A Gardener's Guide to Zone Maps
by Joseph F. Williamson

What zone do you live in? This may seem like an odd question, but the answer is one of the most important guides to knowing which plants will thrive in your garden. A variety of maps, including some new ones, can help you find the information you need.

Understanding climate zones is critical for selecting permanent landscape plants. If you want a shrub, perennial, or tree to survive and grow year after year, the plant must tolerate year-round conditions in your area: the lowest and highest temperatures, the amount and distribution of rainfall (or availability of irrigation), and soil conditions.

In eastern North America, the most commonly used zone map is the United States Department of Agriculture (USDA) Hardiness Zone Map, devised in 1960 and revised in 1990. In the West, most gardeners use the zone maps featured in Sunset's Western Garden Book. The National Garden Book (Sunset Publishing Corporation, 1997; $40 hardbound, $35 paper) extends the western maps to include the eastern half of the country. In addition, the American Horticultural Society has published a heat-zone map. On the Internet, the most commonly used zone map is from National Gardening.

This article explains the origins and uses of these climate zone maps, including those four.

Which Zone Map?

Gardening references include many kinds of climate zone maps. For instance, vegetable gardeners might consult maps that show the average dates of first and last frosts or perhaps the amount of sunshine or rain their regions receive. But the most common zone maps are those that show where various permanent landscape plants can adapt.

Perhaps the safest course to ensure plant adaptability is to grow only plants native to your particular region. Native plants have proved they can survive in your climate. However, plants don't stay in their regions of origin any more than gardeners do. Plants native to China, Siberia, and Mexico thrive alongside each other in many American gardens. Furthermore, a California gardener may want to grow a plant that's native to the Great Plains. In such cases, gardeners need a way to compare their garden climates with the climate where the plant is known to grow well.

Zone maps are fairly recent innovations. German geographer Alexander von Humboldt created the first one in the early nineteenth century. Humboldt used lines, called isotherms, to delineate regions of equal temperatures. In 1927, horticulturist Alfred Rehder created a system of eight isothermic zones for most of the United States, with each zone separated by temperature differences of 5oF. He was the first to relate average winter minimum temperatures to the hardiness of specific plants.

In 1931, German geographer-meteorologist Vladimir Koppen published a zone map divided into regions that share similar native vegetation. By studying and classifying vegetation types, Koppen ensured that his map accounted for rainfall, humidity, elevation, soils, and the myriad

other factors that affect plant growth. The map shown on the facing page, Ecoregions of the United States, is a Koppen-type map and was created by Robert G. Bailey for the U.S. Forest Service in 1980. On it, zones with names like "tropical" and "temperate" are completely distinct, even though parts of them may have similar minimum winter temperatures. All of the climate zone maps in use today derive from these two prototypes.

The Arnold Arboretum Map

In 1938, horticulturist Donald Wyman expanded Rehder's isotherm map to create the Arnold Arboretum (AA) Map. Its temperature bands differ by 5F, 10F, and 15 F, depending on latitude. For example, average winter minimums on the AA map's zone 2 range from -35 F to -50 F, a spread of 15 F. On the same map, zone 7 winter lows are typically between 5 to 10 F, a spread of only 5 F.

Gardeners often confuse the AA map with the USDA map (see below), which it closely resembles. For instance, zone 6 on the AA map has average minimum temperatures between 5 and -5 F. USDA zone 6 is 0 F to -10 F: a difference close enough to be missed in casual examination. More than one gardener has looked up a plant in Michael Dirr's Manual of Woody Landscape Plants (Stipes Publishing, 1990; $40) and assumed that its AA zones are USDA zones.

This map is the most recent and most widespread incarnation of Humboldt's isotherm map. Developed by H. Marc Cathey, it divides North America into 20 separate zones. They are numbered 1 through 11, as in an earlier version, but now zones 2 through 10 are subdivided into "a" and "b" regions. Each zone is 5 F warmer (or colder) in an average winter than the adjacent zone. The USDA map is the one most gardeners in the eastern United States rely on, and the one that National Gardening and most national garden magazines, catalogs, and books currently use. Similar plant hardiness zone maps for Europe and China have also been developed.

The greatest virtues of the USDA map are its widespread use and the fact that many plants have been categorized according to its zones.

The USDA map does a fine job of delineating the garden climates of the eastern half of the country. That area is comparatively flat, so mapping by isotherms is mostly a matter of drawing lines approximately parallel to the Gulf Coast every 120 miles or so as you move north. The lines tilt northeast as they approach the Eastern Seaboard. They also demarcate the special climates formed by the Great Lakes and by the Appalachian mountain ranges.

But this map has shortcomings. In the eastern half of the country, the USDA map doesn't account for the beneficial effect of a snow cover over perennial plants, the regularity or absence of freezeothaw cycles, or soil drainage during cold periods. And in the rest of the country (west of the 100th meridian, which runs roughly through the middle of North and South Dakota and down through Texas west of Laredo), the USDA map fails completely.

