



Arboriculture 101
presented by the CTPA

Non-parasitic Conditions of Trees

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What Is a Non-Parasitic Condition?

- This is a condition that affects a wide variety of trees, not just a single species.
- A condition that's not caused by a disease or insect pest, because these are very host specific.



Class Outline

- We'll review about fifty common non-parasitic conditions.
- Tonight we're going to do this with slides from the field.
- No scientist tonight, just an arborist!
- Our goal is to make you able to walk on any property and diagnose almost any non-parasitic condition you come across.



Samples of Conditions

- Beyond these slides, we have examples of many of these conditions for you to look at.
- But you have to wait for the “hands on class” in a few weeks!



The Whole Tree

- There are many parts of the tree, but think roots and leaves first when diagnosing problems.



The Whole Tree

- When thinking about a tree, consider that about 1/3 of the tree's biomass is in the crown, 1/3 in the trunk, and 1/3 in the roots.





Roots and Leaves

- Two obvious functioning parts of the tree are the leaves and the roots.
- Leaves convert solar energy to stored energy in the form of sugars.
- Roots absorb moisture and nutrients from the soil.




The Root of Happiness

- Roots need to have loose soil so they can grow and so that there can be a gaseous exchange through the soil.
- This loose soil needs to have a proper balance of moisture and air.
- And, the environment the roots are used to must stay the same.

Root Zone

- Understand that the root zone is its own complex ecosystem.
- Composed of roots, soil, microbes, fungi, insects, animals, mycorrhizae, water, etc.





Mycorrhizae, a definition

- A mycorrhiza is a symbiotic association between a fungus and the roots of a vascular plant. In a mycorrhizal association, the fungus colonizes the host plant's roots, either intracellularly as in ...





The Whole Tree

- Realize that any changes to the root zone ecosystem can be a problem for the tree.





Diagnosing

- Why am I out to the property looking at this tree?
- Client is looking at what?
- Brown leaves?
- Consider the total picture.
- Okay, maybe the tree is declining.
- What's gone on around the tree?



Stress Factors

- Acute – occur suddenly and cause immediate damage.
- Chronic – occur slowly over time.



Acute Damage – Examples

- Mechanical injuries
- Frost and freeze damage
- Incorrect pesticide sprays
- Lightning



Chronic Damage – Examples

- Soil compaction
- Low light
- Girdling roots
- Nutritional deficiency



Classify Non-parasitic Conditions Into Categories:

- Environmental – meteorological
- Environmental – man made
- Physiological
- Nutritional
- Mechanical & animal



Environmental-meteorological

- Lightning
- Frost cracks
- Winter injury
- Sunscald
- Leaf scorch
- Salt spray
- Storm damage



Lightning

- Sometimes lightning completely destroys a tree.
- Debris from this strike scattered for hundreds of yards.





Lightning

- Here, two white pines were each struck.
- The strike followed a steel deer fence support wire to other adjacent trees.





Lightning

- The strike used the bottom 8 feet of these adjacent trees to get to ground.





Lightning

- This pine struck in 2014.
- Why another pine?





Lightning

- This tree struck by lightning in 2002.
- The canopy was fine in 2003.





Lightning Strike

- Another tree 11 years after strike.
- Plenty of foliage.
- Lots of trunk decay.
- A clear hazard.





Ash Hit by Lightning

- This ash looks as though it got struck in 2009.
- Fully leafed out in 2011.





Ash

- Cross section shows pretty extensive cracking of trunk.





Ash

- Not a good day for the house.



Ash

- It's anyone's guess how much the root system was damaged by the lightning.





Lightning

- Large pine hit by lightning in summer 2010.
- I drive by the tree every day and noticed it was looking “off”.



Lightning

- Tree shows only one route where the lightning went to ground.





Lightning

- Now the tree is almost all dead.
- If that had been a tree on your clients property, maybe you could have prevented the loss!





Lightning Protection

- You can help prevent damage by installing lightning protection.
- Done for large and important trees.



Lightning Protection

- Similar to protection for buildings, but some materials are different.
- A sample of tree materials.



Lightning Protection

- A climber installs copper wire from top of tree to the base.
- Copper wire is held away from trunk by using bronze tree drives.





Lightning Protection

- Copper wire is placed in trench in ground, running to ground rod driven deep into ground outside the dripline of tree.





Frost Cracks

- Continual freezing and thawing.
- Bark and some outer wood form longitudinal cracks.
- No prevention or treatment.






Winter Rhododendron

- Leaves tightly curled in winter.
- Why?





Winter Injury

- Extreme temperature changes.
- Often occurs more on southern side of plant.
- Why?






