

Name _____

Study Plants to Participate in Community Science

1. Do the activities listed in the Assignments box.
2. Write in your work at the bottom of each assignment.



Assignments	Due Date

Assignment 1: Observe Plants Like a Scientist

1. **Talk** to a family member about what plants can tell us about the seasons.
Talk about what happens to trees, leaves, flowers, and grasses as the seasons change.

2. **Read** the definitions below. Practice pronouncing the words and explain their meaning to a family member in your own words.

Phenology (*noun*): the study of how changing seasons and climate affect the timing of plant/animal life cycles

Phenophase (*noun*): seasonal stage in a plant or animal life cycle

3. **Read** the **Observe Plants Like a Scientist** sheet and answer the questions below.

- How does the weather affect oak trees? Give at least two specific examples.

Observe Plants Like a Scientist: Page 6

<ul style="list-style-type: none"> Which types of plant parts do oak trees grow again each year? How might this help oak trees survive? 	
<p>Exit Slip: Read the Top Observations Tips box in the bottom right hand corner of the Observe Plants Like a Scientist sheet. Then write a journal entry as if you are a scientist observing plants for one afternoon. Include details such as:</p> <ul style="list-style-type: none"> What tools will you need to closely observe the plant? Where will you write your observations? What are the best types of clothing for observing plants? Why? What types of observations will you include about the land and water around the plant? What types of observations will you include about the bugs and evidence of other animals around the plant? What types of observations will you include about the climate? 	

Assignment 2: The Cause and Effect of Plant Growth	
1. Read the How do Plants Know When to Bloom reading passage.	How do Plants Know When to Bloom: Page 7
<p>2. Exit Slip: Answer the following reflection questions:</p> <ul style="list-style-type: none"> What is the definition of phenophase according to the text? Give an example of a spring phenophase and a fall phenophase. 	

- How can phenology help farmers make decisions?
- Is one day of unusual humidity in winter an indicator of climate change? Explain why/why not using evidence from the text.
- What does indicate climate change?
- How can observations by everyday people in their communities help scientists?
- If you participated in community science, what types of plants would you choose to observe? Why?

Assignment 3: Identify Plant Groups and Phases

1. **Make** a list of five familiar plants. What groups would you put them in?

PLANT	PLANT GROUP
1.	
2.	
3.	
4.	
5.	

2. **Read** the **Meet the Plant Groups** sheet. Go back to the chart above and type in the plant group that you think best matches the plant based on the descriptions on the Meet the Plant Groups sheet.

Meet the Plant Groups:
Page 8

3. **Practice** observing plants like a scientist by completing the **Figure Out the Phenophase** activity sheet.

Figure Out the Phenophase: **Pages 9-10**

TIP: Use the Phenophase Finder for descriptions of each plant groups' phenophases.	Phenophase Finder: Pages 11-16
<p>Project Prep: With a family member, take a walk outside or look at the plants in your home. Choose a good location for plant observation. Describe:</p> <ol style="list-style-type: none"> 1. The location you have selected 2. Explain why this is a good location 3. Describe the range of the plants in the area that you may be able to observe (if there are multiple types). <p>You'll use this information for a later project.</p>	

