

# Nature's Notebook: Taking the Pulse of Our Planet



**O**bservation is watching carefully and making note of details. Whether you are outside or inside the classroom, you make observations every day. Maybe you saw the first snowflakes of winter on your way to school or maybe you saw a bird feeding its recently hatched chicks. Observation is one way scientists create questions and conduct research. Just as scientists make observations, you can help make observations as a citizen scientist (**figure 1**).

Citizen scientists contribute to hundreds of different projects. One topic that uses citizen scientist observations is climate change.

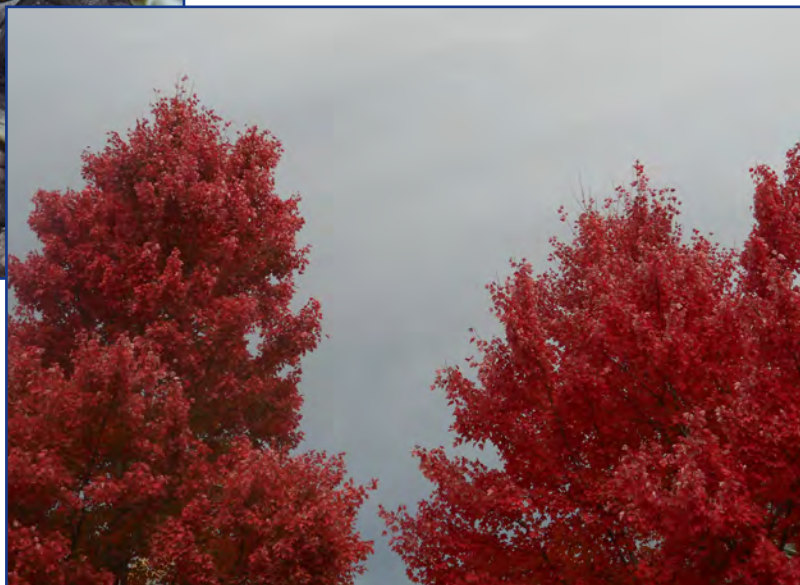
Climate change is a change in global or regional climate patterns. Changes in climate patterns can affect plants and animals in different ways. Phenology is the periodic series of life events in plants and animals that are related to climate.

Phenology is expressed in many different ways. Plants use climate cues to begin flowering or changing color each year. Many birds begin to migrate to their breeding grounds based on the length of day. Amphibians, such as frogs and salamanders, depend on air temperature and precipitation to start breeding each year. These plant and animal phenology events match patterns in climate (**figure 2**).



**Figure 1.** Kids and adults who are citizen scientists can use *Nature's Notebook* to report what they have seen in nature. Photo courtesy of Michelle Andrews.

**Figure 2.** Each plant has its own phenology. Many trees change color each fall when the days reach a certain length. Climate can affect how long and how bright leaf color gets in the fall. Photo courtesy of Babs McDonald.





Changes in plant or animal phenology can show larger changes to Earth and its environment. Just like a change in our heartbeat could show problems in our health, changes in phenology could show signs of a problem in our environment. Some plants and animals may be able to adapt to changes in climate. However, scientists are concerned that some plant and animal phenology may be disrupted by climate change.

The climate can change across all of Earth's ecosystems. Scientists, therefore, are not able to make all of the scientific observations they need by themselves. Some scientists rely on technology located around the world—such as weather stations—to record data (**figure 3**).

Other scientists ask citizen scientists to help gather the data according to a protocol. A protocol is a stated procedure and guarantees that each citizen scientist collects data in the same way. A protocol makes results more



**Figure 3.** Scientists studying climate change need to track worldwide climate information. To help gather data, some scientists rely on weather stations around the world to keep track of air temperature, precipitation, and other indicators. This weather station is located at the University of Georgia in Athens, Georgia. Photo courtesy of Jean Szymanski.

reliable for scientists. Without the help from people across the world, some scientists would be unable to collect all the data they need to complete their research. This lack of needed information would make climate change difficult to study.

Once the data are collected by a protocol, they are often entered into a **database**. A database makes it easier for scientists to

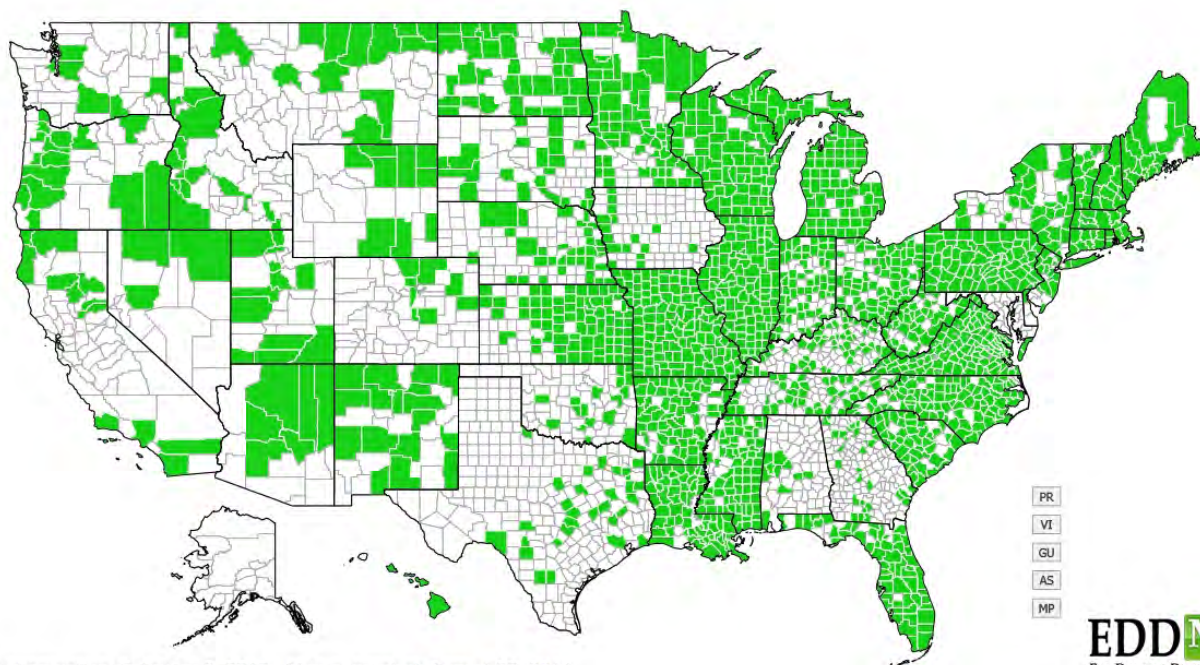
use the data. The USA National Phenology Network is an organization that creates a database. *Nature's Notebook* staff collects the data from citizen scientists, organizes the databases, and distributes data to scientists. Keeping these records is important. Scientists can analyze the information to learn about trends, or changes over time, in climate and phenology.

