Minnesota Valley National Wildlife Refuge

# Nature through the Seasons

### In a Nutshell

Students discover the science of phenology: the observation of nature's patterns and rhythms. Students learn to measure a variety of weather characteristics and record phenological events they observe during a hike on the refuge. They discover how scientists use phenology to track the impact of even small weather changes on the behavior of plants and animals.

| | |
|---|---|
| Grades | K-6 |
| Seasons | Fall, Winter, Spring |
| Location | Refuge-wide |

### Learning Objectives

After participating in this activity, students will be able to:

- measure temperature with a digital thermometer.
- use the Beaufort Wind Scale to estimate wind speed.
- match the clouds they see to a picture key.
- create a list of at least 3 seasonal nature events they can observe and record.
- give at least one example of how weather changes can affect plants and animals.

### Literature Connections

A Child's Calendar by John Updike (NP)
The Reasons for Seasons by Gail Gibbons (AD620L)
Sunshine Makes the Seasons by Franklyn Branley (AD510L)
My Nature Journal by Adrienne Olmsted
Animals in Winter by Henrietta Bancroft (AD380)

3815 American Blvd. East
Bloomington, MN 55425

15865 Carver Highlands Drive
Carver, MN 55315

How do Birds Find Their Way? By Roma Gans
Welcome Brown Bird by Mary Lyn Ray
Oh Say, Can You Say, What's the Weather Today?: All About Weather by Tish Rake
Sky Tree by Thomas Locker (AD490)
John Muir: My Life with Nature by Joseph Cornell (960L)

## Pre-Visit Suggestions

*Younger Students: Phenology Clue Kit*

To start students thinking about the connection between weather and changes in plants and animals, assemble a collection of clues (i.e. red leaf, acorn, paper snowflake, etc.) Ask students to first sort the clues into weather, animal and plant categories. Then ask them to organize the same clues into seasons.

*Older Students: Project WILD Minnesota activity, Wild Words (page 41)*

Students understand phenology by reviewing spring journals and diaries of Minnesota naturalists and by keeping their own journals.

## On-site Activities

Students take a short hike to record weather conditions and plant and animal observations on the refuge. Where possible, they compare their data with state or refuge records and then make connections between their observations, the day's weather, and the time of year.

## Classroom Connection

*Start a Classroom Nature Calendar*

Start your own phenology calendar. Record changes in the weather. Record things you hear and smell as well as what you see. Start by creating a class list of events to watch for, organized by the season. Keep your "data" to compare year after year with your class.

*Become a Citizen Scientist*

A growing number of opportunities exist for the students to participate in biological monitoring surveys. Refuge staff can provide you with a list of local and national programs.

## Teacher Resources

Keeping a Nature Journal by Clare Walker Leslie and Charles Edward Roth
Jim Gilbert's Minnesota Nature Notes by Jim Gilbert
How We Know What We Know About Our Changing Climate by Lynne Cherry and Gary Braasch
The Down-to-Earth Guide to Global Warming by Laurie David and Cambria Gordon
Nature's Calendar, Conservation Volunteer Magazine
Teacher's guide www.dnr.state.mn.us/young_naturalists/phenology

# Nature Through the Seasons
# Pre-visit Activities

## Phenology Clue Kit
## Materials

- Phenology clues kit
  Weather clues: mittens, hat, winter jacket, umbrella, laminated paper snowflake, sunglasses, flip flops/sandals
  Plant clues: fall leaves, seeds, silk flower, lawn model, nuts/acorns
  Animal clues: bird nest with eggs, antler, animal pelt, picture of migrating geese, butterfly, bluebird and/or robin Audubon birds
- Paper/ Colored Pencils or Crayons
- Laminated blank wall calendar
- Laminated phenology calendar markers appropriate to the season

## Introduction

How do you know when the seasons change? Steer students away from answers like "the date on the calendar." We know that the seasons are changing because of the changes in the weather and in the environment around us. Flowers bloom, trees leaf out and then drop their leaves, animals migrate and hibernate, temperatures shift – all of these are signs of a change in the seasons. Watching for these changes and recording them is the basis of the science of phenology – the study of events in nature and how

### Emily's Poem for April

A A new sight each day

P Peonies are blooming

R Robins sing every morning

I Insects buzzing in the prairie grasses

L Little baby animals are born

they are affected by the weather. Anybody can take part in phenology, by simply observing changes in the world around them and recording those observations on a chart or in a journal.

