Tree Stem Protection

By Gary Johnson and Daniel Wattenhofer

Part 1: What exactly is a tree stem protector protecting?

This sounds a bit foolish, but it isn't. Tree stems (aka, tree trunks) are vulnerable to different degrees of damage, depending on the species of the tree and its age. Imagine a mature cottonwood or a bur oak. Those tree stems are wrapped in a very thick layer of outer bark, 4-5" thick with some bur oaks (Figure 1). That outer bark is not living tissue, but it's placed to make sure the living inner bark and the tissues that build wood and bark are protected from temperature extremes, drying out, animals feeding on the stem, or mechanical equipment damage. It's the first line of defense for the functioning interior bark and wood of a tree.

Figure 1. *The outer bark of a mature bur oak can be as thick as 4 inches. Note the perspective of the pen in the photo to the thickness of the bark.*

Figure 2. *Young red oak stem showing the thin outer bark and the light green cambium of the inner bark. Distance from outer bark to inner bark cambium was approximately 0.05 mm.*

The living bark that the outer bark is protecting contains the tissues that move the sugars and carbohydrates produced during photosynthesis. It moves those sources of life-sustaining energy to tree buds, branches, and roots, as well as storage areas within the tree trunk. And to the inside of the inner bark lies a very thin (think microscopic in anatomy) layer of living cells (the "cambium") that is constantly producing those bark tissues to the outside, and wood to the inside (Figure 2).

Now imagine a young, smooth-barked tree in your landscape and how thin that protective outer bark is, and how easy it is for a hungry rabbit or a wayward lawnmower to break through it and kill part or all of

that inner bark (Figure 3). **THAT** is what a tree stem protector is protecting…the life of the tree. But wait, there is even more!

Many trees have photosynthetic bark which contains chlorophyll and the ability to create energy for the tree to use for growth and tissue repair, especially when they are young. Granted, that outer photosynthetic bark is not nearly as productive as the leaves, but it does photosynthesize and helps develop stem caliper (diameter) on those young trees (Figure 4).

Figure 3. *Both the outer and the inner bark of a birch is very thin, especially compared to oaks and cottonwood.*

Figure 4. *The outer bark of young aspens is photosynthetic. Note the hint of green on the bark of this aspen. That green is chlorophyll, the site of photosynthesis.*

Part 2: What is a tree stem protector protecting the tree from?

Stem protection is, at its most elemental, a physical barrier between the bark of a woody plant and an external force (heretofore referenced as "villains". Most commonly that external force is mechanical, such as an animal (or a spouse with a lawnmower, string trimmer), or a non-target chemical drift. While the offender may differ, the result is the same: the destruction of cambial tissue. When the cambium is damaged, it reduces the tree's ability to transport water and nutrients, which can lead to branch dieback, decay, and/or an early death of the tree.

It's spring time and the snow is melting. What do you see with those younger trees in your landscape? Basically, dirty dinner plates. All winter long, rabbits (stop calling them bunnies), voles, pine mice, deer (stop calling them Bambi), and porcupines have been sustaining their lives by feeding on that tender, nutritious inner bark tissue that is usually only a quarter inch or less beneath the outer bark. Or, maybe those young male deer are rubbing their antlers against those young tree trunks and literally scraping off the

outer bark. Too much testosterone, way too much testosterone (Figure 5).

Now it is summer, and string trimmers and lawn mowers are zooming around those tender tree trunks. It only takes one slip and the string trimmer or mower has whipped or crashed into the tree trunk, breaking through the outer bark and exposing the inner bark to sun and drying winds, and…tissue death (see Figure 6).

