



Real Life Science with Dandelions and Project BudBurst

Katherine A. Johnson
Chicago Botanic Garden, Chicago, IL 60022

Project BudBurst is a national citizen-science project that tracks bloom times and other phenological data for plants across the country. Data from Project BudBurst are being used to measure the effects of climate change. Students can participate in this project by watching any of the plants on the list, including the common dandelion, which makes the program easy and accessible to everyone.

INTRODUCTION

Project BudBurst (budburst.org) is a citizen-science program in which ordinary people—including kids ten years old and up—observe and upload information about bloom times and other life stages of plants (called *phenophases*) to a national database online. This site has been actively storing phenological information since 2007 and continues to be a source of information for scientists studying climate change.

Project BudBurst is an excellent project for students who want to do something positive for the environment, and it supports life-science performance expectations outlined in the Next Generation Science Standards (NGSS). College students can benefit from the opportunity to practice scientific inquiry, do authentic research, reflect on efficacy, and contribute to a larger research project that has global implications. Education students will be introduced to a program that supports the kind of hands-on investigations encouraged by the NGSS. Biology and science education professors are already introducing students to Project BudBurst and its application to their course of study—some examples can be found under the site's education tab, on the Undergraduates page. There are many ways to apply this citizen-science project to a school curriculum.

Becoming a Project BudBurst citizen scientist can help research scientists predict and manage environmental problems such as the spread of diseases, wildfire risk, invasive species, migration patterns, and other conditions that affect the environment. Scientists do not have extensive data on phenological events and therefore need help gathering this information so that they can make more reliable predictions

about natural events and potential catastrophes. In fact, the success of research on how plants are changing over a vast area and over a long time depends on the efforts of citizen scientists, who can cover more territory as a group than any individual scientist could. This is especially critical for understanding how interspecies relationships are being affected by large and small changes in their environments (2). Data from Project BudBurst are actually contributing to scientific research on the effects of climate change on living organisms. They have been used in peer-reviewed, published research including a study of predicting the timing of cherry tree blooming in Washington, DC (1).

PROCEDURE

Participating in Project BudBurst is simple. Students begin by registering as a member on the Project Budburst website at budburst.org. There is no charge to become a member, and the site contains useful information about the plants, the project, why it is important, and how the data are being used. Students can access and use the data that has been uploaded by other participants. The site also contains educational resources for teachers of different grade levels. Directions are clear and informative.

After registering, students need to find a plant that grows in their vicinity from the list. The Observing Plants tab at the top has a drop-down menu with Plants to Observe, where browsers will find an extensive list of plants to study. It includes flowering herbaceous plants like sunflower (*Helianthus annuus*), Virginia bluebell (*Mertensia virginica*), and butterfly milkweed (*Asclepias tuberosa*), as well as common trees like apple (*Malus pumila*), red maple (*Acer rubrum*), and eastern white pine (*Pinus strobus*). Shrubs and grasses are also on the list. Recently, the common dandelion (*Taraxacum officinale*) was added to the list of plants, making the program even simpler for younger students and other novices wanting to participate. Watching dandelion is an excellent place to

Corresponding author. Mailing address: Youth Education Programs Director, Chicago Botanic Garden, 1000 Lake Cook Road, Chicago, IL 60022. Phone: 847-835-8343.
E-mail: kjohnson@chicagobotanic.org.

begin because dandelions are everywhere, they are easy to find, there is only one species so students will not confuse it with the wrong plant, and the phenophases are easier to confidently identify than many of the other plants on the list.

Students will need to become familiar with phenophases for this project. The Project BudBurst website defines a *phenophase* as “a distinct event in the annual life cycle of a plant or animal in relation to changes in seasons and climate.” Phenophases for all wildflowers, including dandelions, are First Flower, Full Flower, First Fruit, Full Fruit, and All Leaves Withered. These phases can be easily distinguished on a dandelion because the plant produces a flower bud that turns from bud into fully opened, yellow blossom overnight. Students who are watching the plant will have a definite date for First Flower on their plant. Three open blossoms can be considered Full Flower stage. After pollination, the flower closes as the fruits ripen. There is no guess work in determining the date of the First Ripe Fruit, either—this is when the fluffy white ball of seeds opens for the first time on the plant. When there are three or more fluff balls, the plant is in Full Fruiting stage. Dandelions continue to flower and fruit into the fall, but their show is much less dramatic as the season progresses. It may be difficult to establish the All Leaves Withered date, but this date is less critical than those of the flowering and fruiting stages.

It is worth noting that many students, even those of high school age, do not make the connection between the yellow dandelion flower and its white, wind-dispersed fruits, which contain the seeds. This citizen-science project makes students realize that these two plant events they have seen all their lives belong to the same plant and that all flowers make seeds.

Students will find these phenophases on the Project BudBurst report forms. There are two kinds of reports that a citizen scientist may contribute: a single report for a one-time observation and a regular report for watching the plant over time. While observing a plant growing and changing over multiple seasons gives students a complete picture of the plant’s life cycle, the single report is a good way to get started without being overwhelmed by the need to keep track of this plant for several months. These forms can be found under the Observing Plants tab at the top of the web page. For a dandelion, use the Wildflower Report.

After gaining an understanding of what is required to do Project BudBurst, the next step is to select a dandelion or other plant to study, preferably one growing in a protected area that is not likely to be mowed down or treated with weed killers. It is best to do this early in the spring before the plant has bloomed, but students can observe their plant any time during the year. Student should take a GPS reading of its location using a GPS device or a cell phone with GPS app. If they plan to watch the plant over the spring and summer, they should mark it with a stake or flag to ensure they return to the same individual plant each time.

Students may need assistance completing the report forms. It has been observed that some students associate the word “site” with websites in cyberspace rather than a physical space. The form asks participants to give the area a “Site Name,” and so educators should be prepared to explain the meaning of the word in its physical sense and suggest that students call the site something like “Green Family Backyard” or “Smart Elementary School Playground.”

Longitude and latitude readings may be new to many students. This project presents an opportunity to explain how to read the numbers and symbols using the words “degrees” and “minutes” to indicate pinpoints on the globe. The class can discuss why accurately identifying the location of the plant is important for this project. Students also may not know what “irrigation” means, and they may need help determining the distance of their plant from paved areas.

The rest is pretty straightforward. Students can follow the directions on the website to learn more about their plant and how to record observations. After completing a single report, or at the end of the season, they can login to the website, upload their data, make a valuable contribution to science and climate change research, and call themselves *bona fide* citizen scientists.

CONCLUSION

Dandelions make great subjects for a citizen-science research project on Project BudBurst. They are accessible and easy to identify. Their phenophases are distinct and clear. Moreover, watching dandelions grow through their life cycle supports understanding of plant life cycles, which can be compared to life cycles of other organisms for a deeper understanding of life science. However, that is only the beginning. Students of all ages and levels will find an extensive list of plants to study so that there is great potential to use the site for more sophisticated science projects while contributing to real research on global climate change.

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