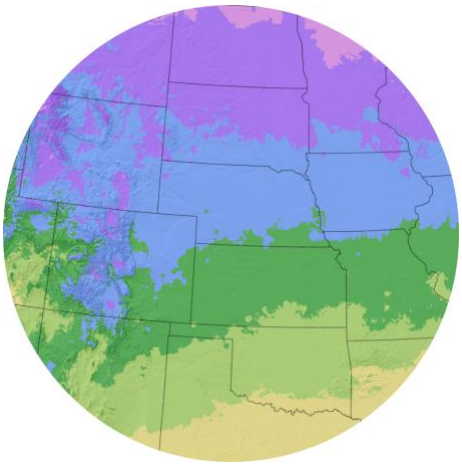
What's Your Zone?



Overview: The USDA Plant Hardiness Zone Map is not only a useful garden design tool, but it also provides students with an excellent example of how scientific data can be translated into an effective graphical display. This lesson introduces students to the USDA Zone Map and how to use it to select plants that will thrive in their gardens.

Grade Level/Range: 3rd – 6th Grade

Objective(s):
Students will:

- Learn about the development of the USDA Plant Hardiness Zone Map and the data it represents.
- Discover how to find the USDA Zone they live in.
- Explore how the USDA Zone Map is used as a tool for plant selection.

Time: 1 hour

Materials:

- Internet Connection
- Plant Tags or the Plant Tag Worksheet
- USDA Plant Hardiness Zone Map Worksheet

Background Information:
First published by the USDA in 1960, the USDA Plant Hardiness Zone Map was inspired by temperature zone maps published by the Arnold Arboretum. It was created to help gardeners determine what perennial plants would grow well in home and public landscaped areas.

Perennial plants are plants that live for three or more growing seasons. They are generally divided into two categories:

- **Herbaceous perennials** have non-woody aboveground growth that dies back each fall/winter and resprouts from the roots in spring.

- **Woody plants**, such as shrubs and trees, with aboveground parts that persist year-round (e.g., trunks and branches). Woody plants can be deciduous (losing their leaves in the fall) or evergreen (keeping their leaves during winter months).

Lifespans of perennial plants vary, with some lasting just a few years and others living for decades (or even centuries). Just like all plants, perennials vary in the growing conditions they prefer, including sun exposure, soil type, temperature range, and water needs.

Tolerance to cold temperatures is a notable challenge. Perennial plants have a range of adaptations that help them survive winter months, but many have limits on how much cold they can take

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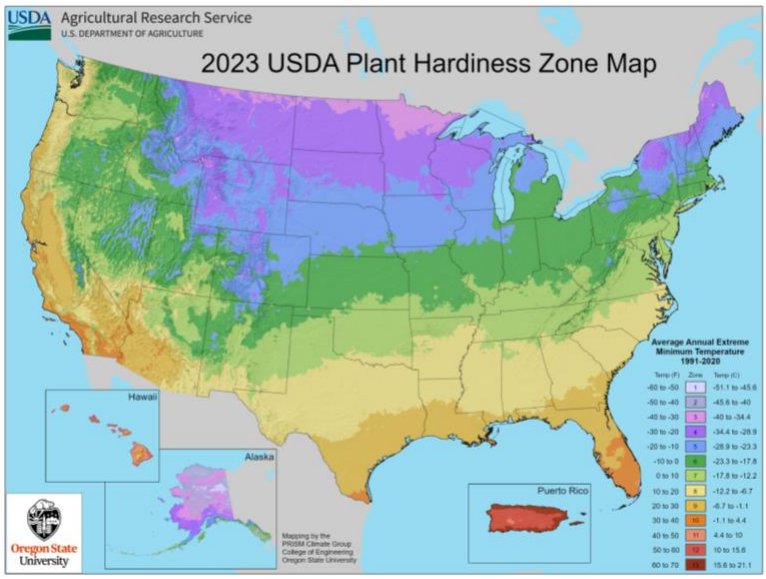
and still spring back to life when warmer weather returns. When temperatures drop below a plant's tolerance, damage to its tissue can occur. In herbaceous plants, this can take the form of damaged roots and crowns (the place at ground level where stems and roots meet and where new growth sprouts in spring). In woody plants, damage can occur on wood, bark, and buds as well as on roots.

