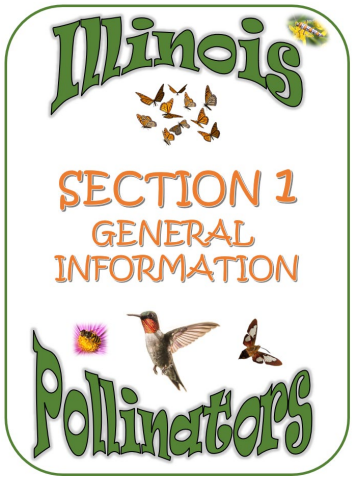
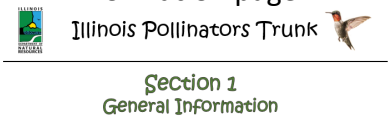
Illinois Pollinators – Binder Contents Checklist Key

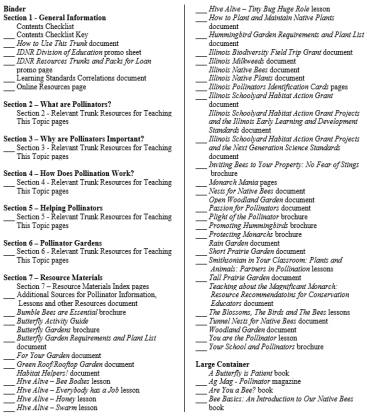
Section 1 General Information cover page



Section 1 General Information page



Contents Checklist



Illinois Pollinators
Illinois Department of Natural Resources
Contents Checklist
Please make a copy of this list before using it.

Binder

Section 1 – General Information
- Contents Checklist
- Contents Checklist Key
- *How to Use This Trunk* document
- *IDNR Division of Education* promo sheet
- *IDNR Resources Trunks and Packs for Loan* promo page
- Learning Standards Correlations document
- Online Resources page

Section 2 – What are Pollinators?
- Section 2 - Relevant Trunk Resources for Teaching This Topic pages

Section 3 – Why are Pollinators Important?
- Section 3 - Relevant Trunk Resources for Teaching This Topic pages

Section 4 – How Does Pollination Work?
- Section 4 - Relevant Trunk Resources for Teaching This Topic pages

Section 5 – Helping Pollinators
- Section 5 - Relevant Trunk Resources for Teaching This Topic pages

Section 6 – Pollinator Gardens
- Section 6 - Relevant Trunk Resources for Teaching This Topic pages

Section 7 – Resource Materials
- Section 7 – Resource Materials Index pages
- Additional Sources for Pollinator Information, Lessons and other Resources document
- *Bumble Bees are Essential* brochure
- *Butterfly Activity Guide*
- *Butterfly Gardens* brochure
- *Butterfly Garden Requirements and Plant List* document
- *For Your Garden* document
- *Green Roof/Rooftop Garden* document
- *Habitat Helpers!* document
- *Hive Alive – Bee Bodies* lesson
- *Hive Alive – Everybody has a Job* lesson
- *Hive Alive – Honey* lesson
- *Hive Alive – Swarm* lesson
- *Hive Alive – Tiny Bug Huge Role* lesson
- *How to Plant and Maintain Native Plants* document
- *Hummingbird Garden Requirements and Plant List* document
- *Illinois Biodiversity Field Trip Grant* document
- *Illinois Milkweeds* document
- *Illinois Native Bees* document
- *Illinois Native Plants* document
- *Illinois Pollinators Identification Cards* pages
- *Illinois Schoolyard Habitat Action Grant* document
- *Illinois Schoolyard Habitat Action Grant Projects and the Illinois Early Learning and Development Standards* document
- *Illinois Schoolyard Habitat Action Grant Projects and the Next Generation Science Standards* document
- *Inviting Bees to Your Property: No Fear of Stings* brochure
- *Monarch Mania* pages
- *Nests for Native Bees* document
- *Open Woodland Garden* document
- *Passion for Pollinators* document
- *Plight of the Pollinator* brochure
- *Promoting Hummingbirds* brochure
- *Protecting Monarchs* brochure
- *Rain Garden* document
- *Short Prairie Garden* document
- *Smithsonian in Your Classroom: Plants and Animals: Partners in Pollination* lessons
- *Tall Prairie Garden* document
- *Teaching about the Magnificent Monarch: Resource Recommendations for Conservation Educators* document
- *The Blossoms, The Birds and The Bees* lessons
- *Tunnel Nests for Native Bees* document
- *Woodland Garden* document
- *You are the Pollinator* lesson
- *Your School and Pollinators* brochure

Large Container
- *A Butterfly is Patient* book
- *Ag Mag – Pollinator* magazine
- *Are You a Bee?* book
- *Bee Basics: An Introduction to Our Native Bees* book

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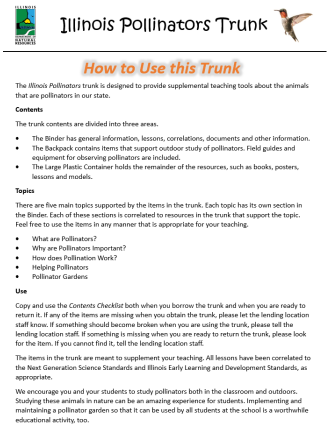
How to Use This Trunk document



Illinois Pollinators Trunk

How to Use this Trunk

The *Illinois Pollinators* trunk is designed to provide supplemental teaching tools about the animals that are pollinators in our state.

Contents

The trunk contents are divided into three areas.

- The Binder has general information, lessons, correlations, documents and other Information.
- The Backpack contains items that support outdoor study of pollinators. Field guides and equipment for observing pollinators are included.
- The Large Plastic Container holds the remainder of the resources, such as books, posters, lessons and models.

Topics

There are five main topics supported by the items in the trunk. Each topic has its own section in the Binder. Each of these sections is correlated to resources in the trunk that support the topic. Feel free to use the items in any manner that is appropriate for your teaching.

- What are Pollinators?
- Why are Pollinators Important?
- How does Pollination Work?
- Helping Pollinators
- Pollinator Gardens

Use

Copy and use the *Contents Checklist* both when you borrow the trunk and when you are ready to return it. If any of the items are missing when you obtain the trunk, please let the lending location staff know. If something should become broken when you are using the trunk, please tell the lending location staff. If something is missing when you are ready to return the trunk, please look for the item. If you cannot find it, tell the lending location staff.

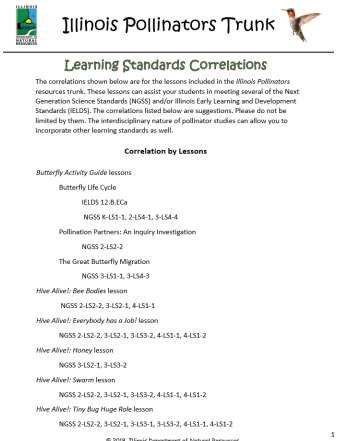
The items in the trunk are meant to supplement your teaching. All lessons have been correlated to the Next Generation Science Standards and Illinois Early Learning and Development Standards, as appropriate.

We encourage you and your students to study pollinators both in the classroom and outdoors. Studying these animals in nature can be an amazing experience for students. Implementing and maintaining a pollinator garden so that it can be used by all students at the school is a worthwhile educational activity, too.

IDNR Division of Education promo sheet

IDNR Resources Trunks and Packs for Loan promo page

Learning Standards Correlations document



Illinois Pollinators Trunk

Learning Standards Correlations

The correlations shown below are for the lessons included in the *Illinois Pollinators* resources trunk. These lessons can assist your students in meeting several of the Next Generation Science Standards (NGSS) and/or Illinois Early Learning and Development Standards (IELDS). The correlations listed below are suggestions. Please do not be limited by them. The interdisciplinary nature of pollinator studies can allow you to incorporate other learning standards as well.

Correlation by Lessons

Butterfly Activity Guide lessons
- Butterfly Life Cycle
  - IELDS 12.B.ECa
  - NGSS K-LS1-1, 2-LS4-1, 3-LS4-4
- Pollination Partners: An Inquiry Investigation
  - NGSS 2-LS2-2
- The Great Butterfly Migration
  - NGSS 3-LS1-1, 3-LS4-3

Hive Alive!: Bee Bodies lesson
- NGSS 2-LS2-2, 3-LS2-1, 4-LS1-1

Hive Alive!: Everybody has a Job! lesson
- NGSS 2-LS2-2, 3-LS2-1, 3-LS3-2, 4-LS1-1, 4-LS1-2

Hive Alive!: Honey lesson
- NGSS 3-LS2-1, 3-LS3-2

Hive Alive!: Swarm lesson
- NGSS 2-LS2-2, 3-LS2-1, 3-LS3-2, 4-LS1-1, 4-LS1-2

Hive Alive!: Tiny Bug Huge Role lesson
- NGSS 2-LS2-2, 3-LS2-1, 3-LS3-1, 3-LS3-2, 4-LS1-1, 4-LS1-2