Winter Injury

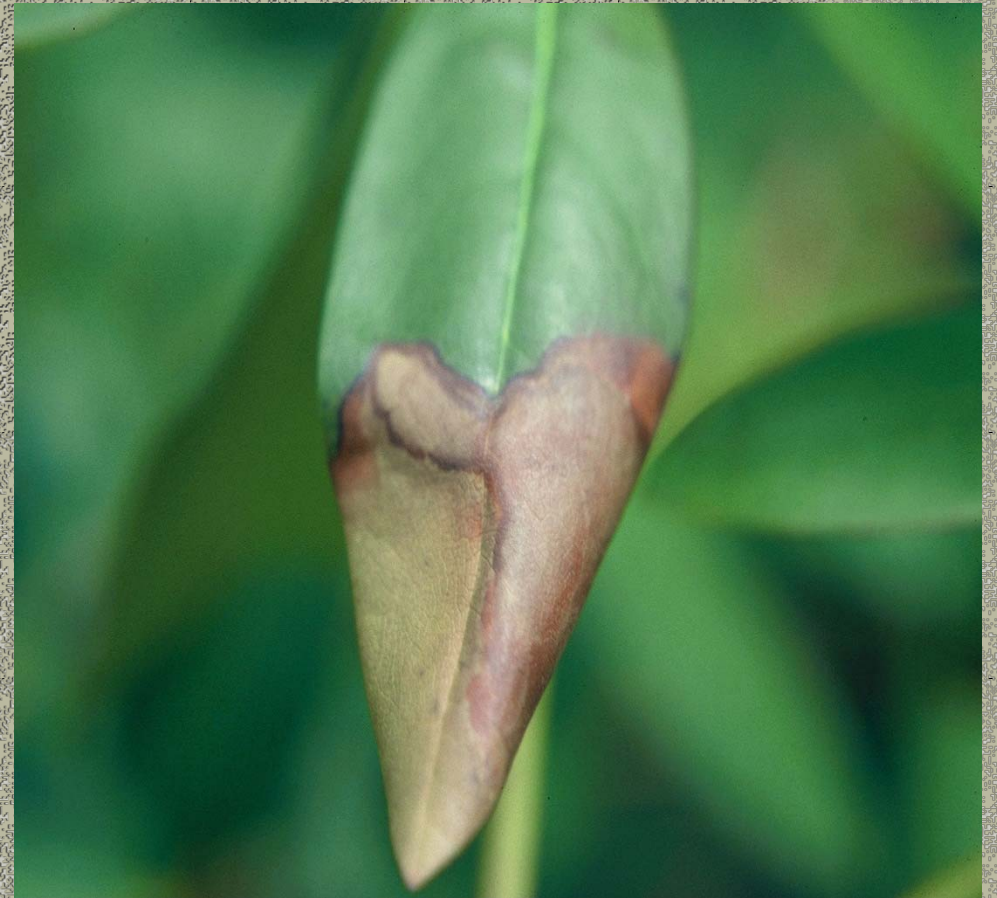
- Here it's on a rhody.





Winter Injury

- Rhododendron leaf.
- General death of leaf tissue.
- Usually most of leaf dies.





Winter Injury

- Close up of holly leaves.





Winter Injury

- These Japanese hollies don't look too good.





Winter Injury

- The deep snow in 2010-2011 covered the bottom of these rhodys so only the top half showed winter damage in the spring.





Winter Injury

- These black pines had a tough winter in 2013-2014.






Winter Injury

- Close up of the black pines.
- The buds seemed okay so we hoped for the best.
- Eventually they pulled through.





Winter Injury - Death

- In winter of 2013-2014 there was a lot of death of younger evergreens.





Winter Injury 2015

- Not too good.





Winter 2015

- This variety of holly really suffered!



Winter Injury Treatment

- Young trees and shrubs can be sprayed with an anti-desiccant material in late fall.
- Sometimes burlap fences are erected around shrubs.





Sunscald

- Usually a result of improper pruning.
- Heavy pruning opens up the center of tree to increased sun exposure.
- Tender bark dies.





Sunscald

- Young weeping beech.
- Don't prune in late spring or summer.
- Weeping beech are very prone to this.
- No treatment, but you can prevent it.





Sunscald

- Hemlock hedge.
- Be careful, don't cut back too hard.
- Especially in summer.





Leaf Scorch

- Happens when tree can't supply enough water to leaves.
- Can be because of lack of soil moisture, a natural drought.
- Sometimes caused by too much water.
- Damaged root system can cause the problem.
- Reflective heat from nearby building can add to the problem.

Leaf Scorch

- Leaves turn brown, first between the veins.
- Browning of canopy will occur mostly on the side of the tree that has the lack of water.





Leaf Scorch

- Summer of 2005 was very dry.
- Top photo in mid-August 2005 shows early signs.
- Other photo shows dying trees in early September.



Drought

- The summer of 2010 was very dry.
- Probably the worst I've seen until this year.
- Many dead limbs on maple.





Leaf Scorch

- More trees along roadside in trouble.
- Typical damage to a maple.





Leaf Scorch

- Trees on residential properties, too.
- Here an old beech shows severe stress.
- Irrigation system was not used during 2005 summer.





Leaf Scorch

- Minimal planting strip.
- Reflected heat from asphalt.
- More reflected heat from the building.



Leaf Scorch

- Drought conditions can be naturally occurring or man-made.
- This shows newly planted trees that didn't get watered.
- Treatment?





Salt Spray

- Prevailing winds off salt water cause dieback on the waterside of tree.
- Plant the proper species!





Salt: Austrian vs. White Pine

Storm Sandy 2012



Salt Spray Fall 2011

- Tropical storm Irene along the coast.
- Lots of brown leaves.





Storm Damage

- Ice storms can be the worst.
- Best to clear the trees of broken limbs; only do basic pruning.
- Wait a season to finish trimming.





ENVIRONMENTAL – Man Made

- Construction damage.
- Soil compaction.
- Soil added.
- Soil removed.
- Air pollution.
- Natural gas.
- Salt damage.
- Excess water.
- Pesticide damage.
- Planted too deep.



Construction Damage

- This was a wooded area.
- Grade wasn't changed too much.
- Soil temperature and moisture content was changed a lot.
- All trees died.



Construction Damage

- This beech had been severely encroached upon in 2004.
- Its future was bleak.
- Tree removed in 2005.



Construction Damage

- Sugar maple has gone through a lot of site changes.





Construction Damage

- Notice the fall color, earlier than neighboring trees.
- Why?





Soil Compaction

- Usually caused by vehicle traffic.
- Can have direct impact to the roots by crushing injury.
- Changes the root zone environment.
- Previous gaseous exchange through soil is changed.
- Tree is unable to absorb moisture and nutrients in its usual manner.



Soil Compaction

- Results in general decline.
- Soil under this tree was very compacted.



Vertical Mulching

- Might want to try to loosen soil in root zone.
- Use a two-inch diameter soil auger to drill vertical holes.
- The auger is powered by a large, gas engine powered drill.



Vertical Mulching

- Another method of drilling is with an air spade.
- With either method, the idea is to make lots of holes and fill these with a loose material, such as compost or vertical mulching product.





Vertical Mulching

- Here, holes are made about two feet apart under the drip line of the tree.
- You also want to go out farther than the drip line, if the site allows.