Assignment 4: Be a Community Scientist											
1. Read the How to Complete the Budburst Plant Trackers Project sheet.	How to Complete the Budburst Plant Trackers Project: Page 17										
2. Fill in the dates on the contest planning chart below. Discuss the plan with an adult family member or teacher.											
<table border="1"> <thead> <tr> <th>DATE</th><th>ACTION</th></tr> </thead> <tbody> <tr> <td></td><td>Select a plant and location to observe. NOTE: You can observe a plant in your home if you need to.</td></tr> <tr> <td></td><td>Observe your plant and make a detailed sketch and detailed notes.</td></tr> <tr> <td></td><td>Fill out the questions on the project form.</td></tr> <tr> <td></td><td>Give your completed entry form to your teacher or parent to send to the contest.</td></tr> </tbody> </table>		DATE	ACTION		Select a plant and location to observe. NOTE: You can observe a plant in your home if you need to.		Observe your plant and make a detailed sketch and detailed notes.		Fill out the questions on the project form.		Give your completed entry form to your teacher or parent to send to the contest.
DATE	ACTION										
	Select a plant and location to observe. NOTE: You can observe a plant in your home if you need to.										
	Observe your plant and make a detailed sketch and detailed notes.										
	Fill out the questions on the project form.										
	Give your completed entry form to your teacher or parent to send to the contest.										
<p>3. Observe your plant. Then draw your plant and write down detailed notes.</p> <p>TIPS</p> <ul style="list-style-type: none"> • You may choose to observe your plant for one day or for multiple days. • Think about how you will submit your drawing. If you are doing a digital submission, will you take a photograph of your drawing and add it to the digital sheet? 											
4. Identify your plant's group and phenophase using the Phenophase Finder .	Phenophase Finder: Pages 11-16										

<p>5. Complete the Budburst Plant Trackers entry form using your notes. Add your drawing from Step 3 above.</p>	<p>Budburst Plant Trackers Entry Form: Pages 17-21</p>
<p>Project Wrap-Up:</p> <p>Read the rubric to make sure your project meets the criteria. You can edit and polish your answers in the entry form.</p>	<p>Contest Rubric: Page 22</p>

For Families: Plant Observation at Home

<p>Choose from five fun family projects to observe plants at home!</p>	<p>Family Activity: Page 23</p>
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Observe Plants Like a Scientist!

Spot and record the changes in a plant's life cycle by looking closely at the whole plant, its surroundings, and the season.

SAMPLE LIFE CYCLE: OAK TREE

1 **SEED**



Seed Inside the oak tree's fruit (acorn) is a seed. Inside the seed is everything the plant will become.

2 **GROWTH**



Germination → Sprout → Seedling

A root grows down into the soil, anchoring the plant. The plant grows into a tree.

3 **SEASONAL CHANGES**



Tree The mature plant goes through seasonal changes. During the growing season, longer days, warmer temperatures, and rainfall cause leaves to grow.

Key Phenophases:

- **Leaf bud burst:** Look for new buds or leaves.
- **First leaf unfolded:** First leaves are completely unfolded from the bud.

SEASONAL CHANGES

4 **Flowering**
Further into the growing season, the tree begins to produce flowers.

Key Phenophases:

- **First flower:** Look for a few flowers that are fully open.
- **Middle flowering:** Half or more of the flowers are fully open (stamens visible).

5 **Fruiting**
Fruit or seed appears, then gradually grows in size and ripens as it matures.

Key Phenophases:

- **First ripe fruit:** Look for fully ripe fruit or seeds dropping.
- **Middle fruiting:** Half or more branches have fully ripe fruit or seeds are dropping.

7 **Prep for dormant season**
The plant slows

food production to prepare for winter. Leaves change color.

Key Phenophases:

- **50% color:** Half or more leaves have started to change color.
- **50% leaf drop:** At least half of the leaves have fallen off.

6 **Seeds spread**
After the acorns drop to the ground, a large number of them are carried away by animals or planted by humans to grow.



Top Observation Tips

To figure out a plant's phenophase, think about...

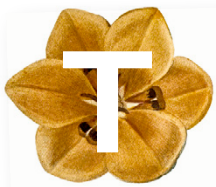
- What evidence of new growth or change do I see?
- What season is it?

Make a plant observation report with key details:

- Date of observation.
- What kind of habitat is your observation site? (Lawn, garden, next to a pond, etc.)
- How much shade does the site receive during the day?
- Can you see other organisms (like insects) interacting with the plants?
- Describe the irrigation (water source) at this site.

How Do Plants Know When to Bloom?

What we can learn about seasons and climate change from observing plants.



The life cycle of a plant is made up of different seasonal life stages, or **phenophases**, that you can easily observe. Think about when you notice leaves falling from trees in the fall or see flowers in full bloom in the spring. Those are examples of phenophases. The study of how changing seasons and climate affect the timing of plant life cycles is called **phenology**.