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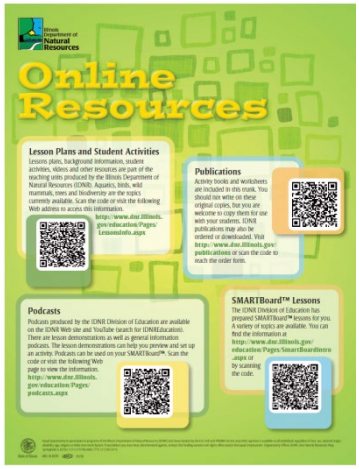
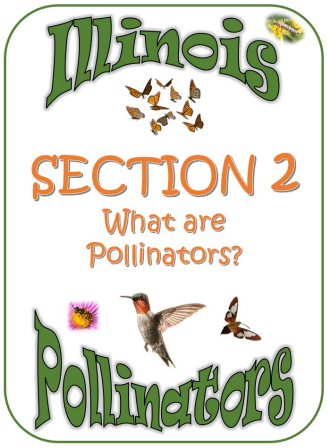
Online Resources page

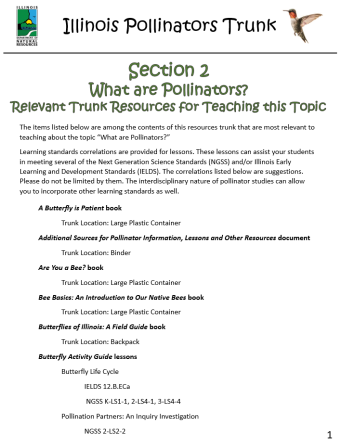


Illinois Pollinators – Binder Contents Checklist Key

Section 2 What Are Pollinators? cover page



Section 2 Relevant Resources page



Illinois Pollinators Trunk

Section 2
What are Pollinators?
Relevant Trunk Resources for Teaching this Topic

The items listed below are among the contents of this resources trunk that are most relevant to teaching about the topic "What are Pollinators?"

Learning standards correlations are provided for lessons. These lessons can assist your students in meeting several of the Next Generation Science Standards (NGSS) and/or Illinois Early Learning and Development Standards (IELDS). The correlations listed below are suggestions. Please do not be limited by them. The interdisciplinary nature of pollinator studies can allow you to incorporate other learning standards as well.

***A Butterfly is Patient* book**
Trunk Location: Large Plastic Container

***Additional Sources for Pollinator Information, Lessons and Other Resources* document**
Trunk Location: Binder

***Are You a Bee?* book**
Trunk Location: Large Plastic Container

***Bee Basics: An Introduction to Our Native Bees* book**
Trunk Location: Large Plastic Container

***Butterflies of Illinois: A Field Guide* book**
Trunk Location: Backpack

***Butterfly Activity Guide* lessons**
Butterfly Life Cycle
IELDS 12.B.ECa
NGSS K-LS1-1, 2-LS4-1, 3-LS4-4
Pollination Partners: An Inquiry Investigation
NGSS 2-LS2-2

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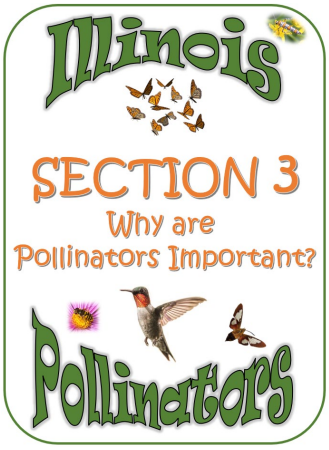
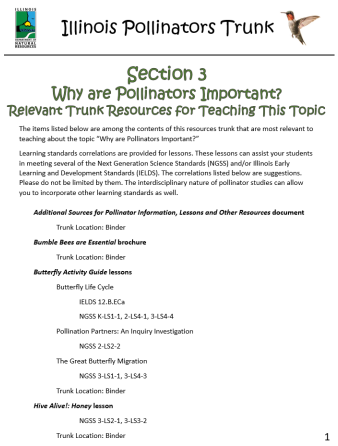
Section 3 Why are Pollinators Important? cover page



Section 3 Relevant Resources page



Illinois Pollinators Trunk

Section 3
Why are Pollinators Important?
Relevant Trunk Resources for Teaching this Topic

The items listed below are among the contents of this resources trunk that are most relevant to teaching about the topic "Why are Pollinators Important?"

Learning standards correlations are provided for lessons. These lessons can assist your students in meeting several of the Next Generation Science Standards (NGSS) and/or Illinois Early Learning and Development Standards (IELDS). The correlations listed below are suggestions. Please do not be limited by them. The interdisciplinary nature of pollinator studies can allow you to incorporate other learning standards as well.

***Additional Sources for Pollinator Information, Lessons and Other Resources* document**
Trunk Location: Binder

***Bumble Bees are Essential* brochure**
Trunk Location: Binder

***Butterfly Activity Guide* lessons**
Butterfly Life Cycle
IELDS 12.B.ECa
NGSS K-LS1-1, 2-LS4-1, 3-LS4-4
Pollination Partners: An Inquiry Investigation
NGSS 2-LS2-2
The Great Butterfly Migration
NGSS 3-LS1-1, 3-LS4-3
Trunk Location: Binder

***Hive Alive!: Honey* lesson**
NGSS 3-LS2-1, 3-LS3-2
Trunk Location: Binder

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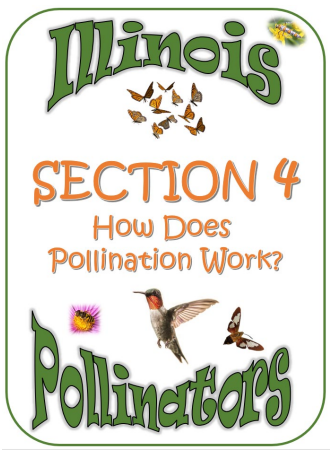
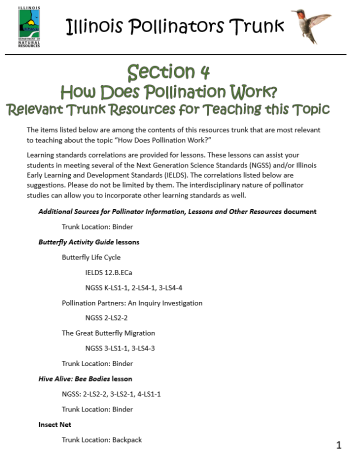
Section 4 How Does Pollination Work? cover page



Section 4 Relevant Resources page



Illinois Pollinators Trunk

Section 4
How Does Pollination Work?
Relevant Trunk Resources for Teaching this Topic

The items listed below are among the contents of this resources trunk that are most relevant to teaching about the topic "How Does Pollination Work?"

Learning standards correlations are provided for lessons. These lessons can assist your students in meeting several of the Next Generation Science Standards (NGSS) and/or Illinois Early Learning and Development Standards (IELDS). The correlations listed below are suggestions. Please do not be limited by them. The interdisciplinary nature of pollinator studies can allow you to incorporate other learning standards as well.

***Additional Sources for Pollinator Information, Lessons and Other Resources* document**
Trunk Location: Binder

***Butterfly Activity Guide* lessons**
Butterfly Life Cycle
IELDS 12.B.ECa
NGSS K-LS1-1, 2-LS4-1, 3-LS4-4
Pollination Partners: An Inquiry Investigation
NGSS 2-LS2-2
The Great Butterfly Migration
NGSS 3-LS1-1, 3-LS4-3
Trunk Location: Binder

***Hive Alive: Bee Bodies* lesson**
NGSS: 2-LS2-2, 3-LS2-1, 4-LS1-1
Trunk Location: Binder

Insect Net
Trunk Location: Backpack

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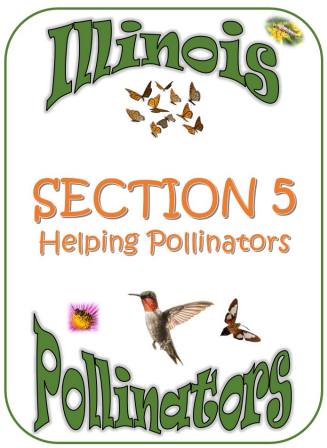
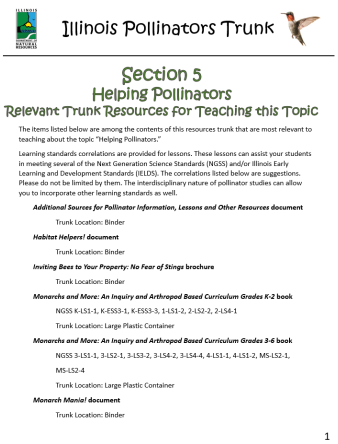
Section 5 Helping Pollinators cover page



Section 5 Relevant Resources page



Illinois Pollinators Trunk

Section 5
Helping Pollinators
Relevant Trunk Resources for Teaching this Topic

The items listed below are among the contents of this resources trunk that are most relevant to teaching about the topic "Helping Pollinators."

Learning standards correlations are provided for lessons. These lessons can assist your students in meeting several of the Next Generation Science Standards (NGSS) and/or Illinois Early Learning and Development Standards (IELDS). The correlations listed below are suggestions. Please do not be limited by them. The interdisciplinary nature of pollinator studies can allow you to incorporate other learning standards as well.