## Activities

Using the phenology clue kit, help students sort the objects into three categories: weather, plant, or animal. Then have them reorganize the items into seasons: fall, winter and spring.

Ask each student to draw their own picture of the animals they expect see, hear or find evidence of during their upcoming visit to the refuge based on the weather outside and the time of year. What will the plants look like? Or, ask them to write an acrostic poem, using the current month's name and the things they expect to see at the refuge during their visit. Ask the teacher to bring their pictures / poems along on their fieldtrip.

## Wrap-up

Remind students that they will be exploring outside during their fieldtrip. Lead a brief discussion on how students should dress for their refuge fieldtrip and answer student questions. Encourage students to wear closed-toe shoes like sneakers or boots, long pants, and jackets as well as hats and gloves if the weather is cold. Let students know that if they do not have warm outer wear, they can borrow items from the Refuge Borrowing Closet when they arrive.

# Nature Through the Seasons
# On-site Activities

## Materials

- Journal page, clipboard and pencil per student
- Students "before" fieldtrip pictures or poems.
- One backpack per leader with the following:
    - One jar of bubbles and bubble wand per group
    - One Modified Beaufort Wind Scale per group
    - One Cloud Dichotomous Key per group
    - One digital thermometer per student
    - One Cloud Identification Chart per student
- One Weather Guide Calendar for each teacher (last year and this year to compare information.)
- One laminated phenology wall calendar similar to what refuge staff uses in the refuge classrooms.

## Introduction

**Inside Visitor Center (30 minutes)**

Welcome the students to the National Wildlife Refuge! Review the term phenology with the students. Pass back the pictures students drew predicting what they would see on their fieldtrip. Make a list on the dry erase board of the things they drew in their pictures during their classroom pre-activity. What did they expect to see? What were their predictions? Explain to the students that the class will refer back to this list after the hike to determine whether or not their predictions were correct.

Pass out the journal sheets, clipboards and pencils to each student. Review the day's date, weather conditions, sunrise, sunset and season with the students. Ask the students to complete this section of the data sheet.

Discuss with the students the most effective way to make good scientific observations: walk slowly and quietly, observe overhead as well as up close, listen, and stay together. Emphasize that there are three sections on their journal sheet for observations: weather, plants, and animals.

Explain to the students that they will be gathering data just like real scientists! Remind them that covering a lot of distance is less important than being good observers.

## Hike

**Hillside Trail (60 minutes)**

Divide students into groups with at least one adult leader. Ask the adult to pack the team's backpack as you explain how to use each item.

1. Bubbles and the Modified Beaufort Wind Scale (for leader use)
   Ask the students if they knew they could guess the speed of the wind by watching the movement of bubbles, leaves, and tree branches. The leader should use the key to guide the students through each observation until they reach consensus on a wind speed estimate.

2. Digital Thermometers (for students use)
   Show students and leaders how to turn on the digital thermometers.

3. Cloud Picture Key (for student use)
   and
   Cloud Identification Key (for leader use)
   Have students look at and interpret the picture key. Which clouds would be the highest in the sky? Which would be closest to the ground? How does the picture show you that? Ask the leaders to look at the Cloud Identification Key. Suggest they use the questions in the key to guide students through the process of determining what type of clouds they are looking at.

Clarify with the leaders where to hike and when to meet back in the classroom to compare and discuss student observations.

## Back in the Classroom

**(10 minutes)**

Make 3 lists on the dry erase board with the headers: Wildlife Observations, Plant Observations and Weather Observations. Ask each student team to report one observation from each category that they

made from their data sheet to add to the class list. Once each team has contributed their observations compare the lists with the student predictions.

