WINTER TREE HEALTH IN ASPEN

UNDERSTANDING STRESS, ADAPTATION, AND SEASONAL CARE

DOCUMENT NAVIGATION

KEY TAKEAWAYS

- Tree health in Aspen is generally stable, but conditions vary by species, site, and cumulative stress over time.
- Winter is an active and important period for tree health, even though growth slows or pauses. Stress experienced during winter often shows up months later in spring.
- Evergreen and deciduous trees respond differently to winter conditions, but both rely on adequate soil moisture, protected root systems, and avoidance of physical damage.
- Most tree health issues result from cumulative stress rather than a single cause. Drought, soil conditions, physical damage, pests, and disease often interact over time.
- Thoughtful winter practices—especially watering during dry periods, careful snow placement, and preventing equipment damage—can significantly improve long-term tree health and resilience.

CURRENT CONDITIONS

Overall, tree health in Aspen is mixed but generally stable, with conditions varying by species, site, and management context. Based on inventories of public right-of-way trees, Aspen's urban canopy is dominated by a relatively small number of species. Narrowleaf cottonwood (*Populus angustifolia*), quaking aspen (*Populus tremuloides*), and blue spruce (*Picea pungens*) together make up nearly 80 percent of the inventoried public canopy.

In the downtown core and residential rights-of-way, many trees are in good to fair condition, particularly where they are actively managed and receive supplemental water and routine care. However, urban trees also experience chronic stressors associated with limited rooting space, compacted soils, and physical impacts[2].

Fungal pathogens, including decay fungi in the genus Ganoderma, are a significant concern in mature cottonwoods and other large-stature trees, where internal wood decay can compromise structural stability over time[26]. Foliar pests such as cottonwood leaf beetle (*Chrysomela scripta*) are also common in urban settings; while rarely fatal on their own, repeated defoliation can reduce vigor when combined with other stressors such as drought or soil compaction[26]. Green ash (*Fraxinus pennsylvanica*) face additional long-term pressure from borers and other stress-related decline factors, particularly when trees are already stressed[22].

It is important to note that this assessment reflects conditions observed in inventoried public right-of-way trees only. Aspen has a substantial number of trees on private parcels that are not currently included in citywide inventories. Tree species composition and health conditions on private property may differ from those documented in public rights-of-way and represent an important component of the community's overall urban forest.

Additional forest health issues have been observed in surrounding open spaces and mountain environments, where trees are influenced by broader landscape-scale processes. These include bark beetles such as Douglas-fir beetle (*Dendroctonus pseudotsugae)* affecting Douglas-fir (*Pseudotsuga menziesii*), as well as parasitic plants like dwarf mistletoe (*Arceuthobium* spp.) impacting a range of conifer species. These dynamics are part of natural forest processes and differ from the more intensively managed conditions of the urban forest[25].

Across both public and private landscapes, trees that enter winter already stressed—whether from drought, disease, insect pressure, or physical damage—are more likely to exhibit symptoms such as dieback, reduced vigor, or delayed recovery in the following growing

season[1]. Understanding these species-specific and site-specific stressors is key to effective tree health management across Aspen's urban forest and surrounding landscapes.

A Note on Cumulative Stress and Long-Term Tree Health

Across Aspen's urban forest and surrounding landscapes, tree decline is rarely caused by a single factor or a single season. Instead, most tree health issues develop gradually as multiple stressors accumulate over time. This pattern holds true regardless of tree species, age, or whether the tree is evergreen or deciduous[21].

Environmental stressors such as drought, variable snowpack, and changing climate conditions often interact with site-related and human-caused impacts, including compacted soils, limited rooting space, physical damage, and exposure to de-icing materials. Individually, these stressors may be tolerable. When they occur repeatedly or in combination, however, they can overwhelm a tree's ability to recover

In this context, insects and diseases are frequently secondary agents rather than the original cause of decline. Pests such as bark beetles or foliar insects, and pathogens including decay fungi, are more likely to affect trees that are already stressed by environmental or physical factors. As a tree's energy reserves are depleted, its natural defenses weaken, increasing vulnerability to additional stressors and accelerating decline[22].