Many factors besides winter lows determine western growing climates. Weather comes in from the Pacific Ocean and gradually becomes less marine and more continental as it moves over and

around mountain range after mountain range. The criteria that define the different western zones are winter cold, summer heat, amount and duration of precipitation, humidity, seasonal winds, and number of sunlight hours.

In the East, nature provides 16 to 44 inches of rain during the growing season, enough water to grow many kinds of plants and crops without irrigation. And humid air often enhances the moisture during this period. If no rain falls for a month, it's called a drought, and many unfortunate farmers lose their shirts.

In the same season, the West gets from a fraction of an inch to maybe 10 to 11 inches of rain. That's not enough to grow a lawn, a flower garden, or a vegetable garden without regular irrigation, but it is enough to grow western native plants. That's why, in the late twentieth century, many western gardeners have turned to native plants to provide foliage and flowers in the dry season.

Additionally, eastern climate definitions aren't useful for the low-elevation West because winters are mild there. Vancouver, Seattle, Portland, San Francisco, Fresno, Los Angeles, San Diego, Phoenix, and Tucson all experience average winter lows of 27 to 48 F (with all-time lows mostly in the high teens and low 20s). And between 27 and 32 F, plant damage from freezing is comparatively unimportant. In most places, freeze damage is not significant enough to qualify as the single defining climatic factor -- but it's the primary criterion for USDA zones.
Rutgers and Floradapt Plant Hardiness Maps

These maps are based on winter-cold isotherms. The Rutgers Plant Hardiness Map, Zones of the United States and Canada (Cook College, Rutgers, Martin Hall, P.O. Box 231, New Brunswick, NJ 08903; $7), has 26 zones based on absolute recorded minimum temperatures. To its credit, the Rutgers map divides the United States into 13 climates east of the 100th meridian, and 13 different ones west of it. Despite the usefulness of this map to gardeners, it's rarely used. Likewise the Floradapt Map (by John Sabuco and the White Oak Group, Inc., 320 202nd St., Chicago Heights, IL 60411). It is a 10-zone, USDA-like map of 10° F increments overlaid with lines and symbols that refine zone descriptions.

The AHS Plant Heat-zone Map

The significance of winter's lowest temperatures decreases as we shift from places where winter freezes may kill many plants to areas where freezes merely mean frost on lawns and windshields. Obviously, winter lows above 20° F, and especially lows in the high 20s, are much less damaging than lower temperatures are. But on the other hand, areas with mild winter temperatures often have soaring summer temperatures. Gardeners have discovered that summer high temperatures can limit plant survival just as surely as winter low temperatures can.

That's why the American Horticultural Society (AHS) published a map (also created by Cathey) that takes heat into account. Called The Heat Map, this 12-zone isotherm map indicates the average number of days each year when given regions experience temperatures of 86° F or higher. According to the AHS, that's the temperature at which many common plants begin to suffer physiological damage. The zones range from 1 (one day or less at 86° F or warmer) through 12 (210 days or more per year at 86° F or warmer). Color posters of The Heat Map cost $15 and are available by calling the AHS at (800) 777-7931, extension 45.

Sunset National Garden Book Map

This map has more in common with the Koppen or Ecoregion Map than with Humboldt's. Long the standard among gardeners who live in the 13 western states, the map now extends to the Eastern Seaboard.

Dividing the United States into 45 garden zones, the Sunset map first and foremost recognizes the difference between garden climates in the East and West. Sunset zones 1 through 24 are west of the 100th meridian, and zones 25 through 45 are east of it. This zone-mapping system acknowledges the West's complex gardening regions and recognizes that in many cases neither minimum nor maximum temperatures determine a plant's survival.

Like Koppen's zones, Sunset's are based on regions where particular plants grow, not on regions that share a feature such as temperature or heat; instead of matching a plant to an established zone, the zone is created to match the plants.

The National Gardening Zone Map

The 14 regions of the National Gardening Zone Map descend directly from the Koppen-type map that organizes regions of similiar native vegetation. It's usefulness comes into play when the zones are correlated to the USDA, average minimum-temperature zones. When a plant or activity is recommended for a particular region and zone within that region, the gardener has significantly more assurance of success compared to advice for the USDA Zone alone. For this reason primarily, this approach has within the past year become the most popular Internet-based zone system.

An example to illustrate the point is the Baily acacia tree (<I>Acacia baileyana</I>). A current reference books recommends it for USDA Zones 8 through 11, suggesting that it is appropriate for a gardeners in Savannah on the east coast through San Diego in the west. But it's not. If on the other hand you can recommend the plant for zones 8 through 11 in the Southwestern Deserts, Southern and Northern California, it works.

Know Your Maps

Although no single map can answer every question about plant adaptability, each one has some merit, often compensating for the weakness of another. In the near future, most home gardeners in the western United States may continue to rely on the Sunset zone map. Gardeners east of the Rocky Mountains will likely continue with the USDA Zone Map and the National Gardening Zone Map, and gardeners throughout the Sunbelt will appreciate the AHS Heat Zone map. Garden designers and others planning permanent landscapes will probably use all kinds.

Joseph F. Williamson is the former garden editor of Sunset magazine, and a key architect of Sunset's gardening zones.