



Ecosystems & Biodiversity Introduction

The *MEECS Ecosystems & Biodiversity Unit* uses a Michigan context to provide students with a solid foundation in understanding basic ecological principals, as well as the importance of biodiversity as it relates to Michigan's environment, economy, and society. The ten core lessons in this notebook are divided into *two separate units*, Ecosystems and Biodiversity. Each of the two units consists of five lessons, and is designed to be taught in eight to ten hours of instructional time. The Ecosystems unit is appropriate for grades 4-6, while the Biodiversity unit is slightly more advanced and is recommended for grades 5-6. In addition, fifteen extension lessons are provided either in the notebook and/or on the *MEECS Ecosystems & Biodiversity Unit CD-ROM*. Teachers are encouraged to use these additional activities selectively as appropriate for their students and curriculum requirements. Many lessons and activities can be adapted for other grades as well as for non-formal education programs. Both units address Michigan elementary and middle school benchmarks for science and social studies.

The Ecosystems unit consists of five core lessons intended to help build a foundational understanding of basic ecological principals. By examining Michigan ecosystems, students learn how ecosystems function, how humans interact with and benefit from Michigan ecosystems, and how Michigan ecosystems have changed over time. Key concepts addressed in this unit include habitat; levels of environment (biome, community, population, ecosystem, organism); major types of ecosystems in Michigan (Great Lakes, rivers/streams, forests, wetlands, coastal dunes, urban areas, and agriculture); food chains and food webs; trophic levels (producer, consumer, and decomposer); interdependence; water cycle; photosynthesis; decomposition; scientific investigation; social, economic, and ecological importance of ecosystems; and historical examples of positive and negative human impact on Michigan's environment.

In the Biodiversity unit, a second set of five lessons is intended as a follow-up to the Ecosystems unit and builds on concepts developed in the first five lessons. However, it may also be used independently of the Ecosystems unit. Because some of the concepts are more advanced, this section is recommended more for grades 5 and 6. Topics addressed in this unit include: biodiversity and its importance; interdependence; scientific investigation; data-based decision-making; factors threatening biodiversity (habitat loss, invasive species, pollution, population growth; and overuse of resources); threatened and endangered species; stewardship; and the role of government. Given that invasive species currently represent the *single greatest threat to biodiversity in the Great Lakes region*, one core lesson and several extension lessons address this topic.

Both the Ecosystems and Biodiversity units are designed around sets of big ideas or enduring understandings as well as a set of overarching essential questions. Each lesson is also framed by one or more key questions. The learning activities and assessments within each unit are aligned with this framework and also are clearly correlated to elementary and middle school benchmarks for science and social studies. It is highly recommended that these big ideas and overarching essential questions be shared with the students during the course of the unit. It may be helpful to keep them posted in the classroom.

Ecosystems Unit (Lessons 1-5)

Big Ideas or Enduring Understandings

1. Every ecosystem is powered by the sun.
2. Materials are constantly cycling through ecosystems and get re-used in the environment.
3. Living things (including people) depend upon one another and their environment to survive.
4. People benefit directly and indirectly from Michigan's diversity of ecosystems.
5. Humans have the power to change the environment more than any other living thing.

Overarching Essential Questions

1. What keeps us and other organisms alive on Earth?
2. What makes Michigan a special place to live?
3. How do people interact with the environment?
4. How have Michigan ecosystems changed over time?
5. Who has responsibility to care for the environment?

Biodiversity Unit (Lessons 6-10)

Big Ideas or Enduring Understandings

1. Everything in nature has a purpose and is interdependent (including humans).
2. People benefit from biodiversity in many ways.
3. People can use knowledge of biodiversity to make decisions about the environment.
4. Humans have the power to change the environment more than any other living thing.

Overarching Essential Questions

1. Why is biodiversity important?
2. What positive and negative effects do people have on biodiversity?
3. What can be done to protect biodiversity?

The future of Michigan's ecosystems, biodiversity, and economy depends on the decisions that will be made by *today's* youth as *tomorrow's* decision-makers. The *MEECS Ecosystems & Biodiversity Unit* will help Michigan students gain the knowledge and skills they need to become stewards of Michigan's environment and to help keep this Great Lakes State GREAT!