The United States Department of Agriculture (USDA) crafted the Plant Hardiness Zone Map by dividing the country into zones based on average annual extreme minimum winter temperatures. Each zone represents a 10-degree range and is further subdivided into half-zones that represent 5-degree ranges. For example, Zone 6 includes locations with average minimum winter temperatures ranging from -10 to 0 degrees F. Zone 6a temperatures range from -10 to -5 degrees F, and Zone 6b ranges from -5 to 0 degrees F.

Zones are labeled with numbers and displayed graphically by color on a U.S. map. The coldest zone is 1, and the warmest zone is 13. Mapped by color, the zones follow the light spectrum, with the coldest zones shown in light purple and the warmest in dark red.



The USDA Plant Zone Map has been updated numerous times over the years, most recently in 2023. There is now an online version that allows viewers to search by zip code for the most precise identification (you can look up your location down to the street level!). With each update, the amount of data collected and compiled increased dramatically, allowing for greater detail. The temperature data used to generate the map is compiled by the Prism Group of the Northwest Alliance for Computational Science and Engineering at Oregon State University. Their data sets can be downloaded and studied in more detail on their website for users who want to take a deeper, more advanced dive into the data.

The USDA Zone Map helps home and professional gardeners select perennial plants that are adapted to their region. Using a combination of research, observation, and experience, plant breeders and horticultural scientists have assigned zone ranges for most plant species, which serve as recommendations for where they will grow best. Gardeners can readily find recommended growing zone information for plants in plant guides and catalogs, and the information is usually included on nursery plant tags.

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These recommendations are meant to be a guide rather than a hard-and-fast rule. A number of factors beyond temperature can also impact a plant's ability to survive cold weather. Light availability, soil moisture, relative humidity, snow cover, and duration of cold are just a few examples of how other environmental conditions can impact how well a plant can survive in the winter.

Tolerance to cold isn't the only temperature-related factor that affects a plant's ability to thrive. As you look at the zone recommendations for various plants, you will note that for most there is a range, with a top and bottom zone listed. That's because some plants won't grow well in climates with very hot summers. For example, sugar maples are rated hardy in USDA Zones 3 through 8. They like the cold but won't tolerate hot summers. Some plants need a certain amount of cold in the winter months to thrive and reproduce.

So why are the USDA zones focused on perennial plants? Annual plants live through one growing season and then die back when outside conditions change (such as frost). For annual plants, gardeners will want to know the average first and last frost dates in their area, which helps define the growing season and determine when to plant different crops. The two calculations are related: generally, areas in colder zones will experience an earlier first frost in the fall and a later last frost in the spring; however, the first and last frost dates can vary significantly within a USDA hardiness zone. Average frost dates may help you determine the best time to plant perennials, especially if starting them from seed, but the zone recommendations are focused on survival through the years.

For more information about USDA Plant Hardiness Zones, read Understanding USDA Hardiness Zones.

Laying the Groundwork:
In small groups or as a class activity, share sample plant tags or the Plant Tag Worksheet with your students. Explain that growers provide plant tags to help buyers/gardeners understand a plant's needs, so they can determine whether it is a good fit for their gardening space.

Read through the information provided on the sample tags or worksheet. Spark discussion using the following questions:

- Why do you think it is important for the tag to include the plant's name and picture? *Depending on the time of year and the plant's maturity, a seedling or small plant may not accurately reflect what it will eventually look like in the landscape.*

- Why do you think tags include both the common name and scientific name? *Each plant has only one scientific name, and each scientific name represents only one plant. However, sometimes plants have multiple common names, and common names are shared by multiple types of plants.*

- What does this tag tell us about what this plant needs? Does it tell us how much water it needs? Light? Soil? Space?

- What other information do we see on the tag? Do you see the listed hardiness zone? What do you think that means?

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Exploration:

1. Share the USDA Plant Hardiness Zone Map available at: https://planthardiness.ars.usda.gov/. If you are working in an outdoor space, you can also print off a copy of the map for students to view.

2. Use the Background Information to introduce how and why the map was created. Explain that perennial plants (plants that live for multiple years) have different amounts of tolerance for cold weather. The map shows the average annual extreme minimum winter temperatures in an area, which can help estimate how cold it will get in certain locations.

