snakes **environment:** Areas with lots of trees	Pond, **Forest**, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
spotted skunk **what it eats:** **Living and dead**—prairie voles, plains pocket gophers, prairie mound ants; Blackberries **what eats it:** Great horned owls **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, **Scavenger** **Prey**, **Predator**
switch grass **what it eats:** Produces its own food using energy from the sun **what eats it:** Thirteen-lined ground squirrels, white-tailed deer, round-winged katydids, prairie voles, bobwhite quail, greater prairie-chickens, upland sandpipers, bobolinks, grassland sparrows, plains pocket gophers, grassland crayfish, leaf beetles **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
termite **what it eats:** **Dead and decaying**—flowering dogwood trees, hickory trees, red maple trees, redcedar trees, sassafras trees, white oak trees **what eats it:** Gray tree frogs, pileated woodpeckers, white-breasted nuthatches, ovenbirds, carpenter ants, centipedes, rough green snakes; **Tiny pieces of dead and decayed termites eaten by**—earthworms **environment:** Where there are many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, Carnivore, **Decomposer**, Scavenger **Prey**, Predator
texas ratsnake **what it eats:** Gray treefrogs, rough green snakes, tiger salamanders, ovenbirds, white-breasted nuthatches, fox squirrels; **Eggs and nestlings of**—pileated woodpeckers, ovenbirds, white-breasted nuthatches, great horned owls **what eats it:** Great horned owls, bobcats **environment:** In an area with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
thirteen-lined ground squirrel **what it eats:** Regal fritillary butterflies, round-winged katydids, leaf beetles, prairie mound ants, big bluestem, little bluestem, Indian grass, switch grass, sideoats grama grass, prairie blazing star, purple coneflowers, compass plants **what eats it:** Coyotes, badgers, great horned owls, bullsnakes **environment:** Area with grasses and forbs	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
three-toed box turtle **what it eats:** Blue violets, mayapples, earthworms **what eats it:** Badgers **environment:** In areas with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
tiger salamander **what it eats:** Earthworms, centipedes, sowbugs **what eats it:** Texas ratsnakes, great horned owls, wild turkeys **environment:** Where there are many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**

Organism	Key
upland sandpiper **what it eats:** Big bluestem, little bluestem, sideoats grama grass, switch grass, Indian grass, compass plants, prairie mound ants, leaf beetles **what eats it:** Bullsnakes, speckled kingsnakes, coyotes **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
virginia creeper vine **what it eats:** Produces its own food using energy from the sun **what eats it:** **Berries eaten by**—white-breasted nuthatches, pileated woodpeckers, fox squirrels; **Leaves eaten by**—white-tailed deer, wild turkeys; **Dead leaves eaten by**—earthworms, sowbugs **environment:** Areas with trees	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
walking stick **what it eats:** White oak trees, hickory trees **what eats it:** Wild turkeys, pileated woodpeckers, white-breasted nuthatches, rough green snakes, gray treefrogs **environment:** Areas with many trees	Pond, **Forest**, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
water flea **what it eats:** Algae, water fleas **what eats it:** Water fleas, water striders, blue-fronted dancer damselflies, yellow drake mayflies, giant floater mussels, young largemouth bass **environment:** Body of water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
water primrose **what it eats:** Produces its own food using energy from the sun **what eats it:** **Seeds eaten by**—white-tailed deer, mallard ducks **environment:** In an area of water surrounded by land	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

Organism	Key
water strider **what it eats:** Water fleas **what eats it:** Green frogs, bluegill fish, fishing spiders, red-eared slider turtles, mallard ducks **environment:** Surface of a small area of water surrounded by land	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
white-breasted nuthatch **what it eats:** Termites, walking sticks, io moths, red maple trees, redcedar trees, flowering dogwood trees, sassafras trees, virginia creeper vines **what eats it:** Great horned owls,Texas ratsnakes **environment:** Areas with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
white oak tree **what it eats:** Produces its own food using energy from the sun **what eats it:** **Leaves eaten by**—walking sticks; **Dead leaves eaten by**—earthworms, sowbugs; **Acorns eaten by**—fox squirrels, wild turkeys, pileated woodpeckers; **Acorns and leaves eaten by**—white-tailed deer; **Dead wood eaten by**—shelf mushrooms, termites **environment:** Land where many trees grow	Pond, **Forest**, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator
white-tailed deer **what it eats:** White oak trees,Virginia creeper vines, mayapples, mosses, shelf mushrooms, flowering dogwood trees, sassafras trees, hickory trees, blue violets, redcedar trees, red maple trees, pin oak trees, black willow trees, little bluestem, big bluestem, switch grass, Indian grass, sideoats grama grass, prairie blazing star, purple coneflowers, gaura, compass plants, blackberries, water primrose **what eats it:** Humans, bobcats **environment:** Wooded areas	[Pond], **Forest**, [Prairie] Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator

Organism	Key
wild turkey **what it eats:** Walking sticks, sowbugs, tiger salamanders, mayapples, red maple trees, white oak trees, hickory trees, flowering dogwood trees, Virginia creeper vines **what eats it:** Humans, great horned owls, bobcats **environment:** In an area with many trees	Pond, **Forest**, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
woodland vole **what it eats:** Mayapples, blue violets, red maple trees **what eats it:** Great horned owls **environment:** In an area with many trees	Pond, **Forest**, Prairie Producer, **Consumer** **Herbivore**, Omnivore, Carnivore, Decomposer, Scavenger **Prey**, Predator
yellow drake mayfly **what it eats:** **Adults**—do not eat; **Nymphs eat**—water fleas, blue-fronted dancer damselfly nymphs, algae **what eats it:** **Adults eaten by**—mallard ducks, green frogs, green darner dragonflies; **Nymphs eaten by**—bluegill fish, predacious diving beetles, green frogs, red-eared slider turtles **environment:** In and near the water	**Pond**, Forest, Prairie Producer, **Consumer** Herbivore, **Omnivore**, Carnivore, Decomposer, Scavenger **Prey**, **Predator**
yellow garden spider **what it eats:** Regal fritillary butterflies, green darner dragonflies, prairie mound ants, honeybees, round-winged katydids **what eats it:** Bobolinks, grasshopper sparrows, great plains skinks, northern crawfish frogs **environment:** Land covered with grasses and flowers	Pond, Forest, **Prairie** Producer, **Consumer** Herbivore, Omnivore, **Carnivore**, Decomposer, Scavenger **Prey**, **Predator**
yellow water lily **what it eats:** Produces its own food using energy from the sun **what eats it:** Muskrats, northern crayfish **environment:** Enclosed bodies of fresh water	**Pond**, Forest, Prairie **Producer**, Consumer Herbivore, Omnivore, Carnivore, Decomposer, Scavenger Prey, Predator

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