Grade Level:
4th Grade

Time:
90 Minutes

Season:
Fall

Objectives:
Students will be better able to...

- Suggest, investigate, and answer questions about prairie insects
- Distinguish between insects and other invertebrates
- Name two types of insect Orders (such as beetles and flies)
- Label the basic parts of an insect (head, thorax, abdomen, 6 legs, 2 antennae, wings, compound eyes)
- Provide one reason why insects are important
- Enjoy searching for and examining prairie insects

Prairie Wetlands Learning Center

Prairie Insects

4th Grade Ecology Series

Summary

During an investigation, students examine land insects in the prairie. They generate questions, collect and closely observe prairie insects, and record data about them. They also classify their collected insects and discover their importance in the prairie.

Background

The purpose of this lesson is to provide students the opportunity to observe, collect, classify, and identify prairie insects through a scientific investigation. The KWHL chart and method often used in reading is applied to science, providing structure to their investigation. The specifics of their investigation are driven by the questions they generate and by the thinking they use for determining their protocol in the field. Putting prairie insects in the hands of students creates an authentic learning opportunity, a chance to apply what they have learned in the school classroom about insects and other invertebrates or about classification. In addition, through their first-hand experience in the prairie, students witness the ecological role of prairie insects. Insects are of immense ecological value in terms of biodiversity, the food chain, decomposition, pollination, and soil modification.

Insects are important because of the **biological diversity** they provide to the prairie. Several thousand insect species may be found in a single Minnesota prairie community. In North America, hundreds of grasshopper species inhabit the prairie. Minnesota is home to more than 130 grasshopper species. In any single "Gopher State" prairie, 50 or more grasshopper species may be found. Insects are the largest group of grassland plant eaters in numbers and likely mass.

Prairie insects are also important because they play an enormous role in the prairie **food chain**. Insects are meals for other small and medium

Minnesota Academic Standards

Subjects Covered: Science, Language Arts

Helps support eight standards and eight benchmarks. See sections "2019 Minnesota Academic Standards in Science: and "2010 Minnesota Academic Standards in Language Arts"

Materials:

- ❑ Insect nets
- ❑ hand lenses
- ❑ collecting containers
- ❑ insect order identification sheets

Skills Used:

Investigating, observing, collecting, counting, grouping, matching, classifying, reading, writing, organizing, listening, following directions, teamwork, exploring, questioning, collecting data, analyzing data, forming conclusions, critical thinking, identifying, sketching, examining, discovering, choosing, reading, reflecting, compare and contrast

Background, *continued*

-sized meat eaters like beetles, ants, spiders, songbirds, American kestrels and other small raptors, and some rodents like the 13-lined ground squirrel. On the flip side, their specialized mouthparts allow them to consume plant life in various ways. For example,

- Aphids and true bugs pierce plants and suck out the juices for a liquid meal.
- Thrips scrape holes in plants to access the liquids inside.
- Bees lap nectar, flies sponge it up, and butterflies and moths sip it through their hollow, siphon tongue.
- The worker caste of harvester ants chew on seeds, leaves, and stems with their powerful jaws. Sawflies, beetles, grasshoppers, and caterpillars feed in a similar fashion.

Many species of prairie bees lay eggs in individual underground nests, placing eggs on small pellets of pollen which is later consumed as these bees develop and grow. Insects, especially grasshoppers and crickets, shape the prairie landscape with their pruning action, creating patchy open areas within it, allowing certain pioneer plant species or those more dependent upon disturbance and daylight to become established. Through their eating behaviors via the food chain, grasshoppers change the prairie landscape and contribute to the diversity of plants found here.

Prairie insects keep nutrients cycling in the system through the food chain and through **decomposition**. Blowflies, ants, carrion beetles, scarab beetles, yellow jackets, and many other species visit freshly dead carcasses to scavenge a meal. Dung beetles consume animal waste, manure which they tear off and roll into a ball then bury underground to eat or lay eggs on. Hatching eggs make a first meal of the manure. A dung beetle can devour its own weight in dung juices in a day. Insect decomposers facilitate efficient and continued movement of nutrients through the prairie.