***Additional Sources for Pollinator Information, Lessons and Other Resources* document**
Trunk Location: Binder

***Habitat Helpers!* document**
Trunk Location: Binder

***Inviting Bees to Your Property: No Fear of Stings* brochure**
Trunk Location: Binder

***Monarchs and More: An Inquiry and Arthropod Based Curriculum Grades K-2* book**
NGSS K-LS1-1, K-ESS3-1, K-ESS3-3, 1-LS1-2, 2-LS2-2, 2-LS4-1
Trunk Location: Large Plastic Container

***Monarchs and More: An Inquiry and Arthropod Based Curriculum Grades 3-6* book**
NGSS 3-LS1-1, 3-LS2-1, 3-LS3-2, 3-LS4-2, 3-LS4-4, 4-LS1-1, 4-LS1-2, MS-LS2-1, MS-LS2-4
Trunk Location: Large Plastic Container

***Monarch Mania!* document**
Trunk Location: Binder

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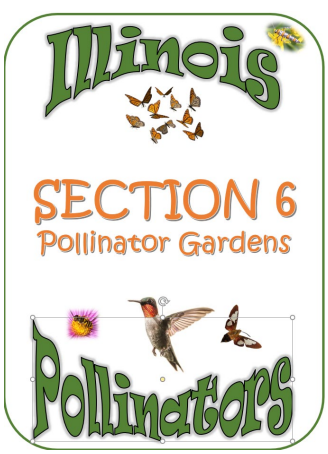
Section 6 Pollinator Gardens cover page



Illinois Pollinators – Binder Contents Checklist Key

Section 6 Relevant Resources page

Illinois Pollinators Trunk

Section 6
Pollinator Gardens
Relevant Trunk Resources for Teaching this Topic

The items listed below are among the contents of this resources trunk that are most relevant to teaching about the topic "Pollinator Gardens."

Learning standards correlations are provided for lessons. These lessons can assist your students in meeting several of the Next Generation Science Standards (NGSS) and/or Illinois Early Learning and Development Standards (IELDS). The correlations listed below are suggestions. Please do not be limited by them. The interdisciplinary nature of pollinator studies can allow you to incorporate other learning standards as well.

***Additional Sources for Pollinator Information, Lessons and Other Resources* document**
Trunk Location: Binder

***Butterfly Garden* brochure**
Trunk Location: Binder

***For Your Garden* document**
Trunk Location: Binder

***Forest Quality Indicators of Illinois* pages**
Trunk Location: Backpack

***Green Roof/Rooftop Garden* document**
Trunk Location: Binder

***How to Plant and Maintain Native Plants* document**
Trunk Location: Binder

***Hummingbird Garden* document**
Trunk Location: Binder

***Illinois Biodiversity Field Trip Grant* document**
Trunk Location: Binder

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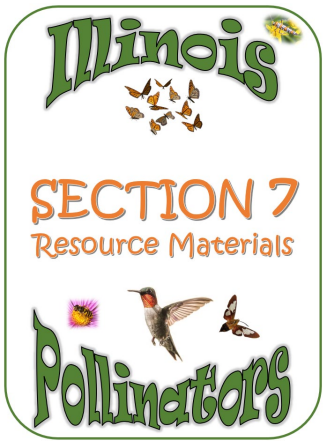
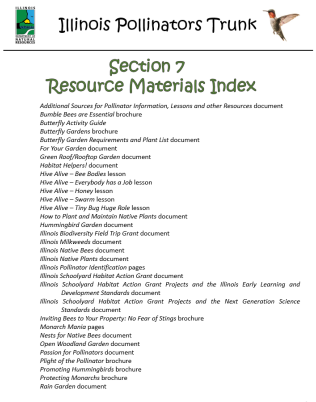
Section 7 Resource Materials cover page



Section 7 Resource Materials Index page



Illinois Pollinators Trunk

Section 7
Resource Materials Index

Additional Sources for Pollinator Information, Lessons and other Resources document
Bumble Bees are Essential brochure
Butterfly Activity Guide
Butterfly Gardens brochure
Butterfly Garden Requirements and Plant List document
For Your Garden document
Green Roof/Rooftop Garden document
Habitat Helpers! document
Hive Alive – Bee Bodies lesson
Hive Alive – Everybody has a Job lesson
Hive Alive – Honey lesson
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Open Woodland Garden document
Passion for Pollinators document
Plight of the Pollinator brochure
Promoting Hummingbirds brochure
Protecting Monarchs brochure
Rain Garden document

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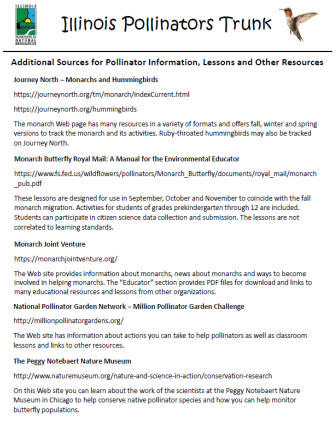
Additional Sources For Pollinator Information document



Illinois Pollinators Trunk

Additional Sources for Pollinator Information, Lessons and Other Resources

Journey North – Monarchs and Hummingbirds

https://journeynorth.org/tm/monarch/indexCurrent.html

https://journeynorth.org/hummingbirds

The monarch Web page has many resources in a variety of formats and offers fall, winter and spring versions to track the monarch and its activities. Ruby-throated hummingbirds may also be tracked on Journey North.

Monarch Butterfly Royal Mail: A Manual for the Environmental Educator

https://www.fs.fed.us/wildflowers/pollinators/Monarch_Butterfly/documents/royal_mail/monarch_pub.pdf

These lessons are designed for use in September, October and November to coincide with the fall monarch migration. Activities for students of grades prekindergarten through 12 are included. Students can participate in citizen science data collection and submission. The lessons are not correlated to learning standards.

Monarch Joint Venture

https://monarchjointventure.org/

The Web site provides information about monarchs, news about monarchs and ways to become involved in helping monarchs. The "Educator" section provides PDF files for download and links to many educational resources and lessons from other organizations.

National Pollinator Garden Network – Million Pollinator Garden Challenge

http://millionpollinatorgardens.org/

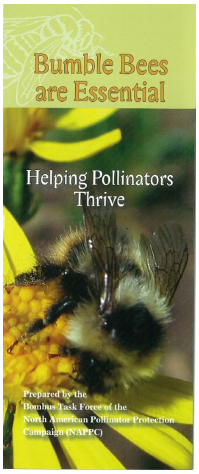
The Web site has information about actions you can take to help pollinators as well as classroom lessons and links to other resources.

The Peggy Notebaert Nature Museum

http://www.naturemuseum.org/nature-and-science-in-action/conservation-research

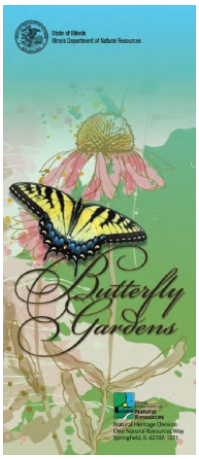
On this Web site you can learn about the work of the scientists at the Peggy Notebaert Nature Museum in Chicago to help conserve native pollinator species and how you can help monitor butterfly populations.

Bumble Bees are Essential brochure



Butterfly Activity Guide

Butterfly Gardens brochure



Butterfly Garden Requirements and Plant List document

Illinois Pollinators Trunk

Butterfly Garden Requirements and Plant List

Requirements

Size: The size of this habitat is variable.

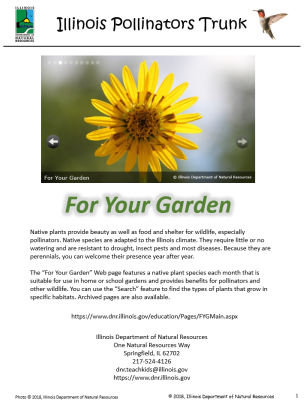
Light: Six or more hours per day of full sun should be provided, although some butterflies will visit certain shade or partial shade plants.

Water: Once established, no additional watering is needed, if native plants are used. Adult butterflies (especially young males) tend to seek low spots filled with mud ("puddling") where they obtain not only moisture, but also minerals. A container of wet sand may also be used. Add sticks or rocks for perching.

Elevation/Topography: A flat or slightly sloped location that is protected from wind and that is suitable for native plant growth is best.

Soil: Loose, well drained loam soil is preferred for this garden, but native butterfly plants will grow in almost any soil and moisture levels.

For You Garden document



Illinois Pollinators Trunk

For Your Garden

Native plants provide beauty as well as food and shelter for wildlife, especially pollinators. Native species are adapted to the Illinois climate. They require little or no watering and are resistant to drought, insect pests and most diseases. Because they are perennials, you can welcome their presence year after year.

The "For Your Garden" Web page features a native plant species each month that is suitable for use in home or school gardens and provides benefits for pollinators and other wildlife. You can use the "Search" feature to find the types of plants that grow in specific habitats. Archived pages are also available.

https://www.dnr.illinois.gov/education/Pages/FYGMain.aspx

Illinois Department of Natural Resources
One Natural Resources Way
Springfield, IL 62702
217-524-4126
dnr.teachkids@illinois.gov
https://www.dnr.illinois.gov

Illinois Pollinators – Binder Contents Checklist Key

Green Roof or Rooftop Garden Requirements and Plant List document


Illinois Pollinators Trunk

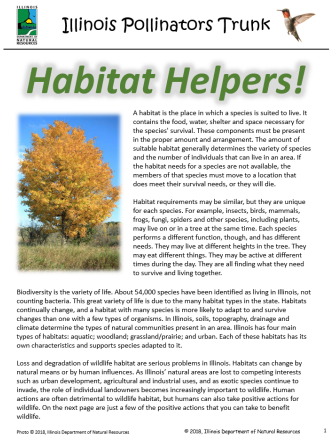
Green Roof or Rooftop Garden Requirements and Plant List

Many commercial landscapers recommend succulents (mostly nonnative *Sedums*), because of the high rate of evaporation/transpiration on a rooftop due to sun and wind. Prairie plants for dry soil may also be used, especially those with shorter root systems. These plants are very well adapted to hot, windy, dry conditions (the prairie in August). On top of City Hall in Chicago (11 stories up) there are 20,000 plants of more than 100 species, including shrubs, vines and even trees!

