Winter Tree Survival

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The ability of a tree or shrub to survive in winter depends on the seasonal change in its metabolism to a dormant state known as acclimation. The first stages of acclimation are induced in early autumn by exposure to short days and non-freezing chilling temperatures both of which combined to stop growth. However, to survive low midwinter, Woody plants must be exposed to temperatures at or below freezing for some time before they become fully acclimated. Once acclimated many of our landscape plants are quite capable of tolerating freezing midwinter temperatures.

It is important to remember that plants are composed primarily of water and that freezing of water inside living cells is fatal to individual cells and potentially deadly for the entire plant. Therefore, living tissues survive low temperatures by suppressing ice formation or by allowing water to freeze but only in areas of the plant that will not be injured by ice crystal formation.

Many trees and shrubs, commonly found in the northern and eastern United States have the ability to suppress ice crystal formation in their cells even at temperatures far below the freezing point this deep super cooling is seen in species such as Oak, Elm, Maple, Beach, Ash, Walnut, Hickory, Apple, Pear, Plum. However, cellular water can supercool only to about -40 Fahrenheit at which temperature ice formation occurs spontaneously resulting in the death of the cell. This -40° F limit explains the existence of timberlines at high elevations, and also why low elevation timber lines exist in Alaska and increasingly higher timberlines occur as you travel from Montana to Wyoming to Colorado and Arizona.

Very hardy woody species such as paper birch, red twig Dogwood, Willow and quaking aspen growing in northern US and Alaska are subject to average annual minimum temperatures well below -40 F. Instead of depending on deep super cooling to survive these plants, prevent water from freezing

within their cells by using a dehydration mechanism. Here water moves out of the cells in response to freezing temperatures freezing in areas between the cells walls were iced formulation is not destructive. This slow dehydration concentrates solutions {sugars and other compounds} in the remaining cell sap, which lowers its freezing point (similar to antifreeze in a car radiator). In midwinter, many hardy woody plants survive extreme dehydration that results when all of their freezable water crystallizes in the spaces between the cells. Generally the hardier the plant the greater the capacity of cells to tolerate dehydration. This may explain why some woody species that are resistant to freezing are also resistant to water deficit during the growing season. Plants appropriately adapted to the local climate and those that have fully acclimated will usually survive even the coldest temperatures.

But injury can occur when: **1)** temperatures fall below a plants maximum low temperature limit even after normal pack Imation has occurred, **2)** when premature freezing occurs before the plant has acclimated in the fall, **3)** when unusually late freezes occur in the spring after the plant has de-acclimated, **4)** and when there are dramatic swings in temperatures during the winter that causes a plant to de-acclimate before the threat of severe freezing is over. These are the main causes for loosing trees and shrubs in the winter in Wyoming along with planting species of plants which do not have this dehydration process, they dry out during our winters, and that is one reason to make sure they are well watered before the ground freezes up or during a warm spell in the winter.

The drastic temperature swings that Wyoming has observed so far this fall and winter will probably cause some to major die back on evergreens and deciduous trees.