Although they are tiny animals, prairie insects also modify and **improve soil**. The infinite tunneling action of ants alone, for instance, loosens and mixes prairie soil, bringing nutrients from below the root zone to the top where plants can use them. Dead and dying birds and insects hauled underground by burying beetles contribute nutrients and organic matter to soil. Holes created by female grasshoppers laying eggs invite water to more easily infiltrate the surface. Perhaps surprisingly, these inconspicuous habits play a major role in soil modification.

Most prairie flowers cannot self-**pollinate**. While grasses rely on the wind to distribute their pollen, most flowers rely on insects to cross-pollinate and produce seed and the next generation of forbs. Lured by a meal of nectar or pollen or other insects, beetles, beeflies, butterflies, moths, wasps, and bees inadvertently carry pollen from one flower to another in their search for food. While many pollinators are generalists and visit a variety of plants, some are specialists. Bees are likely the most important prairie pollinators. Some bees are only found in native prairie as opposed to grasslands in general. Some may be found solely in upland native prairies, sand prairies, or bottomlands.

Background, *continued*

In a different bee example, some bee species match up to certain flower species based on proboscis length matching to the corresponding flower tube length of wild bergamot (long tube), purple coneflower (mid-length), or Culver's root (short). In yet a third bee example, bee species active at different times of the growing season visit certain groups of plants blooming during those same times. Prairie plants and insects depend upon each other for survival. Each team of flowers and insects meets each other's needs and keeps the prairie buzzing and propagating.

According to J. Reese Voshell, Jr., author of *A Guide to Freshwater Invertebrates of North America*, more than 1 million species of animals inhabit the world. Ninety-five percent of them are invertebrates. Of these invertebrates, about 900,000 insect species have been discovered and described by science. Yet scientists estimate there are an equal number of insects that have not yet been discovered. Discovering and studying organisms requires **classifying** them: organizing them into groups of similar organisms. Fourth graders visiting the prairie in fall have the opportunity to collect and classify insects.

The main hierarchical categories for organizing living things are: kingdom, phylum, class, subclass, order, family, genus, and species. They are arranged in a nested series from the broadest categories (kingdom) to the most specific (species). A species is defined as organisms that are similar in structure and can successfully produce fertile offspring. As an illustration, here is how the housefly is classified:

Kingdom Animalia (animals)
Phylum Arthropoda (arthropods)
Class Hexapoda (hexapods)
Order Diptera (true flies)
Family Muscidae (muscid flies)
Genus *Musca*
Species *domestica*

The biology of organisms becomes more uniform the closer to the species level as well as the more challenging to accurately identify. This lesson emphasizes classification of insects to the order level (highlighted in yellow above), a fair compromise between biological uniformity and identification difficulty. All 26 insect Orders are represented on the prairie.

The eight most common insect Orders students collect at the Prairie Wetlands Learning Center are:

Prairie Wetlands Learning Center

Background, *continued*

Order Name	Insect Groups
Odonata	Dragonflies and damselflies
Orthoptera	Grasshoppers, crickets, mantids
Hemiptera	True bugs such as stink bugs, milkweed bugs, box elder bugs
Homoptera	Leafhoppers, treehoppers, aphids, scale insects
Coleoptera	Beetles such as fireflies, ladybird beetles, and weevils
Lepidoptera	Butterflies and moths
Diptera	True flies such as the deer fly, house fly, and blow fly
Hymenoptera	Bees, wasps, ants, ichneumons

According to the *Encyclopedia of Insects*, as a group of insects, beetles have the largest number of known species. The Order Coleoptera contains more described species than in any other Order in the animal kingdom, comprising about 25% of all known life-forms. Forty percent of all described insect species are beetles (about 350,000 species). New beetle species are often discovered.

Classification of insects in the field allows students to become more familiar with the prairie. It helps them become more comfortable with our prairie home as an intricate ecosystem and appreciate its diversity, beauty, and ecological integrity.