Taking Students Outdoors

Today, children are more disconnected from the natural world than ever before. A recent study has shown that, as of 1990, the average radius outside the home where children are allowed to play has decreased 90% since 1970. In a world where children spend more and more time indoors “plugged in” to television, video games, and computers, teachers have the opportunity to help students experience nature and develop a greater appreciation for the natural world. While presented as optional, several lessons and extensions included in these materials are designed to be taught outdoors (in the schoolyard). Generally, these outdoor study sessions are structured and involve short periods of time (10-30 minutes). For this reason, you may want to consider implementing this unit in early fall or late spring, when outdoor conditions are most favorable. No study of the natural environment or ecology is complete without experiencing nature firsthand!

10 Tips for Taking Students Outdoors

1. Visit the location you plan to take students in advance of the trip to make sure that it is appropriate for your activity and free of any hazards.
2. Make sure students (and adults!) dress appropriately for the weather conditions and are prepared for sudden changes.
3. Be familiar with any medical concerns (allergies to bee stings, etc.) of your students. Take along a first aid kit.
4. Recruit a parent volunteer or other adult to accompany the class outdoors, if possible.
5. Set a clear purpose for going outdoors and make sure all students are aware of what they will be doing. Model/demonstrate complicated procedures. Set time limits (5-15 minutes) for students to accomplish specific tasks.
6. Before going outdoors, clearly communicate to students what behavior is expected. For example, use indoor voices instead of yelling or walk instead of running.
7. Have a signal for getting everyone’s attention and for gathering together in one place. It may be helpful to have students practice this before going outdoors.
8. Set boundaries for students while outdoors. It may be helpful to clearly mark the boundaries with stakes or flagging, or to have students walk the boundaries in advance of the activity.
9. Allow time for students to be curious and explore the natural environment, even if it is only for a few minutes. Encourage a “sense of wonder” and curiosity for the natural world. Encourage students to observe carefully.
10. Encourage students to respect all living things. Agree in advance on procedures for collecting any living plant or animal. Consider taking a trash bag outside and having students spending a few minutes picking up litter (using safety precautions).



Ecosystems & Biodiversity Overview

Essential Questions	Core Lesson
Ecosystems	
1 What is an ecosystem and what types of ecosystems do we have in Michigan?	1. Ecosystem Basics – Students identify what living and non-living components all ecosystems have in common with one another and are briefly introduced to some of Michigan’s ecosystems, using the five MDNR posters.
2 How do living things obtain the energy they need to live?	2. It’s All Connected! – Students research, identify, and label possible Michigan-specific food chains/webs using the five MDNR posters and later examine their own place in the food chain.
3 How do the water cycle, photosynthesis, and decomposition help maintain life on Earth?	3. Nature’s Recycling – Using a number of hands-on activities, this three-part lesson introduces students are introduced to roles of the water cycle, photosynthesis, and the decomposition in maintaining life on Earth.
4 How do people benefit from Michigan’s ecosystems?	4. Michigan Ecosystems: What Have They Done for YOU Lately? – Students participate in charades-like activity to learn about some of the benefits provided by ecosystems. Students also consider the ecological, economic, and social importance of these benefits.
5 How have Michigan ecosystems come to exist as they do today? What role have people played in shaping Michigan’s environment?	5. Michigan Time Machine – Students learn about historical events that helped shape Michigan ecosystems, first by participating in a play, and later by taking on the role of news reporters traveling through time.
Biodiversity	
6 Why is biodiversity important?	6. Michigan’s Web of Life – Students use a ball of twine to create a classroom web that shows the interconnections and interdependence within a natural community.
7 How can we measure biodiversity? How can we use information about biodiversity to make a decision about land use?	7. Biodiversity Study Option A (Indoors) – Students use information about the biodiversity of birds in Michigan ecosystems to make a land use decision. Option B (Outdoors) – Students use information about schoolyard biodiversity to make a land use decision.
8 How is Michigan’s biodiversity threatened? What are examples of protections for biodiversity?	8. Threats and Protections for Michigan Biodiversity – Students use events from a timeline of Michigan environmental history to identify examples of major threats and protections for Michigan.
9 How do invasive species threaten Michigan biodiversity? How can we prevent their spread?	9. Most Unwanted: Invaders of the Great Lakes Region – Students learn about invasive species associated with Michigan and/or the Great Lakes, the problems they present, how they were introduced, and how to prevent their spread in the future.
10 What plant and animal species are threatened in Michigan and near our community? Whose responsibility is it to protect biodiversity?	10. Michigan’s Threatened Species – Students learn what it means for a species to be listed as threatened or endangered and the role of government and individuals in protecting biodiversity.

