Unit Overview: Tracking Seasonal Change in Plants

Grades: 3-5

Anchoring Phenomenon: Seasonal change in plants

Driving Question: Why do plants change at certain times?

Time needed: 7 lessons requiring 7-11 45-minute periods

> ***Core Activities***: 4 lessons requiring 4-6 45-minute periods Core activities can be completed as a stand alone unit.
> ***Supplemental Activities***: 3 lessons requirng 3-5 45-minute periods. Supplemental activities provide additional supporting NGSS aligned content, but are not required to complete the unit.***SUPPLEMENTAL AVAILABLE SOON***

Overview:

Over the course of this unit, your students will become Budburst community scientists by studying the timing of seasonal life events in plants. Depending on your interest and the time of year, you may have your class focus on one or more seasonal events, including flowering, fruiting and autumn leaf color change and drop.

Unit Focus: This unit has been developed to facilitate student participation in Budburst during remote learning. Implementation suggestions primarily assume synchronous remote learning; however, activities can be modified for in person, hybrid, and asynchronous learning. Lessons are written with a focus on data collection for the following plant groups: 'Wildflowers and Herbs' or 'Deciduous Trees and Shrubs', but can be modified to focus on other kinds of plants. (See 'Tips for Budburst Datat Collection' on pg. 5 for more information).

Connection to Budburst Plant Trackers Contest:This unit can be implemented along with participation in the Budburst Plant Trackers contest. The contest comes with a free lesson guide and student-facing materials developed by Scholastic. Materials have a slightly different focus than this curriculum (Plant Trackers contest materials discuss climate change, whereas these do not); however, both the Scholastic materials and this unit prep students for Budburst data collection and address concepts such as plant phenology, seasonal life cycles, etc.
*NO PURCHASE NECESSARY. Void where prohibited. For complete details view Official Rules.

Lesson Overview:

	Lesson	# of Classes	Title	Description
Core	1	1	Phenomenal Phenology	Introduce the unit anchoring phenomenon and phenology

Core	2	1	Plants, They Are A Changin'	Introduce Budburst and the unit driving question. Zoom in on plant phenology and why plants go through seasonal change
Core	3	1-2	What's My Plant Type?	Explore Budburst plant groups and introduce the plants (species) your class will collect data on
Coming Soon	4	1	An Herb's Life	Zoom in on the life cycle of a plant in the wildflower and herb group. Discuss how seasonal changes help plants reproduce.
Coming Soon	5	1-2	Food Web Stories	Explore food webs and the importance of plants.
Core	6	1-2	Budburst Data Collection	Prepare for data collection
Coming Soon	7	1-2	Data, Data, Everywhere!	Analyze Budburst data, draw conclusions and propose new areas of investigation

Lesson Format:

Each lesson is divided into three sections: launch, procedure, and closure. The launch primarily engages/orients to content/activates prior knowledge; the procedure offers new content and asks students to practice and apply it; closure allows time for wrap up/review.

Each lesson also includes the following components
- Lesson Overview
- Essential Questions
- Student Objectives
- Time Recommendation
- Materials List
- Vocabulary
  - This section consists of a list of words used in the lesson that may not yet be familiar to students
- Ahead of Time:
  - This section offers advance preparation, background knowledge, and teaching tips.
- Resources
  - Teacher and student resources

Alignment with "The Next Generation Science Standards" (NGSS)

Performance Expectations Built Towards (**Core** Lessons):

- **Third Grade: 3-LS3-2** Use evidence to support the explanation that traits can be influenced by the environment.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions Use evidence (e.g. observations, patterns) to support an explanation.	**Inheritance of Traits** LS3.A. Inheritance of traits: Other characteristics result from individual's interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. **Variation of Traits** LS3.B. Variation of Traits: The environment also affects the traits that an organism develops	**Cause and Effect** Cause and effect relationships are routinely identified and used to explain change

- **Fourth Grade: 4-LS-1** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproductions.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argument from Evidence 3-5 builds on K-2 experiences and progresses to critiquing the scientific explanations or solutions	**Structure and Function** Plants and animals have both internal and external structures that serve various functions (in growth, survival, behaving, and reproduction (4-LS1-1)	**Systems and System Models** A system can be described in terms of its components and their interactions. (4-LS1-1), (4- LS-2)

proposed by peers by citing relevant evidence about the natural and designed world(s). Construct an argument with evidence, data, and/or a model. (4-LS1-1)		

Performance Expectations Built Towards (**Supplemental** Lessons):

The following third grade standard is primarily addressed in lesson 4:

- **Third Grade: 3-LS1-1** Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. Develop models to describe phenomena.	**Growth and Development of Organisms** LS3.A. Growth and Development of Organisms: Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.	**Patterns** Patterns of change can be used to make predictions.