Knowing the schedule of plant development helps farmers and gardeners decide the best time to plant crops. Phenology helps regular people (and kids like you!) too. If you have springtime allergies, for example, it's good to know when the flowers that make you sneeze are in bloom. Or when you notice the leaves changing color in the fall, that's a signal that it's time to pull out your warm sweaters!

Plants grow when they get enough sunlight, air, and water, and when the temperature is right. Weather and climate both play a key role.

Weather refers to daily changes in the local atmosphere (whether it's going to be hot, rainy, or cold outside on a particular day). **Climate** means changes in the atmosphere over a much larger area and longer period of time. So if it is unusually hot for a few days in June, that's the weather. But if it stays hotter than normal for the whole month of June, and this pattern happens many years in a row, it means the climate in your region has changed.

Today, the Earth's climate is warming. Increasing temperatures cause spring to arrive earlier than it used to, which means that plants bloom earlier too. This shift in the seasons affects other parts of the **ecosystem**. Nature's schedule gets messed up when a flower blooms before the butterflies that pollinate it have hatched. Or when caterpillars emerge before the baby birds that eat them have hatched.

What can we do? When everyday people like you collect and share observations (called community science), scientists can use your data to track changes in ecosystems. Studying changes in plant life cycles helps them understand **climate change** and look for solutions to problems.

CRITICAL THINKING

1

How can phenology help farmers make decisions?

.....

2

Is one day of unusual humidity in winter an indicator of climate change? Explain why/why not. What does indicate climate change?

.....

3

How can observations by everyday people in their communities help scientists?

Meet the Plant Groups

Before you begin your plant observations, get to know five key plant categories.



Wildflowers and Herbs

have soft green stems. These plants die or go dormant in the winter and grow back in spring.

Deciduous Trees and Shrubs

shed their leaves every year and have hard, woody stems. Trees have one main stem (trunk). Shrubs are smaller and have many stems.



Broadleaf Evergreens

are trees and shrubs that maintain their green leaves all year long.



Grasses

have long leaves growing from the base of the plant and tiny flowers pollinated by the wind. Grasses die at the end of the growing season.



Conifers are woody trees and shrubs that produce cones with pollen and seeds (instead of fruits and flowers). Most have evergreen needles all year long.

Conifers are a type of evergreen with unique phenophases.



Phenophases & Climate Change

When weather changes with the seasons, it signals plants to move on to a new life cycle stage, or phenophase. But when climate change affects the weather, it can also affect how plants grow. For example, a peach tree needs a certain amount of chilly winter weather. If winters get warmer faster because of climate change, the trees don't produce fruit properly.



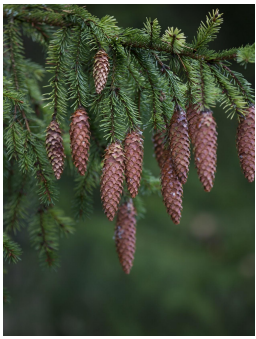
YOUR TURN!


Find a plant, then identify the phenophase using the Phenophase Finder at bit.ly/budburst01.

Figure Out the Phenophase

Be a plant detective by following these steps for each plant below:

1. **Look** carefully at plant image and description.
2. **Write** down detailed observations, especially parts that seem to be changing with the season.
3. Then use the Phenophase Finder (pages 11-16) to **conclude** which phenophase the plant is in.
→ If you're not sure, write about what you would look at more closely if you were with the plant in person (like checking for pollen).