## Wrap-up

**Classroom (10 minutes)**

Explain how refuge staff uses the laminated phenology wall calendars. What observation(s) does the class want to add to the calendar? Refer to the list included in the curriculum unit for ideas. Use the laminated pictures when possible to encourage participation by non-readers or non-English speaking students.

Describe to the students what was observed last year. What is the same or different about the weather? Ask students the question: "What effect does the weather have on the plants and animals?"

## Management Connection

Bring out any phenology data available from the state and / or the refuge to compare with what the students collected. How does today's weather compare to last year? Are today's wildlife observations similar to what rangers and students were seeing this time last year? Why are dates like the "first" and "last" for things like snowfall, ice over, or the appearance of a migratory species important to scientists? Changes in weather patterns can have startling effects on wildlife. Here are a few examples:

- More rainfall in late summer /early fall leads to a better crop of wild berries. This allows fruit eating birds (robins and bluebirds) to delay migration because they can find food. In winter 2008 staff and birdwatchers were reporting robins and bluebirds on the refuge throughout the winter.

- A colder than average spring slows down plant growth. Hummingbirds go hungry when they arrive back in Minnesota and find few blooming plants to take nectar from.

Tracking patterns in nature can help scientists understand the effects of weather changes on plant and animal communities. Tracking patterns in nature can also help scientists predict potential problems in time to search for solutions that might lessen negative impacts on plant and wildlife populations.

Naturalist: _____ Date: _____ Location: _____

# Nature through the Seasons
# Phenology Hike

## The Weather Today

The temperature is_____. The wind is _____.

Today's sunrise was at _____ a.m. The sunset will be at _____ p.m.

The clouds I see are called _____ clouds.

How much of the sky is covered with clouds? (Circle the best answer).

More than half (>1/2) Half (1/2) Less than half (<1/2)

## Here are 3 things I noticed today about plants.

1. _____

2. _____

3. _____

## Here are 3 things I noticed today about animals.

1. _____

2. _____

3. _____

# Cloud Identification Guide

A Dichotomous Key

Created by Dr. Tina Cartwright, WV State Climatologist

Look carefully at your cloud. Answer the questions below, and follow the instructions. When you reach a cloud name in **bold**, that is the type of cloud you are observing. Stop at that point.

## 1. Is it raining?

**No-** go to number **2**.

**Yes-** with thunder, lightning, & heavy rain - your cloud is a **cumulonimbus**.

**Yes-** but only drizzly, with small raindrops - your cloud is a **nimbostratus**.

## 2. Is it a high wispy cloud, like a horse's tail?

**No-** go to number **3**.

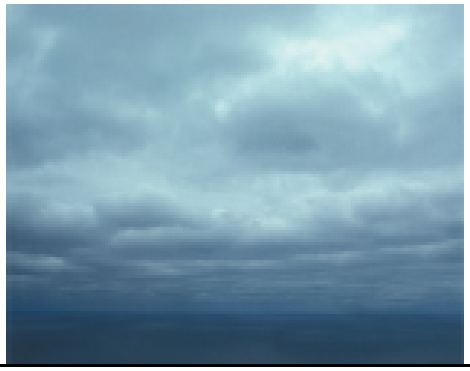
**Yes-** your cloud is a **cirrus**.

## 3. Is it flat & layered, puffy & bumpy, or some of both?

**Flat & layered-**go to number **4**

**Puffy & bumpy-**go to number **5**

**Both-** If your cloud is a nearly solid layer of large puffs (the size of your fist or larger), your cloud is a **stratocumulus**.



## 4. Determine how high and how thick your flat layered cloud is.

If your cloud is high, thin, and the sun is shining casting distinct shadows, it is a **cirrostratus**.

If it is thicker, the sun is dimmer, and there are hardly any shadows, it is an **altostratus**.