Benefits

A green roof:
•lowers temperatures in the summer, saving on energy bills.
•reduces smog caused by pollution reacting with heat and sunlight as a result of increased demands made on power companies for more air conditioning.
•insulates in winter, reducing energy costs. It may provide up to 25 percent more insulation than a regular roof and can reduce heat loss due to wind by 50 percent.
•improves air quality by increasing oxygen and reducing carbon dioxide levels.
•improves water runoff by retaining 75 percent of rainwater that falls on it and traps sediments, leaves and particles.
•increases sound absorption.
•creates habitat for butterflies, birds and other wildlife.
•is aesthetically pleasing to surrounding buildings and creates a garden refuge in a sea of concrete.

Habitat Helpers! document


Illinois Pollinators Trunk

Habitat Helpers!

A habitat is the place in which a species is suited to live. It contains the food, water, shelter and space necessary for the species' survival. These components must be present in the proper amount and arrangement. The amount of suitable habitat generally determines the variety of species and the number of individuals that can live in an area. If the habitat needs for a species are not available, the members of that species must move to a location that does meet their survival needs, or they will die.

Habitat requirements may be similar, but they are unique for each species. For example, insects, birds, mammals, frogs, fungi, *spiders* and other species, including plants, may live on or in a tree at the same time. Each species performs a different function, though, and has different needs. They may live at different heights in the tree. They may eat different things. They may be active at different times during the day. They are all finding what they need to survive and living together.

Biodiversity is the variety of life. About 54,000 species have been identified as living in Illinois, not counting bacteria. This great variety of life is due to the many habitat types in the state. Habitats continually change, and a habitat with many species is more likely to adapt to and survive changes than one with a few types of organisms. In Illinois, soils, topography, drainage and climate determine the types of natural communities present in an area. Illinois has four main types of habitats: aquatic; woodland; grassland/prairie; and urban. Each of these habitats has its own characteristics and supports species adapted to it.

Loss and degradation of wildlife habitat are serious problems in Illinois. Habitats can change by natural means or by human influences. As Illinois' natural areas are lost to competing interests such as urban development, agricultural and industrial uses, and as exotic species continue to invade, the role of individual landowners becomes increasingly important to wildlife. Human actions are often detrimental to wildlife habitat, but humans can also take positive actions for wildlife. On the next page are just a few of the positive actions that you can take to benefit wildlife.

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Hive Alive – Bee Bodies lesson


Hive Alive! Experience the Wonder
BEE BODIES
HONEY BEE ANATOMY

Essential Question:
HOW DOES A HONEY BEE'S STRUCTURE SUPPORT ITS FUNCTION IN THE ECOSYSTEM?

LEARNING OBJECTIVES
- Distinguish between the structural and behavioral adaptations of the honey bee.
- Investigate and infer the function of basic adaptations.
- Explain how different organisms use their unique adaptations to meet their needs.

RESOURCES
- Image, *Bee Pollen Baskets*
- Image, *Bee Body*
- Reading, *Bee Bodies*
- Assessment, *Which Bee Body Part?*

MATERIALS
- Chart Paper
- Markers
- Journals, Paper, or Digital Notebooks
- Writing Utensils

OVERVIEW OF LESSON / BACKGROUND

Most people can describe or draw a basic bee: black and yellow stripes, wings, a 3-part body. This lesson will take students beyond the basics by bringing the honey bee's amazing anatomy and structures alive. From the pollen basket to the hairy eyes, bees are creatures that inspire wonder and curiosity.

Although each of the 20,000 species of bees in the world has something in common with the next, this lesson focuses on honey bees: the only insects that produce food for humans. In order to survive, thrive, and perform their work in the world, honey bees have evolved with a fascinating anatomy and specific adaptations. This detailed, up-close look at both the structures and the functions of honey bee anatomy will help students understand the bee's place in the world.

Honey bees have many parts that are easily recognizable: a head, thorax, abdomen, legs, antennae, eyes, wings, etc. They also have a corbiculae (or pollen basket), tiny hairs on their eyes, a proboscis, and hooks (or hamuli) that hold their wings together in flight. Students will learn about and label these parts.

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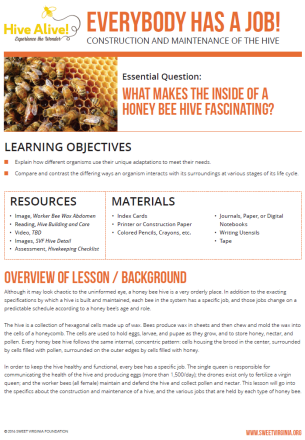
Hive Alive – Everybody Has a Job lesson


Hive Alive! Experience the Wonder
EVERYBODY HAS A JOB!
CONSTRUCTION AND MAINTENANCE OF THE HIVE

Essential Question:
WHAT MAKES THE INSIDE OF A HONEY BEE HIVE FASCINATING?

LEARNING OBJECTIVES
- Explain how different organisms use their unique adaptations to meet their needs.
- Compare and contrast the differing ways an organism interacts with its surroundings at various stages of its life cycle.

RESOURCES
- Image, *Worker Bee Wax Abdomen*
- Reading, *Wax Building and Care*
- Video, *TBD*
- Images, *SVP Hive Detail*
- Assessment, *Hivekeeping Checklist*

MATERIALS
- Index Cards
- Printer or Construction Paper
- Colored Pencils, Crayons, etc.
- Journals, Paper, or Digital Notebooks
- Writing Utensils
- Tape

OVERVIEW OF LESSON / BACKGROUND

Although it may look chaotic to the uninformed eye, a honey bee hive is a very orderly place. In addition to the exacting specifications by which a hive is built and maintained, each bee in the system has a specific job, and those jobs change on a predictable schedule according to a honey bee's age and role.

The hive is a collection of hexagonal cells made up of wax. Bees produce wax in sheets and then chew and mold the wax into the cells of a honeycomb. The cells are used to hold eggs, larvae, and pupae as they grow, and to store honey, nectar, and pollen. Every honey bee hive follows the same internal, concentric pattern: cells housing the brood in the center, surrounded by cells filled with pollen, surrounded on the outer edges by cells filled with honey.

In order to keep the hive healthy and functional, every bee has a specific job. The single queen is responsible for communicating the health of the hive and producing eggs (more than 1,500/day); the drones exist only to fertilize a virgin queen; and the worker bees (all female) maintain and defend the hive and collect pollen and nectar. This lesson will go into the specifics about the construction and maintenance of a hive, and the various jobs that are held by each type of honey bee.

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Hive Alive – Honey lesson


Hive Alive! Experience the Wonder
HONEY
HONEY PRODUCTION

Essential Question:
HOW IS HONEY MADE AND USED?

LEARNING OBJECTIVES
- Describe the process honey bees use to make honey.
- List various ways honey is used in the world.

RESOURCES
- Image Packets, *Honey through History*
- Reading, *Making Honey*
- Assessment, *Recipe for Honey*

MATERIALS
- Whiteboard, Chart Paper, etc.
- Journals, Paper, or Digital Notebooks
- Writing Utensils

OVERVIEW OF LESSON / BACKGROUND

Honey will be familiar to most of your students, but the process by which honey bees make honey from nectar will probably be new. Honey bees collect nectar (and pollen) from flowering plants to store and process into honey. The process is, like most activity in a hive, highly organized and specific. Honey bees process the nectar internally, pass it from bee to bee within the hive, store it in special cells, manipulate its temperature and dehydrate it by fanning it with their wings.

Honey bees are the only bees that produce an excess of honey according to their own nutritional needs. Humans have, for millennia, used honey for their own purposes. Students will have a chance to consider bees and honey in history and the close relationship between bees and humans as a result of this shared history.

Honey has a variety of uses. In addition to the most well-known use as a sweetener, honey is used medicinally around the world. As this lesson concludes, students will be encouraged to consider the role of honey in health and well-being and to think creatively about how it might be used in a variety of scenarios.

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Hive Alive – Swarm lesson


Hive Alive! Experience the Wonder
SWARM
THE SWARM PHENOMENON

Essential Question:
HOW DO HONEY BEES SUPPORT COLONY GROWTH?

LEARNING OBJECTIVES
- Explain how different organisms use their unique adaptations to meet their needs.

RESOURCES
- Anticipation Guide
- Video, *The Swarm*
- Readings, *Preparing to Swarm, Swarming, After the Swarm*
- Video, *Interview with a Beekeeper: Swarm!*
- Assessment, *Trouble with the Swarm Scenarios*
- Journals, Paper, or Digital

MATERIALS
- Notebooks
- Writing Utensils

OVERVIEW OF LESSON / BACKGROUND

The health and growth of the honey bee population is largely dependent on the queens. With only one queen per hive, a huge number of worker bees and smaller number of drones depend on this leader for the survival of the entire community. The queen's main role is laying eggs—up to 2,000 of them in one day. She is also responsible for splitting the community by flying off with a select group of bees, leaving a new queen behind with the hive.

