Name _____

Lilac Festival

Inquiry Overview

Lilacs are an iconic plant that flower in the spring in many parts of the United States. Using data from Project Budburst, a citizen science project in which volunteers monitor the timing of plant life cycle events, you will predict the best date to host a lilac blossom festival so that lilacs are in full bloom.

Step 1: Plant throughout the year.

Reflect on your own or share with a family member:

- What changes where you live tell you that spring or fall is here?
- What events do you celebrate at a specific time of year that you associate with a plant?

Step 2: Consider an interesting phenomenon.

People often host festivals to celebrate specific plants. One celebrated plant is the common lilac. In Rochester, New York, as well as other parts of the country, people host festivals when the lilacs are in full bloom.

Watch this news clip of the Rochester Lilac Festival that was posted in September 2018. The festival took place in May 2019.

Reflect:

- How could they know when the lilacs will be in bloom 8 months in advance?

Step 3: Learn about lilacs.

Read about the common lilac below. *(from https://budburst.org/plants/70)*

Image by Marisa DeMeglio from NYC, USA, licensed under CC BY 2.0.

Scientific name: *Syringa vulgaris*
Plant family: Oleaceae
Leaves
The leaves are simple, smooth, and heart-shaped. They are 2 to 5 in (5 to 12.5 cm) long and dark green in color.
Flowers
Common lilacs have very conspicuous flowers. The small, fragrant, showy flowers grow in clusters 4 to 8 in (10 to 20 cm) long. Generally, they are purple, lilac, or white in color.
Fruits
The fruiting capsules are 0.39 to 0.59 in (1 to 1.5 cm) long with flat, winged seeds.

Habitat
As a nonnative garden shrub, common lilac bushes grow only where they have been planted, such as in parks and gardens. They thrive in the eastern, midwestern, and northern parts of the United States as they prefer areas with colder winters.

Did you know?
Homesick settlers from Europe introduced the common lilac. Bushes still can be seen thriving near abandoned pioneer homesteads. Ethnobotanical uses for the plant have been fever reducer, malaria treatment, perfume, tonic, and homeopathy.

Bloom Time
The greatest bloom is usually observed in the late spring, with fruit and seed production starting in the summer. In the middle of winter, common lilac buds are desiccated (dried out) and appear somewhat “shriveled.” In late winter, after conditions begin to warm, the buds hydrate (swell due to becoming moist) and the tips open slightly. Watching for these two events is the best way to know when to start daily observations looking for first leaf. Once the buds have swelled and bud ends are slightly open and a bit green, the next round of warm weather can force the first leaf event.

Step 4: Watch the lilac life cycle.

In Rochester, they host the festival when the lilacs will be in full bloom. Here is a video from January through May showing changes in one lilac plant throughout half of the year.

Watch this Time-lapse video to see the lilac life cycle in action.

Scientists call these changes in life cycle **phenology**. Phenology is the study of the timing of the biological events in plants and animals such as flowering, leafing, hibernation, reproduction, and migration. Specific plant and animal life cycle stages, such as leafing, flowering, or fruiting are called **phenophases**.

Step 5: Focus question.

