



TREE MANAGEMENT ON GOLF COURSES



- ROOTS
- MATURE TREE CARE



ROOT DAMAGE



ROOT DAMAGE



Are these the same tree
with mower blight or weed
whipped to death?

One is from BC
The other Alberta.



ROOT ZONE BURIED ONE METER



THE SEVEN DIRTY WORDS OF GOLF COURSE MAINTENANCE Watch your language! OCTOBER 1999/NOVEMBER 1999

- ✖ **Trees:** People love to see trees on golf courses. Trees are beautiful, they are challenging obstacles, and they provide some degree of safety.
- ✖ But trees and turf just can't seem to get along. Excessive shade, root encroachment, interference with irrigation, and blocked air movement are just some of the problems caused by trees.

- ✘ When superintendents suggest removing trees to grow healthier turf, they are met with strong opposition.
- ✘ I have heard golfers say, "Do you know how long it took for that tree to reach that size and now you want to cut it down?" I think it is unfortunate that courses have suffered with terrible turf at the expense of trees. After all, the game of golf is played on grass.
- ✘ THE SEVEN DIRTY WORDS OF GOLF COURSE MAINTENANCE Watch your language! OCTOBER 1999/NOVEMBER 1999

A FEW THINGS ABOUT ROOTS

- ✖ **Oxygen.** Roots must have oxygen to survive and grow. *Oxygen is available only near the soil surface in large air-filled soil pores.*
- ✖ **15 % oxygen** is the norm. (3%- 21%)
- ✖ -soil-oxygen levels fall **below 5%**, root growth stops.
- ✖ Soil -oxygen levels of **less than 2%** lead to root decline and death.

SOIL AND AIR TEMPERATURES

- ✘ For every 8 degrees C increase in soil and air temperature, **oxygen demand doubles** for both tree roots and other soil organisms.
- ✘ Increasing temperatures cause tree roots to **respire faster**, which **uses food and oxygen** more quickly.
- ✘ temperature limits to root growth 4 degrees C and 34 degrees C

MOST ROOTS ARE NOT DEEP IN THE GROUND

- ✖ Roots survive and grow where **adequate water** is available, **temperatures are warm**, and **oxygen** is present.
- ✖ Roots are **generally shallow**, limited by oxygen contents, anaerobic conditions, and water saturation in deeper soil.
- ✖ **Near the base of the tree, deep growing roots can be found**, but they are oxygenated by fissures and cracks in the soil and around roots generated by the mechanical forces exerted on the crown and stem under wind loads

CLOSE UP OF ROOT FLARE WITH SOIL REMOVED

- ✖ A closer view shows that the small diameter roots and the mycorrhizae are interspersed with the main horizontal roots
- ✖ This is a very healthy root system



ROOT FLARE ON FOREST GROWN TREES



- Root flare causes no problems where there is adequate soil space for expansion
- Note the abundant flare at the base of all these trees

LATERAL ROOTS GROW HORIZONTAL



- ✗ About a six foot long portion of the root system was exposed
- ✗ The root flare is beginning to swell in normal fashion
- ✗ Long roots grow in the upper soil layers for great distances; they twist around objects often returning to their original orientation
- ✗ They are deflected by hard soil, growing instead in the looser soil which contains more oxygen