New queen bees are created when eggs are laid in queen cups, different from the cells in which other bees are laid, and worker bees tending the larvae feed them a diet rich in royal jelly. Because multiple queen bees may be cultivated at once, an emerging new queen will attempt to kill her rivals and take over the hive. After a queen completes her work of laying eggs in the queen cups, she then leaves the hive with approximately 60% of the worker bees to start a new hive elsewhere. This is known as a swarm and divides the hive and encourages growth of the population.

Bees also rely on an incredibly complex social system and intense cooperation. The worker bees perform a number of jobs during their lifetimes, changing roles on a particular schedule according to age and sometimes interrupted based on the needs of the community. The drones play a very specific but singular role that allows the queen to continue to fertilize her thousands of eggs over time. This lesson addresses all the bees' roles in the community and drives towards an understanding of the swarm.

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Hive Alive – Tiny Bug Huge Role lesson


Hive Alive! Experience the Wonder
TINY BUG HUGE ROLE
POLLINATION

Essential Question:
HOW DO HONEY BEES COLLECTIVELY AFFECT THEIR COMMUNITY, ECOSYSTEM, AND THE WORLD?

LEARNING OBJECTIVES
- Investigate and infer the function of basic adaptations.
- Describe why certain communities exist in given habitats.

RESOURCES
- Communication Challenge Cards
- Reading, *Honey Bee Dances*
- Video, *Honey Bee Dance*
- Image, *Bee Covered in Pollen*
- Reading, *Pollination*
- Assessment, *Pollination Diagrams*

MATERIALS
- Journals, Paper, or Digital Notebooks
- Writing Utensils

OVERVIEW OF LESSON / BACKGROUND

Honey bees are astoundingly good communicators. They need to coordinate their activities according to very specific needs and time-frames. In order to keep the hive functioning, they must all know whether the queen is healthy, what work needs to be done, and where to find sources of pollen and nectar. One of the ways they communicate critical information is through specialized, message-infused movements, commonly referred to as dances. There are three distinct dances, each with its own message. The waggle dance is performed in the hive, near the entrance/exit, by a bee that has discovered a good source of nectar a certain distance from the hive. The waggle dance has amazing mathematical detail, conveying the distance and direction of the source using precise angles related to the location of the sun.

Honey bees are not just honey producers; collecting nectar and pollen and converting it to sweet nourishment, honey bee activity is required for some types of pollination. Although some pollination occurs naturally—as spores being carried from plant to plant on the wind, much of it occurs from bees accidentally moving pollen from plant to plant as they travel around collecting nectar. Bees are an essential part of the pollination process, significantly contributing to our food supply.

This lesson encourages a review of the food web and provides specific information about the pollination process. Students will learn about the basic structures of flowering plants and the methods by which pollinators play a role in their reproduction. Students will finish this lesson with a better understanding of the role of the honey bee—and the importance of pollination—in the food web we all dip into every day.

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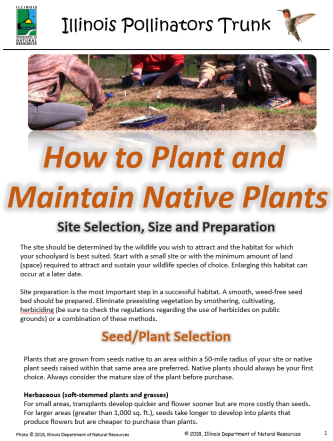
How to Plant and Maintain Native Plants document


Illinois Pollinators Trunk

How to Plant and Maintain Native Plants

Site Selection, Size and Preparation

The site should be determined by the wildlife you wish to attract and the habitat for which your schoolyard is best suited. Start with a small site or with the minimum amount of land (space) required to attract and sustain your wildlife species of choice. Enlarging this habitat can occur at a later date.

Site preparation is the most important step in a successful habitat. A smooth, weed-free seed bed should be prepared. Eliminate preexisting vegetation by smothering, cultivating, herbiciding (be sure to check the regulations regarding the use of herbicides on public grounds) or a combination of these methods.

Seed/Plant Selection

Plants that are grown from seeds native to an area within a 50-mile radius of your site or native plant seeds raised within that same area are preferred. Native plants should always be your first choice. Always consider the mature size of the plant before purchase.

Herbaceous (soft-stemmed plants and grasses)
For small areas, transplants develop quicker and flower sooner but are more costly than seeds. For larger areas (greater than 1,000 sq. ft.), seeds take longer to develop into plants that produce flowers but are cheaper to purchase than plants.

Photo © 2018, Illinois Department of Natural Resources

Hummingbird Garden Requirements and Plant List document


Illinois Pollinators Trunk

Hummingbird Garden Requirements and Plant List

Requirements

Size: The size of a hummingbird garden is variable.

Light: Full sun should be available for six or more hours each day during the growing season.

Water: Once established, native plants require no additional watering.

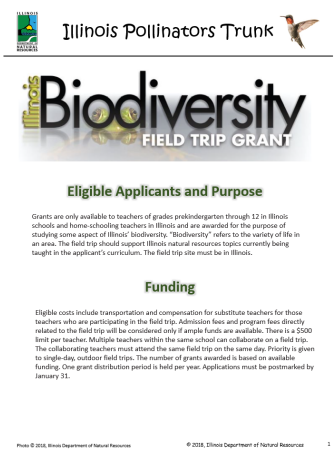
Elevation/Topography: The ground should be flat or slightly sloped. Protection from the wind should be provided, although hummingbirds are strong fliers capable of moving forward, backward, up, down and hovering.

Soil: Loose, well drained loam soil is preferred, although native plants can be selected for most soils and moisture levels.

Photo © 2018, Illinois Department of Natural Resources

Illinois Pollinators – Binder Contents Checklist Key

Illinois Biodiversity Field Trip Grant document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Illinois Biodiversity FIELD TRIP GRANT

Eligible Applicants and Purpose

Grants are only available to teachers of grades prekindergarten through 12 in Illinois schools and home-schooling teachers in Illinois and are awarded for the purpose of studying some aspect of Illinois' biodiversity. "Biodiversity" refers to the variety of life in an area. The field trip should support Illinois natural resources topics currently being taught in the applicant's curriculum. The field trip site must be in Illinois.

Funding

Eligible costs include transportation and compensation for substitute teachers for those teachers who are participating in the field trip. Admission fees and program fees directly related to the field trip will be considered only if ample funds are available. There is a $500 limit per teacher. Multiple teachers within the same school can collaborate on a field trip. The collaborating teachers must attend the same field trip on the same day. Priority is given to single-day, outdoor field trips. The number of grants awarded is based on available funding. One grant distribution period is held per year. Applications must be postmarked by January 31.

Illinois Milkweeds document


Illinois Pollinators Trunk

Illinois Milkweeds

What are milkweeds?

Milkweeds are herbaceous (soft-stemmed), perennial plants.

- They usually have leaves paired or in whorls of four on the stem (exceptions exist).
- Most of them have white, milky sap (exceptions exist).
- Hourglass-shaped flowers are produced in an umbel (central point from which a group of flowers develop) at the stem tip or in the leaf axils in the upper part of the plant.
- Flower color varies by species: white; pink; red; orange; green; red-purple; purple-pink.
- The fruit that develops from the fertilized flower is a pod that contains seeds attached to floss (an exception exists).

How many types of milkweeds grow in Illinois habitats?

Twenty-four species of milkweeds are found in Illinois, but two of them are not native to the state. This number of species was obtained from *Vascular Flora of Illinois: A Field Guide, Fourth Edition* by Robert H. Mohlenbrock.

Illinois Native Bees document


Illinois Pollinators Trunk

Native Bees

What are native bees?

- Native Illinois species are organisms that were present before settlement of the area by people of European descent.
- Bees are insects of the Order Hymenoptera along with wasps, ants and some other relatives.
- The hymenopterans have four, thin wings (if present), two long antennae and mouthparts for chewing.
- Female hymenopterans may have an egg-laying structure that is modified into a sting.
- Their life cycle includes four stages: egg; larva; pupa; and adult. Fertilized eggs produce females. Males develop from unfertilized eggs.
- Bees are different from the other members in the Order Hymenoptera because they have branched hairs (plumose hairs) on some part of their body. Most bees are covered with hairs, but some species have more hairs than others.
- Bumble bees, carpenter bees, plasterer bees, cuckoo bees, mason bees, leafcutter bees, sweat bees and mining bees are types of native bees in Illinois.

Illinois Native Plants document


Illinois Pollinators Trunk

Native Plants

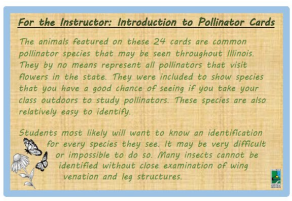
Why do we need native plants?

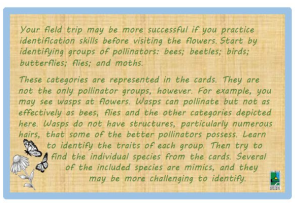
Native plants developed with their native pollinators. Their blooming time coordinates with the activity time of their pollinators. Their shape is developed for their specific pollinators, too. This cooperative effort ensures the success of both groups of organisms, as long as both groups of organisms are available and available at the right time of year. Native plants provide food and shelter for pollinators and are important to more than one part of the pollinator's life cycle.