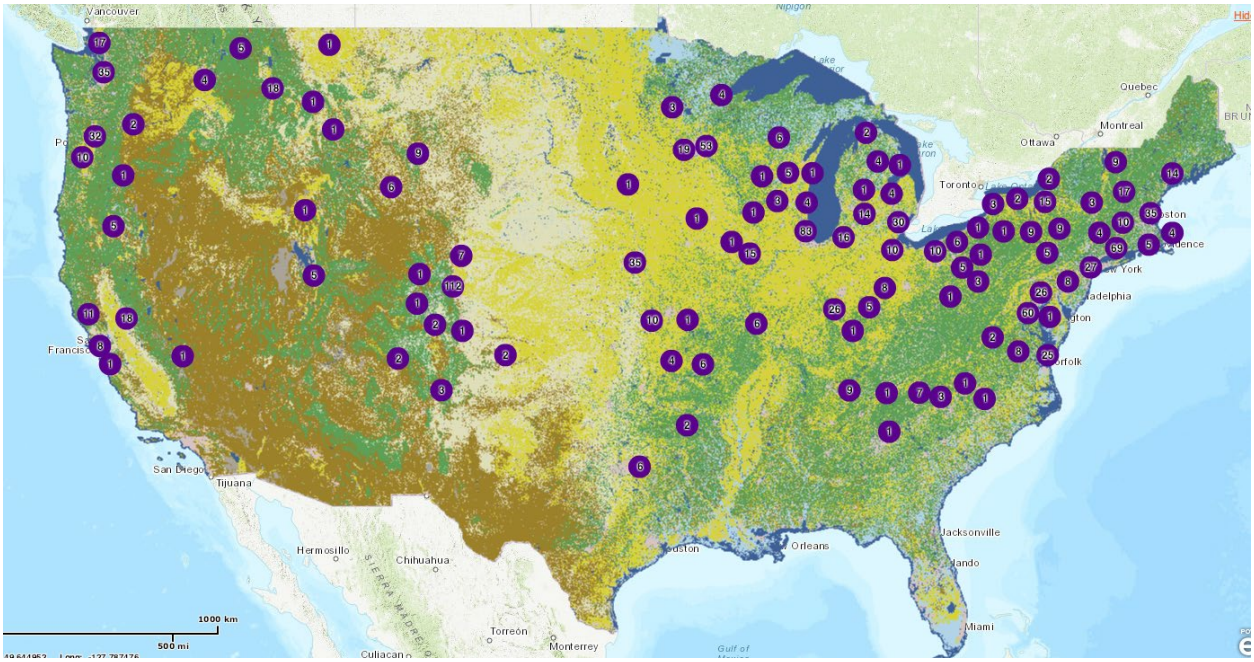
In this inquiry, you will investigate this question:

When should our city host a lilac blossom festival so lilacs would be in full bloom?

Look at the Figure 1 below and see if lilacs grow in your area.

- If lilacs grow near you, use your city for this inquiry.
- If you do not see a purple circle where you live, select another city in the United States that you would like to use to investigate this instead. Record the city you will focus on here.

Figure 1. Map of lilac observations produced by volunteers as part of the Budburst citizen science project.



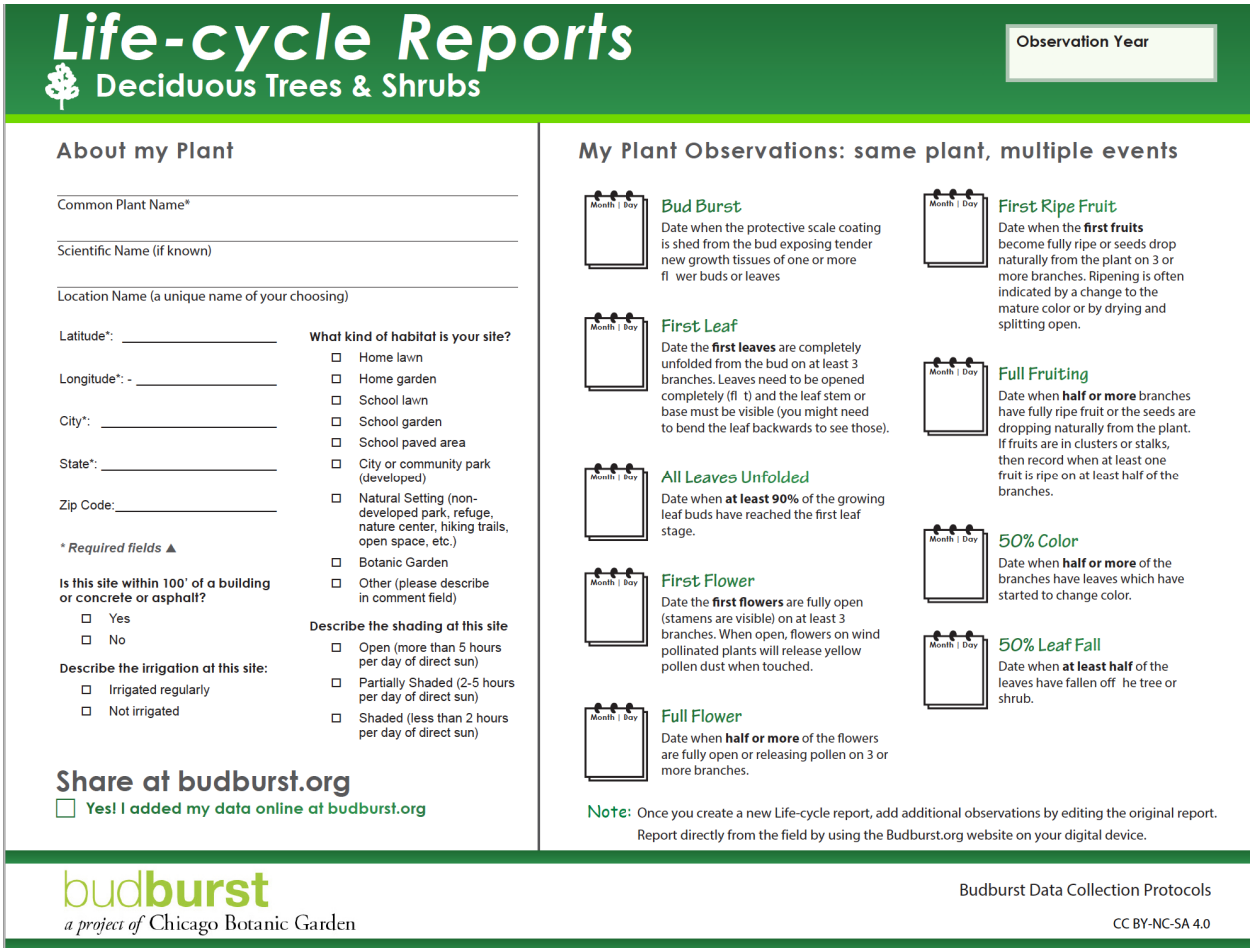
Step 6: Learn about Budburst data collection.