Extensions

Ecosystems

- 1 - **Ecosystem Scavenger Hunt** (in notebook) – Students look for evidence of ecosystems in their schoolyard.
 - **Wildlife Habitat Riddles** (in notebook) – Students answer a series of riddles depicting the habitat requirements for specific Michigan wildlife species.
 - **Observing Schoolyard Ecosystems** (on Unit CD-ROM) – Students compare “mini-ecosystems” in their schoolyards.
- 2 - **Energy Flow Scavenger Hunt** (in notebook) – A schoolyard hunt to find evidence of terms used in the lesson (producer, consumer, food chain, etc.).
 - **Who Am I?** (in notebook) – An interactive game designed to reinforce vocabulary and questioning skills. Utilizes the *Forest Ecosystem Picture Cards* provided with Lesson 6.
 - **Energy Flow Game** (on Unit CD-ROM) – Students simulate the energy flow in an ecosystem in a high energy activity that can also be used to illustrate the process of bioaccumulation.
 - **Sandwich Super Sleuth** (on Unit CD-ROM) – Students trace food items from their places as sandwich ingredients to where they were originally grown. Students then suggest ways that people can minimize their impact on ecosystems and biodiversity by making informed decisions about food choices.
- 3 - **Nature’s Recycling Detective Hunt** (in notebook) – Students look for evidence of the water cycle, photosynthesis and decomposition in their schoolyard.
 - **Water Wonders** (on Unit CD-ROM) – Students roleplay water molecules, simulating the paths that water takes in the water cycle.
- 4 - **Secret Services** (on Unit CD-ROM) – Students perform a series of simulations that demonstrate ecosystem services.
 - **TechAlive Ecosystems Modules** – Explore one of six interactive, online learning modules featuring various Michigan ecosystems (developed at Michigan Technological University as a part of MEECS). (http://techalive.mtu.edu/meec_index)
- 5 - **Data Analysis.** Examine human population figures from Michigan and the World included in the Lesson 8 *Threats to Michigan Biodiversity* student resource.

Biodiversity

- 6 - **Michigan Eco-Savvy Survey** (on Unit CD-ROM) – A fun survey in which students find out how much they know about biodiversity in their local community.
- 7 - **Citizen Science** – Participate in an online monitoring program, such as the *Classroom FeederWatch Program*, sponsored by Cornell Lab of Ornithology (<http://birds.cornell.edu/cfw/>).
- 8 - **TechAlive Ecosystems Modules** – Explore one of six interactive, online learning modules featuring various Michigan ecosystems (developed at Michigan Technological University as a part of MEECS). (http://techalive.mtu.edu/meec_index).
- 9 - **Food Web Invasion** (on Unit CD-ROM) – Students participate in a simulation illustrating how an introduced species may outcompete natives for available food resources.
 - **Deadly Plant Invaders Game** (on Unit CD-ROM) – Students learn about the impacts that non-native plant species have on native species by attempting to gather adequate minerals, water, and space in an active role-playing game.
 - **Mystery Invaders** (on Unit CD-ROM) – Students sharpen their questioning skills and become more familiar with a variety of aquatic and terrestrial invasive species in Michigan.
 - **The Great Lakes Food Web Drama** (on Unit CD-ROM) – In this read-aloud drama students are introduced to some of the organisms of the Great Lakes and to the five trophic levels they occupy in the food web.
- 10 - **Schoolyard Habitat Program** – Develop a plan to enhance biodiversity on your school ground. Refer to the *Schoolyard Habitat Guide* (U.S. Fish & Wildlife Service) provided on the Unit CD-ROM and/or to the National Wildlife Federation Schoolyard Habitats Program (<http://www.nwf.org/schoolyardhabitats>).