Soil Added

- Adding more soil inhibits the gaseous exchange through the soil.
- The roots can't breathe.
- When the roots can't breathe they don't function properly.
- This condition results in similar tree problems as compacted soil, a general decline, ending in death.



Soil Removed

- Most tree roots are in top one foot of soil.
- Removing soil destroys roots immediately.
- Removal of natural leaf litter also raises the soil temperature a great deal.
- Does this affect all trees the same?



What Went Wrong?

- Property was re-done in 2004.
- Plantings look healthy.
- Nice green turfgrass in September 2005.





Dying Oak

- Why is oak dying?





Construction Damage

- Sometimes a tree adjacent to work area is exposed to more winds.





Construction Damage

- Wind throw.





Hurricane Ivan 2004

- Why did this tree fail?





Examine the area of failure.

- Note the basal decay.





Tropical Storm Ernesto

- Mature oak fell.
- Tree didn't appear to be hazardous before it fell.





T.S. Ernesto

- Examination of base shows extensive rot and decay.
- Easy to see why it fell.
- Why so much decay?





Air Pollution

- Most pollution problems are chronic.
- High pollution levels can cause a general decline in tree health.
- Some pollution is acute.
- The exhaust of equipment blowing on foliage will kill sections of the tree or plant.

Equipment Exhaust

- Street paving equipment had upward pointing exhaust.
- Here white pines show injury.



Equipment Exhaust

- This shows damage to all trees along the side of this road.



Natural Gas

- Underground gas lines can leak.
- The gas itself isn't the problem.
- The gas replaces the oxygen in the soil so roots can't function properly.





Salt Damage

- Salted sand is spread on road in winter.
- Spray from passing cars is very salty.
- Causes direct needle injury.
- Salt in soil affects roots.





Salt Damage

- Close up of needle damage from road salts.





Salt Damage

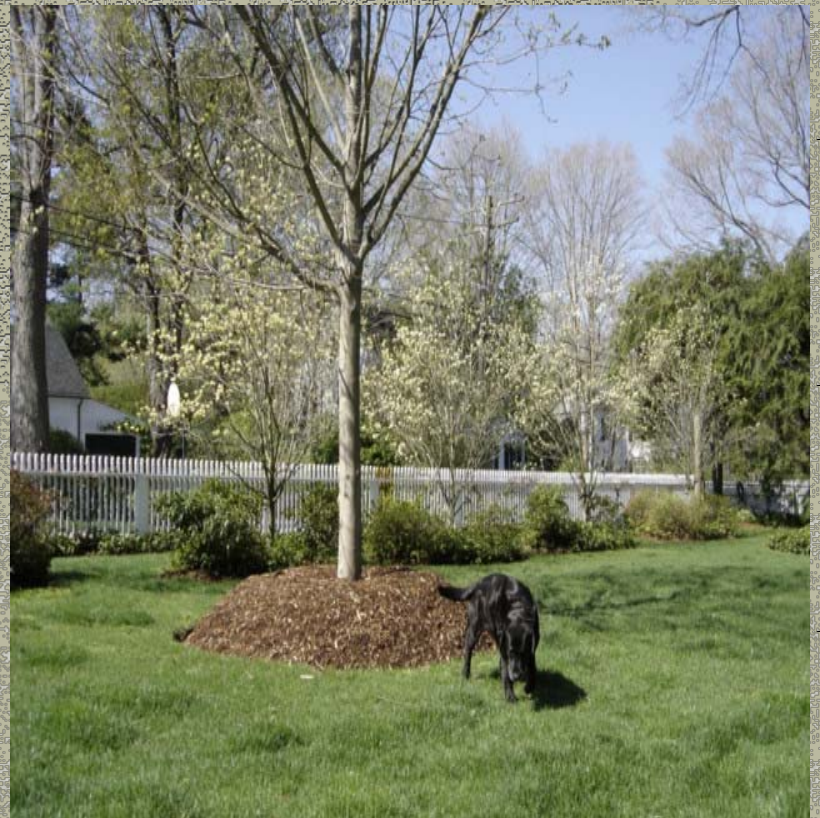
- More close-up





Volcano Mulch

- Mulch is piled high against trunk.
- Trunk bark is not the same as root bark.
- This can result in trunk decay.
- Many small roots develop in mulch.





Excess Water

- Creates an improper balance of oxygen and moisture in the soil.
- Roots can't function properly and soon start to die.





Excess Water

- Close up of the declining maples from excess water.



Pesticide Damage

- Herbicide damage on linden.
- Absorbed through soil and causes unusual growth of leaves.



Pesticide Damage

- Usually the growth is elongated and twisting.
- Often the herbicide is from a lawn application.





Pesticide Damage

- Tree injected with bidrin.
- Or, rather, over-injected with bidrin.



Pesticide Damage

- Close up of leaves of bidrin injected elm.





Planted Too Deeply

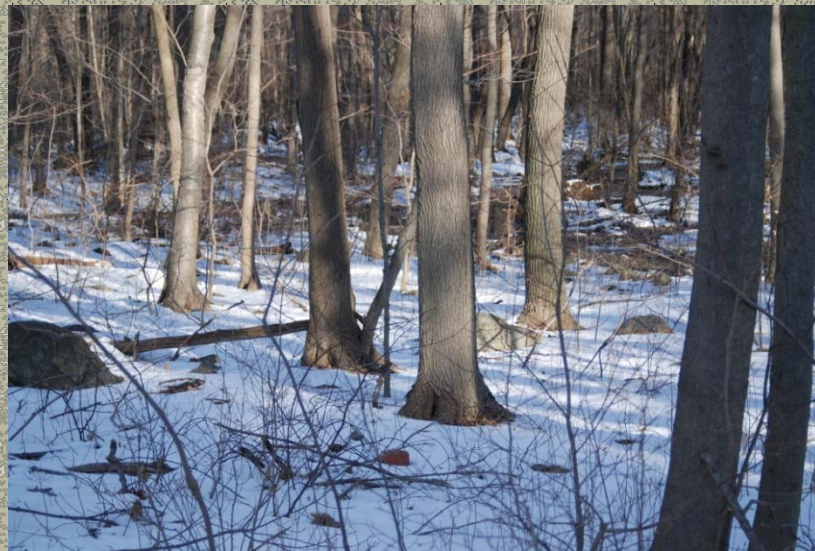
- If trees are planted too deeply, all kinds of trouble can develop.
- This maple tries to grow a new root system above the old one.