We can predict when lilacs will be in full bloom in our area by looking at when they bloomed in the past. Read the information below about a project called Budburst.

Throughout the year, volunteers across the United States monitor individual plants and record the timing of plant life cycle events including leafing, flowering, fruiting, as well as changes in leaf color. Anyone can decide to monitor a plant and can observe and report one plant on one day or the same plant over many years. People started collecting data in 2007, and since then, almost 10,000 people from 50 states have participated.

Budburst data are freely available, and anyone (including scientists, educators, horticulturalists, and students) can use them to answer specific and important research questions.

Here is an example of the data collection sheet that volunteers use to record data.



Life-cycle Reports

Deciduous Trees & Shrubs

Observation Year

About my Plant

Common Plant Name*

Scientific Name (if known)

Location Name (a unique name of your choosing)

Latitude*: _____

Longitude*: - _____

City*: _____

State*: _____

Zip Code: _____

* Required fields ▲

Is this site within 100' of a building or concrete or asphalt?

- ☐ Yes
- ☐ No

Describe the irrigation at this site:

- ☐ Irrigated regularly
- ☐ Not irrigated

What kind of habitat is your site?

- ☐ Home lawn
- ☐ Home garden
- ☐ School lawn
- ☐ School garden
- ☐ School paved area
- ☐ City or community park (developed)
- ☐ Natural Setting (non-developed park, refuge, nature center, hiking trails, open space, etc.)
- ☐ Botanic Garden
- ☐ Other (please describe in comment field)

Describe the shading at this site

- ☐ Open (more than 5 hours per day of direct sun)
- ☐ Partially Shaded (2-5 hours per day of direct sun)
- ☐ Shaded (less than 2 hours per day of direct sun)

Share at budburst.org

☐ Yes! I added my data online at budburst.org

My Plant Observations: same plant, multiple events

Bud Burst

Date when the protective scale coating is shed from the bud exposing tender new growth tissues of one or more fl wer buds or leaves

First Leaf

Date the **first leaves** are completely unfolded from the bud on at least 3 branches. Leaves need to be opened completely (fl t) and the leaf stem or base must be visible (you might need to bend the leaf backwards to see those).

All Leaves Unfolded

Date when **at least 90%** of the growing leaf buds have reached the first leaf stage.

First Flower

Date the **first flowers** are fully open (stamens are visible) on at least 3 branches. When open, flowers on wind pollinated plants will release yellow pollen dust when touched.