ROOT GROWTH IN COMPACTED SOIL

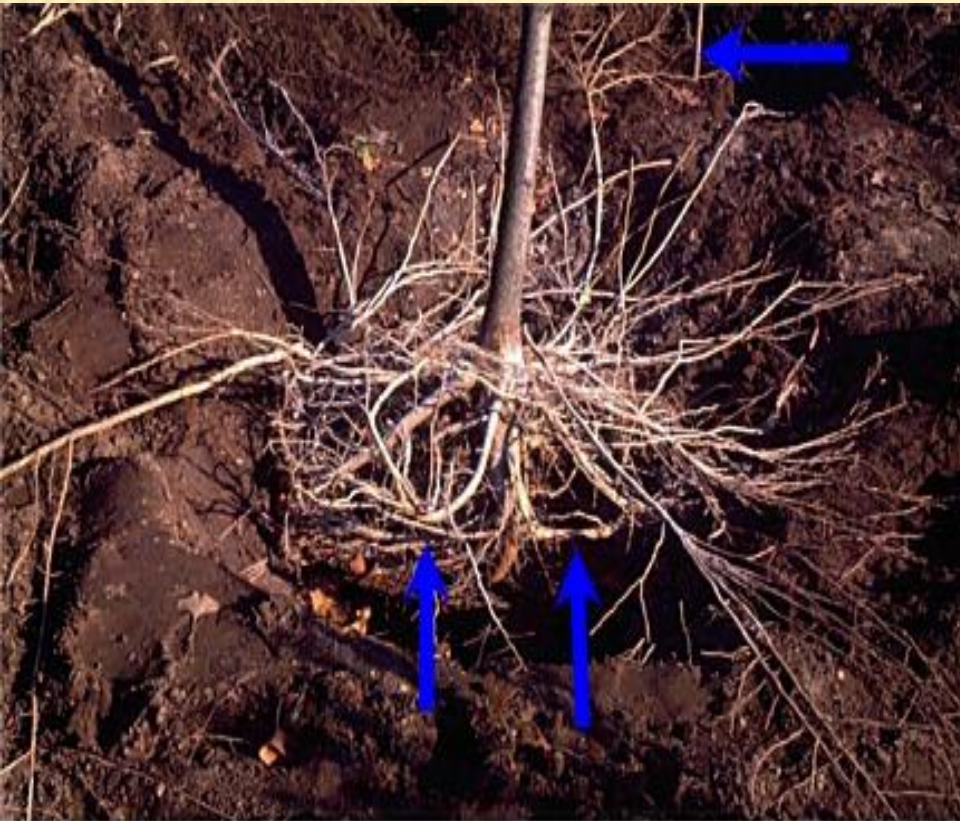
- ✗ Roots are deflected (see bottom 2 arrows) by the mechanical impedance and low oxygen present in the compacted soil.

Most roots appeared to spiral around inside the original planting hole

Several escaped by growing up the side of the planting hole. They proliferated once they reached the well aerated soil at the soil surface

Large gaps in the root system can result from planting in compacted soil as shown above

Note that there are no roots growing on the near side of the tree-most grew into landscape soil on the far side of the tree resulting in a one-sided root system.



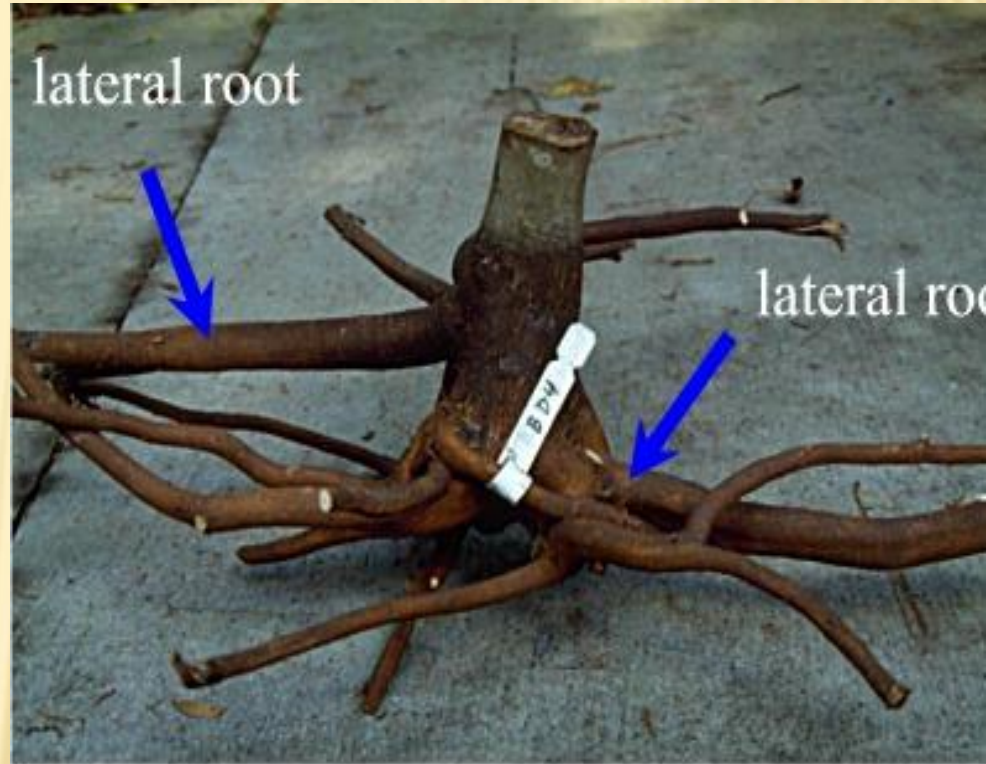
MAIN LATERAL ROOTS JUST UNDER SOIL SURFACE

- Most trees develop many of their main lateral roots just under the soil surface
- The small diameter fine roots and mycorrhizae grew from these main roots but they were removed before this photo was taken
- A few inches of the clay soil was removed to expose the lateral roots
- All roots on this maple were in the top 13 inches of soil



RED MAPLE ROOT SYSTEM

- Red maple and some other trees do not develop many deep roots under any circumstances
- This five year old maple was grown in a nursery on deep sandy soil with nothing to restrict deep root penetration; all roots grew horizontally



WATER

- ✗ **Too much** water and the tree drowns (suffocates).
- ✗ **Too little** water and the tree starves (desiccates).