	<p>1. Daffodil (Wildflower)</p> <p>What I observe:</p> <p>Phenophase (Flowers):</p>
	<p>2. Red Maple (Deciduous)</p> <p>What I observe:</p> <p>Phenophase (Leaves):</p>
	<p>3. Spruce (Conifer)</p> <p>What I observe:</p> <p>Phenophase (Fruit):</p>

 A close-up photograph of a flowering apricot branch. The branch is dark brown and covered with numerous small, white, five-petaled flowers. Some flowers are fully open, showing yellow centers, while others are still in bud form, appearing as small, rounded, reddish-brown structures.	4. Flowering Apricot (Deciduous)
	What I observe:
	Phenophase (Flowers):
 A photograph of a field of Little Bluestem grass. The grass is tall and thin, with a reddish-brown hue, suggesting it might be in a dormant or late autumn state. In the background, there are some dark, vertical structures that could be trees or other vegetation.	5. Little Bluestem (Grass)
	What I observe:
	Phenophase (Leaves):

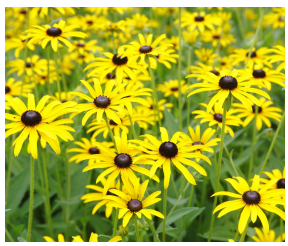
Phenophase Finder

Different plant groups have different growth phases.

When you observe plants outside or in photos, use this field guide to help figure out what phenophase(s) they're in. You can choose a phenophase for each plant part, like leaves, flowers, and fruits!

See the phenophases for these plant groups:

- Page 12 → Wildflowers and Herbs
- Page 13 → Deciduous Trees and Shrubs
- Page 14 → Conifers
- Page 15 → Broadleaf Evergreens
- Page 16 → Grasses



Wildflowers and Herbs

← Wildflowers and herbs have soft green stems.

KEY PHENOPHASES

Leaves

- **First Shoot:** The first shoot can be seen growing above ground.
- **First Emerged:** First leaf has begun to grow from its bud. The leaf can still be partly folded.
- **First Unfolded:** First leaf has fully unfolded and has almost reached (or reached) its full size.
- **All Unfolded:** All leaves are unfolded and at their full size.
- **First Withered:** First leaf has lost its green color or is dried/dead.
- **All Withered:** Most or all leaves have lost their green color or are dried/dead.

Flowers

- **None.**
- **First Bud:** First flower bud can be seen. A bud is small and sticks out from the stem or branch. (Flowers or leaves may grow out of buds. Watch the bud carefully to see which one grows!)
- **Bud Burst:** Flower buds are a little bit open and show the beginning of the flower and its color.
- **First:** The petals of the first flower are fully open. (You might see the stringy stamens in the middle!)
- **Early:** A few flowers are fully open.
- **Middle:** Half or more of the flowers are fully open.
- **Late:** Most flowers have dried up or fallen off.
- **All Withered:** All flowers have dried up or fallen off.

Fruits

- **None**
- **First:** The first fruits become fully ripe or the first seeds are dropping naturally from the plant.
- **Early:** A few more ripe fruits or seeds can be seen.
- **Middle:** Half or more of the fruits are completely ripe or many seeds are dropping.
- **Late:** Most fruits or seeds are gone. (They fell off or were carried away!)



Deciduous Trees and Shrubs

- ➔ Deciduous trees and shrubs shed their leaves every year and have hard, woody stems. Trees have one main stem (trunk). Shrubs are smaller and have many stems.

KEY PHENOPHASES

Leaves (Spring: Unfolding)

- **None.**
- **Bud Burst:** A bud opens to show a new leaf beginning to grow.
- **First:** The first leaves are fully unfolded from the bud.
- **Early:** A few more leaves have unfolded from the buds.
- **Middle:** Half or more leaves have unfolded from the buds.
- **All Unfolded.**

Leaves (Autumn: Color Change)

- **None.**
- **Early:** Only a few leaves have changed color.
- **50% Color:** Half or more of the leaves have changed color.
- **All Changed.**

Leaves (Autumn: Dropping)

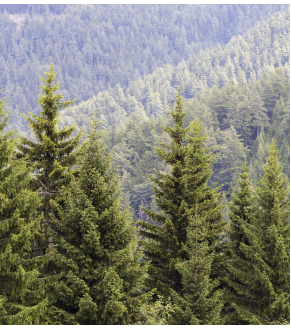
- **None:** No leaves have dropped (fallen off the plant).
- **Early:** Only a few leaves have dropped.
- **50% Leaf Fall:** Half or more of the leaves have dropped.
- **All Dropped.**