Figure 5. *When male deer rub young tree stems to remove the "velvet" from their new antlers, this type of severe cambium loss is common and often results in the premature death of those trees.*

Figure 6. *Mowers and string trimmers tend to cause weekly damage to young tree stems during the growing season. Lawn mower deck damage to the left easily penetrates that outer bark, severely damages the inner bark and sapwood, leading to early and often severe instances of wood decay. String trimmer damage to the right is a common cause of damage to newly planted and young trees and can be equally damaging.*

It's still growing season and the landscape manager is using herbicides around the base of the tree trunk to keep the grass and weeds down so they don't need to get too close with the string trimmer or mower. Consistent with the law of unintended consequences, photosynthetic tissues can absorb herbicides (weed killers) and suffer damage to the tree trunks or sometimes the whole tree (see Figure 7).

Figure 7. *The stems of this young tree lilac absorbed the glyphosate spray that was applied near the ground line and contacted the thin outer bark, resulting in the disfigurement of the foliage for the growing season.*

This damage could be as subtle as localized dead patches in the bark that eventually are less obvious as the tree forms new inner and outer bark or disfigured leaves for one growing season, or more long-termed damage such as the development of stem cracks. Stem crack wounds go through the bark into the wood, opening up the potential for decay to weaken the stem and shorten the tree's life.

According to research conducted by Hannah Mathers, formerly of the Ohio State University Extension, exposure of young tree stems to chemical herbicides like glyphosate can cause or worsen bark splitting in young trees, especially near recent wounds (pruning or otherwise) (Pollock, 2008). These wounds or cracks can also stress the tree and serve as potential openings for pests and pathogens. Furthermore, applications of glyphosate have been shown to reduce the cold-hardiness in some tree species. Other symptoms can include witches broom, stunted growth, chlorosis, malformed leaves, and/or death, and can happen years after the initial exposure.

Is that it? Nope, there are beavers, busy beavers…smart, busy beavers (see Figure 8). They know that younger, tender trees are easier to gnaw down and cart away to their little homes on the rivers, streams, creeks. Plus, it's easier for them to devour the tender buds and shoots when they've harvested the trees and they're lying flat on the ground.

Figure 8. *Beavers can cause significant damage to trees, even if they don't topple them completely. Beavers have chewed through the outer bark to get to the more nutritious inner bark of this mature tree, effectively girdling it and guaranteeing its early death. Photo Credit: Jim Blake.*

Figure 9. *A tree that has been severely damaged by porcupine feeding of the inner bark. Photo Credit: Katie Druwitz.*

Part 3: Identify the villain.

Identifying the culprits that have bothered the trees in the past or that may be problems in the future is critical to the type of stem protection that will be most effective. For instance, if you note extensive bark stripping high up into the tree by late winter/early spring, that's not a rabbit or a deer (unless it was the largest rabbit or deer in the history of the world). Rabbits feed above the snowline to a distance up to 18-24 inches (depending on the type of rabbit).

Figure 10. *In a low snow winter, rabbit feeding of the bark can extend almost to the ground line as shown in the photo to the left. In a deep snow winter, the rabbit damage can extend up and into lower branches, as shown on the apple tree to the right on branches that were 40-48 inches above ground. Photo credit for the photo to the left: Luke Plunkett.*

Aside from the antler-rubbing damage, deer also feed on buds and branches within four to five (4-5) feet above ground. This feeding can be gentle and similar to rabbit damage, leaving the classic 45 degree angle to the cut, or they can cause some pretty gross damage when they aggressively rip off branches. Porcupines can start close to the ground but then work their way up into the crown of the tree, stripping the trunk and branches on their way up (see figures 9 and 11).

Finally, the smallest and sometimes the most damaging of all the animal damage: voles. Voles are scared… to…death of raptors, so they tend to spend their winters under the protection of snow cover, feeding on that tender

Figure 11. *Porcupine feeding off of inner bark, high in a birch tree. Source of photo unknown.*

Figure 12. *Vole damage to mugo pine. Snow had been plowed up and over the mugo pine during this winter, and voles had lived in and feasted off the cambium of these pines, under the protection of the snow cover for several months.*

cambial tissue of the inner bark. You won't even know they are there, working on killing your trees until the snow melts in the spring.