Michigan Curriculum Standards and Benchmarks

Ecosystems

- 1
 - Develop an awareness of and sensitivity to the natural world (SCI.II.1.E.4; SCI.II.1.MS.5).
 - Describe the basic requirements for all living things to maintain their existence (SCI.III.5.E.2).
 - Explain basic ecosystem concepts and processes (SS.II.2.LE.1).
- 2
 - Identify familiar organisms as part of a food chain or food web and describe their feeding relationships within the web (SCI.III.5.E.1).
 - Describe how organisms acquire energy directly or indirectly from sunlight (SCI.III.5.MS.2).
 - Predict the effects of changes in one population in a food web on other populations (SCI.III.5.MS.3).
 - Explain basic ecosystem concepts and processes (SS.II.2.LE.1).
- 3
 - Describe the basic requirements for all living things to maintain their existence (SCI.III.5.E.2).
 - Describe how organisms acquire energy directly or indirectly from sunlight (SCI.III.5.MS.2).
 - Trace the path that rain water follows after it falls (SCI.V.2.E.2).
 - Describe how surface water in Michigan reaches the ocean and returns (SCI.V.2.MS.2).
 - Explain basic ecosystem concepts and processes (SS.II.2.LE.1).
- 4
 - Develop an awareness of and sensitivity to the natural world (SCI.II.1.E.4; SCI.II.1.MS.5).
 - Explain how humans use and benefit from plant and animal material (SCI.III.5.MS.5).
 - Explain the importance of different kinds of ecosystems to people (SS.II.2.MS.3).
- 5
 - Describe the positive and negative effects of humans on the environment (SCI.III.5.E.4).
 - Describe ways in which humans alter the environment (SCI.III.5.MS.6).
 - Explain how humans modify the environment and describe some of the possible consequences of those modifications (SS.II.2.MS.4).
 - Describe the consequences of human/environment interactions in several different types of environments (SS.II.2.MS.5).

Biodiversity

- 6
 - Develop an awareness of and sensitivity to the natural world (SCI.II.1.E.4; SCI.II.1.MS.5).
 - Explain how humans use and benefit from plant and animal material (SCI.III.5.MS.5).
 - Explain the importance of different kinds of ecosystems to people (SS.II.2.MS.3).
- 7
 - Develop an awareness of and sensitivity to the natural world (SCI.II.1.E.4; SCI.II.1.MS.5)
 - Construct an answer to the question posed and support their answer with evidence (SS.V.2.LE.3; SS.V.2.MS.3).
 - Compose a short essay expressing a decision on a local, state, or national policy issue (SS.VI.3.LE.1).
- 8
 - Describe positive and negative impacts of humans on the environment (SCI.III.5.E.4).
 - Describe ways in which humans alter the environment (SCI.III.5.MS.6).
 - Explain how humans modify the environment and describe some of the possible consequences of those modifications (SS.II.2.MS.4).
 - Describe the consequences of human/environment interactions in several different types of environments (SS.II.2.MS.5).
- 9
 - Compare and contrast (K-2) or classify (3-5) familiar organisms on the basis of observable physical characteristics (SCI.III.2.E.2).
 - Describe positive and negative effects of humans on the environment (SCI.III.5.E.4).
 - Predict the effects of changes in one population in a food web on other populations (SCI.III.5.MS.3).
 - Describe ways in which humans alter the environment (SS.III.5.MS.6).
 - Explain how humans modify the environment and describe some of the possible consequences of those modifications (SS.II.2.MS.4).
 - Describe the consequences of human/environment interactions in several different types of environments (SS.II.2.MS.5).
- 10
 - Describe positive and negative effects of humans on the environment (SCI.III.5.E.4).
 - Describe ways in which humans alter the environment (SCI.III.5.MS.6).
 - Explain how humans modify the environment and describe some of the possible consequences of those modifications (SS.II.2.MS.4).
 - Describe the consequences of human/environment interactions in several different types of environments (SS.II.2.MS.5).
 - Interpret social science information about the natural environment and cultures of countries from a variety of primary and secondary sources (SS.V.1.MS.3).

