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PLANT HARDINESS ZONES IN NEVADA HORTICULTURE

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Major Plant Hardiness Systems

To help gardeners and growers make suitable plant material selections, several systems have been developed over the years to provide information about their local climate. The three most commonly used systems are the U. S. Department of Agriculture's (USDA) Plant Hardiness Zones[1], Sunset Publishing Corporation's Climate Zones[2,3] and the American Horticultural Society's (AHS) Plant Heat-Zone Map.[4] Each of these systems was developed using somewhat different criteria.

The USDA Plant Hardiness Zone system is based on the "average annual minimum temperatures."[1] The USDA system consists of 11 zones and 9 subdivisions, covering the United States, Canada, and Mexico. The major USDA zones reflect 10° F divisions. Subdivisions within Zones 2 through 10, designated 'A' and 'B', reflect 5° F differences within the respective zones.[1] Today, the USDA Agricultural Research Service (USDA-ARS) "is developing a new version of the hardiness map using new mapping technology and an extended set of meteorological data. The new version is expected to include 15 plant hardiness zones to reflect growing regions for sub-tropical and tropical plants."[4] In some areas, the next release of this system may raise the current zone one unit, e.g., zone 5 to zone 6.

Sunset Publishing Corporation's Sunset Climate Zones, found in the *Sunset Western* and *Sunset National Garden Book*, is based on a comprehensive set of parameters that include not only "average winter minimum temperatures, but also average summer high temperatures, altitude, proximity to seacoast or mountains, rainfall, relative humidity, aridity, and the length of the growing season."[2,3] The Sunset system is composed of 45 climate zones in the United States, with descriptions for Canada and Mexico limited to narrow areas along the respective international borders.[3]

Finally, the AHS's Plant Heat-Zone Map divides the United States, including Alaska and Hawaii, into 12 zones. The AHS system "is based on the average number of days each year that a given zone experiences "heat days", i.e., temperatures above 86° F—the temperature at which plants begin suffering physiological damage from heat," or in other words, decline due to non-reversible damage. The data used to create the AHS system were obtained from the National Climatic Data Center for the years 1974 to 1995.[4]

To determine the plant hardiness zone where you live, go to these links:

USDA Plant Hardiness Zones:
http://www.usna.usda.gov/Hardzone/ushzmap.html

Sunset Climate Zones:
http://www.sunset.com/sunset/web/Sponsors/Garden/sunsetmonrovia_r1/htmlfiles/botwzones.html

AHS Plant Heat-Zones:
http://www.ahs.org/pdfs/05_heat_map.pdf

Weather and Climate

A common question posed by Nevada gardeners is, "What is plant hardiness and how does it affect my garden and landscaping?" Simply defined, plant hardiness is a plant's ability to withstand cold. The terms 'weather' and 'climate' are often used interchangeably. While clearly related, the difference is a matter of magnitude. "Weather is the state of the atmosphere at a given time and place, i.e., "a snapshot of the atmospheric variables *today* or over the space of a few days.[5] On the other hand, climate is the "average weather over a long period of time, usually a minimum of 30 years."[6]

Microclimates

Knowledge of the climate for an area is only part of the puzzle. The various plant hardiness zones indicated by the three systems are all based on a limited amount of data. Averaging and statistical "smoothing" of data can provide only a generalized picture of temperatures. Because of this, none of the systems include local variations known as *microclimates*. *Taylor's Dictionary for Gardeners* defines microclimates as "local conditions of shade, exposure, wind, drainage, and other factors that affect plant growth at any particular site." Gardeners often take advantage of microclimates to grow plants that might otherwise not succeed in their general area."[8] The climates and microclimates of Nevada vary widely from location to location. Microclimates are the climatic subtleties that permitted pioneers to succeed and even prosper in a most inhospitable environment. Microclimates also provide today's grower and gardener with an opportunity to grow plant species that otherwise should not be able to survive the most extreme season, winter.