## How Do Scientists Use Data From *Nature's Notebook*?

Scientists want to know how a changing climate will affect plants. One group of plants they study is invasive species. Ragweed is one plant that some scientists consider an invasive species because it is spreading as the climate warms. The phenology of ragweed requires a certain temperature, length of day, and number of days without freezing temperatures to start growing.

In 2014, scientific research predicted that ragweed would spread to more North American locations. The scientists believed it was spreading due to a changing climate which created conditions suitable for the plant's phenology. Scientists used citizen science data from *Nature's Notebook* to confirm the accuracy of their research conclusions about ragweed.

*Ambrosia artemisiifolia*



Ragweed is an agricultural weed that causes allergies in humans. Green areas on the map show counties where citizen scientists have observed ragweed. Photo courtesy of EDDMapS.



## Glossary

**accurate** (ə kyə rət): Free from error.

**adapt** (ə dapt): To adjust to new conditions.

**cue** (kyū): A signal.

**database** (dā tə bās): A comprehensive collection of related data organized for convenient access, generally in a computer.

**invasive species** (in vā siv spē shēz): Any plant, animal, or organism that is not native to the ecosystem it is in and is likely to cause harm to the environment, the economy, or human health.

**migrate** (mī grāt): To move from one place to another.

**protocol** (prō tə kāl): A plan for a scientific experiment.

**reliable** (ri lī ə bəl): Giving the same results in repeated attempts.

**trend** (trend): A behavior pattern occurring and developing over a period of time.

Accented syllables are in **bold**. Marks and definitions are from <http://www.merriam-webster.com>. Definitions are limited to the word's meaning in the article.

## FACTivity

### Time Needed

One class period

### Materials

(for each student or group of students)

- Computer (optional)
- Pen/pencil
- *Nature's Notebook* Field Datasheets
- Field guides (optional)
- Binoculars/magnifying glass (optional)

Become a citizen scientist by collecting phenology data from your school, town, or home using *Nature's Notebook* ([https://www.usanpn.org/natures\\_notebook](https://www.usanpn.org/natures_notebook)). Follow the directions below to start observations or visit the *Nature's Notebook*.

Website to learn about starting observations for your citizen science project (<https://www.usanpn.org/nn/guidelines>).

### Methods

1. As a class, brainstorm up to five plants or animals that you would like to observe. These can be plant or animal species from *Nature's Notebook* "Campaign Species," or species discussed in class. Make sure that the chosen species are those that you know live nearby.
2. Choose an easily accessible location where your class can conduct observations. You can choose your schoolyard, your backyard, or a local park. If plants are being observed, remember to flag the individual plants your class is observing. Plastic flagging,



yarn, or string can be used to identify the study plant.

3. Your teacher will create a *Nature's Notebook* profile on the website. You and your classmates can submit observations to this profile. Once a profile is created, the "My Observation Deck" link allows your teacher to create an observation location. Give your location a name, such as "Riverview Middle School."
4. Next, your teacher will add the plants and/or animals that your class will observe.
5. Together with your teacher, review the protocol that you will use while observing and recording. Each plant or animal observed will have a Field Datasheet that can be printed for your use (figure 4).
6. Conduct observations two or more times per week using the Field Datasheet for each species. The longer period over which you make observations and collect data, the more you will learn about the phenology of the species you chose.
7. How did your plant or animal change during your observations? Compare your observations to the observations of other citizen scientists that are collected for the same species on *Nature's Notebook*.

## Trees and Shrubs *Deciduous*

**Directions:** Fill in the date and time in the top rows and circle the appropriate letter in the column below.

y (phenophase is occurring); n (phenophase is not occurring); ? (not certain if the phenophase is occurring).

Do not circle anything if you did not check for the phenophase. In the adjacent blank, write in the appropriate measure of intensity or abundance for this phenophase.



Species: **Cornus florida**

Common Name: **flowering dogwood**

Nickname: **flowering dogwood-1**

Site: **Sandy Creek Nature Center**

Year: **2016**

Observer: **null null**

	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:
Do you see...	Time:	Time:	Time:	Time:	Time:	Time:	Time:	Time:
Breaking leaf buds	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Leaves	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Increasing leaf size	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Colored leaves	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Falling leaves	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Flowers or flower buds	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Open flowers	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Fruits	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Ripe fruits	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Recent fruit or seed drop	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Check when data entered online:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:								

**Figure 4.** A Field Datasheet produced by *Nature's Notebook*, like this one for flowering dogwood trees, can be made for each plant or animal species your class observes. Photo courtesy of *Nature's Notebook*.