Clonal and Common and Lilac Protocol

Purpose

Record the five phenophases of either common or clonal lilac plants.

Overview

During the growing season, students will observe their lilac plants and identify the five phenophases (first leaf, full or 95% leafed, first bloom, full bloom and end of bloom) for each lilac plant.

Student Outcomes

Students will learn to,

- Identify the five phenophases of lilac plant;
- Examine relationships between weather and climate, and when the phenophases occur;
- Communicate with other GLOBE schools;
- Collaborate with other GLOBE schools;
- Share observations by submitting data to GLOBE archive.

Science Concepts

Earth and Space Sciences

Weather changes from day to day and over the seasons.

The sun is the major source of energy at Earth's surface.

Life Sciences

Organisms can only survive in environments where their needs are met.

Organisms' functions relate to their environment.

Organisms change the environment in which they live.

Plants and animals have life cycles.

Energy for life derives mainly from the sun.

Living systems require a continuous input of energy to maintain their chemical and physical organizations.

Scientific Inquiry Abilities

Identify answerable questions.

Design and conduct scientific investigations.

Use appropriate mathematics to analyze data.

Develop descriptions and explanations using evidence.

Recognize and analyze alternative explanations.

Communicate procedures and explanations.

Time

5-10 minutes

Frequency

Once a day preferably at the same time each day, starting in early spring to the end of bloom

Materials and Tools

For Site Definition (once only)

- *GPS Field Guide*
- *GPS Data Sheet*
- GPS
- Compass
- Camera

For Observations

- *Clonal and Common Lilac Site Field Guide*
- *Clonal and Common Lilac Site Definition Sheet*
- *Clonal and Common Lilac Field Guide*
- *Clonal and Common Lilac Data Sheet*
- Pencil or pen

For Planting and Care

- Pail
- Bone meal or superphosphate
- Fertilizer
- Peat moss or compost
- Wooden or metal stakes
- Flagging tape

Preparation

Make copies of *Data Sheets*

Make color copies of color photographs of the 5 phenophases (if color copier is available)

Prerequisites

Practice identifying phenophases of lilac plants

Introduction

The *Common and Clonal Lilac Protocol* asks students to examine one or two species of plants– lilacs (*Syringa vulgaris and S. chinensis*). *Budburst, Green-up and Green-down Protocols,* on the other hand, ask students to observe native vegetation in their area. In places where lilacs grow, students can observe the budding and blooming of common lilac plants. There may be plants already growing at or nearby your school, or a lilac plant can be bought and planted for students to observe. Clonal plants *(Syringa chinensis)* are genetically identical individuals. Cloned plants are available in limited supply each year. GLOBE schools can apply to receive a pair of cloned lilac plants.

Plants of the same species respond similarly to environmental changes, such as changes in temperature and moisture, even if they are located in different regions in the world. By having a network of lilac plants around the world (where this plant species is capable of growing), scientists can then examine regional and global patterns in phenology. Clonal plants respond identically to environmental changes. Variations observed in the dates of growth stage events in clonal plants can be clearly linked to climate rather than to variations between individual plants.

Scientists will use on-the-ground observations of native trees to refine the interpretation of satellite data. Scientists are interested in learning how native vegetation responds from year-to-year and over many, many years. Clonal and common lilac observations serve as vital links between satellite measurements and native plant phenology in local areas. Phenology data will improve models of Earth systems and understanding of global climate change. Lilac and native tree phenology observations are easy and inexpensive and are a wonderful way to learn about interactions between plants and the atmosphere and soil.

Teacher Support

How to obtain common or clonal lilac plants

Common lilacs can be bought at a local garden center. Please make sure you buy lilac plants with the scientific name *Syringa vulgaris*. They are often called 'old-fashioned' or 'hedge' lilacs. Only grow lilacs if the local climate can support them. Do not perform the protocol in areas where continued watering is required for lilacs to survive. If you have any questions about the lilac's ability to thrive "naturally" in your region, please consult a local horticulture specialist.

Cloned plants are available in limited supply each year. GLOBE schools can apply to receive a pair of cloned lilac plants. Up to twenty-five GLOBE schools will be selected each year and given two clonal lilac plants. Selection will be made from geographically diverse areas where the lilacs are likely to grow successfully. Preference will be given to schools making the GLOBE Chief Scientist's Atmosphere Honor Roll. To be eligible, the school must commit to participate in this special project for a minimum of five years and also must plant and observe at least two common lilac plants. The common and clonal lilacs must be planted next to one another so that they will experience the same climate conditions.