Winter conditions play an important role in this cumulative process. Stress experienced during the dormant season—such as moisture loss, root damage, or mechanical injury—may not become visible until months later, when trees attempt to resume growth in spring. As a result, symptoms such as poor leaf-out, needle browning, reduced growth, or structural failure often reflect a history of stress rather than a recent or isolated event[2].

Understanding tree health as a cumulative process is critical for effective management. It shifts the focus away from identifying a single cause and toward reducing repeated stress over time. Protecting soil conditions, maintaining adequate moisture, preventing physical damage, and supporting trees through seasonal extremes all contribute to long-term resilience. Small, consistent actions—particularly during winter—often have a

greater impact on tree health than reactive interventions after decline is already visible[23].

HOW TREES FUNCTION IN WINTER

Evergreen and deciduous trees use different strategies to survive winter, but neither group becomes completely inactive. Instead, trees enter a period of dormancy characterized by slowed metabolism, suspended growth, and a shift toward protecting tissues and conserving energy.

Evergreen trees retain their needles year-round, which allows them to take advantage of favorable winter conditions. On sunny days when temperatures rise above freezing, evergreens can continue photosynthesis at a reduced rate, producing small amounts of energy even during winter[19]. Their needles are adapted to withstand cold, wind, and snow through thick waxy coatings, narrow shape, and high concentrations of protective compounds that reduce cellular damage from freezing.

However, retaining needles also means that evergreen trees continue to lose small amounts of water through transpiration throughout the winter. When soils are frozen, roots cannot replace this lost moisture, making evergreens particularly vulnerable to winter drought stress and needle desiccation[2].

Deciduous trees take a different approach by shedding their leaves in fall, which dramatically reduces water loss during winter. Once leaf drop occurs, aboveground physiological activity slows significantly, and trees rely on stored carbohydrates and moisture reserves within roots and woody tissues to survive until spring[20].

Although deciduous trees are less prone to winter desiccation than evergreens, they are still affected by winter conditions. Soil moisture availability, root-zone protection, freeze–thaw cycles, and physical damage during the dormant season all influence spring recovery. Winter stress in deciduous trees often becomes apparent later as delayed leaf-out, reduced shoot growth, branch dieback, or increased susceptibility to pests and disease during the growing season[3].

For both evergreen and deciduous trees, winter conditions are not a pause from stress but a continuation of the growing season's challenges under different constraints. Stress accumulated during winter—particularly moisture loss, root damage, or mechanical injury—

often does not become visible until trees attempt to resume active growth in spring. Understanding these seasonal physiological differences helps explain why winter management practices play such a critical role in long-term tree health and resilience.

WINTER BEST MANAGEMENT PRACTICES

Effective winter tree care focuses on protecting root systems, minimizing additional stress, and preventing damage that can have long-term consequences. While evergreen and deciduous trees respond differently to winter conditions, many of the best management practices apply to all trees and are especially important at high elevation.

Maintaining adequate soil moisture is one of the most important winter care practices. During dry periods when temperatures are above freezing and soils can absorb water, supplemental watering helps replenish moisture lost through transpiration and evaporation. This practice is particularly beneficial for evergreen trees, which continue to lose moisture through their needles throughout the winter, but it also supports deciduous trees by maintaining soil moisture needed for root health and spring recovery[1].

Protecting the root zone is equally critical. Applying mulch around the base of trees helps moderate soil temperatures, reduce moisture loss, and protect fine roots from freeze–thaw cycles. Mulch also reduces soil compaction and helps maintain healthier soil structure over time. Mulch should be applied in a broad, shallow layer and kept away from direct contact with the trunk to avoid moisture-related decay[5].

Avoiding unnecessary disturbance during the dormant season is another key practice. Heavy equipment traffic, soil compaction, trenching, and root disturbance during winter can damage root systems when trees are least able to respond or recover. Pruning should generally be limited to corrective or safety-related needs, as excessive pruning during winter can reduce stored energy reserves needed for spring growth (Colorado State Forest Service, *Urban Tree Care*: https://csfs.colostate.edu/forest-management/urban-tree-care/).

Managing snow thoughtfully also plays a role in tree health. Clean, untreated snow can be placed beneath trees in moderation and may provide some benefit by slowly releasing moisture into the soil as it melts. However, snow that has been exposed to de-icing salts, sand, or gravel should be kept away from tree bases, as salt accumulation can damage roots and contribute to needle injury, canopy decline, and long-term stress[7].