Figure 13. *Snow had been plowed over the trunks of these trees all winter, providing a perfect winter feeding home for voles. By the time the snow had melted, the damage had been done, undetected.*

Part 4: Matching the protection to the villain.

It should be obvious by now that "one size does not fit all" when it comes to winter stem protection of trees and shrubs. Tall voles just don't match up to tall deer. To that end, matching the protection strategy to the villain is critical. There are two protection strategies (legal and ethical ones) that will be addressed here: exclusionary and olfactory.

Exclusionary tactics are those that physically keep the villains away from the plants. They can be specific to the stem or to the entire plant. Olfactory strategies as the name implies are those that stink, stink so bad that the animals that normally feed on the cambial tissues opt to seek out less offensive tree and shrub stems, ideally on your neighbor's property. Table 1 illustrates the options for matching villains to tactics. Table 2 specifically describes the individual tactic materials necessary to thwart the villains.

Table 1. *Tactics for minimizing stem damage by villain.*

Villain	Tactic
Voles/mice	Exclusionary
Rabbits	Exclusionary, olfactory
Deer	Exclusionary, olfactory
Beaver	Exclusionary
Porcupines	n/a
Chemicals	Exclusionary
Mowers/weed whips	Exclusionary

Table 2. *Description of stem protection tactics.*

Tactic	Description	Figure No.
Crinkled paper tree wrap	Exclusionary protection from non-target chemical drift.	14
Flexible, plastic tree trunk protectors	Exclusionary protection from non-target chemical drift, mowers and string trimmers. Various sizes*.	15
White, corrugated, LDPE plastic	Exclusionary protection from non-target chemical drift, voles, rabbits, deer antler-rubbing, lawn mowers and string trimmers. Various sizes*.	16
Spiral, plastic tree guards	Exclusionary protection from rabbits, deer antler-rubbing, non-target chemical drift, lawn mowers, and string trimmers. Various sizes*.	17
Plastic tree shelters	Exclusionary protection from voles, rabbits, deer antler-rubbing, lawn mowers, string trimmers, non-target chemical drift. Various sizes*.	18
Chicken wire, 0.5” to 1.0”	Exclusionary protection from rabbits, deer antler-rubbing, beaver damage. Various sizes*.	19
Welded wire fence	Exclusionary protection from rabbits, deer antler-rubbing, deer browse, lawn mowers, string trimmers, beaver damage. Various sizes*.	20
Hardware cloth, 0.5”	Exclusionary protection from rabbits, deer antler-rubbing, beaver damage. Various sizes*.	21
UV treated, rigid plastic mesh tree guard	Exclusionary protection from rabbits, deer antler-rubbing, beaver damage. Various sizes*.	22
Hardware cloth, 0.25”	Exclusionary protection from rabbits, deer antler-rubbing, beaver, and vole damage. Various sizes*.	23
Mulch ring	Exclusionary protection from mowers, string trimmers (theoretically)	24
Liquid Fence™; Animal Stopper, Rodent Stopper™; Plantskydd™	Olfactory protection from rabbits, deer browse. This is only a partial listing of the many good olfactory repellents on the market, and not intended to promote any one product. Non-chemical, variety of oils, and organic additives to provide a foul-odor. Sprays or granular.	25,26

*Recommended heights for stem protection

48 in - Maximum Deer Antler Rub Protection, Beaver

36 in - Minimum Deer Antler Rub Protection, Beaver

24 in - Small Rodents, Rabbits, Weed Trimmers, Mowers

18 in - Small Rodents (Mice, Voles), Weed Trimmers, Mowers

These recommendations are simply guidelines, as an animal's capacity to damage tree stems may be influenced by winter snow drifts and their ability to balance on their hind legs.