To apply for cloned lilac plants, please send your GLOBE School name, mailing address, GPS coordinates and a written statement of commitment to participate in this research for five years from the school principal or other appropriate authority to Prof. Schwartz (email: mds@uwm.edu or Fax: (414) 229-3981).

Advance Preparation

Use the pictures of the five phenophases to teach students how to correctly identify the growth stages on their lilac shrubs.

Measurement Procedures

When to Start Observations:

In the middle of winter, lilac buds are desiccated (dried out) and appear somewhat 'shriveled' (winter buds closed).

In late winter, after conditions begin to warm, the buds hydrate (swell due to becoming moist) and the tips open slightly (winter buds open).

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.

Phenophases of the Lilac Shrub:

1. **First leaf** is when the widest part of the newly emerging leaf has grown beyond the ends of its opening winter bud scales. The leaf is distinguished by its prominent midrib and veins

2. **Full or 95% leafed** is when nearly all (at least 95%) of the actively growing leaf buds have already leafed

3. **First bloom** is when at least 50% of the flower clusters have at least one open flower. The lilac flower cluster is a grouping of many, small individual flowers.

4. **Full bloom** is when 95% of the flower clusters no longer have any unopened flowers but before many of the flowers have withered

5. **End of bloom** is when at least 95% of the flowers have withered or dried up and the floral display has ended.

Connections to Other Measurements

Before you plant your lilacs, you could either dig a soil pit or collect a soil profile with an auger and perform a soil characterization following the *Soil Characterization Field Measurement Protocol* in the *Soil Chapter*. If the soil profile has been affected by previous plantings, or the addition of water and fertilizer, please mention this in the comment section on the *Soil Characterization Data Sheet*.

Measurements of air and soil temperature, soil moisture, and precipitation could lead to very interesting student research projects exploring relationships between atmosphere and soil measurements, and plant phenology.

Site Selection

Choose a site that represents the natural soil and climate of the region. Use the following guidelines to help you select a site. We realize that you may not be able to locate an "ideal" site. Do the best you can and record any deviations from the ideal in the comment (metadata) section on your *Common and Clonal Lilac Site Definition Sheet*.

Find a location to plant your shrubs with the following specifications:

- An unshaded place that is away from buildings, trees, or other obstacles. The minimum distance from the base of any obstacle should be at least 2 times the height of that obstacle.
- Away from footpaths, sidewalks, and roads. The distance from a two-lane road should be at least 8 meters. The distance from a large eight-land highway should be at least 25 meters.
- Easily accessible.
- Where there is no risk of plants being trampled by people or animals.
- Where excessive amounts of snow do not accumulate from drifting or plowing.
- On a level surface. If you have a hilly landscape, avoid if possible, the low areas that can unduly delay shrub development in the Spring. Avoid places with slopes greater than 3 degrees.
- In soil commonly found in your area. Avoid planting in soil, such as a garden, that has received heavy applications of manure or compost.
- Where there are no special microclimates (such as frost pockets or windy slopes) for plants.
- Avoid places with lots of artificial light.

Planting and Care

1. Planting

Lilac shrubs can be planted as soon as the ground is warm in the spring and on into the summer, provided there is at least a month of warm weather to bring out leaves before the cold season. Late spring, early summer planting is best.

Materials

- ❑ Pail
- ❑ Bone meal or superphosphate
- ❑ Fertilizer
- ❑ Peat moss or compost
- ❑ Wooden or metal stakes
- ❑ Flagging tape

Note: The quality and validity of data depend strongly upon healthy shrubs, so you should observe the following practices to ensure their health. You may want to consult a horticulturist.

1. As soon as you get the plants, soak the roots in a pail of water for a few hours.
2. Dig holes deep enough to just cover the roots and wide enough you can spread roots horizontally. Leave at least 5 meters between plants.
3. Mix about 120 ml of bone meal or superphosphate into the soil in which the plant is going to be planted. In heavy clay soils or in very sand soils, add equal parts of compost to backfill soil to improve growing conditions.
4. At least once a week for the first month, water the new transplants until the soil is soaked.

5. Apply either a dry fertilizer such as 10-10-10 or a liquid soluble one during the first growing season according to label directions.
6. Place a wooden or metal stake beside each plant to indicate its location and prevent accidental damage.
7. Mark each shrub with flagging tape or some other durable identification. Label the flagging tape with the name of the plant variety for each shrub.