Teacher Preparation

To maximize outdoor classroom time at the Prairie Wetlands Learning Center, you may:

- Organize your students into small groups at school, each small group led by an adult chaperon, everyone wearing nametags.
- Teach the introductory steps in the "Field Investigation Procedure" at school. Upon arrival at the Prairie Wetlands Learning Center, you may provide Prairie Wetlands Learning Center staff with a written list of what students know and wonder for quick review before heading out into the prairie.
- With your students, practice thinking of appropriate questions that can be investigated outdoors. For example, which of these two questions can they best answer today by going outdoors? *How many insects are there in the world?* Or *How many kinds of insects are in our school yard right now?* Being as specific as possible helps make the questions more realistic. Appropriate questions are key to developing an effective investigation and help develop critical thinking skills.
- Lead one or more of the suggested extensions before your visit in order to integrate this field investigation into the classroom study of animals, insects, invertebrates, insects, classification, life cycles, adaptations, prairie, or other topics. See section, "Ideas for Teacher-Led Extensions and Assessments." We believe such integration enhances student motivation for learning in other curricular areas.
- Help save paper. Bring your students' science notebooks or journals to record their investigation questions, field data, results, and conclusions.

Prairie Wetlands Learning Center Staff Prep

Organize field materials and select appropriate prairie sites for insect collection.

Field Investigation Procedure

Introduce the Topic

1. Welcome students, teachers, and chaperons to the Prairie Wetlands Learning Center. Review basic rules for the trail.
2. Organize students into small groups, each led by a chaperon, and inform chaperons of their role in following through on instructions for students.
3. Next, prepare to go out in the field and collect prairie insects. Ask students to open their science notebooks.
4. To begin the investigation, start a KWHL chart and ask students what they know about prairie insects. Record their responses on the white board or poster paper. Give them plenty of time to think and respond, guiding where needed, but not answering for them. (At this point, and from their perspective, there is no right or wrong answers in asking them what they know. Even if the information they give is incorrect, resist the temptation to correct them. Doing so will allow for open sharing and for you to gauge where they may need help with this topic during their visit. However, you may prompt students for specifics by asking them such things as, "What do you know about insects? The adaptations of insects? What kinds live in the prairie? What do you know about the life cycle of prairie insects? Where do insects live in the prairie?")
5. Next, ask students what they wonder about prairie insects? What questions do they have about them? They should think about questions that can be answered by going outside today and exploring. Each question should also be recorded in the column next to what they know. Again, give them ample time to think and respond. Try not to provide them with questions to investigate. (Coming up with their own questions will give them more ownership in the investigation. If necessary, prompt them with questions like: "Is there something you would like to find out today about prairie insects? What do you wonder about prairie insect adaptations?")
6. Select four questions to investigate. For the third KWHL column, ask students how we will find the answer to each question. Will we stay on the trails or go off-trail? What kinds of rules or tools will we need to bring and use? Match the tools with the appropriate questions on the chart, creating the third column, "H," how we will find out.
7. Demonstrate how to organize a journal page to record data with a title, date, location, and four titled quadrants, one for each question. Incorporate their suggestions if possible.
8. Line up in small groups. Remind students that they are scientists conducting a real scientific investigation just like adult scientists do. Scientists are quiet and respectful outdoors. They have a purpose in the field to complete their mission (in this case, collecting insects).

Explore Outside

9. Line up in small groups at the door. Travel to the area you will collect insects and give space boundaries. In their small groups, students can collect and identify their insects to the Order and record their data. Move from group to group to assist and check that chaperons and students are correctly

Procedure, *continued*

identifying their insects and to answer questions. They should release the insects when finished or as needed.

Reflection Time

10. Return to the four questions and answer them together as a class. Write down answers with the questions or add a last column (the L in KWHL, Learned).
11. Ask students to write a one-sentence discovery they made about the prairie or about insects. If needed, prompt them with sentence starters like, "I never knew that ..." or "Today I discovered that ..." Ask a few students to read their sentences to share their discoveries with the class.
12. Invite students to share any new questions they have about prairie insects. Are prairie insects important? Why or why not?
13. Challenge them as scientists to go home and find at least one other person they can share today's discoveries within person, via email, on the phone, in a letter, etc. They should briefly and quietly share who they will share their discovery with a classmate.
14. Thank students for their help with the investigation and the chaperons for their leadership. Thank everyone for their kind treatment of the insects that were collected and examined. Invite them to come back again to visit and to search for insects at school and home.

