

SPRING PHENOLOGY INVESTIGATION

Grade: Fourth Grade

Number of Students: Up to 27 students/class, 54 students/visit

Number of Groups: 6 - 8 adult leaders with up to 6-8 students per group

9:00 a.m. - 9:15 a.m.	Getting In the Moment
9:15 a.m. - 9:45 a.m.	Introduction to Spring Phenology (Indoors)
9:45 a.m. - 10:30 a.m.	Investigation (Outdoors)
10:30 a.m. - 11:15 a.m.	Writing Exercise and Wrap-up (Indoors)

*Sample schedule; plan for as much time outside as possible, but be sure to allow 45 minutes for final activity.

Phenology Investigation

Grade: Fourth Grade

Group Size: Two Classes

Time: 2 hours

Season: Spring

Summary:

Students learn the definition of **phenology** and how it relates to their Sherburne NWR visits. They work in small groups to make observations in nature and use their nature journals to record examples of spring phenology. After the outside investigation, students return to the classroom to share their findings and use a mind map to compare their spring findings to their previous findings in the fall and winter.

Performance Objectives:

After completing this activity, students will be able to...

- Collect data about living and nonliving things in spring.
- View 3 paintings and use a mind map to write about their refuge visits in 3 different seasons.
- Explain in their own words how phenology influences the study of habitats.

Materials Needed:

- White board and dry erase markers
- Rulers, wind meters, thermometers
- Pencils and clip boards
- Attached Facilitator's Guide
- Attached Nature Journal Sheet for students
- Attached Mind Map + Venn Diagram (**completed at school** and brought with nature journals)

Background Information (Adapted from Prairie Wetlands Learning Center):

Phenology is nature's calendar of events. The events change with the seasons depending upon the climate. In Minnesota, we experience four distinct seasons with varying air temperatures, prevailing wind patterns, and precipitation. In response, animals and plants alter their behaviors, appearances, and life cycle stages for their own survival. For example, sometimes we casually notice our first earthworm when the ground thaws out, along with the arrival of our first robin.

The Earth moves in cycles. This includes cycles of living things (e.g., plant life cycle, frog lifecycle, insect lifecycle) and cycles of nonliving things (e.g., water cycle, rock cycle, moon phases). There is a predictable, seasonal progression of natural events from year to year. Our observation, recording, and study of these cyclical changes is called **phenology**. When we study phenology, we can find the link between living and nonliving factors, and therefore, better understand the function of an entire ecosystem. Author and conservationist Aldo Leopold described it this way: "Many of the events of the annual cycle recur year after year in a regular order. A year-to-year record of this order is a record of the rates at which solar energy flows to and through living things. They

are the arteries of the land. By tracing their response to the sun, phenology may eventually shed some light on that ultimate enigma, the land's inner workings." Phenology can solve the ultimate enigma – how the earth works.

Below is a list of common phenology observations at Sherburne NWR. These observations are from the Friends of Sherburne's Nature's Calendar brochure, which is available free of charge at the refuge.

FALL Phenology Observations (early to late):

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| <ul style="list-style-type: none">• Watch for flocks of migrating white pelicans spiraling high in the sky.• Migrant monarch butterflies headed for Mexico can be seen nectaring at flowers during the day to refuel.• Look for the purple and white blossoms of asters along the Wildlife Drive and the Blue Hill Trail.• The autumnal equinox, the astronomical first day of fall, occurs between September 19 and 21 signaling equal length of days and nights.• Hummingbirds, orioles, warblers, swallows, and other migrant birds go south to winter where food is more available.• Expect the first light frost.• Watch as fall colors become prominent.• Don't be surprised to see a few snow flurries mixed with rain as fall weather begins to set in.• The first hard freeze can occur any day.• Sandhill cranes gather in numbers to roost in wetlands at night and feed in upland fields by day in preparation for migrating to Florida in late November. | <ul style="list-style-type: none">• Fall colors are at their peak—maples, sumac, oaks, aspen.• See numerous bald eagles and hawks migrating south.• Snow flurries and sleet are possible.• Many trees have dropped their leaves. Exceptions are the buckthorn, northern pin oak, and northern red oak.• Mourning cloak butterfly, anglewing butterfly, and others begin hibernation.• A skin of ice may be seen on Buck Lake on the Blue Hill Trail on chilly mornings.• During the nine-day firearms deer hunting season, many hunters are at the refuge.• Crows, blue jays, pileated woodpeckers, chickadees, finches, owls, nuthatches, and a few hardy robins stay at the refuge through the winter and may be seen on the Blue Hill and Mahnomen trails.• The first significant snowfall is possible around Thanksgiving.• Sandhill cranes begin migration to Florida as ice covers the wetlands. |
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WINTER Phenology Observations (early to late):