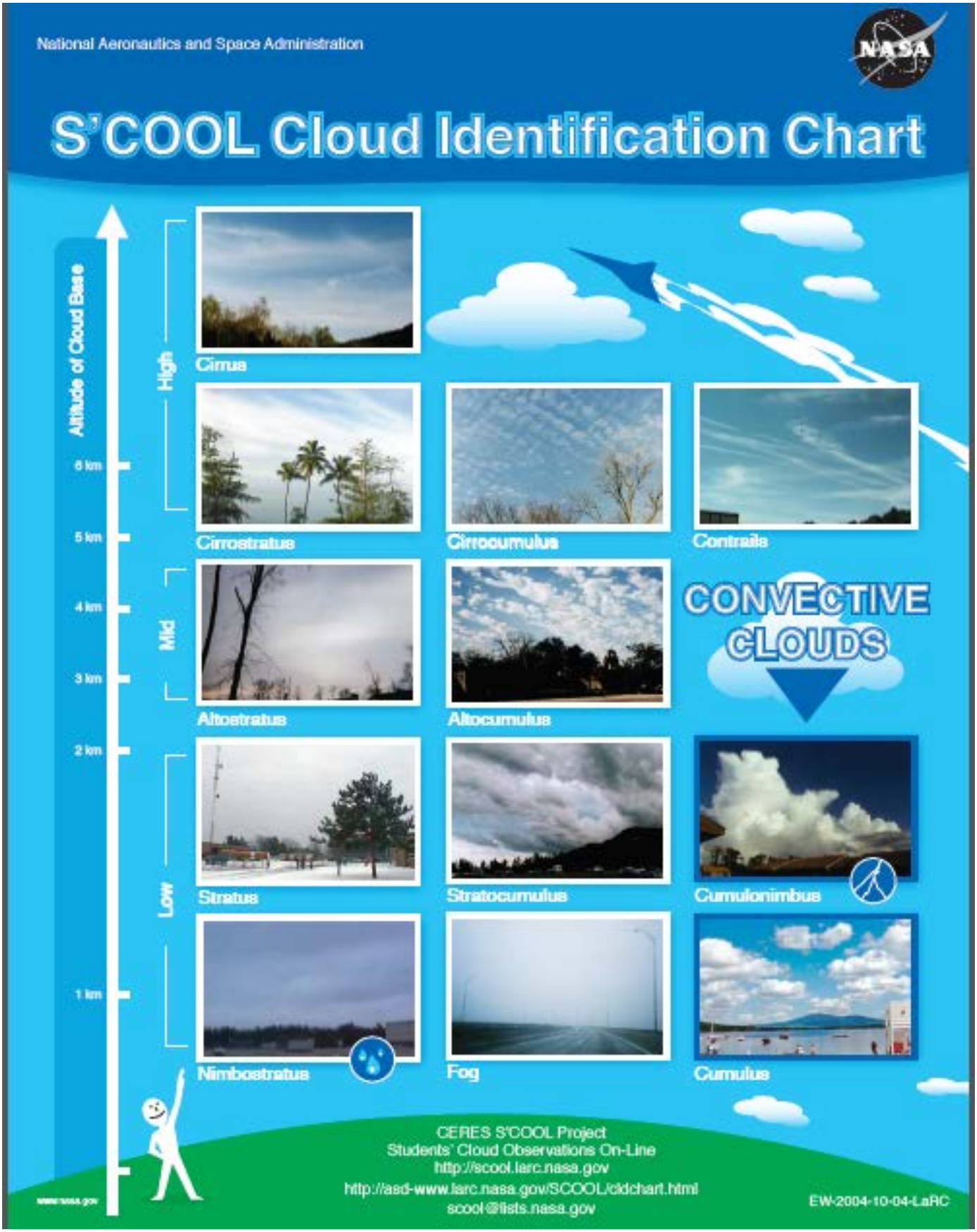
If it is a low cloud, so low it's hard to see the bottom and it covers most of the sky, it is a **stratus**.

## 5. Hold your hand up toward your cloud. Look at the size of the puffs. Compare them to your hand.

If the puffs are the size of your fingernail (very small), your cloud is a **cirrocumulus**.

If the puffs are the size of your thumb (medium-sized), your cloud is an **altocumulus**.

If the puffs are the size of your fist (large), your cloud is a **cumulus**.