Preventing physical damage during winter maintenance is especially important. Plows, snowblowers, and other equipment can cause bark wounds, trunk damage, and broken branches. These injuries disrupt water and nutrient transport and create entry points for pests and disease, increasing the likelihood of long-term decline (Colorado State Forest Service, *Common Tree Damage*: https://csfs.colostate.edu/forest-management/common-tree-damage/). Clearly marking tree locations, identifying planted areas, and ensuring snow-removal operators are aware of tree locations can significantly reduce accidental damage.

Together, these winter best management practices help reduce cumulative stress and support long-term tree health. Small, consistent actions taken during the dormant season—particularly those that protect roots, maintain moisture, and prevent physical injury—can have a greater impact on tree resilience than reactive measures once decline is already visible.

A Homeowner Checklist for Winter Tree Health

This checklist applies to both evergreen and deciduous trees, particularly in urban and residential settings at high elevation.

Soil Moisture and Watering

- Water trees during dry winter periods when temperatures are above freezing and soils can absorb moisture.
- Prioritize newly planted trees, trees in exposed or windy locations, and evergreen species, which continue to lose moisture throughout winter.
- Apply water slowly and deeply to ensure moisture reaches the active root zone rather than running off frozen or compacted soil.

Mulching and Root Protection

- Apply mulch around the base of trees to help retain soil moisture, moderate soil temperatures, and protect fine roots from freeze–thaw cycles.
- Maintain a mulch-free space immediately around the trunk to reduce the risk of decay and pest issues.
- Avoid excessively deep mulch layers, which can limit oxygen exchange and create moisture-related problems.

Snow Placement

- Place clean, untreated snow beneath trees in moderation when possible, particularly during dry winters.
- Do not pile snow that contains de-icing salts, sand, or gravel near tree bases, as these materials can damage roots and contribute to long-term decline.
- Distribute snow evenly beneath the canopy rather than piling it directly against trunks or lower branches.

Preventing Physical Damage

- Use caution when operating plows, snowblowers, and shovels near trees, especially young trees and those in narrow planting strips.
- Clearly mark tree locations, planting beds, and landscape edges when using snow-removal services.

- Communicate with contractors about the location of trees and root zones to reduce accidental damage during winter maintenance.

Protecting the Root Zone

- Avoid driving, parking, or storing snow, equipment, or materials over tree root zones during winter.
- Limit repeated foot traffic over frozen or compacted soils where possible, particularly near trees with limited rooting space.
- Avoid unnecessary digging, trenching, or soil disturbance near trees during the dormant season.

Pruning and Tree Maintenance

- Winter is generally an ideal time for structural pruning of many tree species, particularly deciduous trees, because trees are dormant and disease and insect activity is low.
- Focus winter pruning on removing dead, damaged, or hazardous branches and improving structure and clearance.
- Avoid excessive pruning during periods of severe drought stress, and follow species-specific best practices when pruning evergreens.
- Consult a certified arborist to determine appropriate timing and pruning methods for individual trees.

CITATIONS & ADDITIONAL RESOURCES

WINTER DROUGHT STRESS & EVERGREEN NEEDLE BROWNING

1. *Winter Watering of Trees and Shrubs* — Colorado State University Extension
   https://extension.colostate.edu/topic-areas/yard-garden/winter-watering-7-211/
2. *Abiotic Disorders of Woody Plants* (includes winter desiccation and drought stress) — CSU Extension
   https://extension.colostate.edu/topic-areas/yard-garden/abiotic-disorders-of-woody-plants-2-920/
3. *Winter Injury to Landscape Plants* — Colorado State University Extension *(NEW – evergreen & deciduous winter injury)*
   https://extension.colostate.edu/topic-areas/yard-garden/winter-injury-to-landscape-plants-7-005/
4. *Evergreen Needle Browning and Winter Desiccation* — University of Minnesota Extension *(NEW – widely cited cold-climate source)*
   https://extension.umn.edu/plant-diseases/winter-injury-evergreens

