



How to manage flood damage to trees

Quick facts

- Flood damage can affect tree growth and tree survival.
- Tree flood damage can be caused by soil changes, physical damage, insects and diseases.
- The potential for damage to trees from flooding depends on when and how flooding happens and tree characteristics.
- Trees may need special care following a flood to minimize longer-term damage.

Flooding may cause direct damage to trees by changing soil conditions, interrupting normal oxygen and carbon dioxide exchange between trees and their environment, sedimentation and physical damage.

Flooding also can weaken trees, making them more susceptible to damage from insects and diseases. The likelihood of insect and disease damage depends upon the severity of the flood and tree health. A tree in weak condition before a flood can be further stressed by flooding.

Trees that are flood stressed exhibit a range of symptoms that may include:

- Leaf chlorosis (yellowing), followed by leaf loss.
- Reduced leaf size.
- Early fall coloration and leaf drop.
- Watersprouts or small shoots emerging from the main stem.
- Crown dieback.
- Large seed crops or no seed crops in years following a flood.

Symptoms may progress and ultimately kill a tree over a period of several years or they may lessen as the tree recovers. It is very difficult to link a flood to the cause of tree death years later.

Timing of flooding

Trees are more likely to be damaged by flooding during the growing season than by flooding during the dormant season. Trees are most susceptible to flood damage in late spring just after the first flush of growth. Tree species begin their spring flush at different times so the timing of a flood influences the species that are likely to be damaged.

If trees are flooded by heavy rain or snow melt in late winter or early spring when the trees and shrubs are not actively growing, and the water recedes before growth begins, flooding usually is not a problem. Most tree species can withstand one to four months of flooding during the dormant season.

When flooding occurs during the growing season, especially during warmer weather, one to two weeks of flooding can cause major, long-term damage to sensitive trees and shrubs, even death with some species. Some species can survive as long as three to five months in flooded situations.

Types of flood damage

A long-duration flood, especially during the growing season, may decrease height and diameter growth of tree species that are intolerant of flooding. But height and diameter growth may increase for flood tolerant species.

Soil changes

Water covering the soil reduces the supply of oxygen to tree roots. Roots must have oxygen to survive and grow.

A well-drained soil for trees and shrubs allows water to drain (percolate) at a rate of one inch per hour. To test the drainage rate of your soil, dig a hole 24 inches deep, fill with water, let it drain completely and then fill once again. If the 24-inch deep hole drains within 24 hours, this well-drained soil is considered close to optimum for most landscape trees and shrubs.

A poorly-drained soil will take more than 24 hours to drain a 24 inch deep hole, but there are degrees of poor drainage. A soil that takes 36–48 hours to drain is not nearly as bad for trees as a soil that percolates at a rate of 24 inches in seven to ten days.

Sediment

- Sediments carried by the water and deposited over the roots reduce the supply of oxygen to tree roots.
- As little as three inches of sediment can be harmful.
- Tree species vary in their tolerance to sedimentation, but all seedlings are susceptible to root injury from sediment.
- Eastern cottonwood and black willow seedlings can withstand moderate silt buildup.

pH

Flooding increases the pH of acid soils and decreases the pH of alkaline soils. Tree species vary in their pH tolerance.

Decomposition

- The rate of decomposition of organic matter in flooded soil tends to be only half that in unflooded soil.
- The major end products of decomposition of organic matter in flooded soil is carbon dioxide, methane and humic materials.
- The high concentrations of ethanol and hydrogen sulfide that are produced in waterlogged soil can damage tree roots.

Chemical damage

Flood waters may contain chemicals from urban areas or agricultural fields that may be harmful to trees when absorbed by their roots.

Physical damage

Strong currents, waves or suspended particles may cause soil around the base of trees to be washed away, exposing their roots. Exposed roots can stress trees and make them more vulnerable to being uprooted or broken by wind (windthrow or blowdown).

Ice flows and debris carried by rushing waters can remove bark and damage tissues. Such wounds may then be subject to wood stain and decay organisms.

Flood waters that cover foliage on lower branches will interfere with photosynthesis and gas exchange, leading to death of those branches.

Insect damage

Borers

Stem boring insects are the major insect group of concern. The most common stem borers are beetles, either adults or immature larvae depending on the species. Other stem borers which may damage trees are a few moth or woodwasp larvae. Stem boring insects can be further divided into phloem borers and wood borers.

Phloem borers include bark beetles and many of the metallic wood-boring beetles. They are serious pests because the damage they cause occurs in the tree's phloem (inner bark) and outer sapwood layers. These two layers are important in food and water transport and, if significantly damaged, can kill trees.

Wood borers may spend some time in the phloem layer, but generally tunnel deeper and feed in the wood of tree stems or branches. This tunneling is not usually a serious impediment to tree survival, but it can significantly reduce the quality of any eventual wood products. Wood borers, however, weaken stems, which may lead to breakage during ice, wind or snow storms.