National Aeronautics and Space Administration
NASA
S'COOL Cloud Identification Chart
Altitude of Cloud Base
6 km
5 km
4 km
3 km
2 km
1 km
High
Mid
Low
Cirrus
Cirrostratus
Cirrocumulus
Contrails
Altostratus
Altocumulus
CONVECTIVE CLOUDS
Stratus
Stratocumulus
Cumulonimbus
Nimbostratus
Fog
Cumulus
CERES S'COOL Project
Students' Cloud Observations On-Line
http://scool.larc.nasa.gov
http://asd-www.larc.nasa.gov/SCOOL/cldchart.html
scool@lists.nasa.gov
www.nasa.gov
EW-2004-10-04-LaRC

# Estimating Wind Speed

## Modified Beaufort Scale*

### Calculate wind speed at about 10-15 feet off the ground

**Start at A.**

A. Bubbles drift.
If true go to B.
If false, wind speed = 0 m.p.h.

B. Flag moving and needles, leaves rustling.
If true go to C.
If false, wind speed = 1-3 m.p.h.

C. Flag fully extended and needles, leaves and small twigs constantly in motion.
If true go to D
If false, wind speed = 4-7 m.p.h.

D. Small branches move.
If true go to E.
If false, wind speed = 8-12 m.p.h.

E. Small tree with leaves, needles sway.
If true go to F
If false, wind speed = 13-18 m.p.h.

F. Large branches in motion
If true go to G.
If false, wind speed = 19-24 m.p.h.

G. Whole trees in motion and it is hard to walk into the wind
If true go to H.
If false, wind speed = 25-31 m.p.h.

H. Twigs break off.
If true go to I.
If false, wind speed = 32-38 m.p.h.

I. Some shingles fly off roof
If true go to J.
If false, wind speed = 39-46 m.p.h.

J. Uprooting of trees near clearings.
If true go to K.
If false, wind speed = 47-54 m.p.h.

**Adapted with permission from Wolf Ridge Environmental Learning Center*

# Nature Through the Seasons
# Rainy day Alternatives

## Materials

- Data sheet, clipboard and pencil per student team or team leader as decided by the teacher
- Large sections of butcher paper
- Crayons

## Inside Observation

Visitor Center (10 min)

Divide students into four groups each with at least one adult leader. Assign each group to a designated area in the Visitor Center to observe outside. Ask the adult to record student observations on the data sheet. Meet back in the classroom to compare observation and discuss the results.

## Season Mural

From the student's observations today and during the season have them draw pictures of what changes they have witnessed outside. In their groups, give them a piece of butcher paper and crayons.

May provide extra paper to teacher for students to draw the other seasons and make a large mural of the seasons for their classroom.

## Visit a Refuge

Using one of the videos, *America's Wildest Places volume 1-3*, students explore another Refuge in the United States. Compare the selected refuge with Minnesota Valley.

What are some similarities? Differences?

Does the selected refuge have seasonal changes like Minnesota?

# Nature Through the Seasons
# Post Activities

## Phenology Pictures

Pass out the students' original refuge drawings or acrostic poems. Ask them to look carefully at what they expected they might see on their fieldtrip. Were they accurate? What did they see or hear on their refuge fieldtrip that they did not put in their first picture or include in their poem? Pass out crayons and colored pencils. Ask students to continue working on their pictures / poems to make them more accurate or more detailed. Select one student from each team to share how they changed their drawing.

## Classroom Nature Calendar

- Start your own phenology calendar. Record changes in the weather. Record things you hear and smell as well as what you see. Start by creating a class list of events to watch for, organized by the season, or use the *Refuge Phenology Checklist* provided. Encourage students to include dates especially fun for kids: the first day they need a jacket…or can wear sandals; the first day they can catch a snowflake on their tongue or can go sledding; the first day they come to school in the dark or leave school in the dark.

