



madison  
AUDUBON



Curriculum Set: Climate Initiative

*Young Ambassadors for Birds in the Face of Climate Change*

Lesson 1: The Scientific Method told through Phenology

Goal: Students grasp the importance of the scientific method, data collection and long-term data sets. We introduce phenology, and get the class started on collecting their year-long phenology data.

Science | Writing | Math | Art

Adaptable for Grades 4-8

**Created By:**

Carolyn Byers, Education Director  
(608) 255-2473, ext. 555 (office)  
carolyn.byers@madisonaudubon.org

**Contact us at MAS:**

1400 East Washington Ave  
Madison, WI 53703  
608-255-2473  
info@madisonaudubon.org



Produced under a 2014-2016 Grant from National Audubon Society and a 2015-2016 grant from the Wisconsin Environmental Education Board.





## Total lesson time: 1 hr 15 min

Lesson: 30 minutes

Group Activity: 40 minutes

### Materials needed:

Presentation on Climate Initiative Lesson 1

Printed phenology worksheets

Art supplies (pencils, crayons, markers)

Printed data sheets for bird data

### Lesson

#### Tips:

- Write the new vocabulary words on the board so that kids know how they are spelled AND teachers can refer to them later throughout the day.
- During our pilot lessons, it was more engaging for the class if one student took notes in a visible way during the presentation: either on a large notepad, chalkboard or white board. The rest of the class saw what that student was highlighting, and this reinforced key ideas.
- It would be helpful for teachers to review the key points of this lesson with the class before the next Climate Initiative lesson.


### Outline

#### The Scientific Method: Group discussion before presentation (2 minutes)

1. Ask the class what they think scientists do.
2. Discuss what scientists actually do:
  - a. Make observations about the world around them.
  - b. Ask important questions and look for the answers.
  - c. Try to figure out why things are the way they are.
  - d. Create experiments to test their ideas.
3. Tell the class that today we will start our own research project- they will be scientists!

#### PPT Presentation: (28 minutes)


4. Ask if anyone knows what the scientific method is (the rules of science!)
  - a. Explain the scientific method
    - i. Ask a question: look at the world around you for inspiration. What would you like to know more about?
    - ii. Make a hypothesis: this is a possible answer to your question, kind of like an educated guess. You should be able to say that it is true or false (accept or reject it) at the end of your experiment.


- 
- iii. Collect data: go collect data that will help answer your question. Be sure to discuss the importance of unbiased data with older kids.
  - iv. Draw conclusions: Look at your data. Does it support or contradict your hypothesis?
  - v. Share your results: spread the word! Scientists do this by writing papers, making posters, and giving presentations.
5. Discuss importance of data collection
- a. Careful, correct, clean data: a very important part of science is making sure that your data is accurate.
  - b. Long term data sets are powerful because they include more data, and span many years.
6. Phenology:
- a. Today, we're going to talk about phenology-
  - b. Define: recording natural events as they happen throughout the year
    - i. Discuss the pictures: ask the students how the leaves, grass, and precipitation are different in each season.
    - ii. Use the American Goldfinch as an example: what is its lifecycle stage during each season?
      - 1. Spring: they are getting ready to have a nest: the males are in breeding plumage (bright yellow) and both males and females are eating lots of food to get healthy and strong.
      - 2. Summer: building nests! Most birds build their nests in the spring, but American goldfinches are one of the latest nesting birds in the Midwest.
      - 3. Fall: The young (fledglings) have left the nest and are learning to survive on their own. Juveniles and adults are eating lots of food to get strong for winter.
      - 4. Winter: Adults are in winter plumage (dull brown). They are spending almost the entire day looking for food. It takes a lot of energy to stay warm enough to survive a Midwestern winter!
  - c. Why phenology is important:
    - i. Introduce Aldo Leopold – one of the most important scientists in Wisconsin. He studied wildlife and birds in the 1935 – 1945. He kept very detailed phenology records: lists of all of the animals

- ii. and plants he saw, when he saw them, and what they were doing.
- iii. His daughter, Nina, continued keeping these records until 2011, and other people continue this work there today.
- iv. We still have these records- more than 70 years of data, and we're able to compare data that we collect today with what has been collected decades ago.
- v. WATCH PHENOLOGY VIDEO  
[climatewisconsin.org/story/phenology](http://climatewisconsin.org/story/phenology) (2:39 min)
  - 1. Emphasize the text at the end of the video. *"One third of birds and plants recorded by the Leopolds are arriving two to three weeks earlier."*
  - 2. This is why we're conducting our own research. We will see if our phenology data matches the Leopold data, or if birds are returning earlier each spring in our neighborhoods too.

7. Passing on the science torch:

- a. Circle back to the scientific method: more data is more powerful.  
Example: Your class wants to have a party, but needs to decide if there should be ice cream or pizza. How many people should they survey: 2, 10, or the entire class? Which would be the best way to find out what everyone wants? Science is the same way. The more data you have, the more accurate your results will be.
- b. Madison Audubon Society, The Wildlife Department at UW Madison, and many others are collecting Phenology data each year. This year we need your help!
- c. More data is more powerful, and working together we can create a huge dataset! It will be able to tell us more about our world.
- d. Our Hypothesis: **Many spring events are happening earlier now than they did in the past.**
  - i. This year we will collect data to explore this hypothesis.
  - ii. This spring we will compare our data to the data that Aldo Leopold collected.
- e. We need your help this year collecting phenology data!
  - i. The whole class will all collect bird phenology data together.
  - ii. There will be 5 groups, each responsible for collecting one other type of phenology data
- f. At the end of the school year, we will check to see if our data supports our hypothesis or not.