Figure 14. *Crinkled paper wrap installed on a newly planted tree.*

Figure 15. *Flexible plastic tree protector.*

Figure 16. *White corrugated plastic protector.*

Figure 17. *Spiral plastic stem protector.*

Figure 18. *Plastic tree shelters.*

Figure 19. *Chicken wire.*

Figure 20. *Welded wire fence.*

Figure 21. *Hardware cloth, 0.50".*

Figure 22. *UV treated rigid plastic mesh.*

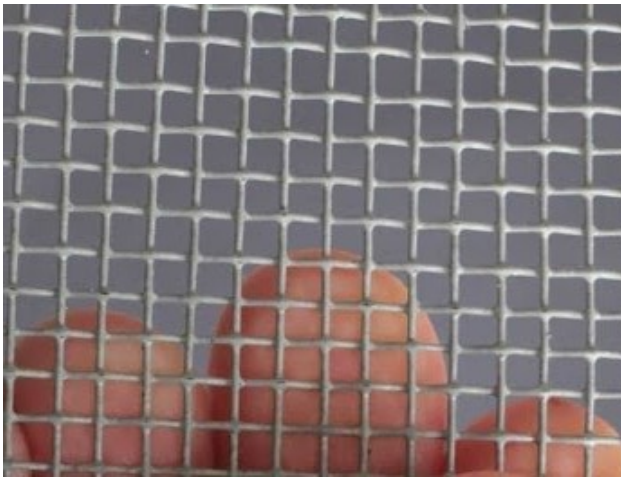

Figure 23. *0.25" hardware cloth.*

Figure 24. *Mulch ring.*

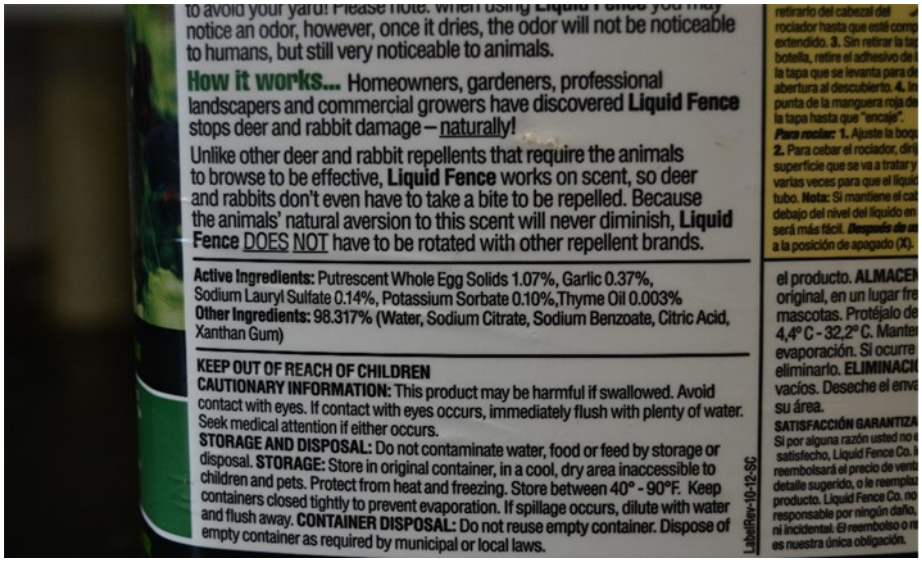

Figure 25. *Olfactory options for protecting tree stems and foliage from animals.*

Figure 26. *Olfactory options for protecting tree stems and foliage from animals.*

Part 5: The Tactics Are Only As Good As The Installation

Timing…is everything

Timing is a balance between when the photosynthetic stems need sunlight and the common villains need food in their bellies…it's not a perfect science. Ideally, any stem protection device that restricts sunlight from reaching the stem would be removed by early May in the Upper Midwest. That may or may not coincide with the end of critter damage potential. You know when that date is for your part of the country. Don't restrict your actions to a calendar if you know that damage is likely after May 1. If you make a mistake and leave the protection on too long or remove it too soon, it's not the end of the world. Just don't do it again next year. That WOULD be the end of the world (to a tree hugger).