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| <ul style="list-style-type: none">• Daylight lengthens as earth's northern hemisphere tilts toward the sun.• Chickadees begin to sing, "Spring's here."• Listen for downy, hairy, red-bellied, and pileated woodpeckers drumming on trees to advertise territory and attract mates.• Blue jays seem to cry, "Spelunker."• Remaining northern pin oak and northern red oak leaves gradually drop.• Look for mouse, vole, and bird tracks in the snow.• Sunset comes at 5 PM.• Expect significant snowfalls.• A "January thaw" is possible. | <ul style="list-style-type: none">• Average coldest week of the year occurs in January.• Look for long, linear tracks made by otters sliding in snow.• Listen for courting calls of great horned owls.• Note the warmth of the sun.• Bald eagles court and refurbish their nests.• The crimson stems of red-osier dogwood may show signs of being snipped by rabbits or torn by deer.• Expect warmer temperatures and snowmelt on sunny days. |
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SPRING Phenology Observations (early to late):

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| <ul style="list-style-type: none">• The first thunderstorm or severe weather of the year is possible.• Listen for the high pitched, bird-like chirping of the spring peeper.• Listen for the long “cre-e-ek” sound of the Western chorus frog.• Pasque flowers begin to bloom.• Mourning cloak butterflies wake from hibernation and begin to mate.• Prescribed burning season begins at the refuge. Look for fresh green grass emerging from areas recently burned.• First eaglets hatch.• Ice-out occurs on refuge pools, lakes, and marshes.• Loons and wood ducks arrive as the ice leaves.• Pocket gophers push soil above ground as they dig tunnels below (April through freeze-up).• Snakes and turtles bask in sunlight to warm themselves.• First dandelions dot the landscape with their yellow blossoms. | <ul style="list-style-type: none">• Newly returned migrant songbirds are in full song to establish territories and attract mates.• Expect changeable weather—snow, rain, wind, or maybe temps in the 70s!• Look along wetland edges for the yellow blossom of marsh marigolds.• Check prairie openings for the red blossom of prairie smoke and woodlands for the white blossom of the wood anemone.• Look for tropical birds such as rose-breasted grosbeaks, orioles, warblers, and hummingbirds, which come north to nest where insect abundance and longer days of spring and summer allow greater reproduction.• Look in the wetlands for cattail lodges of muskrats and the wood/mud lodges of beaver.• Look for the gold hue changing to green in the treetops as buds swell, trees flower, and branches leaf out. |
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These are just some examples, but phenology is a broad subject. Phenology may include: the timing of the sun’s position relative to the earth’s surface, air/soil/water/snow temperatures, wind speed/direction, precipitation, day/night length, moon phases, ice out, freeze-up, migration, feeding, resting, preening, mating, birthing, egg-laying, hatching, maturing, shedding, molting, sprouting, bud burst, flowering, pollinating, seeding, dormancy, hibernating, resisting, surviving, aging, dying, decomposing, nutrient cycling, photosynthesis, and more.

Phenology is important to the refuge because the refuge is attempting to understand the inner workings of a habitat. Tracking phenology allows staff to know when to change water levels for waterfowl reproduction phases, conduct prescribed burns, spray invasive species to target specific plant lifecycle phases, or spread new seed, etc. Phenology tracked over long periods of time can also give important clues about climate change and its impact on living and non-living cycles.

Procedure:

1. **Lead Refuge Volunteer:** In the classroom, welcome students, teachers, and chaperones to Sherburne National Wildlife Refuge. Remind them of your name. Explain traits of a naturalist and expectations for behavior: calm and quiet, inquisitive, respectful, prepared, use all of their senses.
2. **Teacher:** Explain to students that today they are going to investigate the refuge’s spring habitats. The last two times they were here, they explored habitats in the fall and winter. During their visits, they observed and recorded living and non-living things. Ask briefly for a few examples of their past observations and write them on the board.

3. **Teacher, with assistance from volunteer:** Naturalists know that the Earth moves in cycles. Invite the students to look over the list of their observations and provide examples of living and non-living cycles found in nature. Examples could include water cycle, rock cycle, animal life cycle, and plant lifecycle. Record answers on the board.

