Why is my tree dying?

How drought stress and climate change affect Washington's trees

The problem first gained attention in bigleaf maples, which have been dying off since 2011 in Washington and Oregon.

The Washington State Department of Natural Resources, the University of Washington, the U.S. Forest Service, the Oregon Department of Forestry, and Oregon State University tried to find out why. They investigated a wide variety of insect-related diseases and fungal pathogens to determine if any of those could be the cause of the sick and dying bigleaf maples in Washington, Oregon, and British Columbia.

Despite many attempts to uncover the cause and treat the sick and dying bigleaf maples in western Washington, by the end of 2018 there were no signs of recovery. The most recent decline symptoms include partial or entire crown dieback, discoloration and reduced size of the leaves, crown thinning, and death.

A recent University of Washington study (read more here: http://bit.ly/UWtreestudy) suggests that increased human development, higher summer temperatures, and severe summer droughts, made worse by climate change, are linked to the tree's decline.

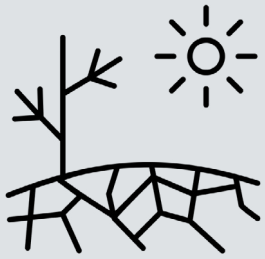
Now scientists fear other Pacific Northwest tree species are suffering a similar fate. Across Washington, people are reporting diebacks not only in bigleaf maples, but in conifers: Douglas-fir, western red cedar pines, and western hemlock, Washington's state tree.

Many bigleaf maple trees in Washington have exhibited symptoms of decline, including partial to entire crown dieback, discoloration and reduced leaf size, loss of leaves and death.

In conifers, symptoms include entirely red crowns, red tops and scattered red branches, with symptoms more difficult to notice in western hemlock because they dropped foliage without color change. They are more susceptible to attack by bark beetles and wood borers, which may be the cause of some mortality and branch dieback.

The problem will likely get worse. Seven out of the past 10 years have been warmer than average in Washington, supporting projections by the Climate Impact Group at UW. According to the group, "the Pacific Northwest is projected to warm rapidly during the 21st century, relative to 20th century average climate, as a result of greenhouse gases emitted from human activities."

Learn what DNR is doing to combat climate change at www.dnr.wa.gov/climate-change.



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WHAT IS DROUGHT?

Droughts occur when average temperatures increase and average precipitation (snow and rainfall) decreases. This can create water stress within a tree, stunting its growth, making it more susceptible to insects and dieseases, and even killing it directly.

TIPS FOR REDUCING DROUGHT STRESS*

» Thin tree stands during a non-drought year if possible as thinning can cause short-term water stress. Remove damaged, stressed or overly mature trees.

» Plant native and local drought-tolerant tree species appropriate for your site and soil conditions.

» Control vegetation, especially grasses, that compete with soil moisture around your tree.

» Prevent insect infestations by removing or destroying freshly dead or dying trees, and slash or blowdown created in the past year.

» Apply mulch to landscape trees to retain soil moisture.

» Do not alter drainage patterns near established trees.

(Continued on reverse)

WASHINGTON DEPARTMENT OF NATURAL RESOURCES

*SOURCE: OREGON DEPARTMENT OF FORESTRY

Drought stress: A closer look

Forestry researcher explains what goes on in a drought-stressed tree

Trees have an amazing ability to transport water from their roots all the way up to their tops, which may be over 100 feet tall. The dominant theory of how this is done is called transpiration pull.

A large portion of the stem of a tree is called sapwood, and this is a big plumbing system through which water (sap) flows upward. The sapwood comprises many tiny "pipeline" pathways for water. Water flows into the tree roots through osmosis, flows up the sapwood, and makes its way into the leaves. The leaves have tiny pores called stomata that open up for gas exchange to occur as part of photosynthesis. The pores open up to take in carbon dioxide, and in the process oxygen and a little bit of water vapor are released. This is called transpiration.

As the leaf pores open up, the water molecule evaporates out. As it does, its cohesive nature "pulls" the water molecule next to it forward, which pulls the water molecule next to it, and so forth. There is a continuous chain of water molecules, called the water column, that runs from the leaves down to the roots. So as a tree transpires, water molecules are pulled up the tree, hence the term "transpiration pull."

This pulling by evaporation from the leaves creates a negative pressure that draws new water from the soil into the roots to replenish the bottom of the water column. As long as there is adequate water to be drawn in, all is well. In drought conditions, though, there may not be any soil water available.

As water continues to evaporate from leaf pores, especially on hot, dry days, the tension on the water column gets tighter and tighter because no new slack is coming in through the roots. Under extreme water stress, the water column breaks at some point in the stem, which is called a cavitation. This can result in an air bubble in the pipe, which is called an embolism. The chain of water molecules is now disconnected between the roots and the leaves. If the tree is unable to repair the disconnect, that water pathway no longer functions and everything above it dies. That's why classic symptoms of water stress are dead tree tops and branches.

- Kevin Zobrist, Associate Professor, Washington State University Extension Forestry

TIPS FOR REDUCING DROUGHT STRESS*

» Irrigate landscape trees during dry weather, applying water slowly over many hours to penetrate the roots.

» Avoid damage and compacting soil around tree root zones, including from vehicles and grazing animals, especially during the wet season.

» Do not fertilize during droughts. Fertilization stimulates foliage production and can increase water requirements.

» It may be less effective to use systemic pesticides, which are absorbed into a plant's tissues, on drought stressed trees. These pesticides rely on water translocation within the tree.

SOURCE: OREGON DEPARTMENT OF FORESTRY