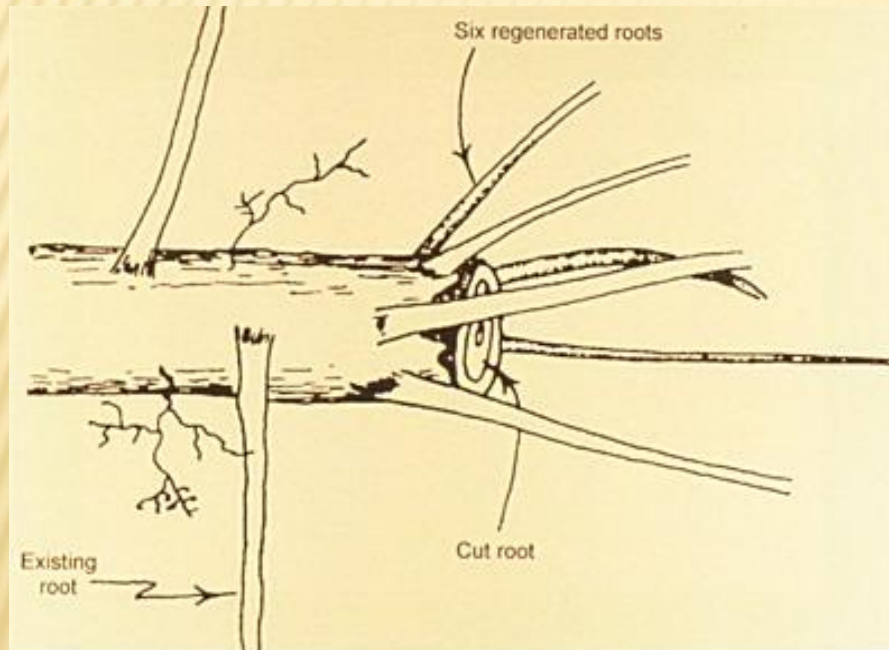
ROOTS ON THE SOIL SURFACE

- ✖ Tree roots growing on the soil surface are **trying to escape bad soil conditions below.**
- ✖ Compaction, toxins, low oxygen, excess water, a high water table, excessive mulch or other conditions lead to shallow, woody transport roots.

READY TO CUT ?

- ✖ 1. To cut surface roots, make clean cuts with sharp blades. Minimize bark disruption, root twist and bending.
- ✖ 2. Add one of the many types of root barriers to minimize severe damage within one event & help control further growth.

ROOTS EMERGING FROM A CUT ROOT



- ✗ New roots emerge primarily from the ends of a cut root
- ✗ Some new roots emerge from a few inches behind the cut
- ✗ Some existing lateral roots are stimulated to grow when the main root is cut

ROOTS EMERGING FROM A CUT ROOT

- ✖ The white roots are the new ones that are growing in response to the cutting; they are just one week old



ROOTS AFTER THREE YEARS



- ✖ About ten roots emerging from a cut root after three years may look like this
- ✖ One or two are likely to become larger than the others in a few years from now

SIZE OF ROOT PLATE

✗ <u>Tree Diameter</u>	<u>Structural Root Distance</u> radius
✗ 10 cm (4 in)	1 meter (3.3 ft)
✗ 15 cm (6 in)	1.2 meters (4 ft)
✗ 25 cm (10 in)	1.8 meters (6 ft)
✗ 30 cm (12 in)	2.1 meters (7 ft)
✗ 40 cm (16 in)	2.4 meters (8 ft)

*Root plate encompasses the **structural roots**, these should not be damaged or disrupted without potential of structural failure.*

ROOT PLATE



NOVA SCOTIA HURRICANE



NOVA SCOTIA HURRICANE

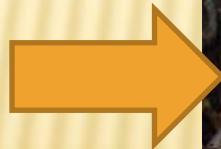




Decayed
structural roots



Irrigation
system



CRITICAL ROOTING ZONE

✖ <u>Tree Diameter</u>	<u>Critical Root Distance</u> radius
✖ 25 cm (10 in)	4.0 meters (13 ft)
✖ 30 cm (12 in)	4.5 meters (15 ft)
✖ 40 cm (16 in)	6.0 meters (20 ft)

Critical rooting zone needed for healthy tree survival and to minimize infrastructure damage.