Flowers

- **None.**
- **Bud Burst:** Flower buds are a little bit open and show the beginning of the flower and its color.
- **First:** The petals of the first flowers are fully open. (You might see the stringy stamens in the middle!)
- **Early:** A few more flowers are fully open.
- **Middle:** Half or more of the flowers are fully open.
- **Late:** Most flowers have dried up or fallen off.

Fruits

- **None.**
- **First:** First fruits become fully ripe or first seeds drop naturally.
- **Early:** A few more ripe fruits or seeds can be seen.
- **Middle:** Half or more branches have fully ripe fruit or seeds dropping.
- **Late:** Most fruits or seeds are gone. (They fell off or were carried away!)



Conifers

- ➔ Conifers are woody plants that produce cones rather than flowers and fruits. Most of these trees and shrubs have evergreen needles that can stay on all year long.

KEY PHENOPHASES

Needles (Leaves)

- **None:** No new needles are growing.
- **First:** First new needles emerge (begin to grow from buds).
- **Early:** A few more new needles have emerged.
- **Middle:** Many new needles have emerged.

Pollen

- **None:** No pollen is being released.
- **First:** Plant starts releasing powdery, yellow pollen from a few of its cones.
- **Early:** A few more cones are releasing pollen.
- **Middle:** Half or more cones are releasing pollen.

Fruits (Cones)

- **None.**
- **First:** The first seed cones become ripe (turn brown, with scales expanded) or first seeds drop naturally from the tree.
- **Early:** A few more ripe cones or dropping seeds can be seen.
- **Middle:** Half or more of the cones are fully ripe or many seeds are dropping.
- **Late:** Most cones are ripe and most seeds are gone. (They fell off or were carried away!)



Broadleaf Evergreens

- ← Broadleaf evergreens are trees or shrubs that keep their green leaves year-round.

KEY PHENOPHASES

Leaves: Evergreen leaves look the same throughout the year!

Flowers

- **None.**
- **First:** The petals of the first flowers are fully open. (You might see the stringy stamens in the middle!)
- **Early:** A few more flowers are fully open.
- **Middle:** Half or more of the flowers are fully open.
- **Late:** Most flowers have dried up or fallen off.

Fruits

- **None.**
- **First:** First fruits are fully ripe or first seeds are dropping naturally.
- **Early:** A few more ripe fruits or seeds can be seen.
- **Middle:** Half or more of the fruits are fully ripe or many seeds are dropping.
- **Late:** Most fruits or seeds are gone. (They fell off or were carried away!)



Grasses

- ➔ Grasses have long leaves that grow from the base of the plant and tiny flowers that are pollinated by the wind. Grasses die at the end of the growing season.

KEY PHENOPHASES

Leaves

- **First Emerged:** First leaf has begun to grow from the ground.
- **Middle:** Most or all leaves are still fully green or at least green at their base.
- **All Withered:** Most or all leaves have completely lost their green color or are dried/dead.

Flower Stalks

- **None.**
- **First:** The first flower stalk is growing from the stem. A flower cluster (group of tiny flowers) is at the top of the stalk.
- **Early:** A few flower stalks have grown.
- **Middle:** Many flower stalks have grown.

Pollen

- **None:** No pollen is being released.
- **First:** Grass flowers start to release powdery pollen when touched. Pollen is usually yellow, but could be white to bright orange.
- **Early:** A few more grass flowers are releasing pollen.
- **Middle:** Half or more of the grass flowers are releasing pollen.

Fruits

- **None.**
- **First:** First fruits/seeds become ripe (hard when squeezed).
- **Early:** A few more ripe fruits or seeds can be seen.
- **Middle:** Half or more of the fruits/seeds are fully ripe.
- **Late:** Most fruits/seeds are gone. (They fell off or were carried away!)