Full Flower

Date when **half or more** of the flowers are fully open or releasing pollen on 3 or more branches.

First Ripe Fruit

Date when the **first fruits** become fully ripe or seeds drop naturally from the plant on 3 or more branches. Ripening is often indicated by a change to the mature color or by drying and splitting open.

Full Fruiting

Date when **half or more** branches have fully ripe fruit or the seeds are dropping naturally from the plant. If fruits are in clusters or stalks, then record when at least one fruit is ripe on at least half of the branches.

50% Color

Date when **half or more** of the branches have leaves which have started to change color.

50% Leaf Fall

Date when **at least half** of the leaves have fallen off he tree or shrub.

Note: Once you create a new Life-cycle report, add additional observations by editing the original report. Report directly from the field by using the Budburst.org website on your digital device.

budburst

a project of Chicago Botanic Garden

Budburst Data Collection Protocols

CC BY-NC-SA 4.0

Review the information above and the data collection sheet. When participants enter data, in addition to submitting information from this sheet, they also enter the observation date. Consider the following questions.

- **Who** collected the data?
- **When** did they collect the data?
- **What** data were collected? What was measured? How was it sampled?
- What data from this data collection sheet might help us predict when to host a lilac festival so lilacs are in full bloom?

Step 7: Investigate lilac full -flower data from around the United States

We will use a mapping and graphing software called FieldScope to investigate Budburst lilac full-flower data from around the United States.

- Go to this graph in FieldScope: **https://budburst.fieldscope.org/visualizations/205/**
- Analyze and interpret the data in the histogram.
    - First, make observations with the online histogram:
        - Write "What I see" (or WIS), then write your observation in a complete sentence in the chart below.
        - Do this for each observation.
    - Second, interpret what these observations mean:
        - Think about what each observation means.
        - Write "What it means" (or WIM) and then add your explanation next to the observation in the chart below.
    - As you explore the graph online, you can make WIS and WIM statements about the graph, the data table, and the map.

What I see	What it means
Example: The shape of the graph is like a mountain.	*Example: Some lilacs flower really early and others flower later. But most flower in the middle.*

Step 8: What did we figure out?

As you observed, lilacs flower at many different times throughout the spring. Why is there so much variability in the timing of lilac flowering?

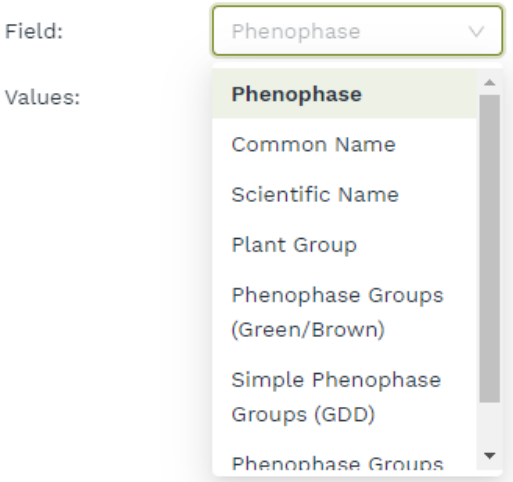
Record your initial ideas to the questions below:

- Why does the timing of when lilacs flower vary so much?
- What might influence when a lilac will flower?

- Watch this video - [How Do Trees Know When It's Spring video] - to gather more information.

The length of the night and day is what triggers trees and flowers to bloom. Project Budburst does not collect data on length of day. At right are the variables they do record.

Could we substitute any of the Budburst variables instead of day length? Which one could we use and why? Record your thinking here.



Step 9: Further investigation.