3. If working online, enter your zip code into the map to find your zone. Use the key to determine what that information tells us. Ask students, what is our typical winter weather like? Does the information we found in the map match our experiences with winter weather?

4. Next, go out into your schoolyard or garden and identify 5 perennial plants (herbaceous perennials, shrubs, or trees), then list them on the USDA Plant Hardiness Zone Map Worksheet. This can be done as a class activity, in small groups, or individually, depending on the time available and student ability. For help with identification, you can use an app like Seek by iNaturalist or a printed plant field guide.

5. Return to the classroom and identify the recommended zones for each observed plant. Explain that plant experts devise the zone recommendations through research, observation, and experience.

6. Match your plants' recommended zones with the zone you uncovered at the beginning of this Exploration. Ask students: Does our zone fall within the recommended range? Should these plants grow well in our landscapes and gardens?

7. Discuss the fact that the zone recommendations are meant to be guides, but they are not exact. Some plants may survive outside of their recommended zone. Remind students that the zone map shows average temperatures, but temperatures can dip below average. Ask students to brainstorm ideas for how a plant could be sheltered from extreme cold.

   Additionally, many other factors may influence a plant's microenvironment. The USDA Zone Map site shares the following factors:

   - Light availability – Light can impact the temperature around and inside a plant.
   - Soil moisture – Plants that enter dormancy while experiencing water stress may be more vulnerable to cold temperatures.
   - Duration of Cold Temperatures – Some plants can survive short periods of exposure to cold, but can be damaged by more prolonged exposure.
   - Humidity – High humidity can reduce the moisture loss from plants and protect them from severe temperatures.

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8. Finally, ask students: What if we really want to grow a plant, but it is not recommended for our zone? Are there any steps we can take as gardeners to help it survive cold winter temperatures? Some possible answers include:

    - Bringing it inside for the winter. If the plant is small enough, it can be dug out of the ground once it enters its dormant period and kept in a cool spot, such as an unheated garage or basement, so it continues its dormancy and is protected from the most severe temperatures. Some plants will need to be placed in pots with soil, but others can be stored bare-rooted.
    - Provide protection from extreme temperatures with mulch or blankets.
    - Planting close to a building where it may be sheltered a bit more from wind and temperatures.

Making Connections:
The USDA Plant Hardiness Zone Map is a good example of how data can be presented graphically. Inspire kids to think about different ways to display data with the following questions:

- Thinking back on the plant tag, what if instead of listing the hardiness zone, the plant had stated the temperature range that the zone information represented? If you used the Plant Tag Worksheet, the question could be: "What if the coneflower tag had said: 'This plant will survive average annual extreme minimum winter temperature between -40- and 30-degrees F.' What would you have thought about seeing that information on the tag?"
- Do you think having the temperatures represented by a zone number helps with communication and use?
- Do you find the colors on the U.S. map helpful? Do you like being able to see what other parts of the country have weather conditions similar to ours?
- Do you think this tool makes it easier for gardeners to choose suitable plants for their garden? Why is it important for gardens to select plants that will grow well for them?
- Do you think this system might make it easier for plant growers who sell plants, too? Why would they want to make sure the people who are buying their plants are well informed about their choices?

Branching Out:
Learn about some adaptations plants have developed to help them survive the winter months. Try the lesson, Green Forever? Amazing Evergreens to dive deeper into the internal and external structures of plants that support their survival.

Standards:
3-ESS2-1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

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Plant Tag Worksheet

Purple Coneflower

Purple Coneflower

A North American native prairie plant with showy flowers with purple ray petals and golden cone centers. Attracts a variety of wildlife and is adaptable to many different growing conditions.

Full Sun

Moderate Water

Well-draining Soil

3 to 4'

Hardiness Zones 3 - 8

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USDA Plant Hardiness Zone Map Worksheet

Our USDA Plant Hardiness Zone is: _____

Directions: Identify five plants in your schoolyard or garden, and research their recommended hardiness zones. Determine if the plant is recommended for your area.

Plant Name	Recommended Plant Hardiness Zone	Is this plant recommended for your area?

Were all the plants you explored recommended for your area?

If not, did you notice any signs of stress? If they are growing well, can you think of any reasons why they may be more protected or better adapted to your growing conditions?

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