How to Complete the **Budburst Plant Trackers** Project

Hello, students! Ready to be plant detectives? Here's how to complete the Budburst Plant Trackers project to show off your skills.

1. **Observe** → Find a plant to observe.
2. **Take Notes** → While you look closely at all the plant's parts, draw what you see and write notes to help you remember. You will use this information later.
3. **Match** → Locate your plant's group on the Phenophase Finder (pages 11-16) then find your plant's phenophase(s).
4. **Explain** → Fill out the contest entry form on the next four pages. If you need more space, you can use extra pages.
5. **Check** → Use the rubric (page 22) to make sure you have done your best work.



Budburst Plant Trackers

Entry Form

Your Name:	Grade:
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A. PLANT SKETCH Draw the plant you are observing. Label the parts.

Plant Group: _____ **Date of Observation:** _____

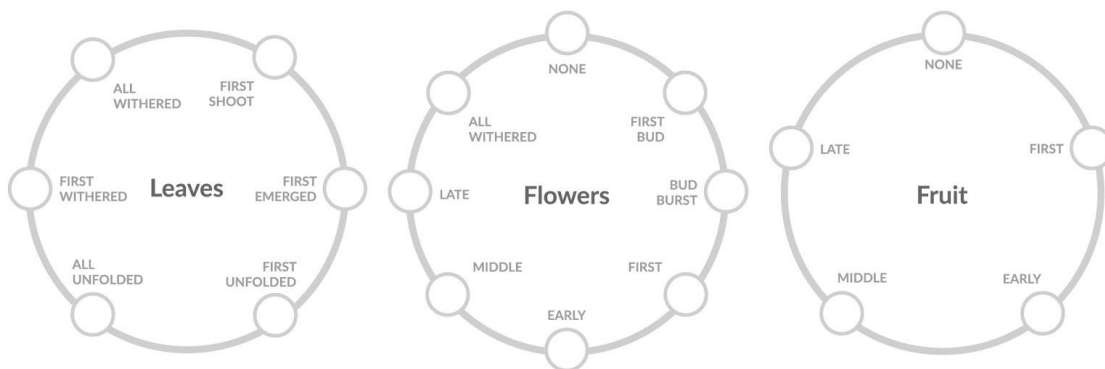
↑ *Hint: You can find descriptions of the plant groups in the *Phenophase Finder* (pages 11-16).*