Weather Alternatives

Field investigations take place rain or shine. Everyone should dress appropriately for the weather. In the event of unsafe weather (lightning, high winds) or pouring rain, everyone must come indoors. Prairie Wetlands Learning Center staff make every effort to make your travel worthwhile despite the weather and prepare indoor, age-appropriate plans. Prairie Wetlands Learning Center staff welcome teacher input into these plans. Some possible alternatives might include

- Go outside for a very short amount of time, even if only under the deck to search for prairie insects near the building.
- Tour the exhibit area and watch prairie wetlands videos with the objective of keeping track of which insects are observed. Which Orders do they belong to? How many of the eight common Orders were observed?
- Set up insect stations such as displays of preserved specimens, Insects and Spiders card game, pre-collected live specimens to observe and sketch, and insect books. Rotate students among the stations

Vocabulary

invertebrate, vertebrate, insect, investigate, classify, pollinate, food chain

Teacher-Led Extensions and Assessments

Try any of these activities to extend your visit.

School Connections

- To help students understand the concept of classification, ask each student to remove one shoe. Place all of these single shoes into a pile. Practice classification by organizing them into groups based upon similar characteristics. Students can suggest what those characteristics might be (such as color, size, shape, design, function, etc.). Then they should write down their groupings and randomly select one shoe. By observing the shoe and studying their groupings, can they place it into the correct group? Try the same process with a few more shoes and revise the groupings if needed.
- Diagram an insect and it external body parts (head, thorax, abdomen, six legs, two antenna, wings, compound eyes).
- Ask an art teacher to instruct your students in basic sketching techniques for insects. Practice using schoolyard insects. A great resource is *Draw and Color Insects* by Walter Foster and Diana Fisher. Good insect choices relevant for the prairie and included in the book are cricket, stink bug, treehopper, damselfly, ant, leaf beetle, acanthosomatid bug, and katydid
- Introduce the common insect Orders to your students (as described in the Background section). You may use the scientific names of the Orders (such as Hymenoptera) or the common names (ants, bees, wasps) or both.
- Collect, observe, and release insects in your school yard to compare/contrast to those students collect at the PWLC. Which insect Orders are represented? Are they the same ones as found in the prairie? Why or why not?
- In September, keep a chrysalis or cocoon in a container and watch the butterfly or moth emerge. Record daily observations and use that data to draw conclusions about them. Release the adult moth or butterfly outdoors while the weather is still warm.
- Use insects to create a prairie food chain or food web or food pyramid.

Neighborhood Connections

- Take a walk around the block once per month and keep a classroom insect phenology notebook through the school year. From this log, make a timeline using register tape to hang in the hallway or classroom. When is the last insect observed in fall? Are any insects active in winter? When do hibernating insects begin to emerge? Which kind is first? How many Orders of insects are observed through the year?
- Maintain and record behavior observations of ant hills on the sidewalks outside of your school. Bring food scraps from lunch and experiment with which kinds the ants carry into the hills and which they ignore.

Home Connections

- Encourage students to search for insects outside at home. They can look under leaves, rocks, logs, and mulch. They can search on flowers and tree trunks. Allow them to report their discoveries and surprises to the class.

For the Prairie Wetlands Learning Center Educator

Prairie Wetlands Learning Center Theme – the Prairie Pothole Region

Primary Environmental Education Message - The prairie pothole region is valuable and in need of restoration and protection.

Sub-message - Wildlife: The prairie pothole region is home to a variety of resident and migratory wildlife.

Prairie Wetlands Learning Center Environmental Education Objectives:

- Use scientific methodology to explore the environment (ask questions, hypothesize, collect data, analyze data, form conclusions, make recommendations).
- Identify the components and functions of a given ecosystem by observing, counting, and describing the animals and plants in that ecosystem.