Plant Trials

Another important part of the puzzle is the determination of which plant species, varieties, and cultivars can be successfully grown in the respective zones. To supply science-based information, a wide variety of plants have been experimentally grown over many years and in many locations to establish their respective hardiness values under the various systems. New species, varieties, and cultivars are continuously studied for hardiness so that they may be added to ever-growing databases. The results of this long-term research are to be found in a great many plant reference books and catalogs, as well as on many Internet sites dedicated to horticulture.[1,2,3,4,7,9,10,11,12]

Practical Application

Each of the plant hardiness systems attempt to provide information to help successfully grow plants, whether as crops or ornamentals. Yet each system is useful only insofar as it is sufficiently sensitive in its ability to describe (or predict) the growing conditions in a particular location. The USDA system is based on long-term data provided by the official weather services of the United States, Canada, and Mexico (National Weather Service and the National Climatic Data Center, Environment Canada-Canadian Climate Center, and Servicio Meterologico Nacional, respectively). Data utilized in the development of the USDA system were provided by nearly 8,000 weather stations that collected the requisite data over a period of 12 years in the United States and Canada and 16 years in Mexico.[13] While deceptively simple, the single parameter defining the USDA system, i.e., average winter low temperatures, is an excellent predictor of any plant's ability to survive. From a purely practical perspective, if a plant is unable to survive predictable winter lows, it matters little what conditions it may encounter during the remainder of the year.

In terms of other parameters such as heat, soils, pH, etc., a resourceful gardener can often modify existing conditions in order to provide a suitable environment for plant growth. The successful growing of any perennial plant, whatever the kind (tree, shrub, forb, which is a broad-leaved herb other than a grass, etc.), requires knowledge of climatic extremes in each zone and every plant species' ability to survive them. This is particularly true of cold, since there is little to be done to protect susceptible plants over the length of winter. Similarly, summer high temperatures can exclude many plant species, because few practical and economical solutions are available to moderate summer heat over landscape-sized areas. The success of growing annual plants, typically grown as seasonal 'color' displays, can be readily predicted by any of the three systems.

When compared with the USDA system, Sunset's complex system is not sensitive to the wide variations found in Nevada's climate. It is particularly insensitive at predicting microclimates. For instance, the Sunset "1A" designation applied to most of northern, central, and eastern Nevada is very coarsely detailed and does not adequately predict climatic conditions found in and around the many mountain ranges, totally ignoring the concept and existence of microclimates. Conversely, as a California-based entity, the Sunset system is an excellent predictor of conditions found throughout California and the Pacific Northwest. Sunset's Climate Zones may or may not be the best tool to use for all of Nevada growing climates.

Similarly, the AHS system, based on the average number of days exceeding 86° F is an excellent predictor of plant success, so long as a plant species' success is limited by summer high temperatures. But how can this system accurately predict hardiness to winter low temperatures? It cannot because its design was intended to determine the upper thermal limitations of plants and to be used in conjunction with USDA data. Overall, in the northern and eastern part of our state, the USDA Plant Hardiness Zone system, utilizing winter lows, is the better predictor of plant success. Here, it is reasonable to presume that winter low temperatures are responsible for greater plant loss (assuming the best cultural practices are employed under all conditions) than loss due to summer high temperatures.

Other Factors

A gardener should always bear in mind, however, that climate is not the only reliable predictor of plant success. Low winter temperature is just one factor that can affect plant survival. A plant may be well-adapted to the temperatures of a particular location, but may perish as a result of stresses imposed by unrelated environmental factors. The success of perennial plants depends on many factors, including:

Temperature: "Plants *survive* within a relatively broad range of temperatures. However, they *thrive* within a more narrow range of temperatures. Also, plants can survive very low temperatures only when they are fully hardened off. If very low temperatures occur in late fall before plants have fully hardened off (in this context, the process a plant undergoes in preparation for winter) the plant may not survive. Temperatures that occur beyond a plant's adaptation, together with temperature fluctuations throughout the year, can also impact a plant's success."[14] Also, combined factors such as low soil moisture and wind can result in death from desiccation injury, regardless of a plant's cold hardiness.