Trees in Nature

- All the trees you'll see in the woods have a basal flare.





Trees in Nature

- When trees grow from seed, note the natural basal flare.
- Roots grow outward from trunk.





Deer Damage?

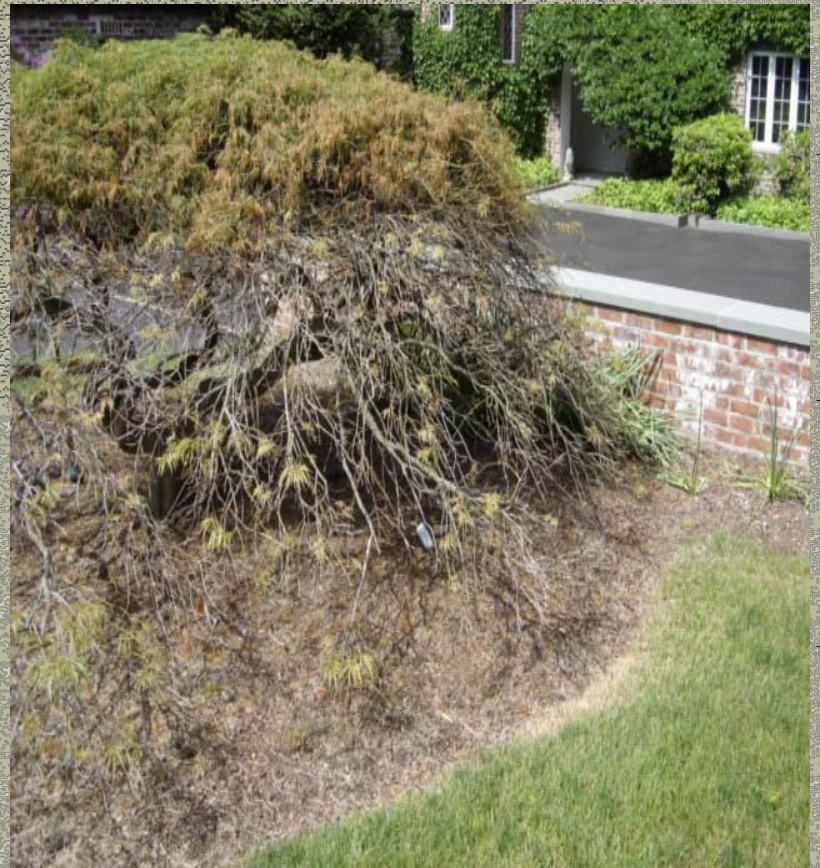
- Damage just up to deer browse height.
- Often a good clue that deer have been around.





Deer Damage?

- Client said she's been seeing deer feeding.
- So she sprayed with bobbex or hinder.
- We checked her spray bottle – it was Roundup she used!





Break



PHYSIOLOGICAL

- Low light
- Nutritional
- Girdling roots
- Plastic twine & burlap



Low Light

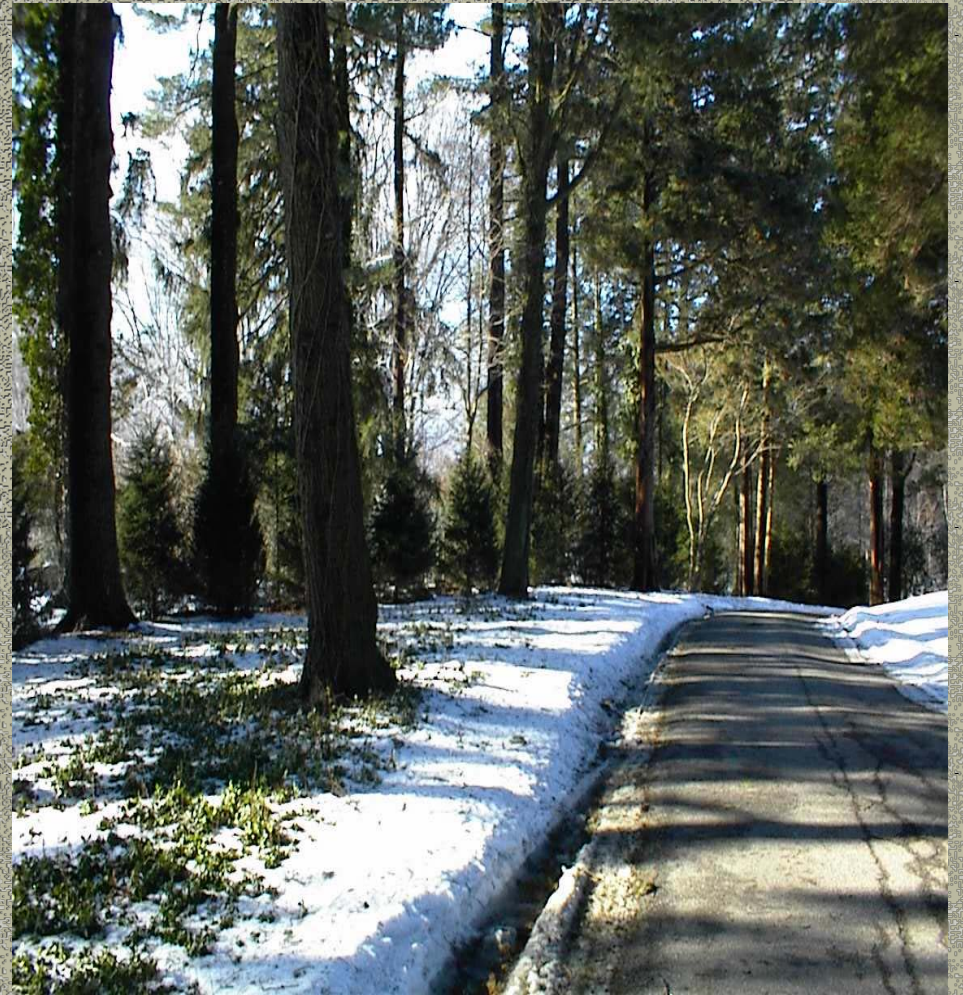
- Often seen with new plantings.
- Evergreens used as screening.
- General decline starting with lower limbs.