Other ideas include:

- **Winter:** The date ice first appears on the edges of nearby lakes. The last day you can comfortably wear shorts and sandals. The first snowflake big enough to catch on your tongue. The first Goldfinch you see wearing its dull yellow and black winter feathers.
- **Spring:** First sightings of returning robins, monarchs, hummingbirds and orioles. First hibernating turtles and groundhogs seen enjoying the sunshine. Day the last bit of ice melts on nearby lakes. First time you hear frog calls. The date you spot the first nest of goslings paddling behind mom.
- **Summer:** The first goldenrod and aster blooms on the prairie. The first day the grasshoppers, katydids, and crickets start calling to each other.

- **Fall:** The day the first flock of geese fly overhead. The day the first maple leaves start changing color. The date the last leaf falls of a nearby maple tree.

Keep your "data" to compare year after year with your classes. Students may choose to record their observation with drawings, words, or a combination of both. For more ideas and examples on keeping a phenology calendar:

- download the Young Naturalists article *Nature's Calendar* from the DNR website at www.dnr.state.mn.us/young_naturalists/phenology . On "E-nature" create and store your class's phenology data and compare with data collected worldwide www.enature.com/wildlifelists/wildlifelist_home.asp
- download the Minnesota Weather Guide Environment Calendar Curriculum for additional observation checklists at www.freshwater.org

# Refuge Phenology Checklist

(compiled using a variety of sources including Three River's Park District "Phenology Notes", Jim Gilbert's Year Phenology Notes in the Freshwater Society Weatherguide Environment Calendar, Wild Bird Store Newsletters)

## January

- Black capped chickadees & hairy & downy woodpeckers began their territorial sounds
- Forest moss begins to turn green
- Male wild turkeys are starting to call "gobble, gobble, gobble" as they fan their tails in display
- Lake ice can be heard groaning, booming, & cracking
- Red oak leaves finally fall off the trees
- Flocks of snow buntings appear in the open countryside
- Great horned owls, first birds to nest in MN, are hooting in duets to signal setting up territory.
- Raccoons retreat to underground dens or hollow trees until it gets above freezing

## February

- Black bear cubs are born
- Northern cardinals and eastern cottontail rabbits arrive at feeders about 15 minutes before sunset
- Gray squirrels begin their mating season
- Great horned owls are incubating their eggs
- Red-tailed hawks return
- Red foxes are out in pairs, signaling their mating season
- Timber wolves are out searching for mates
- First eastern chipmunks are out and about
- Garter snakes come out to sun themselves on warm days

## March

- Silver maple and elderberry buds are swollen and easy to spot
- Ponds and lakes begin to show rings of open water
- Fuzzy catkins burst on aspen trees
- Canada geese pairs stand on ice in wetlands to stake their nesting territories
- Painted turtles are lined up on logs
- Skunk cabbage is blooming in the floodplain forests

- American robins return very vocal.
- Maple trees begin to produce sap for maple syrup
- Migration is flushing song sparrows, great blue herons, killdeers, eastern bluebirds, hooded mergansers, and wood ducks into Minnesota

## April

- Wood ducks and eastern bluebirds examine nesting boxes
- Red-winged blackbirds start returning to the wetlands
- Mourning doves begin cooing at the crack of dawn
- Honey bees start visiting flowers of silver maple trees
- Pasque flowers and prairie smoke bloom in the prairies
- Chorus frogs can be heard calling from wetlands
- Spring ephemerals start blooming on the forest floor
- Barn swallows, chipping swallows, house wrens, and yellow-rumped warblers return
- Large numbers of waterfowl are seen on lakes

## May

- Deciduous trees are leafing out
- Baltimore orioles, rose-breasted grosbeaks, and ruby-throated hummingbirds return
- Eastern bluebird and Canada geese eggs begin to hatch
- Red fox kits are out of their dens
- American woodcocks are displaying
- Mushrooms are popping up in the forests
- Warbler migration is at its peak
- Moose calves are being born up north
- New growth on evergreen trees is bright and tender
- Female wild turkeys can be observed with newly-hatched young

## June

- Monarch butterflies return and are laying eggs on milkweed
- Snapping and painted turtles are laying eggs
- Striped skunks are out traveling
- Canada geese start shedding their flight wings and are flightless
- Wood duck ducklings are seen on ponds with the hens
- Deer flies are abundant near swamps and ponds
- Offspring of the American toad are up on land