If day length influences when lilacs flower, instead of using day length, we can use latitude as a substitute. We can investigate: **Is there a relationship between latitude and when lilacs are in full bloom?**

We will use a scatter plot graph to look at the relationship between these two variables:

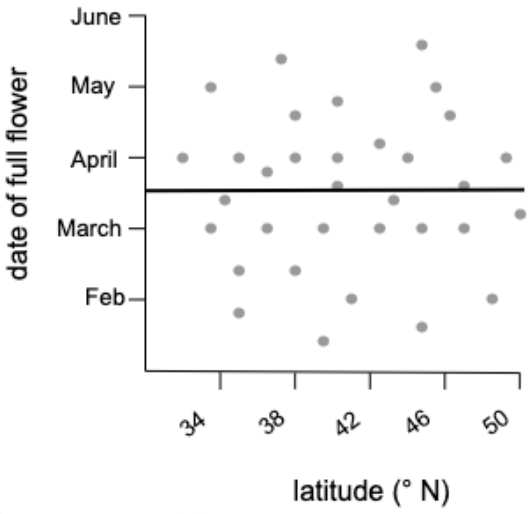
- latitude
- date of full lilac flower

Latitude will be the independent variable and date of full lilac flower will be the dependent variable. On our scatter plot, we will see latitude on the x-axis and date of full lilac flower on the y-axis.

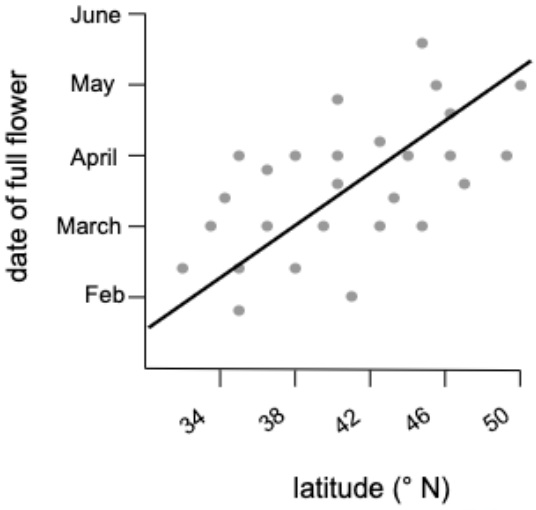
Step 10: Anticipate what we would expect to see an d what it would mean.

Examine Graphs A-D below. These are examples of what we might expect to see.
Record your ideas about what each graph would mean below each graph.