Low Light

- Tough to “fix” the problem.
- Best to do good planning right from the start.
- This photo shows the heavy canopy over the young spruces.





Low Light

- These spruce were planted in fall 2006 to shield road noise.
- Not much chance they'll thrive.





Low Light

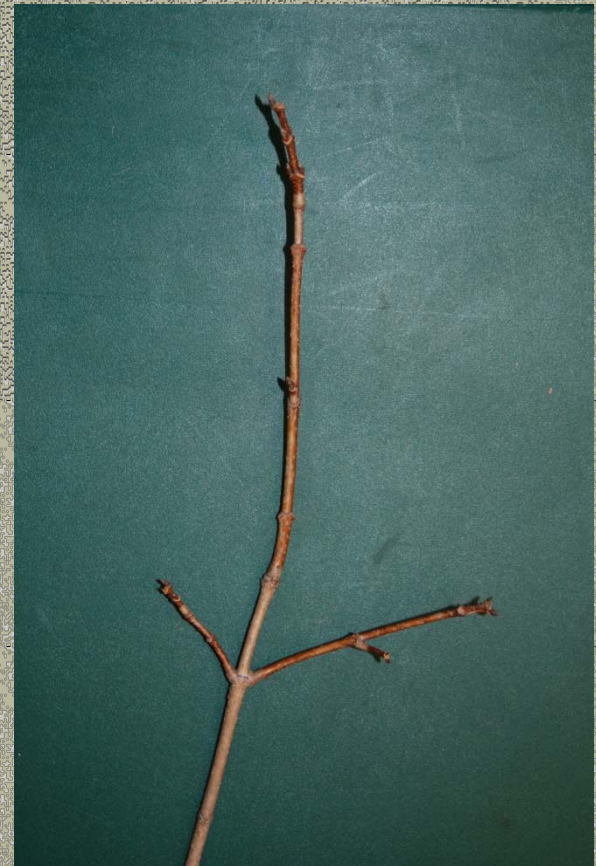
- Same trees in December 2007.
- Not doing too well.
- Many have been replaced.





Internodal Growth

- A twig will have nodes, or seams, between the growth for each year.
- Some trees are more distinct than others.





Internodal Growth

- Can be a gauge of how healthy a tree is.
- When did that stress happen?





Declining Maple – Why?

- General thinning of crown.
- Dieback in top center of tree.
- Early fall color a powerful stress sign, but from what?





Declining Maple

- Approach tree and see the trunk goes into ground without root flare.





Girdling Root

- Evident girdling roots.
- Should this be removed?
- Why or why not?



Girdling Roots – young dogwood

- Obvious sign of early trouble.
- Dig carefully with hand tools or use an air spade.
- Then use mallet and chisel to remove section of root.





Girdling Root Removal



Girdling Root – Air Spade

- An air spade is the easiest and best method to excavate soil.
- No harm to roots and it's quick.



Girdling Root Removal

- Sometimes you can use a chain saw.



Girdling Root Removal

- Finish up removing roots with mallet and chisel.





Zelkova w/ Girdling Roots

- This is after the air spade work.



Zelkova w/ Girdling Roots

- After roots have been cut.



Declining Hornbeams – Why?

- Row of hornbeams showing decline in some of the trees.





Hornbeams

- The worst specimen.
- Significant overall decline.





Hornbeams

- Newly planted site seemed okay.
- Closer inspection showed trunks had no flare.





Hornbeams

- Digging showed that plastic twine was never cut or removed at planting.
- Worse than a girdling root.





MECHANICAL & ANIMAL

- Mowers and trimmers
- Deer damage
- Mouse damage
- Japanese maple
- Sapsucker feeding
- Woodpeckers



Mowers & String Trimmer

- Mowers and string trimmers often kill bark on young trees.





Mowers & String Trimmers

- Why not plant or mulch around trees?
- Everyone's happy!





Bark Damage & Borers

- Very often the damaged trunks of dogwood trees allow easy entry for borers.
- Stressed trees signal to borers and bark beetles.





What Caused This?





Blue





Horse Damage

- Chewing and stripping of bark.
- In just a few minutes work, a bored or hungry horse can strip a lot of bark.





Horse Damage

- Blue was very bored this day.





Horse Protection

- Nice horse properties will have barrier fences put up, ones that match the property's other fences.





Dog Damage

- I think this was done by a German shepherd.
- Not seen very often!





Deer Damage

- Deer browse on leaves, twigs and buds.
- Favor certain species.
- They love rhododendron like this one.





Deer

- You can do a few things to help.
- Late fall sprays with thiram will reduce winter browsing.
- A bit obvious.





Deer

- The sprays do leave a visible residue.





Deer

- A property can be fenced to prevent deer access.





Deer

- You do need to keep the driveway blocked off.
- Note the cattle grate.





Deer

- Close up of cattle grate.
- This one is about six feet wide – you need twice that or the deer will jump it.





Deer

- A second grate has been installed.





Deer Damage 2

- Deer also injure tree trunks.
- In fall, bucks rub antlers on saplings to scrape off the “velvet”.
- Often seriously damages or kills young trees.





Deer 2

- To protect young trees, place rigid fencing around trees in fall.