4. **Teacher, with assistance from volunteer:** Explain that today students will conduct a spring investigation by studying phenology. Write “phenology” on the board with its definition, “nature’s calendar of events.” During their fall and winter visits, students were studying phenology and didn’t even realize it! Their observations and recording of cyclical changes found in nature *is* phenology. Phenology is the link between living and nonliving factors and can therefore help us to better understand an entire ecosystem. Ask students how day length might affect a plant life cycle. How might the water cycle affect a frog’s lifecycle? When the ground thaws, earthworms come out of the ground at the same time robins make their first appearances.

4. **Volunteer, with assistance from teacher:** Explain that soon the class will be splitting into groups and heading outside to explore phenology and spring. Help students prepare their journal entries by modeling on the board. Ask students what they think will be the most important observations to record while outside. Have students split a page of their nature journals into four boxes and label each box with one important thing to observe outside. Examples might include: plant life, animal life, water, soil observations, and weather.

6. **Volunteer, with assistance from teacher:** Tell students that they are ready to go outside to explore. Divide students into small groups and put an adult volunteer with each group, if possible. Adult volunteers should make sure students have all of their materials. Remind students that naturalists are happy outside--explorers, adventurers, respectful, prepared, responsible, and quiet. They ask questions, use words, numbers, and pictures, and share their discoveries. Review the journal sheet with them one more time. **Also:** Either while leaving for field time or while returning inside, volunteers should take their small groups to view the Gary Moss paintings in the lobby. *Ask students to notice what is happening in nature in each painting.*

7. **Volunteer:** Once outside, adult leaders will guide students in exploring spring and phenology examples; this will include visiting wetland, prairie, and/or oak savanna habitats.

8. **Volunteer and Teacher:** Once back inside, have students sit down in the classroom and study slides of the Gary Moss paintings. Instruct students to take out the three-circle Venn diagram that they completed at school. The diagram should compare fall, winter, and spring observations and list discoveries common to all 3 seasons. Using the paintings, compare the seasons in each, pointing out similarities and differences.

9. **Teachers and Volunteers:** Pass out the Mind Map Sheet. Explain to students that they will use the sheet to write five sentences about their 3 refuge visits. The first sentence will introduce their main topic, or in this case, a discovery they made for each season they visited. The second sentence will be about fall, the third sentence about winter, and fourth about spring. The last sentence will be a conclusion. Before they begin, they will need to come up with a topic. Provide some examples of a topic and how it would relate to the other sentences. Examples of topics are provided on Mind Map sheet. Encourage them to use descriptive words and to think of all of their senses when they write.

9. **Teacher:** To wrap up as a whole class, ask students to review their three visits. What conclusions can they now draw about phenology at Sherburne NWR? What differences and similarities did they discover among fall, winter, and spring at Sherburne NWR?

10. **Volunteer:** At the end of the lesson, explain to students that today they discovered how magical the oak savanna, prairie, and wetlands can truly be if they just look closely. There are endless discoveries to be made about different habitats. Students don’t even have to come to Sherburne NWR to track these changes; they can do it in their very own yard, at a park, or anywhere outside. Explain that the world needs more naturalists who will stop to examine the beauty of different habitats and that, because they did such a good job today, they seem like perfect candidates.

Core Standards:

Science: Physical Science

- Objects have observable properties that can be measured.
 - ✓ Measure temperature, volume, weight and length using appropriate tools and units.
- Energy can be transformed within a system or transferred to other systems or the environment.

Science: Earth Science

- Rocks are an Earth material that may vary in composition.
 - ✓ Recognize that rocks may be uniform or made of mixtures of different minerals.
- Water circulates through the Earth's crust, oceans and atmosphere in what is known as the water cycle.
 - ✓ Identify where water collects on Earth, including atmosphere, ground, and surface water, and describe how water moves through the Earth system using the processes of evaporation, condensation and precipitation.
- In order to maintain and improve their existence, humans interact with and influence Earth systems.
 - ✓ Describe how the methods people utilize to obtain and use water in their homes and communities can affect water supply and quality.

Writing: Research to Build and Present Knowledge

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

Writing: Text Types and Purposes

- Write narratives and other creative texts to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.
 - ✓ Use a variety of transitional words and phrases to manage the sequence of events. Use concrete words and phrases and sensory details to convey experiences and events precisely. Provide a conclusion (when appropriate to the genre) that follows from the narrated experiences or events.

Speaking, Viewing, Listening and Media Literacy: Comprehension and Collaboration

- 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.
 - ✓ 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. 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. Follow agreed-upon rules for discussions and carry out assigned roles. 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. Review the key ideas expressed and explain their own ideas and understanding in light of the discussion. Cooperate and problem solve as appropriate for productive group discussion.