2. Annual Care

Materials

- ❑ 5-10-10 fertilizer or its equivalent
- ❑ Mulch: peat moss, bark, well-rotted sawdust or similar organic matter

1. Spread 50 g of 5-10-10 fertilizer or its equivalent evenly around each plant. Shrub fertilizer stakes may be used instead.
2. Keep the soil within 30 cm of the base of each plant free of grass and weeds with a mulch of peat moss, bark, well-rotted sawdust, wood chips, or similar organic material.
3. During a long dry period, you may have to water the plants.
4. During the first and second years, the plants may need extra care to make sure that they are strong. After that, fertilizers may not be needed. Check periodically to make sure that they are in good health.

3. Pruning

Plants should be pruned every 5-10 years to maintain good shape. Prune lilacs immediately after bloom in spring because the following year flower buds are formed on new wood that grows after bloom. Avoid fall pruning because it will destroy the buds for the next year. Old, dried-up flowers may be cut off if desired so that the shrubs do not look unsightly.

One or more of the older main stems at the base of the plant may be removed and some, or all, of the remaining stems trimmed back to maintain the size and shape desired. Never remove more than 1/3 of the plant at any one time.

4. Protection Against Disease, Pests, and Severe Weather

These plants are relatively resistant to insects and diseases. Occasionally they may be affected by powdery mildew, leaf spot, scale, or aphids. Control measures rarely are needed except for scales. Should these diseases or insects become serious, regular applications of a pesticide may be necessary. Contact the Agricultural Extension Service in your state, province or county for the latest control recommendations.

In some locations animals, such as rabbits and mice, may severely damage the plants. Wire-mesh guards around the base of the plants help to control such damage.

For winter protection in areas of little snowfall, 5-10 cm of mulch around the base of each plant will protect its roots from frost damage. To prevent breakage from ice, wrap stems together loosely with twine or place burlap (such as from a feed bag) on a frame over the plant. Do not use plastic.

Frequently Asked Questions

1. Are these plants invasive?
No. Lilacs are not invasive. The clonal lilacs are also sterile hybrids that produce no seeds.

2. Can we plant both clonal and common lilacs?
Yes. Comparison data between the clonal and common lilacs are highly desirable.

3. What do I do if a lilac shrub dies?
On the Lilac Site Definition page, record when the plant died. You can plant another lilac shrub and enter the new planting information.

4. What if all our lilacs die?
Plant new lilacs and define a new site.

Common and Clonal Lilac
Site Definition Field Guide

Task
To take photographs and locate the latitude, longitude, and elevation of your lilac site

What You Need
- ❑ *Common and Clonal Lilac Site Definition Sheet*
- ❑ *Basic GPS Field Guide*
- ❑ *GPS Data Sheet*
- ❑ GPS receiver
- ❑ Pencil or pen
- ❑ Compass
- ❑ Camera
- ❑ Flagging tape or some other durable identification
- ❑ Tape measure

In the Field
1. Fill out the top portion of the *Common and Clonal Lilac Site Definition Sheet.*
2. Identify the latitude, longitude, and elevation following the *Basic GPS Measurement Protocol.*
3. If known, record the distance and direction to, and elevation difference with, your Atmosphere Site.
4. Label each shrub with flagging tape or some other durable identification.
5. Measure the height of each lilac plant.
6. Take photos in the North, East, South, West directions. Use the compass to determine the directions.
7. Submit photos to GLOBE by mailing them to the address given in the *Implementation Guide* in the GLOBE *Teacher's Guide.*

Clonal and Common Lilac Protocol

Field Guide

Task

Observe when the five phenophases of common or clonal lilacs occur

What You Need

❑ *Common and Clonal Lilac Data Sheet*

❑ Pencil or pen

In the Field

1. Examine each lilac plant.
2. For each lilac plant, record dates of the five phenophases on the *Common and Clonal Lilac Data Sheet*. The five phenophases in order are:

   First leaf: when the widest part of the first new leaf has grown beyond the end of its bud.

   Fully leafed: when nearly all (greater than 95%) of the actively growing leaf buds have leafed

   First bloom: when at least 50% of the flower clusters have at least one open flower .

   Full bloom: when greater than 95% of the flower clusters no longer have any unopened flowers but before many of the flowers have withered.

   End of bloom: when greater than 95% of the flowers have withered or dried.

3. In the autumn, measure the height of each lilac plant. This is done once a year only. Record if the lilac plant appears to be in poor health.