Rodent Damage

- Mice and voles chew the tender bark, mostly in winter.
- This stem girdling kills the plant.





Rodent Damage

- Junipers in spring.
- Individual branch death.





Rodent Damage

- Closer views.





Rodent Damage

- This area showed lots of chewing in 2010-2011. They chewed maple, winged euonymus and poison ivy.





Rodent Damage

- Base of euonymus vine has been chewed.





Rodent Damage

- Come this spring they'll be quite a bit of dieback.
- Treatment?





Rodent - squirrels

- Squirrels sometimes find a sugar maple to be quite tasty.





Squirrels

- Close up of another maple being chewed.





What's This?

- Japanese Maple.
- Unusual marks on limbs.





Japanese maple

- Pock marks on limbs.
- Old marks on older limbs.
- New marks on younger limbs.





Best Clue – Bird feeders

- Heavy bird activity.
- Birds use tree as an anvil when pecking open the sunflower seeds.





Sapsucker Damage

- Holes in bark of certain trees, arranged in a fairly linear pattern around trunk or limbs.



Sapsucker Damage

- The bird is called the yellow bellied sapsucker.
- It pecks holes to get to the sap – that's its primary food in certain parts of the year.
- Sap also attracts insects for the bird to feed on.





Woodpecker

- When you see wood chipper-sized chips, it's usually the pileated woodpecker.





Pileated woodpecker

- A large bird, maybe 20 inches in length.
- Looks a lot like “woody woodpecker”.





Pileated Woodpecker

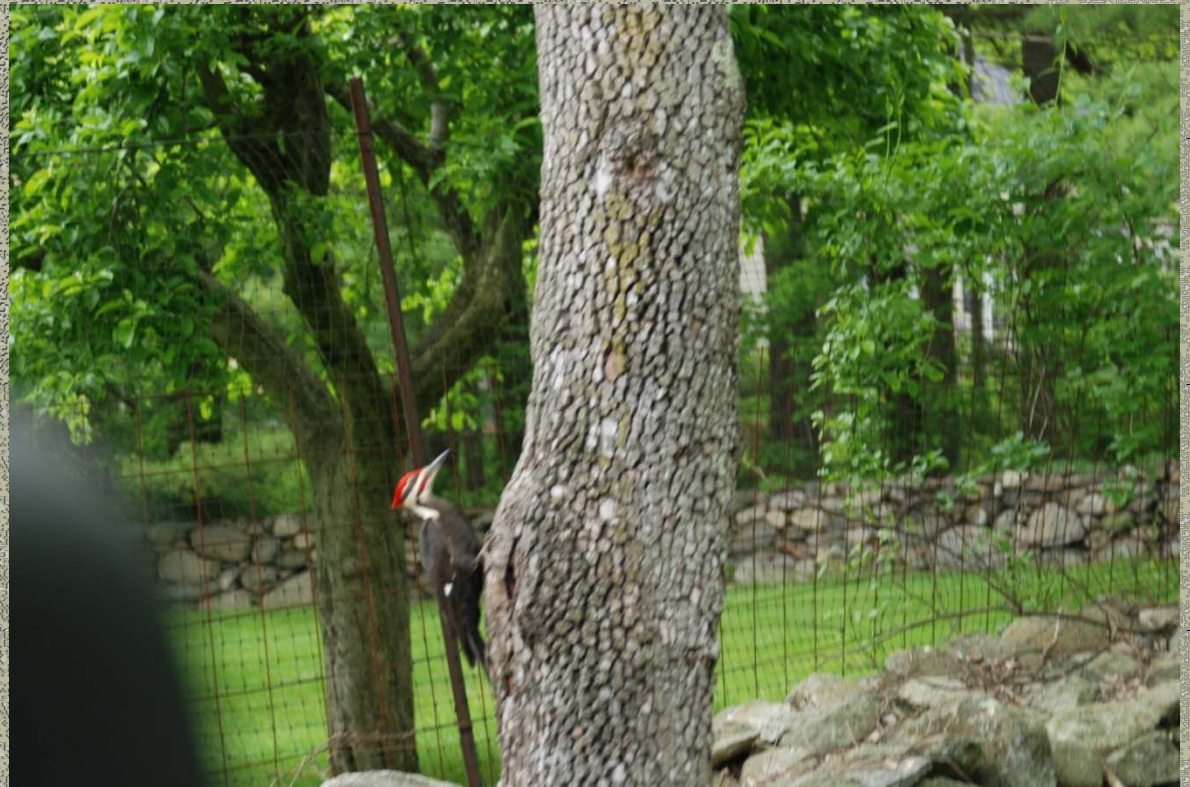
- These are feeding holes.
- Sometimes you'll find large cavities they're making. Those are nesting cavities.





Pileated Woodpecker

- Here “Woody” is pretty tame.





MISCELLANEOUS

- These don't easily fit into categories.
- But you'll get asked about them!



Lichens and Mosses

- Everyone has probably seen these life forms on trees before.





Lichens

- Lichens are usually a bluish/greenish color.
- Actually two forms of life in one – both fungi and an algae.





Lichens

- Each helps the other.
- Tree is used as an anchoring place; no harm to the tree.
- Normally found when the tree is in poor vigor.





Lichens

- When you find this much lichen growing on a tree or shrub, you know that it's growing slowly and in poor health.





Lichens

- Here the lichen is growing on a rock.





Mosses

- A plant that anchors to tree trunks, much as lichens do.
- Uses tree as a base to anchor to.
- No harm to trees.





Mosses

- I took this picture in the crown of an old elm tree.
- Most of the limbs were covered with moss.
- The tree seems quite happy.





Lichen, Moss ? Which?