The following fifrth grade standard is addressed in lesson 5:

- **Fifth Grade: 5-LS2-**: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts

Developing and Using Models	Interdependent Relationships in Ecosystems	Systems and System Models
Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. Develop models to describe phenomena. (5-LS2-1)	LS2.A: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)	A system can be described in terms of its components and their interactions. (5-LS2-1)

Tips for Budburst Data Collection:

Before beginning this unit, review our website to learn more about Budburst. A central component of this unit is student collection of plant phenology data using Budburst protocols - students observe plants and record when they go through important seasonal changes, like blooming, fruiting, etc.

Specifically, students will be following data collection protocols for Budburst's Phenology and Climate Project (https://budburst.org/phenology-and-climate) (The project examines how plants respond to climate change; this is not the unit's focus, but activities can easily be adapted for class's that do want to focus on climate). Further familiarize yourself with our data collection protocols by viewing our "Getting Started" page.

The following tips are written to help you structure and support student data collection in remote-learning situations, but could be applicable to in-person learning scenarios. See also our page Set Up For Students page for general tips, including how to set up a virtual classroom (Budburst Group) and more suggestions for in person/hybrid classrooms.

Structuring Data Collection

You can have students collect and submit data on their study plant once, or collect data for a longer period of time (suggested: 1-2 times a week for at least 1 month). Students will benefit from longer observation periods by seeing their plant go through multiple phenophases. Students can report their observations using printable observation forms and/or submit data online to a class Budburst Group. Detailed suggestions are outlined in the 'Ahead of Time' section of Lesson 6 (Budburst Data Collection).

Narrowing Your Focus and Choosing Plants:

Budburst data can be collected on any plant, anywhere, but we suggest you set limits on the types of plants your class will focus on for data collection. The following tips are written to help you narrow down your class's focus.

- *Focus on a specific plant group*

    We highly suggest limiting students to observing plants within 1 or at most 2 Budburst plant groups. Budburst plant groups are determined by the similarity of plant phenology, not necessarily by botanical family or groupings. Therefore, the phenophases of interest/observation forms vary with plant group. It will be easier to go over data collection protocols as a class and analyze class data if all students are focused on plants within the same Budburst plant group.

    Specifically, we suggest focusing on plant species that fall within the 'Wildflowers and Herbs' or 'Deciduous Trees and Shrubs' groups. Students will be most familiar with the life cycles and structures of plants in these groups, and there will be interesting seasonal change to observe in both spring and fall semesters. For instance, if you are implementing this curriculum in mid-late Fall, you can focus on leaf color change and leaf dropping in deciduous trees.

Learn more about plant groups on our website https://budburst.org/plant-groups, and Review the printable observation forms for the plant group(s) you choose to focus on by clicking the links below:

- Wildflowers and Herbs Observation Form
- Deciduous Trees and Shrubs Observation Form
- Grasses Phenology Observation Form
- Conifers Phenology Observation Form
- Broadleaf Evergreen Phenology Observation Form