Ecosystems & Biodiversity Master Materials List

Lesson 1. Ecosystems Basics	
<p>Reproducible Materials <i>per class</i></p> <ul style="list-style-type: none"> • <i>What Makes Michigan A Special Place to Live?</i> (teacher resource) • <i>Levels of Interaction</i> (transparency master) <p><i>per small group</i></p> <ul style="list-style-type: none"> • <i>Is That really an Ecosystem?</i> card set (12 cards) 	<p>Materials in MEECS kit <i>per class</i></p> <ul style="list-style-type: none"> • MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions (<i>Observing Schoolyard Ecosystems</i>), PowerPoints (<i>What Makes Michigan A Special Place to Live?</i>), and other resources. (optional) • Set of Michigan Department of Natural Resources (DNR) Non-Game Wildlife Posters – teacher should laminate these before using <ul style="list-style-type: none"> – Coastal Dunes – Wetlands – Michigan Forests – Jack Pine Forest – Rivers • <i>Michigan Landcover</i> map (classroom poster) <p><i>per small group</i></p> <ul style="list-style-type: none"> • <i>Michigan Landcover</i> map, desktop size (optional) <p>To be supplied by teacher <i>per class</i></p> <ul style="list-style-type: none"> • classroom globe (optional) • overhead projector • computer (optional PowerPoint presentation)
Lesson 2. It's All Connected!	
<p>Reproducible Materials <i>per small group</i></p> <ul style="list-style-type: none"> • <i>Who Eats What in Michigan Ecosystems</i> chart (matching the group's poster) • <i>It's All Connected</i> (optional student activity) 	<p>Materials in MEECS kit <i>per class</i></p> <ul style="list-style-type: none"> • MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions (<i>Energy Flow Game, Sandwich Super Sleuth</i>), PowerPoints, and other resources. (optional) <p><i>per small group</i></p> <ul style="list-style-type: none"> • 1 Michigan Department of Natural Resources (MDNR) Non-Game Wildlife Poster (Coastal Dunes, Wetlands, Michigan Forests, Jack Pine Forest, or Rivers) – teacher should laminate these before using <p>To be supplied by teacher <i>per class</i></p> <ul style="list-style-type: none"> • teacher lunch as example <p><i>per small group</i></p> <ul style="list-style-type: none"> • 15 feet of yarn • student scissors • transparent tape • sticky notes (or note cards and tape)

Lesson 3. Nature's Recycling!—Part A

Reproducible Materials

per class

- *Water Cycle* (transparency master)

Materials in MEECS kit

per class

- MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions (*Water Wonders*), PowerPoints, and other resources. (optional)

per small group

- 1 Michigan Department of Natural Resources (MDNR) Non-Game Wildlife Poster (Coastal Dunes, Wetlands, Michigan Forests, Jack Pine Forest, or Rivers) – teacher should laminate these before using

To be supplied by the teacher

per small group

- small amount of water in a cup (1-2 Tb.)
- cold mirror (or classroom window—in cold weather)
- a low power microscope, Discovery scope, or a good hand lens (at least 10X)
- a healthy houseplant (only if staying indoors)
- transparent plastic bag (1-gallon size)
- 10-inch piece of string (or 6-inch twist-ties)
- measuring device for water (e.g., graduated cylinder)

Lesson 3. Nature's Recycling!—Part B

Reproducible materials

per class

- *Photosynthesis and Carbon Cycle* (transparency master)

per small group (or student)

- *Investigating Photosynthesis* (student activity)

Materials in MEECS kit

per class

- MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions, PowerPoints, and other resources. (optional)

To be supplied by the teacher

per small group

- prepared “Photosynthesis Dish” (see Advance Preparation in lesson); materials needed for each: 1 tsp. sugar, a freshly-cut leaf, tape, an 8-oz. clear plastic deli container with lid, and a permanent marker to write on the plastic container
- 2 medium-sized plastic or glass bowls, labeled A and B
- 2 transparent plastic (or glass) cups
- water (cool temperature)
- aquatic plant (such as pondweed or elodea from an aquarium supply shop)

Lesson 3. Nature's Recycling!—Part C

Reproducible materials

per class

- *Nutrient Cycle* (transparency master)

per small group (or student)

- *Investigating Organic Matter in Soil* (student activity)
- *Leaf Litter Critter Data Sheet* (student activity)

Materials in MEECS kit

per class

- MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions, PowerPoints, and other resources. (optional)

To be supplied by the teacher

per class

- plant (e.g., weed from schoolyard) with its roots exposed
- 2 fist-sized rocks (sand stone or other soft rock)
- paper plate

per small group

- 3 identical 4-inch vials or cylindrical tubes (preferably plastic) with lids
- water; vials should be labeled A, B, and C
- 1 tsp. alum (available in grocery stores)
- plastic bags or cups for soil samples (3 per group)
- 3-4 cups of leaf litter/soil from a nearby forest in a sealed container such as a plastic shoebox or a resealable plastic bag
- 8" x 13" tray lined with white paper or aluminum pan
- magnifying glass (preferably 10X)

Lesson 4. Michigan Ecosystems: What Have They Done for YOU Lately?