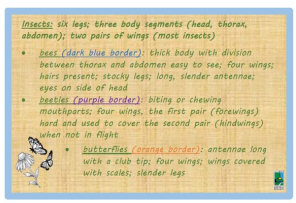
Nonnative plants and those plants that have been bred for traits important to humans (flower color, length of blooming period, size of flower, etc.), often do not provide much or any pollen and nectar for native pollinators. You can have a yard full of blooming plants that will provide little food and nectar for any pollinators. These types of plants may also only provide one feature needed for a pollinator's life cycle. For example, butterfly bush (*Buddleja davidii*) is often planted in home landscaping. This species is native to Asia. It will attract pollinators, but it does not provide support for their entire life cycle. Some nonnative plants are invasive, spreading and taking away habitat from native species.

Adding native plants to your landscape can be done simply. Plant them between other plants in your garden. Plant them along a fence or next to a garage. You can also use them in container and raised-bed gardens. A small native butterfly or pollinator garden can be added to many home landscapes with little expense. Even small patches of native plants can provide big benefits for pollinators.

Illinois Pollinators Identification Cards pages







Illinois Schoolyard Habitat Action Grant document


Illinois Pollinators Trunk

Illinois Schoolyard Habitat ACTION GRANT PROGRAM

Eligible Applicants

Teachers, nature center personnel and adults who are youth group leaders (grades prekindergarten through 12) in Illinois may apply.

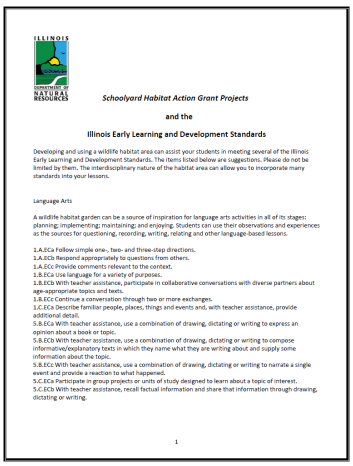
Purpose and Eligible Projects

Projects must emphasize student/youth involvement with planning, development and maintenance and increase the educational and wildlife habitat values of the site. The applicant must be prepared to maintain the project for at least five years. The project must be implemented on school grounds or another public place (for example, a park or nature center/forest preserve district land). Plans that include vegetation should use native species. Habitat projects may include, but not be limited to, the following activities: enhance or establish and maintain a schoolyard prairie plot, butterfly garden, rain garden, wetland, native tree arboretum, nesting platform or watering station; design and build a bird feeder or feeding station; or construct and install bat roosting boxes.

Project Time Line

The project must be completed before November 30 of the calendar year in which the grant is awarded. More information will be provided to grant award winners.

Illinois Schoolyard Habitat Action Grant IELDS document


Schoolyard Habitat Action Grant Projects

and the

Illinois Early Learning and Development Standards

Developing and using a wildlife habitat area can assist your students in meeting several of the Illinois Early Learning and Development Standards. The items listed below are suggestions. Please do not be limited by them. The interdisciplinary nature of the habitat area can allow you to incorporate many standards into your lessons.

Language Arts

A wildlife habitat garden can be a source of inspiration for language arts activities in all of its stages: planning; implementing; maintaining; and enjoying. Students can use their observations and experiences as the sources for questioning, recording, writing, relating and other language-based lessons.

1.A.ECa Follow simple one-, two- and three-step directions.
1.A.ECb Respond appropriately to questions from others.
1.A.ECc Provide comments relevant to the context.
1.B.ECa Use language for a variety of purposes.
1.B.ECb With teacher assistance, participate in collaborative conversations with diverse partners about age-appropriate topics and texts.
1.B.ECc Continue a conversation through two or more exchanges.
1.C.ECa Describe familiar people, places, things and events and, with teacher assistance, provide additional detail.
5.B.ECa With teacher assistance, use a combination of drawing, dictating or writing to express an opinion about a book or topic.
5.B.ECb With teacher assistance, use a combination of drawing, dictating or writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
5.B.ECc With teacher assistance, use a combination of drawing, dictating or writing to narrate a single event and provide a reaction to what happened.
5.C.ECa Participate in group projects or units of study designed to learn about a topic of interest.
5.C.ECb With teacher assistance, recall factual information and share that information through drawing, dictating or writing.

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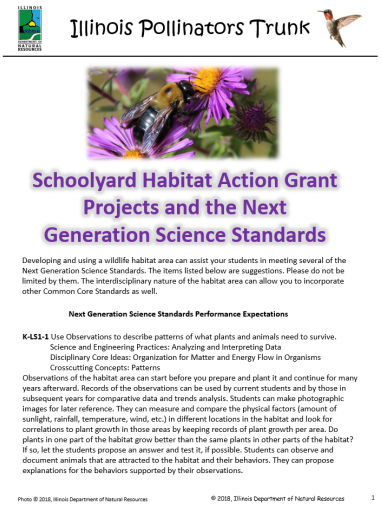
Illinois Schoolyard Habitat Action Grant NGSS document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Schoolyard Habitat Action Grant Projects and the Next Generation Science Standards

Developing and using a wildlife habitat area can assist your students in meeting several of the Next Generation Science Standards. The items listed below are suggestions. Please do not be limited by them. The interdisciplinary nature of the habitat area can allow you to incorporate other Common Core Standards as well.

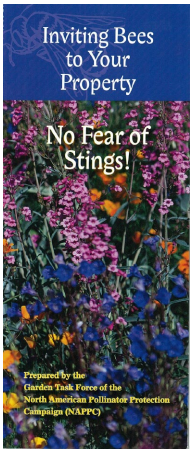
Next Generation Science Standards Performance Expectations

K-LS1-1 Use Observations to describe patterns of what plants and animals need to survive.
Science and Engineering Practices: Analyzing and Interpreting Data
Disciplinary Core Ideas: Organization for Matter and Energy Flow in Organisms
Crosscutting Concepts: Patterns

Observations of the habitat area can start before you prepare and plant it and continue for many years afterward. Records of the observations can be used by current students and by those in subsequent years for comparative data and trends analysis. Students can make photographic images for later reference. They can measure and compare the physical factors (amount of sunlight, rainfall, temperature, wind, etc.) in different locations in the habitat and look for correlations to plant growth in those areas by keeping records of plant growth per area. Do plants in one part of the habitat grow better than the same plants in other parts of the habitat? If so, let the students propose an answer and test it, if possible. Students can observe and document animals that are attracted to the habitat and their behaviors. They can propose explanations for the behaviors supported by their observations.

Illinois Pollinators – Binder Contents Checklist Key

Inviting Bees to Your Property: No Fear of Stings brochure



Monarch Mania!! pages


Illinois Pollinators Trunk

Monarch Mania!

Illinois Department of Natural Resources

Visit the Web page this text was taken from to view the video podcast associated with each section. https://www.dnr.illinois.gov/education/Pages/monarchgen.aspx

- Life Cycle
  - Monarchs and Milkweeds
- Monarch Facts
  - An International Migrant
- Monarchs at Risk
  - Helping Monarchs
- Schools and Monarchs
  - Invasive Species and Monarchs
- Value of Monarchs and Other Pollinators

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Nests for Native Bees document


Invertebrate Conservation Fact Sheet

Nests for Native Bees

Pollinators are a vital part of a healthy environment.

Native bees are North America's most important group of pollinators.

Nest sites are simple to make, and can be added to any area of greenspace, large or small.

A selection of home-made bee nests: (clockwise from left) wooden block, bamboo bundle, and bumble bee box.

Pollinators are a diverse and fascinating group of animals. In addition to their beauty, pollinators provide an important link in our environment by moving pollen between flowers and ensuring the growth of seeds and fruits. The work of pollinators touches our lives every day through the food we eat. Even our seasons are marked by their work: the bloom of springtime meadows, summer berry picking, pumpkins in the fall.

There are 4,000 species of native bees in North America. Together they form the most important group of pollinators. Like all wildlife they are affected by changes in our landscapes, especially the loss of nesting sites. Bees make nests in which they create and provision brood cells for their offspring. In many modern landscapes, a desire for neatness has usually resulted in the removal of bare ground, dead trees, and untidy corners of rough grass—all important nesting sites for bees.

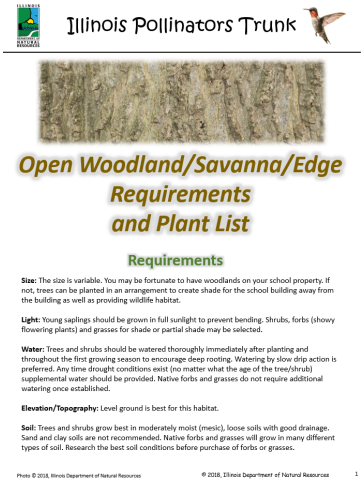
This fact sheet gives information on how to provide nest sites for native bees, including nest blocks and bare ground for solitary-nesting bees, and nesting boxes for bumble bees.

For more information, visit our web site, www.xerces.org, where you will find other fact sheets and more detailed guidelines on how to enhance habitat for pollinators. You'll also find information about *Attracting Native Pollinators: Protecting North America's Bees and Butterflies.*

Written by Matthew Shepherd

The Xerces Society for Invertebrate Conservation
(855) 232-6639
www.xerces.org

Open Woodland/Savanna/Edge Requirements and Plant List document


Illinois Pollinators Trunk

Open Woodland/Savanna/Edge Requirements and Plant List

Requirements

Size: The size is variable. You may be fortunate to have woodlands on your school property. If not, trees can be planted in an arrangement to create shade for the school building away from the building as well as providing wildlife habitat.

Light: Young saplings should be grown in full sunlight to prevent bending. Shrubs, forbs (showy flowering plants) and grasses for shade or partial shade may be selected.