- *Focus on a specific plant structure / phenophase 'wheel'*

Review the observation forms for your chosen plant group. Each form includes multiple phenophase 'wheels'. See the image below for an example (it shows the phenophase wheels from the deciduous trees and shrubs observation form):
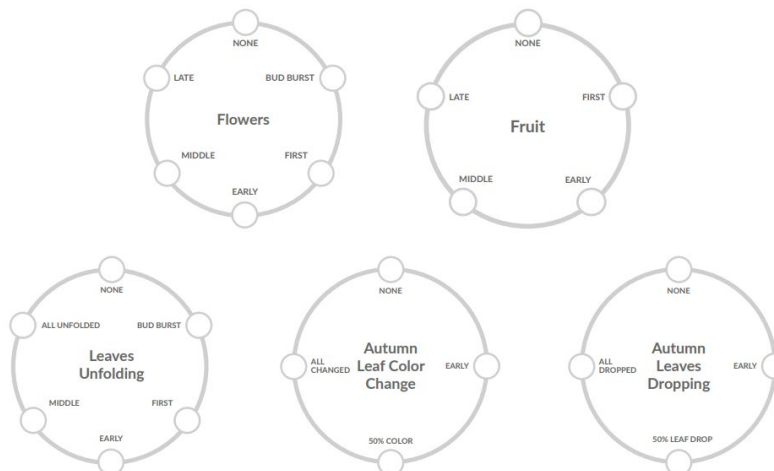
Phenophase wheels focus on seasonal changes associated with different plant parts (e.g. changes in flowers, leaves, and fruit). You can choose one or more of these wheels for your students to focus on during data collection. You may for instance, only require students to collect/submit data on flowers in spring or on autumn leaf color change in fall.

Be sure to keep your focus in mind when choosing which plant species to focus on (see information below). For example, if you want to focus on flowers, choose species that will be in bloom during data collection.

- *Choose specific plant species to focus on*

Before they can collect Budburst data, students must first choose and identify the plant they will observe. If students are at school part time, we suggest that you pre-identify some plants in the schoolyard for them. If students are remote, it makes sense to give them some freedom in choosing/identifying their own plant to observe based on what is around them (with a caretaker's help of course!). However, you may want to direct students towards some easily-identified, abundant plant species (e.g. dandelions) to both provide extra support for students who are having trouble identifying plants and to streamline data collection and analysis. Below are suggestions for choosing plant species to focus on:

- Explore your area and see which plants are abundant and recognizable around the time you are beginning data collection. There are many free mobile apps that will help you identify the plants you see (We suggest iNautralist, Seek by iNaturalist, or our own mobile app (available mid-march 2021). Note that these apps give the most accurate identifications if given pictures of leaves or flowers). More plant identification tips are outlined on the Budburst Getting Started page.

- Research what plant species are common in your area. You can (a) find online or local guides (e.g. Websites like Wildflower Search (https://wildflowersearch.org/) allow you to type in your location to see wildflowers common to your area.) and/or (b) browse featured Budburst plant species in your area (https://budburst.org/plants)

   Note: If a plant species is not in the Buburst plant species database, you can still report observations for it as long as it falls into one of the 5 Budburst plant groups. If you find such a species and want it to be added to the database or have questions about what plant group it belongs to, please email info@budburst.org.

- Remember to pay attention to phenology: Look for species that may be in interesting phenophases during the time period your students will observe them.

NOTE: If identifying the plant down to the species level is too difficult, studets can still collect and submit Budburst data! You can lower the difficulty by choosing a plant genus to focus on (e.g. oaks, maples, asters). For instance, you can have students find an oak tree (any species), and simply type in 'oak' under species when submitting data into the online form.

FAQs – Class Data Collection

1) Q: What if the phenophase defininitions on the phenology observation forms are too advanced for my students?

   A: A list of simplified phenology definitions ([Phenophase Finder](#)) can be found with the [Budburst Plant Trackers Contest](#) teaching materials. You can use these for your class, but be aware that they will not perfectly match the definitions on Budburst observation forms. You may also have to slightly adjust activities in this curriculum, which were designed to be used with standard Budburst phenophase definitions.

2) Q: I'm worried that my students's data aren't accurate. What should I do?

   A: If your student's observations aren't perfect, don't worry! When you set up your Budburst Group, click the box that says 'includes youth observations'. We'll know that your Group members are still learning!

3) Q: My students can't identify their plant's species.

   A: Users can enter Budburst data without providing a species name, as long as they know the plant group (e.g. deciduous trees and shrubs).

Please do not hesitate to reach out with any questions, comments, or concerns. We are available to help you with any aspect of the process.

Contacts:

Sarah Jones, Ph.D., Budburst Education Manager, sjones@chicagobotanic.org

Budburst, info@budburst.org