Reproducible materials

per class

- One set of *Ecosystem Services Charade Cards* cut apart
- *Michigan Ecosystem B-I-N-G-O Clue Sheet* (teacher resource)

per student

- *Ecosystem Benefits* (student activity)
- *Ecosystem Benefits B-I-N-G-O* (student activity)

Materials in MEECS kit

per class

- MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions (*Secret Services*), PowerPoints, and other resources. (optional)
- *Michigan Ecosystems: What Have They Done for You Lately?* unit poster

To be supplied by the teacher

per student

- 16 tokens for bingo (i.e., beans or poker chips)

Lesson 5. Michigan Time Machine

Reproducible materials

per class

- *Michigan Environmental Timeline* (33 cards printed from the PowerPoint file located on the MEECS Ecosystems & Biodiversity CD-ROM)
- *Answers to Sequence Activity* (transparency master)

per small group

- *Sequence Cards* (set of 8 cards)
- *Michigan Time Machine Fact Find* (student activity)

per student

- *Michigan Time Machine: Journey to 1830 Skit* (student resource)
- blank *Compare–Contrast Chart* (optional student activity)

Materials in MEECS kit

per class

- MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions, PowerPoints (*Michigan Environmental Timeline*), and other resources

per small group

- *Michigan Landcover* map

To be supplied by the teacher

per class

- sample newspaper headlines
- overhead projector
- Computer and LCD Projector – if using PowerPoint presentation (optional)

per small group

- paper and art supplies (markers or colored pencils, tape, etc.) for creating headlines

Lesson 6. Michigan's Web of Life

Reproducible materials

per class

- *Michigan Biodiversity* (transparency master)

per student

- *Michigan Biodiversity Blitz* (student activity)

Materials in MEECS kit

per class

- MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions (*Eco Savvy Survey*), PowerPoints (*What Makes Michigan A Special Place to Live?*), and other resources. (optional)
- 1 set of *Forest Ecosystem Picture Cards* (32 cards)
- *Michigan Ecosystems: What Have They Done for You Lately?* unit poster
- *Biodiversity Around the Great Lakes–EPA* CD-ROM (optional)

To be supplied by the teacher

per class

- 1 ball of twine or string

Lesson 7. Biodiversity Study—Option A (Indoors)

Reproducible materials

per class

- *Protecting Michigan's Biodiversity* (transparency master)
- *Summary of Bird Diversity in Michigan Ecosystems* (transparency master)
- *Bird Species Found in Each Ecosystem* (answer key-located on the MEECS Ecosystems & Biodiversity CD-ROM)

Materials in MEECS kit

per class

- MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions, PowerPoints, and other resources. (optional)
- set of 5 Michigan Department of Natural Resources (MDNR) Non-Game Wildlife Posters (Coastal Dunes, Wetlands, Michigan Forests, Jack Pine Forest, and Rivers) – teacher should laminate these before using
- *Michigan Wildlife Habitats* PowerPoint Presentation (optional – on the MEECS Ecosystems & Biodiversity CD-ROM)

per small group

- *Wildlife Habitat Picture Cards* (set of 14 cards)
- *Bird Habitat Cards* (set of 224 cards)

To be supplied by the teacher

per class

- one urban areas poster (Not provided. Refer to Advance Preparation section for instructions.)
- one agricultural land poster (Not provided. Refer to Advance Preparation section for instructions.)
- Computer and LCD Projector (optional – if using PowerPoint presentation)

Lesson 7. Biodiversity Study—Option B (Outdoors)

Reproducible materials

per class

- *Protecting Schoolyard Biodiversity* (transparency master)

per small group

- 2 copies *Rapid Ecological Assessment Data Sheet* (student activity)

Materials in MEECS kit

per class

- MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions, PowerPoints, and Internet resources. (optional)

To be supplied by the teacher

per small group

- clipboard
- thermometer
- magnifying glass
- containers for examining insects and storing leaves (white yogurt and cottage cheese containers work well)
- pencil
- materials to make study area (i.e., 4 tent stakes and 4 meters of string, or hoola hoop)