B. PHENOPHASE

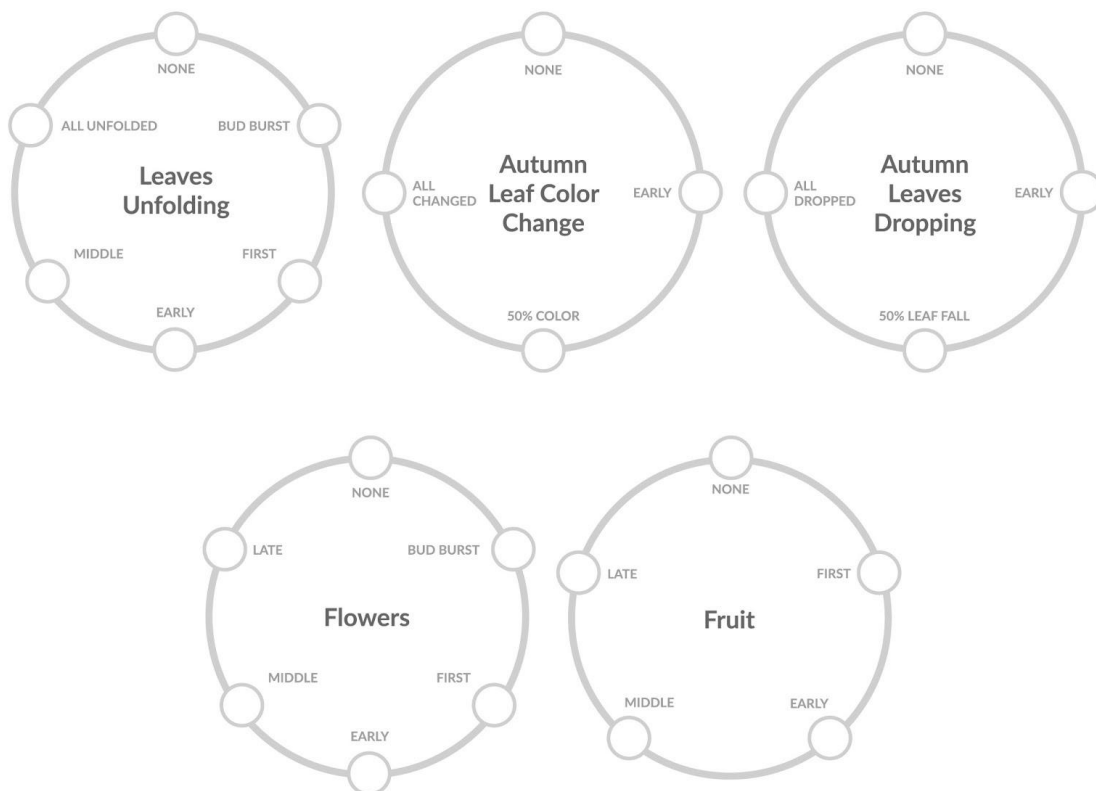
A **phenophase** is a seasonal stage in a plant life cycle. Find your plant group on the phenophase wheels below. **Choose the phenophase for a specific part (or multiple parts) of your plant** (such as Leaves: First Shoot). If you need more details to help you decide, check the Phenophase Finder (pages 11-16).

Plant Part(s):	Phenophase(s):
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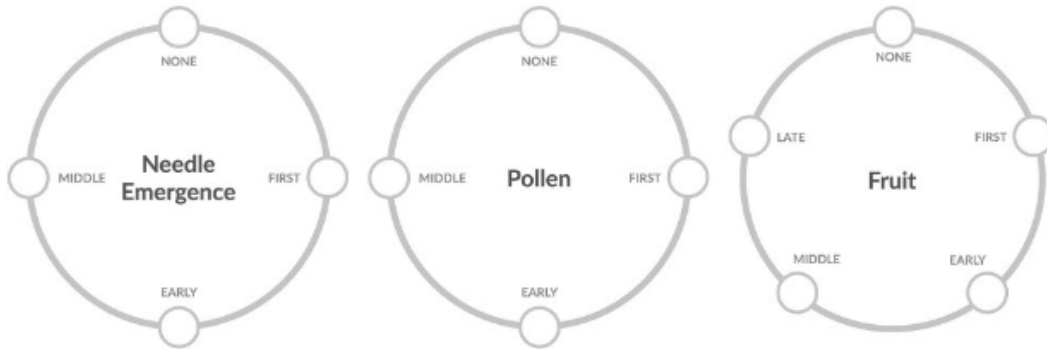
WILDFLOWERS AND HERBS