Water: Trees and shrubs should be watered thoroughly immediately after planting and throughout the first growing season to encourage deep rooting. Watering by slow drip action is preferred. Any time drought conditions exist (no matter what the age of the tree/shrub) supplemental water should be provided. Native forbs and grasses do not require additional watering once established.

Elevation/Topography: Level ground is best for this habitat.

Soil: Trees and shrubs grow best in moderately moist (mesic), loose soils with good drainage. Sand and clay soils are not recommended. Native forbs and grasses will grow in many different types of soil. Research the best soil conditions before purchase of forbs or grasses.

Photo © 2018, Illinois Department of Natural Resources

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Passion for Pollinators document


Illinois Pollinators Trunk

Passion for Pollinators

Pollinators

Pollen is a powdery substance formed by seed-producing plants. Cone-bearing and flowering plants produce seeds. Pollen is produced by the male cone (cone-bearing plants) or by the anthers (flowering plants). Pollen contains a non-reproductive cell or cells as well as a reproductive cell that will become two sperm cells.

Pollination is the process of transferring the plant's male reproductive cells (pollen) to the plant's female reproductive structures (stigma and style) so that sperm and egg can meet resulting in a new plant. The female structures are located in a different place than the male structures.

Pollinators are animals that transfer pollen to fertilize plants. Many insects and some bats are pollinators. Hummingbirds, some monkeys, some rodents and other animals are pollinators, too. Humans can be pollinators as well! Not all plants need pollinators, but about 85 percent of them do. These plants would not be able to produce seeds without pollinators. In Illinois, the ruby-throated hummingbird (*Archilochus colubris*) and some butterflies, moths, bees, flies and beetles are pollinators.

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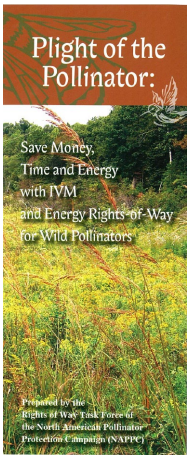
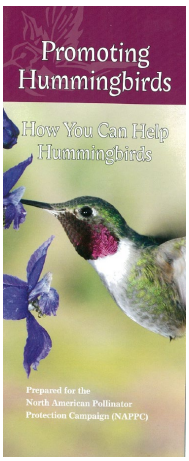
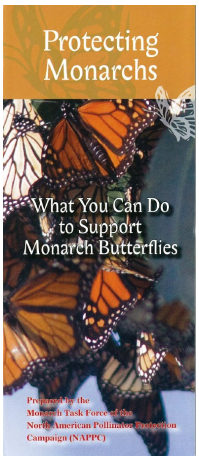
Plight of the Pollinator brochure



Promoting Hummingbirds brochure



Protecting Monarchs brochure



Rain Garden Requirements and Plant List document


Illinois Pollinators Trunk

Rain Garden Requirements and Plant List

Benefits

- Keeps rainwater and melted snow on site, so as not to overload storm sewers and cause flooding.
- Allows streams and creeks to be fed by cool groundwater at a constant rate.
- Provides a way to use and optimize rainfall, reducing or avoiding the need for irrigation.
- Because water is held for a short amount of time, mosquito breeding does not take place.
- Filters some pollutants caused by runoff from paved areas, roads and roofs.
- Encourages wildlife and biodiversity.
- Recharges groundwater, reducing the need for costly stormwater treatment structures.

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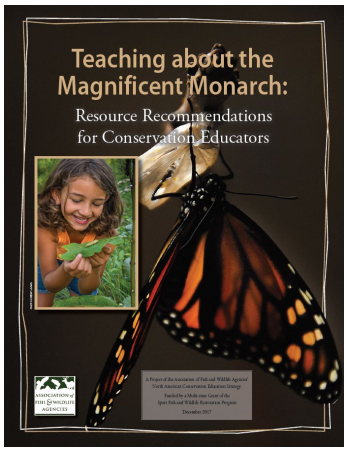
Illinois Pollinators – Binder Contents Checklist Key

Short Prairie Requirements and Plant List document

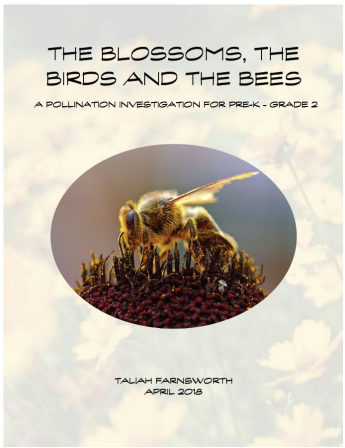
Smithsonian in Your Classroom lessons

Tall Prairie Requirements and Plant List document

Teaching about the Magnificent Monarch document

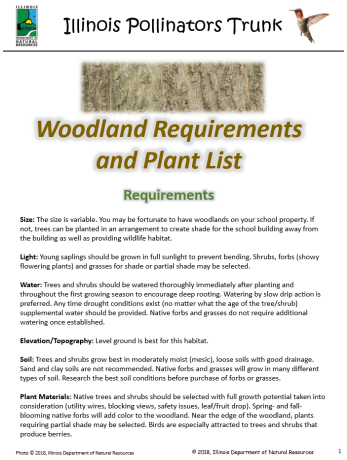


The Blossom, The Birds and The Bees lessons

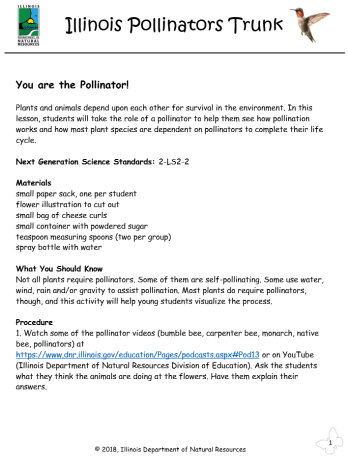


Tunnel Nests for Native Bees document

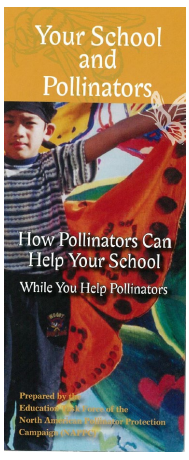
Woodland Requirements and Plant List document



You are the Pollinator! Lesson

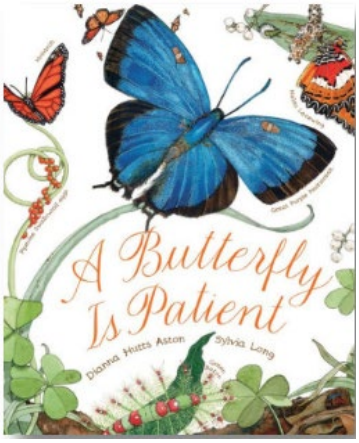


Your School and Pollinators brochure

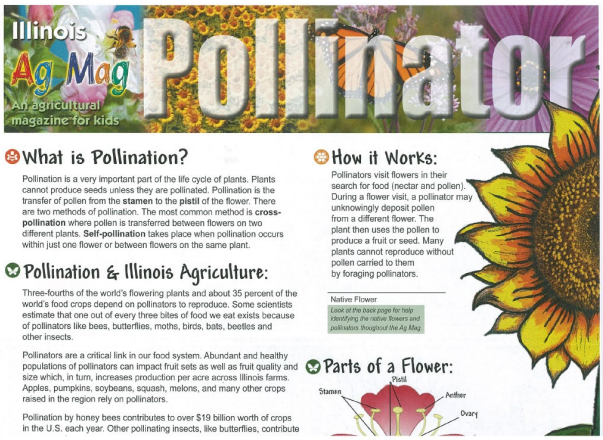


Illinois Pollinators– Large Container Contents Checklist Key

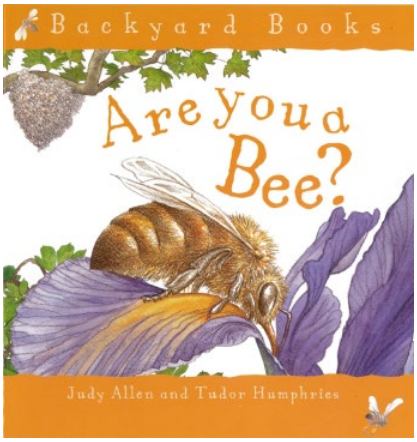
A Butterfly is Patient? book



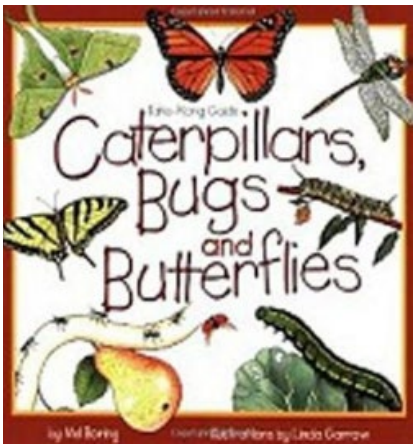
Ag Mag – Pollinator magazine



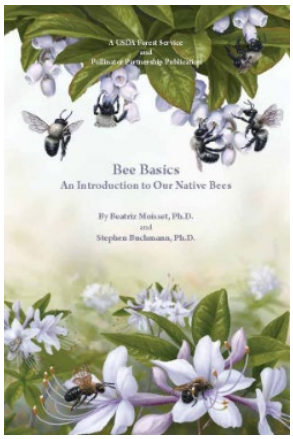
Are you a Bee? book



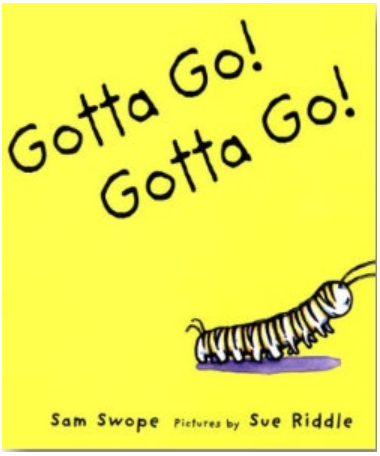
Caterpillars, Bugs and Butterflies Take-Along Guide book