2019 Minnesota Academic Standards in Science

Strand 3 Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.1 Developing and using models

Standard 3.1.1 Students will be able to develop, revise, and use models to represent their understanding of phenomena or systems as they develop questions, predictions and/or explanations and communicate ideas to others.

Benchmark 4E.3.1.1.1 Develop a model based in part on student observations or data to describe ways the geosphere, biosphere, hydrosphere, and atmosphere interact. (P: 2, CC: 4, CI: ESS2) Emphasis is on how rock, living things, water, and/or air are individual systems that make up the larger Earth system and interact with each other.

2010 Minnesota Academic Standards in Language Arts

This lesson helps support the following 4th grade state standards.

Strand: READING

Substrand 2. Information Reading Text K-5

Standard 3: Analyze how and why individuals, events, and ideas develop and interact over the course of a text.

Benchmark 4.2.3.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

Standard 5: Analyze the structure of texts, including how specific sentences,

Language Arts Standards, *continued*

paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.

Benchmark 4.2.5.5 Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.

Strand: WRITING

Substrand 6. Writing K-5

Standard 7: Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

Benchmark 4.6.7.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

Standard 9: Draw evidence from literary or informational texts to support analysis, reflection, and research.

Benchmark 4.6.9.9 Draw evidence from literary or informational texts to support analysis, reflection, and research

b. Apply grade 4 Reading standards to informational texts (e.g., "Explain how an author uses reasons and evidence to support particular points in a text").

Standard 10: Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

Benchmark 4.6.10.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Strand: SPEAKING, VIEWING, LISTENING, AND MEDIA LITERACY

Substrand 8. Speaking, Viewing, Listening and Media Literacy K-5

Standard 1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

Benchmark 4.8.1.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.

a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
b. Follow agreed-upon rules for discussions and carry out assigned roles.
c. Pose and respond to specific questions to clarify or follow up on information and make comments that contribute to the discussion and link to the remarks of others.
d. Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.
e. Cooperate and problem solve as appropriate for productive group discussion.

Language Arts Standards, *continued*

Strand: LANGUAGE

Substrand 10. Language K-5

Standard 6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering and unknown term important to comprehension or expression.

Benchmark 4.10.6.6 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered) and that are basic to a particular topic (e.g., wildlife, conservation, and endangered when discussing animal preservation).

References and Resources

Books and Web Sites for Adults

- *A Guide to Common Freshwater Invertebrates of North America* by J. Reese Voshell, Jr.
- *Encyclopedia of Insects* by James K. Liebherr and Joseph V. McHugh in Resh, V. H. & R. T. Cardé (editors)
- *How Should We Live Together?* U.S. Fish and Wildlife Service, Minnesota Valley National Wildlife Refuge curriculum
- *Insectigations* by Cindy Blobaum
- *Kaufman Field Guide to Insects of North America* by Eric R. Eaton and Kenn Kaufman
- *Minnesota's Natural Heritage, an Ecological Perspective* by John R. Tester
- *Prairie, a Natural History* by Candace Savage
- *Ranger Rick's NatureScope, Incredible Insects* by National Wildlife Federation
- Bugguide website

Books and Web Sites for Children

- *Bugs!* By Christopher Nicholas
- *Flies Taste with their Feet, Weird Facts About Insects* by Melvin and Gilda Berger
- *Golden Guide, Insects* by Herbert S. Zim, PhD and Clarence Cottam, PhD
- *Hey Little Ant* by Phillip and Hannah Hoose
- *Peterson First Guides, Butterflies and Moths* by Paul A. Opler
- *The Bug Book* by Dr. Hugh Danks
- *The Everything Kids' Bugs Book* by Kathi Wagner
- *Thinking About Ants* by Barbara Brenner
- *What's Inside? Insects* by Dorling Kindersley, Inc.
- North American Insects and Spiders/Orders at the cirrusimage website
- What's That Bug? Website

Credits

This field investigation was developed and written by Prairie Wetlands Learning Center Staff, U.S. Fish and Wildlife Service. (Thanks to Prairie Science Class naturalist Tia

Credits, *continued*

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