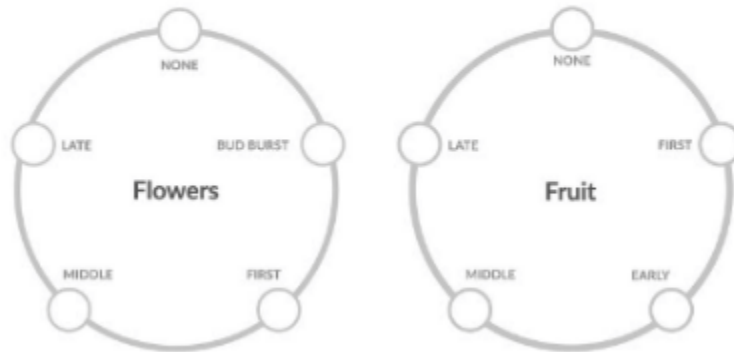
DECIDUOUS TREES AND SHRUBS



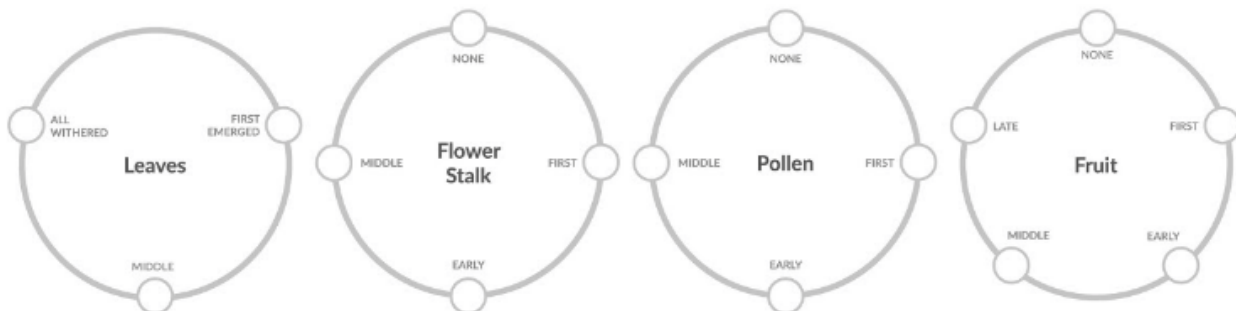
CONIFERS



BROADLEAF EVERGREENS



GRASSES



C. OBSERVATIONS/FINDINGS

<p>1. Describe the parts of the plant you observed (size, parts, colors, etc.).</p>
<p>2. How did your observations help you choose your plant's phenophase?</p>
<p>3. Describe the habitat where the plant is growing (grassy area, park, forest, etc.).</p>
<p>4. How might recent weather have affected your plant? Is the weather usual for this time of year?</p>

D. PREDICTIONS

<p>1. What might happen next in this plant's life?</p>
<p>2. For Grades 5–6: Predict how climate change might affect your plant's life cycle patterns in future decades. Explain your reasoning.</p>

Name _____

Budburst Plant Trackers

Project Rubric

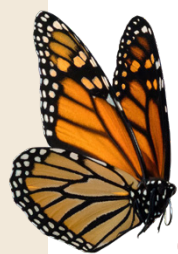
Use the criteria below to help you write your contest entry.

CRITERIA	Possible Points	Points Earned
WRITING <ul style="list-style-type: none">• Observations are described clearly (can include: size, color).• Observations include topic-specific vocabulary.• Claims about the plant and its phenophase are accurate and thoughtful, supported with reasons and/or evidence.• Predictions show knowledge of plant life cycle patterns.	10	
DRAWING <ul style="list-style-type: none">• The drawing includes different plant parts.• Multiple plant parts are labeled with accurate vocabulary (examples: stem, trunk).• The drawing is neat and clear.	5	
LANGUAGE <ul style="list-style-type: none">• Writing is clear and organized.• Spelling, capitalization, punctuation, and grammar show careful editing.	5	
TOTAL POINTS	20	



Dig In to a Plant Project!

In class, your child has been exploring plant life cycles. Extend the learning at home with these fun family activities.



Get Outside With Budburst

Participate in *community science*—when everyday people share what they see to help scientists gather data from across the country! Find a fun plant observation project at budburst.org/projects.



Grow a Garden Indoors

Plant a windowsill herb garden and keep a growth journal. Bonus: You can use the herbs to cook a favorite dish for the whole family to enjoy!



Compare and Contrast

Plant two of the same type of plant in pots and experiment with different exposure to sunlight, heat, or water. Create a chart for everyone's observations and post it on the fridge!



Host a Plant Podcast

Grow a bean in a jar, then record a daily podcast or write and illustrate journal entries to describe its progress.



Create a Plant Puzzle

Draw and color a plantscape on cardboard (include roots, stems, leaves, and flowers). Cut the cardboard into puzzle pieces and mix them up. Then, assemble them as a family!