Bee Basics: An Introduction to Our Native Bees book



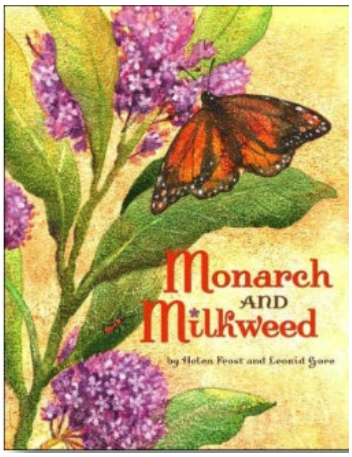
Gotta go! Gotta Go! book



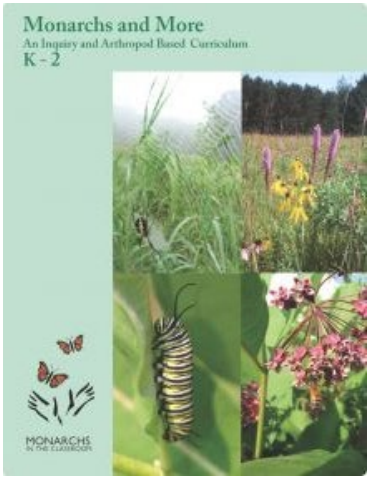
Honey Bee Life Cycle Stages model

Illinois Pollinators– Large Container Contents Checklist Key

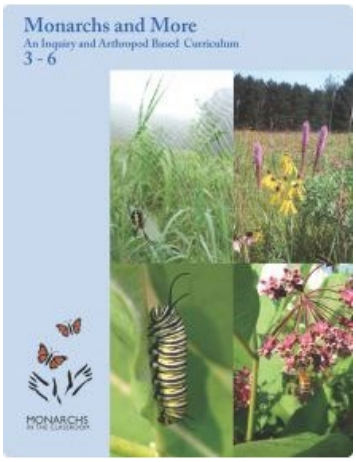
Monarch and Milkweed book



Monarchs and More K-2 book



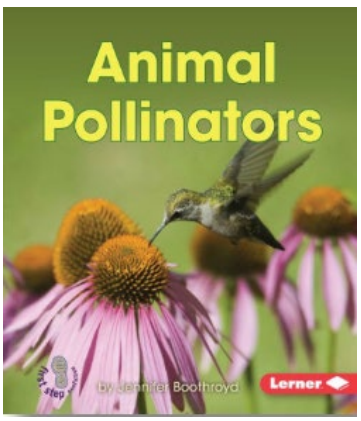
Monarchs and More 3-6 book



Monarch Life Cycle Stages model

Nature Circles NGSS Grade 2

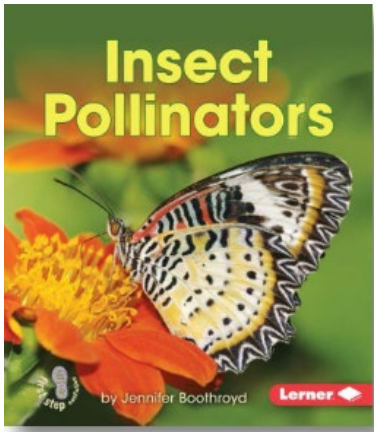
Pollination Book – ***Animal Pollinators***



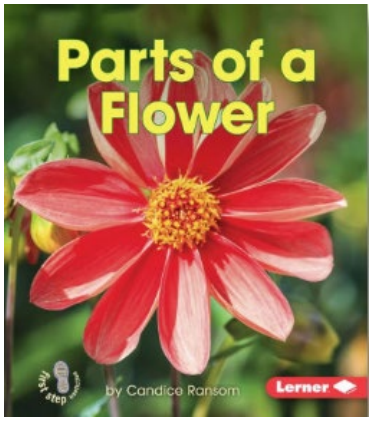
Pollination Book – ***Cross-Pollination***

Illinois Pollinators– Large Container Contents Checklist Key

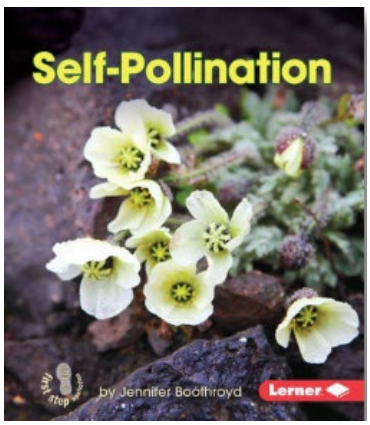
Pollination Book – ***Insect Pollinators***



Pollination Book – ***Parts of a Flower***



Pollination Book – ***Self-Pollination***



The Honey Makers book

Illinois Pollinators– Backpack Contents Checklist Key

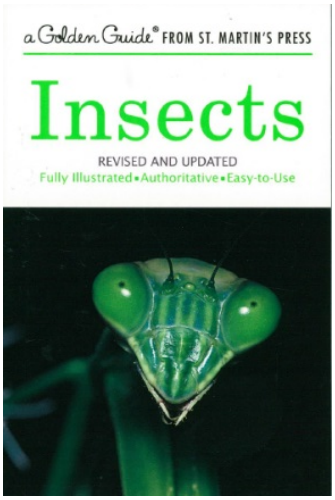
Bees and Other Pollinators folding pocket guide

Butterflies of Illinois: A Field Guide book

Forest Quality Indicators of Illinois pages

Illinois Pollinators– Backpack Contents Checklist Key

Golden Guide to Insects book



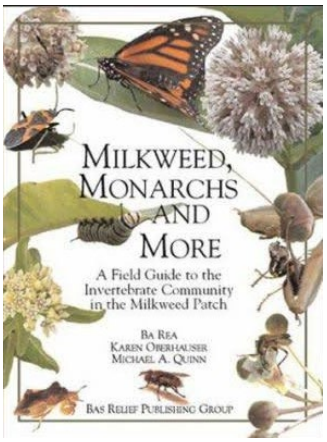
Illinois Pollinators Identification Cards

Insect Net

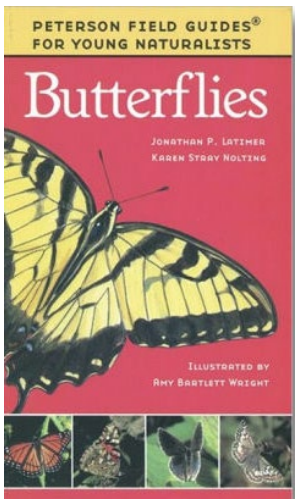
Magnifying Lens

Magnifying Observation Container

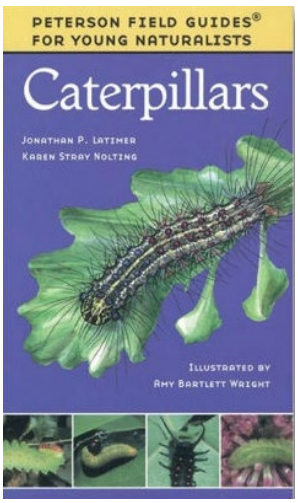
Milkweed, Monarchs and More book



Peterson Field Guides for Young Naturalists Butterflies book



Peterson Field Guides for Young Naturalists Caterpillars book

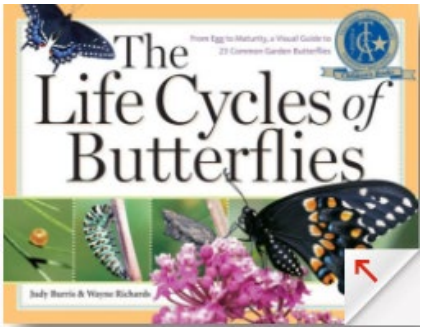


Port-a-bug

Illinois Pollinators– Backpack Contents Checklist Key

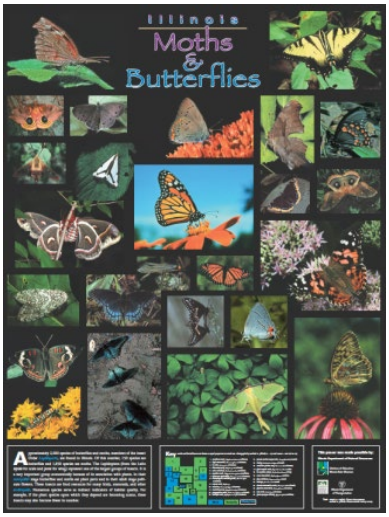
Prairie Quality Indicators of Illinois pages

The Life Cycles of Butterflies book



Illinois Pollinators– Poster Tube Checklist Key

Illinois Moths and Butterflies poster



Illinois Native Bees poster

Monarch Life Cycle poster

Pollinators and Seeds poster