- 
8. Types of data we will collect:
    - a. Bird species – record important bird sightings:
      - i. The last time you see a bird that is only found in our state during the winter.
      - ii. The first time you see a new spring bird. It must be a species that is not commonly found in our state during the winter.
    - b. Bird behaviors – behavior will tell us a lot about how the birds are doing.
      - i. Foraging behavior- are they caching the food they get from the feeder (storing it for later) or are they eating it right away? What might this mean? (caching it = they are full right now, and can afford to save some. Eating = they are hungry, and need energy now to survive!)
      - ii. Breeding behavior- observations of birds building nests, or carrying nesting material, birds singing (defending a territory & attracting a mate), or baby birds.
    - c. Temperature- daytime high
      - i. Option 1 (easy) – Once a week, record the highest temperature that happened during the day.
      - ii. Option 2 (difficult) – obtain the daytime high temperatures for every day of the week. Average this to obtain a weekly average daytime high temperature.
      - iii. Record the first (fall) and last (spring) time the daytime high was below freezing.
    - d. Temperature- nightly low
      - i. Option 1 (easy) – Once a week, record the lowest temperature during the night.
      - ii. Option 2 (difficult) – obtain the nightly low temperatures for every day of the week. Average this to obtain a weekly average nightly low temperature.
      - iii. Record the First (fall) and last (spring) time the nighttime low was below freezing.
    - e. Ice on the lakes
      - i. Record the first day ice starts to form on local lakes
      - ii. Find data online that reports ice thickness
      - iii. Record the last day that the lakes are frozen over (spring breakup)
      - iv. Record if any of the bodies of water did not freeze completely
    - f. Precipitation
      - i. Record the amount of snow or rainfall at your school (daily, weekly, or monthly).
    - g. Plants-
      - i. Record which plants are green throughout the winter

- 
- ii. Record the date & species (if able) of the first NEW growth in spring
  - iii. Record when buds open on trees (identify tree species, if able)
  - iv. Record when leaves begin to grow on trees
  - v. Record when leaves are full sized
  - vi. Record the first date flowers open, and what type of flower they were.

### **Group work: familiarize kids with data collection (40 minutes)**

9. Have the kids break into two groups: each group does one activity, then switch.
  - a. Group 1: Bird Observations (20 minutes)
    - i. Review data collection process: what data they will collect, how to record it, what the role of the PI is.
    - ii. Emphasize careful, correct, clean data!
    - iii. It would be helpful if students could view a bird feeder from their classroom windows.
  - b. Group 2: Phenology Wheel worksheet (20 minutes)
    - i. Materials needed: phenology wheel worksheet, pencils, crayons, markers, etc.
    - ii. TIP: it was helpful to show the kids an example of what we were looking for. It may also be useful to provide a list of plants or animals for them to choose from.
10. Wrap up
  - i. Bring the groups together at the end of the class for one last minute of discussion
  - ii. Ask them to define phenology
  - iii. Ask them why we are collecting phenology data and why it is important.

### **Adjust this lesson for different age groups:**

#### **Less Challenging:**

- Collect fewer types of data, or have the entire class only collect data on one phenology topic.
- Alter the types of data you collect (example: just bird species, not the number of individuals seen) or how frequently you collect it (daily, weekly, monthly).
- Alter the data output: using only tables or lists rather than graphs.

#### **More Challenging:**

- Give the students more responsibility in data collection: more groups, more phenology topics.

- Collect more data on each item, or collect it more frequently.
- Alter the data output to be more complicated: have students work in groups or individually to create graphs, a final report, or a presentation.

### RESOURCES:

Aldo Leopold Foundation Phenology Resources:

<http://www.aldoleopold.org/Programs/phenology.shtml>

Specifically their phenology recording worksheets:

<http://www.aldoleopold.org/Programs/PhenoCal.pdf>

Printable Phenology Template & Help:

<http://www.aldoleopold.org/Programs/PhenoCal.pdf>

Phenology study- includes a list of phenology items to look for, and the range of dates that they occurred over 61 years.

(Bradley, Nina L., A. Carl. Leopold, John Ross, and Welington Huffaker. 1999.

Phenological changes reflect climate change in Wisconsin. Ecology. 96, p9701-9704.)

<http://www.aldoleopold.org/Programs/phenology%2ostudy.pdf>

Statewide data for temperature (high & lows), precipitation (and snowfall precipitation):

<http://www.aos.wisc.edu/~sco/clim-watch/>

Madison Lakes ice summary

<http://www.aos.wisc.edu/~sco/lakes/msnicesum.html>

Climate Wisconsin: especially the phenology video (ice cover, temperature change, and adaptation also good for this lesson).

<http://climatewisconsin.org/>

Aldo Leopold Archives:

<http://uwdc.library.wisc.edu/collections/AldoLeopold>