Lesson 8. Threats and Protections for Michigan Biodiversity

Reproducible materials

per class

- *Michigan Environmental Timeline* cards (printed from the MEECS Ecosystems & Biodiversity CD-ROM, also used in Lesson 5)
- *Major Threats to Michigan's Ecosystems* (teacher resource)
- *Coastal Dunes: Problems and Protections* (teacher resource)

per student (or pair of students)

- *Threats to Michigan Biodiversity* (student resource)
- *Problems and Protections Cards* (1 set of 10 cards)
- *Problems and Protections Table* (student activity)
- *Problems and Protections Concept Map* (optional student activity)

Materials in MEECS kit

per class

- MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions, PowerPoints, and other resources

To be supplied by the teacher

per student (or pair of students)

- scissors

Lesson 9. Most Unwanted: Invaders of the Great Lakes Region

Reproducible materials

per class

- 1 set of *Problem-Solver Role Play Cards* (10 cards)

Materials in MEECS kit

per class

- MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons (*Food Web Invasion*, *Deadly Plant Invaders Game*, *Mystery Invaders*, and *The Great Lakes Foodweb Drama*), extensions, PowerPoints, and other resources. (optional)
- 1 set of *Invasive Species Picture Cards* (30 cards)

To be supplied by the teacher

per class

- 1 ball of twine or string

Lesson 10. Michigan's Threatened Species

Reproducible materials

per class

- *The Decline of the Passenger Pigeon* (teacher resource)

per small group

- *Michigan's 101 Most Threatened Species List* (student resource on MEECS Ecosystems & Biodiversity CD-ROM)
- *Protecting Michigan's Biodiversity* (student resource)
- *Michigan's Threatened Species Poster Assignment* (optional student assessment)

Materials in MEECS kit

per class

- MEECS Ecosystems & Biodiversity CD-ROM: teacher lessons, extensions, PowerPoints, and other resources (including *Endangered Species Teacher's Packet* and *Schoolyard Habitat Guide* publications from the U.S. Fish & Wildlife Service). (optional)

To be supplied by the teacher

per small group

- poster board and art supplies (optional)

Michigan Content Standards and Benchmarks Correlations for Ecosystems & Biodiversity Unit

X - Addresses/Supports

	1 Ecosystem Basics	2 It's All Connected!	3 Nature's Recycling! (Parts A, B, and C)	4 Michigan Ecosystems: What have they done for You lately?	5 Michigan Time Machine	6 Michigan's Web of Life	7 Biodiversity Survey	8 Threats and Protections to Michigan Biodiversity	9 Most Unwanted: Invaders of the Great Lakes Region	10 Michigan's Threatened Species
Science	II.1.E.4 & II.1.MS.5 Develop an awareness of and sensitivity to the natural world	X		X		X	X			
	III.2.E.2 Compare and contrast (K-2) or classify (3-5) familiar organisms on the basis of observable characteristics.								X	
	III.5.E.1 Identify familiar organisms as part of a food chain or food web and describe their feeding relationships within the web.	X	X							
	III.5.E.2 Describe the basic requirements for all living things to maintain their existence.	X		C						
	III.5.E.4 Describe positive and negative effects of humans on the environment.					X		X	X	X
	III.5.MS.2 Describe how organisms acquire energy directly or indirectly from sunlight.		X	B, C						
	III.5.MS.3 Predict the effects of changes in one population in a food web on other populations.		X						X	
	III.5.MS.5 Explain how humans use and benefit from plant and animal material.				X		X			
	III.5.MS.6 Describe the ways in which humans alter the environment.					X		X	X	X
	V.2.E.2 Trace the path that rain water follows after it falls.			A						
Social Studies	V.2.MS.2 Describe how surface water in Michigan reaches the ocean and returns.		A							
	II.2.LE.1 Explain basic ecosystem concepts and processes.	X	A, B, C							
	VI.3.LE.1 Prepare a short essay expressing a decision on a local, state or national policy issue.							X		
	II.2.MS.3 Explain the importance of different kinds of ecosystems to people.				X		X			
	II.2.MS.4 Explain how humans modify the environment and describe some of the possible consequences of those modifications.					X		X	X	X
	II.2.MS.5 Describe the consequences of human/environment interactions in several different types of environments.					X		X	X	X
	V.1.MS.3 Interpret social science information about the natural environment and cultures of countries from a variety of primary and secondary sources									X
	V.2.MS.2 Construct an answer to the question posed and support their answer with evidence							X		