See [Flatheaded borers](#) and [Emerald ash borer](#)

Numerous small holes in the bark are a common symptom of stem borers. Insect entrance holes may have pitch, sap or sawdust exuding from them. Exit holes are generally very clean and may be round, oval or D-shaped. Removing the bark will expose larval tunnels on the wood surface. Removing bark on living trees will damage a tree, so do this only on dead trees or low quality trees to test for the presence of stem borers.

To reduce damage from stem borers:

- Prevent additional wounding or root damage to trees. Wounds create stress and attract many insects.
- Sanitize areas by removing and destroying large broken limbs and dead trees. This material may act as breeding sites for stem-boring insects which may later infest surrounding live trees.
- Increase tree vigor through light fertilization treatments and watering if soil conditions become excessively dry during the two or three years following flooding.
- Insecticides rarely help control stem borers. They should be used only for high value trees and following the recommendations of a professional entomologist, arborist or forester. Stem borer insecticides are applied to the tree bark as a protectant, application must be made before infestation.

See [How to hire a tree care professional](#)

Leaf feeders

It is unknown whether leaf-feeding ([caterpillars](#)) or sucking insects ([scales](#) and [aphids](#)) will become more of a problem following flooding.

Plant stress can alter the biochemistry of trees making nutrients and sugars more available to insects feeding on leaves or sap. This could increase survival of these insects and increase their population size.

Outbreaks of caterpillars or scales and aphids could further increase stress levels on trees severely weakened by a flood. Control of these insects should be considered a priority on high value trees for one to three years after a flood. This may require application of insecticides following label directions.

Trees most prone to insect damage after flooding

There are too many potential insect pests and tree species to list all possible sources of insect damage, but the following tree species are notorious for insect attacks following stressful periods:

- all pines
- oaks
- hybrid poplars

- birches (especially white birch)
- hickories

Be especially aware of these insects:

- **Pine bark beetles** (*Ips* spp.)
- **Twolined chestnut borers** (*Agrilus bilineatus*) on oak
- **Bronze birch borer** (*Agrilus anxius*)
- **Hickory bark beetle** (*Scolytus quadrispinosus*)

Disease damage

Several diseases may weaken or kill trees following flooding. They mainly affect a tree's roots, root collar and lower stem.

Armillaria root rot is also known as shoestring root rot. There are hundreds of species of *Armillaria* fungi. It can cause wood decay, growth reduction and death to hundreds of tree species, but commonly infects and kills trees already weakened by other factors. Although drought is usually considered the precursor to *Armillaria* infections, flooding has been implicated in *Armillaria* root rot infections in oak, chestnut and larch.

Symptoms of *Armillaria* infection include leaf chlorosis (yellow then brown), defoliation, reduced leaf and shoot growth, dieback, and death.

On most conifer species, lower stems usually are somewhat enlarged and exude large amounts of resin. Broadleaved trees may develop sunken cankers covered with loose bark or bark infiltrated with gum. Removing the bark will expose white mycelia fans on the wood surface or black, shoestring-like rhizomorphs attached to roots. Clusters of honey-colored mushrooms growing in clumps around the base of a tree in the fall are further signs of *Armillaria*.

To reduce damage from *Armillaria*:

- Reforest stands with a mixture of species ecologically suited to the site and not obviously infected with *Armillaria*.
- Maintain vigorous tree growth without damage to the soil.
- Minimize stress to and wounding of crop trees.
- On high-risk sites where the disease is present, uproot infected or susceptible root systems and stumps to minimize dead wood where *Armillaria* can survive and spread. Clear such wood at least 33 feet beyond the visible margin of the disease center.

Flood stressed trees are especially susceptible to root collar and root rot diseases caused by species of *Phytophthora* and *Pythium*, which are considered water molds and are not true fungi. Free-standing water aids in both the reproduction and dissemination of these fungi. Oxygen starvation, wounding, and loss of cell permeability due to flooding provide ideal infection sites for these organisms to colonize.

Phytophthora species cause root and collar rot diseases on a wide range of nursery and forest tree species including:

- apple
- cherry
- walnut
- American beech
- sweet birch
- flowering dogwood
- fir
- horse chestnut
- black, Norway, red, silver, sugar, and sycamore maples
- pin and red oaks
- pines
- yellow-poplar
- weeping willows
- azalea
- rhododendron

Symptoms of Phytophthora collar rot of flood damaged trees include brown to reddish water-soaked lesions with abrupt margins beneath the bark. A reddish brown liquid sometimes exudes from the canker margin. Cankers may not be noticed until foliar symptoms develop, which include sparse, chlorotic (yellow) leaves, premature fall color, and dieback.

Pythium species cause damping off and root rot disease on young seedlings in nurseries and can infect nearly all conifers and hardwoods.

Pythium root rot produces less distinctive diagnostic symptoms that include stunting, leaf chlorosis, reduced leaf size, basal stem cankers which often ooze sap, root and collar decay, crown dieback and death.

Management strategies for Phytophthora and Pythium species are targeted only at tree nurseries since little can be done to control these diseases after trees are outplanted.

In nurseries:

- Avoid planting tree species highly susceptible to Phytophthora species in poorly drained fields.
- Improve soil drainage in poorly drained fields.
- Employ alternative cropping regimes in fields with a previous history of root rot disease. Consider bare fallow for one to two years to reduce disease inoculums.
- Use chemical fumigation.