Exposure: "Plants may *survive* while receiving less-than-ideal sunlight, but *thrive* only in locations where they get the amount of light to which they are adapted."[14] A trip to a local garden center displays plants marked with words or symbols indicating their adaptability to "shady" environments, "partial shade," "sunny," "full sun," or some intermediate exposure to solar radiation, depending on the plant's particular adaptation. Many plant species perform best when receiving full sun throughout the day. Other plants cannot tolerate full sun, performing best in full or partial shade, or when receiving only cool morning sunlight. Bear in mind that daily sunlight exposure for plants is cumulative, so a plant can receive dappled light in the morning and direct sunlight in the afternoon, thus satisfying (or exceeding) its daily requirement. Other factors to consider are typical cloud cover for your area and shade cast by buildings and nearby plants. Another factor that is frequently forgotten is sunlight reflected from glass and mirror-filmed windows. Here, plants receive not only direct sunlight, but also light "bounced off" adjacent buildings. Under these conditions, even if adapted to full sun conditions, plants can suffer severe sunscald, particularly young trees or those with thin bark. In Nevada, particularly at higher elevations where less atmospheric filtering occurs, the intensity of sunlight is an additional factor to consider. The effects of exposure can be moderated within the landscape by integrating various hard- and softscape features into the design.

Daylength: Daylength refers to the number of hours of light that a plant receives in a 24-hour period. This varies throughout the year. It is daylength that "drives" many of the functions carried on by plants, including when to break dormancy in spring and begin dormancy in autumn. Daylength (and temperature) largely define the seasons. Altering daylength through the use of garden lighting can significantly affect a plant's metabolic processes as a seasonal change is approached. A plant receiving additional light at night may fail to properly harden-off in autumn, leaving it vulnerable to freezing temperatures. This could cause significant injury and "increase the chances that it may not survive the winter, particularly if the plant is only marginally hardy or in a 'cold' location."[14]

Soil, water, oxygen, and nutrients: With the exception of sunlight, everything a plant needs to prosper must be available in the soil where plants can extract water and nutrients in adequate measure. In Nevada, these are often in short supply for one reason or another and as a result, we irrigate and fertilize as necessary. To better understand garden soils and learn how to develop and enhance fertility where you live, consult other UNCE fact sheets or those of other universities. Gardeners everywhere know that a fertile and productive soil is one rich in organic matter (OM). Unfortunately, a common deficiency of desert soils is low organic matter. Adequate organic matter in soils has many advantages. Among them are: a) OM enhances tilth, making the soil easier to work; b) the presence of OM increases porosity, thus enhancing the availability of oxygen to the root system; c) OM increases water infiltration and availability to plants; d) OM provides a steady release of nutrients to plants; and finally, e) OM helps to moderate and stabilize the high pH of Nevada's alkaline soils. Of particular concern are soils having a high pH which often limit the availability of certain essential nutrients to plants. Virtually all nutrients are available in greater amounts when soil is near neutral (pH 7.0). Nevada soils are often well over 7.0 and frequently limit the availability of several crucial elements, particularly iron, manganese, and zinc. This can cause chlorosis or yellowing and add yet another layer of stress to plants.

Unpredictable Events

Finally, in Nevada and much of the western United States as well, meteorological events may occur in spring and autumn that drastically affect many plants' survival. These damaging seasonal events occur when plants begin to break dormancy in spring or have begun the transition towards dormancy in fall, yet are not fully hardened off. Significant cold (below 32°F) during either of these periods can devastate susceptible plants by destroying cambial tissues (a thin layer of cells directly beneath the inner bark). The greater the cold, the greater the potential damage. Plants that break dormancy too early in the season can be killed by the cold temperatures that accompany a single weather event. Similarly, plants that harden off late in the season, for genetic or cultural reasons, can also be killed or severely injured. These early-season weather events are often the true test of a plant's adaptability. While severe damage or death may result, some plants may be able to recover by virtue of energy reserves and latent buds.

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