Algae

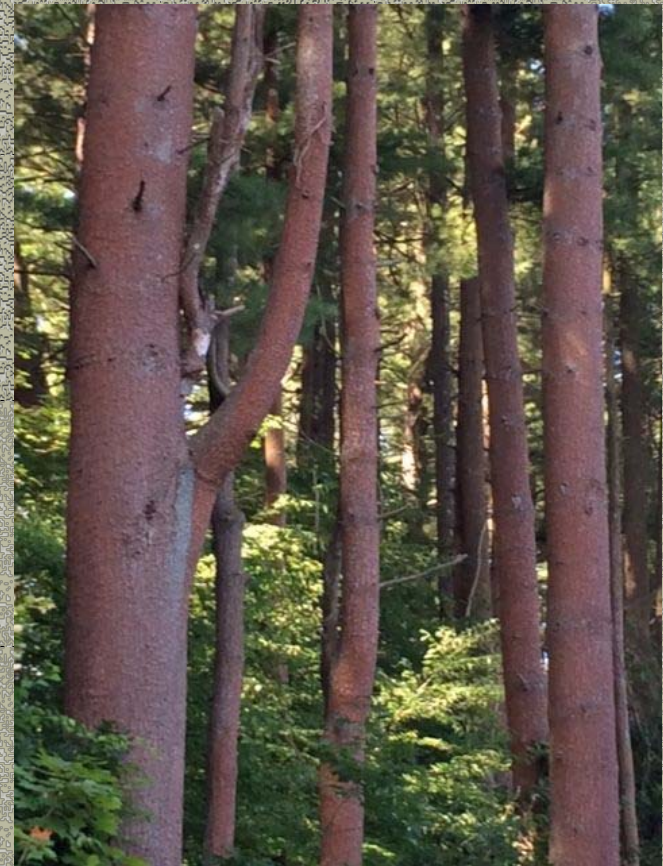
- You might come across unusual colors on the bark of trees.
- This is a white algae existing on a hickory.





Algae

- This stand of eastern white pines has given a red hue for decades.
- Some type of red algae is living here.





Guy Wire

- You often come across old wires that have caused girdling.
- Why the bulge above the wire?





Wires

- These wires have been on the tree for about five years.





Wire Removed

- Able to pull them out of the grooves.





Vines

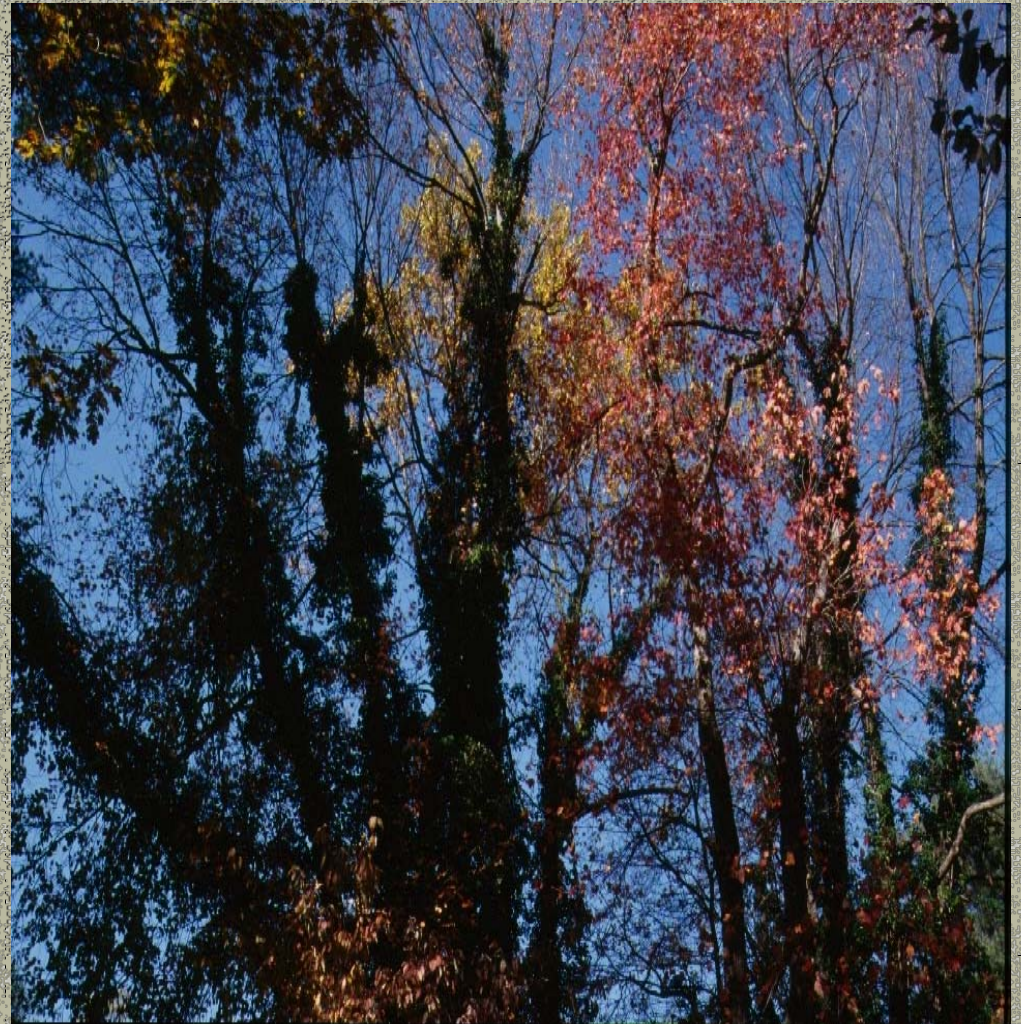
- Evergreen vines on the lower trunk of an old tree can be a nice look.





Vines

- Don't let vines grow high into the tree.
- Competition for light.





Vines

- Too much leaf surface from vines subjects the tree to more wind.





Vines

- Too much wind and the tree can be blown over.





Vines

- Vines can hide a problem, so look carefully.
- This looks innocent enough.





Vines

- Close examination shows a lot of trunk decay, hidden by the ivy.
- This tree has to go.





Vines

- Note how extensive the ivy has become on this tree.





Vines





Vines

- Sycamore has been removed because...