Tree care after a flood

Trees that are healthy before a flood are more likely to survive flooding in good condition. Tree care after a flood depends on whether you are managing many acres of woodland or a few yard trees.

For professional assessment and care of tree damage after flooding, [hire a forester or arborist](#).

Trees in a woodland

Inspect your woodland soon after floodwaters recede. Look for trees that have been uprooted, abraded by moving debris or killed.

A timber harvest or sale may be appropriate if you have a sufficient number of damaged trees.

- Trees with damaged roots, bark and major branches will soon develop wood stain and decay that greatly reduces their wood product value, so harvest these trees within a few weeks after the damage occurs.
- Remove trees that may be a source of stem boring insects.
- Harvest carefully to minimize damage to residual large trees as well as desirable seedlings and saplings.
- Do not harvest when the soil is saturated since rutting may damage roots and soil compaction may affect future root growth.
- Small quantities of wood may be used around your home or farm for firewood, lumber, erosion control, brush piles for wildlife or fish habitat.

Many trees will sprout from the stump and grow again. Sprouting ability varies by tree species but is more likely among small trees than big trees. Cut stumps close to the ground to encourage sprouts that will persist after the stump decays.

Take advantage of scoured floodplains and freshly-eroded stream banks to replant with flood tolerant species.

If you have substantial damage, [seek advice from a forester](#) about how to manage your woodland or conduct a timber sale.

Trees in a yard or urban community

To increase tree health:

- Apply a low nitrogen fertilizer, aerate the soil, mulch around the base of small trees to eliminate weeds and conserve moisture, and water if soil conditions become excessively dry.
- Remove branches that are broken, cankered or dead, but prune trees only when bark surfaces are dry or during the dormant season to minimize infection by opportunistic pathogens.
- Remove sediment deposited over the roots by the flood. Roots usually extend at least as far out as the canopy.

- Protect high-value trees from leafspot diseases, such as [anthracnose](#), and from early-season insect defoliators and sucking insects, such as aphids or scales.
- Large trees that have been partially uprooted may need to be removed by a professional arborist. They are difficult to set upright and may not recover from the root damage.

Replanting

- Reset only small, easy-to-manage trees.
- If trying to salvage fallen or partially uprooted trees and shrubs, keep roots covered and moist until resetting.
- Replant trees and shrubs at their original planting depth. Excess soil or exposed roots can cause further shock and damage.
- Pack soil firmly around the roots to eliminate air pockets and provide support.
- Stake the tree for a year or two until its roots become reestablished.
 - When staking, use hardwood or metal stakes that will not decay in the coming year.
 - Use three stakes and place each at an angle away from the trunk.
 - To avoid injuring the trunk, fasten a tree to its supporting stakes with a wide strap or wire wrapped in cloth.
- Water reset trees frequently to promote root growth.
- When pruning branches, cut close to forks or the main stem, but minimize the surface area of an exposed cut.

Clean up plant waste

Find other uses for tree and plant waste to prevent overburdening landfills. Hardwood trees make good firewood. If not removing the stump, speed up the decay process by cutting grooves in the stump, covering it with soil or leaves, occasionally adding nitrogen fertilizer to the top of the stump, and keeping the stump moist.

Compost

Leaves, weeds, and other non-woody garden debris can be composted. If grass clippings are composted, mix them with other materials to prevent over-packing that leads to obnoxious odors. Sawdust and wood chips require extra nitrogen fertilizer or fresh lawn clippings. Do not compost meat, bones, grease, eggs and dairy products or diseased or insect-infested plants and weeds.

- Create a compost pile close to where it will be used, but not offend neighbors.
- Protect it from drying winds. Locate it in partial sunlight to help heat the pile.
- Prepare a compost pile or bin in layers to facilitate decomposition. A compost pile ideally should be about 5 feet high.
- Moisten the materials as they are placed into the pile or bin. Oxygen and water are critical elements in the composting process. Keep the pile moist, but not waterlogged.
- To encourage oxygen infiltration, avoid over-chopping composting materials or packing the pile.

- Compost is ready to use when it has shrunk to one-half its original volume, has lost the identity of its original material, and has a pleasant, earthy smell.

See [Composting in home gardens](#).

Assess tree loss and damage for insurance or tax purposes

The decrease in value of your trees or property due to a flood may be recovered by your flood insurance or it may constitute a casualty loss for income tax purposes.

If you have flood insurance, it may pay for cleanup and replacement of trees to restore your property to its original condition before the flood. Contact your insurance company immediately after damage has been noticed to learn about filing a claim.

To help with your claim, take photographs of the damage, keep receipts for cleanup, repairs and tree replacement, and collect local newspaper articles as evidence of the flood.

To claim an income tax deduction for flood damage:

- Department of the Treasury, Internal Revenue Service. 2016. [Casualties, Disasters, and Thefts \(Publication 547\)](#).
- [National Timber Tax site](#) — Tax management for timberland owners.

Sources

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Mel Baughman, retired professor of forest resources, College of Food, Agricultural and Natural Resource Sciences

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