



ENVIRONMENTAL INJURY: FROST CRACKS

Home Garden Series

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Environmental Injury: Frost Cracks

Frost cracks are vertical splits in the bark or wood of trees that appear to occur after very severe cold winter weather.

Symptoms of Frost Cracks

Frost cracks, or splits in the tree trunk wood and bark, typically extend longitudinally in the center of the trunk and may appear after unusually cold winters (Figure 1). Cracks appear most frequently on the south or southwest sides of young trees. Certain species, especially those with thin bark, seem more prone to frost cracks. These species include red maple, Norway maple, oak, crabapple, sycamore, linden, horse chestnut, willow, beech, golden rain tree, Japanese snow-bell, and poplar. All young trees that have not reached their mature height and still have thin bark are also susceptible to frost cracks.



Figure 1. Note the long longitudinal frost crack in the trunk of this Eastern cottonwood. (Photo by James Solomon, USDA Forest Service, Bugwood.org.)

Researchers in the Czech Republic found that birch trees in forest stands (trees of uniform type, age, spacing, and condition) younger than 20 years had more frost crack damage than trees in older stands (Kula et al. 2006). When frost cracks in plantations of eight-year-old hybrid poplar trees were evaluated, 66% of the trees from one clone had cracks but only 16% of trees of a second clone were damaged (Diamandis and Koukos 1992). This difference between the clones was attributed to the thicker and more wrinkled bark of the clone more resistant to frost cracking. For additional information on freeze injury of trees, see the WSU Extension Home Garden Series on [Cold Temperature Injury of Landscape Woody Ornamentals](#) and [Sunscald and Sunburn on Trees](#).

Cause of Frost Cracks

Scientists do not universally agree on the underlying cause of frost cracks, but all agree they are related to fluctuations in the temperature of trunk tissues that can occur during severely cold weather. Kubler (1987) attributes frost cracks to the differential shrinkage and expansion of wood that occurs when water moves out of moist cell walls to form ice. This process continues as the temperature drops, increasing the likelihood of frost cracking in colder stems. However, not all trees exposed to the same temperature suffer frost cracks, which may be due to different moisture contents in the wood (Kubler 1987) or to preexisting wounds. When Butin and Shigo (1981) dissected 25 frost-cracked oak trees, they found all of the frost cracks were associated with earlier wounds or branch stubs. They concluded that frost only continued a crack started by an earlier injury.

Treatment of Frost Cracks

The crack may appear to close, and callus tissue may form at the edge of the crack. The wood, however, will never seal (Figure 2). Once the wood fibers are split, they are split forever.

The crack remains in the wood and is an opportune location for the entry of wood decay fungi and insects. Cracks may make the trunk wood more vulnerable to wood decay, and the tree's life span may be shortened (Kubler 1987). If there is loose bark around the wound, it can be removed to improve the appearance of the wound and remove places for insects to hide. Callus, the new tissue trees produce at the edges of wounds, will grow from the wound margins and may eventually close the frost crack.



Figure 2. See how the wound has sealed over, but the frost crack still extends to the center of the trunk wood. (Photo by James Solomon, USDA Forest Service, Bugwood.org.)

Do not try to seal the wound crack with any type of wound compound or paint. Research has shown these wound dressing compounds are ineffective in preventing decay in trees, so these are not recommended for use. The best treatment for a frost crack wound is to maintain tree vigor through appropriate irrigation, fertilization, mulching, and pest management (Harris et al. 2004).

A cracked tree may live many useful years. Keep a watchful eye out for the development of extensive wood rot in the trunk that can lead to a hazardous tree prone to breakage or wind damage. You may want to consult a certified arborist with Tree Risk Assessment Qualifications (TRAQ) to determine if the tree is hazardous or may become hazardous with time.

In the past, some arborists would try to prevent tree cracks from enlarging or the trunk from outright splitting by installing rods through the trunk and bolting them on the outside of the trunk to provide support. However, this treatment is not recommended because there is no evidence that it will stop the crack. It also can lead to cracks elsewhere in the trunk and introduce decay organisms into the wood.

Prevention of Frost Cracks

Research indicates that wounds or weakened areas due to branch or root death are the start of potential frost cracks (Butin and Shigo 1981; Shigo 1986). Preventing tree wounds by protecting the trunk from mower and weed trimmer damage, removing branches with proper pruning cuts, and preventing injury to root systems will help prevent frost cracks in trees. Researchers studied sugar maple stands in northern Minnesota and concluded that wounded trees were more likely to have frost cracks (Burton et al. 2008). They recommended that forest managers reduce frost crack incidence by reducing mechanical damage to the trees.

Deciduous trees are more susceptible to frost cracking than evergreens (Harris et al. 2004). Another commonly recommended method to protect against frost cracks is to prevent the south and southwest side of deciduous tree trunks from warming up on cold, sunny days. Another possible solution is to protect susceptible deciduous species by careful selection of the planting site. Consider planting susceptible species near evergreens, existing structures, or solid fences that will shade their trunks.

Wrapping the trunk with commercially available trunk guards that reflect sunlight may also provide some protection against frost cracks (Harris et al. 2004). The guards should be white or light colored. Apply the guards late in the fall and remove them in the spring as soon as danger of damage has passed. It is important to remove the trunk wraps because they can harbor insects and diseases and may constrict diameter growth of the tree trunk.

Research in Michigan orchards showed that good quality exterior white latex paint applied to the south and southwest side of cherry tree trunks provided the least expensive method of minimizing damage (Kesner and Hansen 1976). However, this may not be aesthetically pleasing in the home landscape.

Additional Resources

Hummel, R. L. and M. C. Ophardt. 2016. [Environmental Injury: Cold Temperature Injury of Landscape Woody Ornamentals](#). *Washington State University Extension Publication* FS196E.

Jull, L.G. 2008. [Winter Injury and Winter Protection of Woody Ornamental Plants](#).

Ophardt, M. C. and R. L. Hummel. 2016. [Environmental Injury: Sunscald and Sunburn on Trees](#). *Washington State University Extension Publication* FS197E.

Swanson, B.T. and R. Rideout. 2013. [Protecting Trees and Shrubs Against Winter Damage](#).

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Diamandis, S. and P. Koukos. 1992. Effect of Bacteria on the Mechanical and Chemical Properties of Wood in Poplars Damaged by Frost Cracks. *European Journal of Forest Pathology* 22: 362-370.

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