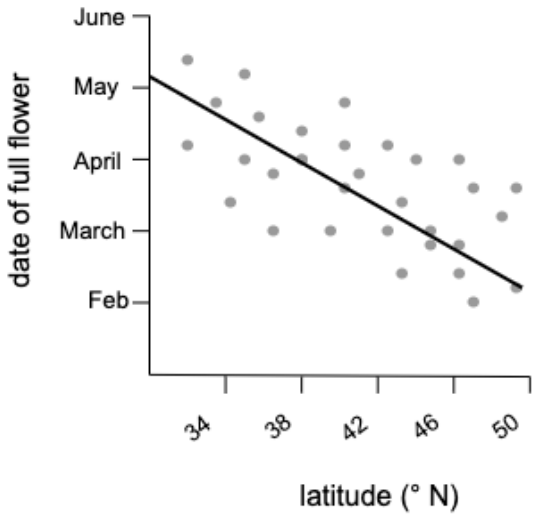
Graph A



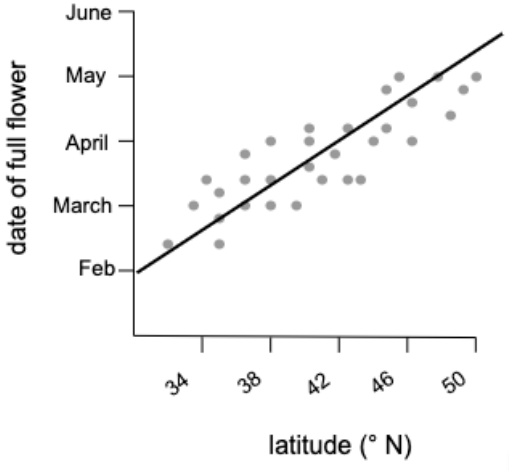
Graph B



Graph C

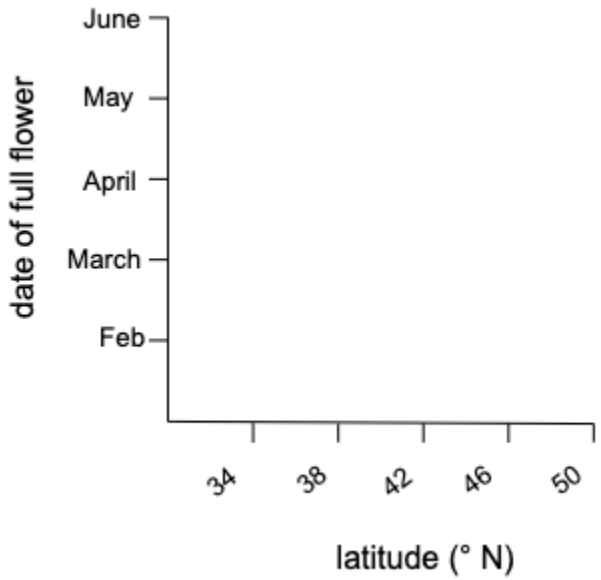


Graph D



Step 11: Make a prediction.

Draw your prediction about what you think the actual relationship is between date of full flower and latitude on the graph.



Step 12: Investigate the relationship between latitude and lilac full -flower date.

We will use FieldScope to investigate the relationship between latitude and lilac full-flower date.

- Go to this graph in FieldScope: https://budburst.fieldscope.org/visualizations/206/
- Analyze and interpret the data in the scatter plot.
    - First, make observations with the online scatter plot.
        - Write your observation about the High, Low, Pattern, and Anomalies you observe in a complete sentence, using the chart below. Do this for each observation.
        - High - What is the highest value?
        - Low - What is the lowest value?
        - Pattern - What patterns do you notice in the data?
        - Anomaly - Are there any data points that do not follow the trend? Any outliers?
    - Second, interpret what these observations mean:

- Think about what each HLPA observation means.
- Write “What it means” (or WIM) and then add your explanation next to the observation in the chart below.

- As you explore the graph online, you can also make HLPA and WIM statements about the graph, the data table, and the map views.

HLPA: High, Low, Pattern, Anomaly	What it means
Example: High: The highest y value was day 178.	*Example: The 178th day of the year was the latest day that lilacs flowered. This happened in Colorado.*

Step 13: Make sense of the data.

We are trying to figure out: Is there a relationship between latitude and when lilacs are in full bloom? Record your reflections about the following questions:

- What did you notice?

- What does it mean?

- How certain are you?

Step 14: Use the model to make a prediction.

Our guiding question is: When should our city host a lilac blossom festival so lilacs would be in full bloom? The best-fit line equation is $y = 4x - 43.38$. In this equation, x = latitude and y = day of year. Use the line to predict when lilacs would be in full bloom in our city.

1. Look up the latitude of your city at https://www.latlong.net/ and record it here.

2. Plug that latitude value into the best-fit line equation $y = 4x - 43.38$ and solve for y.
   a. x = latitude
   b. y = date of full flower

3. Use a day of year converter (on this website) to convert your y value to the actual day of the year that the model predicts flowers to be in full bloom.

   Here are some example latitudes, days of year, and actual dates in 2021.

Latitude (x value)	Day of year (y value)	Actual date of 2021
36	101	April 11
38	109	April 19
40	117	April 27
42	125	May 5
44	133	May 13
46	141	May 21
48	149	May 29

Step 15: Next steps.

When should our city host a lilac blossom festival so lilacs would be in full bloom? Record your ideas about the following questions:

- How certain are you about hosting a lilac festival on the predicted date from the model?

- What else would you want to investigate to hone the window for the lilac festival date with greater certainty?

Step 16: Record a written argument.

Should our city host a lilac blossom festival on the day predicted by the model?

Write your argument below and make sure to include the following key points.

- Make a **claim** that answers this question.
- What **evidence** did you use that supports your claim?
- Explain your **reasoning** and how the evidence supports your claim.

BECOME A CITIZEN SCIENTIST (*OPTIONAL EXTENSION*)

You are invited to become a citizen scientist by participating in a project where volunteers contribute important environmental data about our world. Below you can read about how to get started with Budburst.

Budburst

Trained individuals record key life events of plants throughout the year and submit these observations to the Chicago Botanical Garden. For more information, visit Budburst online.

Who can participate: Anyone with

- An interest in plants;
- A plant that you can observe either one time (One-time observation) or multiple times (Life-cycle observation)

Where do you need to collect data: A plant you can observe near your home
When: Any time of day