MULCHING AND SOIL PROTECTION

5. *Mulches for the Home Grounds* — Colorado State University Extension
   https://extension.colostate.edu/topic-areas/yard-garden/mulches-for-the-home-grounds-7-214/
6. *Mulching Woody Ornamentals* — USDA Forest Service (NEW – reinforces correct mulch depth and trunk clearance)
   https://www.fs.usda.gov/nrs/pubs/jrnl/2008/nrs_2008_chalker-scott_001.pdf

SALT, SAND, AND SNOW MANAGEMENT IMPACTS

7. *Effects of Deicing Salts on Plants* — Colorado State University Extension
   https://extension.colostate.edu/topic-areas/yard-garden/effects-of-deicing-salts-on-plants-7-241/
8. *Road Salt Damage to Trees* — USDA Forest Service
   https://www.fs.usda.gov/inside-fs/delivering-mission/sustain/road-salt-damage-trees
9. *Urban Soil Salinity and Tree Stress* — USDA Forest Service *(NEW – connects salt exposure to cumulative stress)*
   https://www.fs.usda.gov/foresthealth/technology/pdfs/salinity.pdf

MECHANICAL DAMAGE FROM PLOWS AND EQUIPMENT

10. *Protecting Trees from Mechanical Injury* — Colorado State Forest Service
    https://csfs.colostate.edu/forest-management/common-tree-damage/
11. *Urban Tree Damage and Wounds* — USDA Forest Service
    https://www.fs.usda.gov/foresthealth/technology/pdfs/wounds.pdf
12. *Construction Damage to Trees* — Colorado State University Extension *(NEW – applies directly to equipment impacts)*
    https://extension.colostate.edu/topic-areas/yard-garden/construction-damage-to-trees-7-426/

PRUNING & WINTER TREE MAINTENANCE

13. *Pruning Shade Trees* — Colorado State University Extension https://extension.colostate.edu/topic-areas/yard-garden/pruning-shade-trees-7-403/
14. *When to Prune Trees* — Colorado State University Extension *(seasonal timing clarity)* https://extension.colostate.edu/topic-areas/yard-garden/when-to-prune-trees-7-406/
15. *Best Management Practices: Tree Pruning* — International Society of Arboriculture (ISA) *(industry standard)* https://www.isa-arbor.com/Portals/0/Assets/PDF/Pruning_BMP_2017.pdf
16. *Winter Pruning and Disease Prevention* — USDA Forest Service *(pathogen vector reduction)* https://www.fs.usda.gov/foresthealth/technology/pdfs/pruning.pdf

HIGH-ELEVATION FORESTS, CLIMATE STRESS, AND RESILIENCE

17. *Climate Change and Rocky Mountain Forests* — USFS Rocky Mountain Research Station https://www.fs.usda.gov/rmrs/climate-change
18. *Forest Stress and Climate Interactions* — USDA Forest Service *(cumulative stress framing)* https://www.fs.usda.gov/foresthealth/climate_change/
19. *Winter Photosynthesis in Conifers — USDA Forest Service https://www.fs.usda.gov/research/treesearch/27112*
20. *Tree Dormancy and Cold Hardiness — USDA Forest Service https://www.fs.usda.gov/foresthealth/technology/pdfs/cold_hardiness.pdf*

CUMULATIVE STRESS, FOREST HEALTH, AND STRESS INTERACTIONS

21. *Forest Health Protection – Overview — USDA Forest Service https://www.fs.usda.gov/foresthealth*
22. *Forest Health Protection: Insects and Disease Dynamics — USDA Forest Service https://www.fs.usda.gov/foresthealth*
23. *Urban Tree Care and Stress Reduction — Colorado State Forest Service https://csfs.colostate.edu/forest-management/urban-tree-care/*
24. *Forest Stress and Climate Interactions — USDA Forest Service https://www.fs.usda.gov/foresthealth/climate_change/*
25. *USDA Forest Service, Bark Beetles in the Rocky Mountains: https://www.fs.usda.gov/rmrs/science-spotlights/bark-beetles).*
26. *CSU Extension, Insects of Shade Trees: https://extension.colostate.edu/topic-areas/insects/insects-of-shade-trees-5-530/).*

LOCAL CONTEXT

27. *White River National Forest – Forest Health* https://www.fs.usda.gov/detail/whiteriver/landmanagement/foresthealth