The flip side of the calendar is equally important…when does the seasonal damage usually occur? Sometimes, rabbits begin drooling over succulent cambium in early September, but often later. Adjust the installation of protection devices according to your local damage pressure. If you have difficulty predicting, avoid the stem protection tactics that restrict sunlight. Use the materials that protect yet don't deny the stems sunlight (e.g. chicken wire, hardware cloth). Lots of options fulfill lots of restrictions.

It's a material world

Opaque stem protection should only be installed for the duration of the dormant season or impact season of the animal or spousal browse you're seeking to prevent, but rigid mesh stem protection may be left on all year. Stem protection, like wire fence and hardware cloth, should be removed before the stem out-grows the guard diameter, otherwise tree guards may girdle and kill a tree.

Tree shelters however are designed to remain on the tree year 'round and until the tree begins to grow taller than the height of the tube, which depending on the species and growing conditions, may take years.

Wire materials provide the best protection against animal damage while not blocking sunlight from reaching the photosynthetic bark. For this reason, as long as they are large enough, the wire cylinders may be left on year 'round. Depending on the size of the tree, the wire fencing may require stakes for support. Wire fencing should be inspected annually for effectiveness and removed before the fencing becomes too tight and constricts the tree's trunk. Avoid that "law of unintended consequences."

Mulching around trees is one of the lowest cost ways to improve tree survival and health. When properly applied, mulch can provide many benefits including improved soil moisture of the area around the tree's roots (Montague et al, 2007), increased root growth and density (Scharenbroch, 2009), insulation of tree roots from extreme temperature swings (Montague et al, 1998; Singer and Martin, 2008) and reduction in competition pressures from grasses and other plants. However the key benefit that the mulch ring provides here is protection from mechanical damage resulting from incidental mower and/or weed whip strikes.

Part 6: Common FAQs

I can probably just leave that opaque tree stem protection on the tree year 'round, right?

Myth

An interesting fact about trees that often goes overlooked is that the stems of young trees and shrubs contain photosynthetic tissue and require sunlight. This type of photosynthetic stem tissue has been shown to provide the tree many benefits including radial stem growth and new leaf development (Saveyn et al, 2010). Opaque tree stem protection (any device that restricts sunlight) prevents this stem photosynthesis from occurring, leading to a significant reduction in stem caliper development and bud formation (Figure 27). This can lead to decreased structural stability in the stem, and possibly stem failure during wind storms. It is for this reason that it is recommended that opaque tree stem protection be removed during the growing season. However, if you're using rigid mesh stem protection, wire fencing, or semi-transparent tree shelters, those may be left on all year.

Figure 27. Reduction of stem caliper growth caused by opaque stem protection left on for too long. Photo credit Stephan Papiz.

Chicken wire pretty much excludes any animal damage to my trees, yes?

Myth.

Voles and pine mice can squeeze into very small spaces, including chicken wire, and do some massive damage to trees over the course of a winter. To that end, it's critically important that you identify what kind of damage is most likely to occur, and adjust the tactic to the villain.

I think that bunnies and bambis are cute. How can they cause so much damage to trees?

Myth.

They are not cute. They are hungry villains. Keep them away from trees…don't encourage their presence. Don't feed them or encourage them to stay in the area of your trees.

I've heard that hanging bars of soap from trees keep deer from feeding on them.

Myth.

Soap smells good. Deer like to smell good, especially young bucks. You need to promote foul-smelling odors.

I've heard (detect a pattern?) that deer and beavers don't damage larger trees.

Myth.

If you like that tree, if there are deer and beavers in the area, regardless of size, protect the stems from damage.

Deer and rabbits prefer certain species.

Half Myth.

There are some trees, oaks and elms and crabapples, that critters prefer, but there's one over-riding preference factor: store-bought trees. Nursery-grown trees have large energy reserves and nitrogen…that's what critters want. They will always go for store-bought over native species.

For More Information:

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