Vines

- Not much solid wood left.





Vines & Hollow Maple

- Here are some trunk pieces from a sugar maple, completely hollow, hidden by a lot of ivy.





Fall Color

- Every evergreen has to lose some inner leaves or needles each fall.
- Some years it's a dramatic change.





Galls

- Not very well understood.
- Sometimes caused by a virus, bacteria, or ?
- Maybe a tree's response to... ?





Galls Can Be Useful

- Large trunk galls on certain tree species are sometimes used for wood working.
- Have you ever heard of burl wood used in woodworking?





Burl Wood

- A tree burl that starts out like this...





Burl Wood

- Might end up as something like this.





Witches Broom

- Occasionally you'll find a piece of a branch where the needles grow in a tight bunch.
- In many trees it looks like a broom.





Witches Broom

- I'm not sure that we know what causes this.
- You won't see it often, so it's good to be aware that it does exist.





Witches Broom





“Twisting” Growth

- Notice the pronounced “twist” to the lower limbs.
- Not a real common condition.





“Twisting” Growth

- Seems to be a reaction to weight and stress.
- Sometimes you’ll also see oval shaped lower limbs.





“Twisting” Growth

- Sugar maple showing same condition on one limb.
- Not really a twist in the grain, but more of side plates grown for strength.





Pruning

- A good example of pruning.
- A good example of bad pruning, that is!





Pruning

- Severe crown reduction.
- Poor final cuts.
- No plan or attempt to follow a plan.





Pruning - Topping

- Notice that this silver maple tree had been topped about 25 years ago.
- Not a good idea.





Pruning - Topping

- Here I'm looking down between my feet into the decayed area where a cut was made in that previously "topped" silver maple tree.





Pruning - Topping

- Close up of decayed leader.
- Extensive decay.
- A wonder the tree is still up!



Topping

- This other silver maple had been topped 20 years ago.
- Most of the leaders were now hollow.





Topping

- This tree was severely trimmed in 2013.
- A300 compliant?



Pollarding

- Pruning a tree each year, cutting all last year's growth back to the same point.
- This is a recognized pruning technique to achieve a specific look or purpose.





Pollarded trees

- Street trees in southern France are pollarded every few years.





Older Pollarded Maple

- This maple used to be pollarded regularly.
- Now that it hasn't been, what do you expect to find in crown?





Lion Tailing is a no-no!

- Sometimes you can get carried away with pruning, thinning out all the inside growth.
- You want to take it easy when removing inside growth.





Asked to Give Opinion

- London plane trees planted too deeply.
- Also pruned a bit oddly.



Asked to Give Opinion

- Attempt by landscaper to start to train to pollard form, at time of transplanting.





Tree Paint

- Arborists used to use tree paint.
- Not for the past 25 years though.
- This fellow must think blue paint looks more appealing.





Blue Tree Paint





What's going on here?





What's going on here?

- Dwarf Alberta Spruce.
- As with most unusual plant varieties, this was developed by nurserymen.
- Same with weeping forms, variegated leaves etc.





Alberta Spruce

- Another example.





Two Trees?

- One weeping cherry tree, in flower.
- One upright cherry tree.





Two trees?

- Actually just one tree showing branches of both forms.



Street Project

- For two years around 2009-2011 there had been a street improvement job going on. The project came in at 9.4 million dollars.





Street Project

- The project allowed for a planting zone for the landscaping detail.
- Note the compacted road base fill.





Street Project

- I counted a total of 97 trees of pretty good size.
- Stuffed into their planting strip.





Street Project

- Not actually a very ideal planting location.
- The mortar was polymer.



Street Project

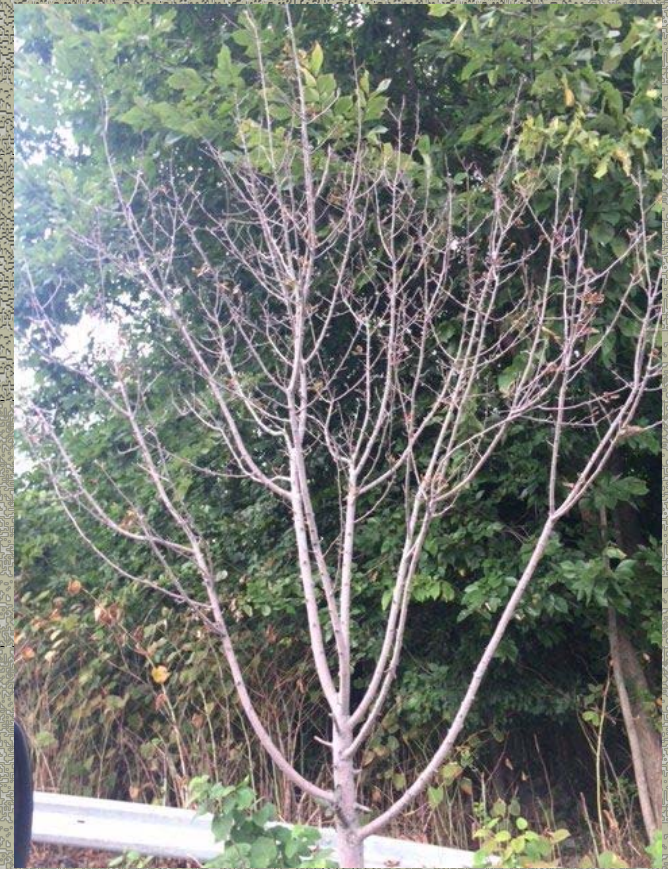
- Branches on street side are already being “trimmed” by passing vehicles.





Street Project Dead Trees

- Recently I counted 22 dead trees and a handful of stumps.





Street Project

- There will be some arborist asked the question in 5 or 10 years...
- “How come these trees look so bad?”



That's All Folks!



Questions?

For next week...



Question for Next Week

- Construction impact can be a big problem for trees.
- What is the most likely type of damage that occurs?
- How does this activity actually hurt the tree?