- Prairie forbs start displaying a wheel of colors
- Cattails are shedding pollen
- Juvenile 13-lined ground squirrels are above ground and exploring

## July

- Lightning bugs come out at night
- Mosquitoes and deer flies become annoying
- Young raccoons are roaming about with their mothers
- Prairies forbs are in full color
- Canada geese are ready to fly again
- Tree crickets, cone-headed grasshoppers, katydids, and black field crickets fill the night air with their songs
- Second generation of eastern tiger swallowtail butterflies are on the wing
- Lake temperatures reach the mid to upper 70s
- Wild raspberries are ripe for eating
- Gartner snake young are born

## August

- American goldfinches, barn swallows, and mourning doves start nesting
- Cicadas buzz loudly on hot, humid, hazy days
- American lotus plants are blooming in the backwaters and quiet bays along the lower Minnesota River Valley
- Mud dauber wasps are creating tubular nests of mud
- Ruby-throated hummingbirds and shorebirds are seen migrating in flocks around the metro area
- Wild cucumber vines display their showy clusters of white flowers
- Joe-Pye-weed, boneset, broad-leaved arrowhead, and spotted touch-me-not are blooming in the wetlands
- Wild grapes are available as a food source for wildlife
- Prairie grasses are shedding pollen from their seed heads
- Spider webs are filled with dewdrops in early morning light

## September

- Monarch butterflies are heading south
- Warblers, vireos, and thrushes migrate at night to protect themselves from predators
- Acorns, walnuts, and butternuts begin to fall

- Deciduous plants begin to change into their autumn colors
- Snapping turtle eggs are hatching
- Common milkweeds shed their seeds
- Staghorn and smooth sumac are displaying red colors
- Wild rice is ready to eat for migrating waterfowl

## October

- Trees along the lower Minnesota River Valley are exploding with fall foliage colors
- Dark-eyed juncos start arriving at feeders
- White-tailed deer bucks can be seen and heard head-butting defending breeding territories
- American coots occupy many wetlands
- Short-tailed weasels are turning from brown to white
- Black bears are heading towards their den
- Flocks of tundra swans and American white pelicans are migrating
- Muskrats continue to add plant materials to their huts
- Surface water temperatures fall into the lower 50s

## November

- Snowshoe hares are changing from brown to their white winter coats
- Red squirrels gather dried mushrooms to store for winter food
- Downy woodpeckers make holes in goldenrod galls and feed on the fly larva inside
- Daylight retreats to just over nine hours by end of the month
- Bald eagles patrol the shorelines of rivers and open lakes
- Raccoons are sleeping in sheltered places
- Ice starts forming on lakes, ponds, and rivers
- Growing season ends as first snows arrive
- Coyotes are heard howling in the night

## December

- White-tailed deer switch the diet from grasses and leaves to twigs from shrubs and trees
- Lake ice cracks and booms as it contracts with increasingly cold temperatures
- Pileated woodpeckers become more common at suet feeders

- Eastern cottontail rabbits venture out shortly after sundown to forage on twigs and bark of small shrubs
- White-tailed deer start shedding their antlers
- Gray squirrels excavate their stores of acorn for winter feeding
- Muskrats climb out of the ice to eat water plants they gathered
- Flying squirrels that sleep during the day are active at night
- Ice fishing season starts with pan fish and walleye biting

## Become a Citizen Scientist

A growing number of opportunities exist for the students to participate in biological monitoring surveys. Especially student friendly programs include:

- Project Budburst http://www.windows.ucar.edu/citizen_science/budburst/
- Feeder Watch http://www.birds.cornell.edu/pfw/
- Monarch Watch http://www.monarchwatch.org/
- USA National Phenology Network http://www.usanpn.org/
- Journey North-Global Study of Wildlife Migration and Seasonal Change http://www.learner.org/jnorth and http://www.learner.org/jnorth/pde/PhenDataAbout.html
- Great Backyard Bird Count: http://www.birdsource.rog/gbbc/