**WHEN WE PLANT,
THINK ABOUT THE ROOTING SPACE.**



TWENTY FOOT ROOT SYSTEM IN ONE YEAR



- ✗ These oaks have been in the ground one year in hardiness zone 9
- ✗ The root system already has grown to where the people are standing
- ✗ Note the faint white line on the ground from the trunk to where the man is standing; this is a root that we painted white

DISCOVERING ROOT SPREAD IN THE SCHOOL OF HARD KNOCKS

- ✖ Roots on these oaks spread well into this unpaved parking lot
- ✖ Soil sterilant was used to keep the parking lot clear of weeds
- ✖ The chemical was absorbed by the tree roots and the trees are dying back as a result



**OCT 20 - WORK AROUND #18 TEE - NOTE ROOTS
BEING REMOVED. THE POPLARS MIGHT DIE - TOO BAD. SOME OF
US KEEP HITTING INTO THEM ANYWAY.**



WE WILL BE REPAIRING THE CART PATHS USING ONE OF THREE STRATEGIES:

- 1. Removing the existing damaged pavement and then “**coring**” out the subsurface to remove **roots**. We will, when possible, use a **trencher** to cut **tree roots**.

The trenching will need to be an ongoing process in an effort to control root damage. **Clean gravel** will be brought back and the area will be **paved again**.

- 2. Unfortunately, many of the damaged cart paths are **directly adjacent to large trees that, some may argue, are an asset to the golf course.** Removing those roots would not only negatively affect the trees health but would also seriously **hinder the trees stability.** The approach in those circumstances will involve **smoothing out the roots by applying small lifts of pavements and creating, hopefully, subtle humps.** In time we will have to address these areas again but without removal of those trees this seems to be the best approach.
- 3. Other areas will involve **the creation of a new cart path** that will require excavation of native material and adding gravel and then paving.



24 INCH ROOT BARRIER : SHEET METAL



SELECTED LIST OF TREE ROOT GROWTH CONTROL BARRIERS FOUND TO BE EFFECTIVE FOR VARIOUS LENGTHS OF TIME.

- ✕ Copper sulfate-soaked, synthetic, non-woven fabric
- Copper screen
- Cupric carbonate (CuCO_3) in latex paint
- Fiberglass and plastic panels
- Fiber-welded synthetic fabric / mesh
- Galvanized metal screen
- Ground-contact preserved plywood
- *Heavy rigid plastics**
- Infrastructure aprons and footings
- Metal roofing sheets**
- Multiple layers of thin plastic sheets
- Nylon fabric / screen
- Permeable woven fabric sheets
- Rock impregnated tar paper / felt
- *Slow-release chemical barriers**
- Thin layer asphalt / herbicide mix
- Woven and non-woven plastic sheets
- ✕ ** = common commercial tree growth control products*

ROOT GROWTH CONTROL BARRIERS.

✖ General Advantages

- ✖ effective in trapping and constricting, deflecting, and/or inhibiting root growth
- ✖ tree circling barriers inhibit shallow rooting
- ✖ roots pushed to deeper depths
- ✖ initiated more smaller roots and delay on-set of infrastructure damage
- ✖ can be used in combination with drainage / aeration treatments to control roots
- ✖ when deeply seated into ground water or anaerobic soil layers will contain growth
- ✖ must break surface of soil and any mulch layer to be completely effective

ROOT GROWTH CONTROL BARRIERS.

✗ General Disadvantages

- ✗ roots commonly grow under and over barriers causing damage
- ✗ many barriers are not installed deep enough
- ✗ surface damage to the top of root barriers is common
- ✗ thin plastics subject to easy damage along soil surface area
- ✗ buried thin plastics failed punctured or torn during installation
- ✗ circling barriers & barriers placed too close, make circling roots
- ✗ roots can physically push through thin zones of thin plastic
- ✗ may disrupt water and gas movement (anaerobic conditions and freezing heave)
- ✗ deep, tree circling barriers may compromise structural roots and tree stability

AIR GAPS

- ✖ One of the more effective means of controlling tree root growth is creating supporting stone matrices that dry quickly, have extremely **large pores filled with air**, have poor water holding capacity, and are impermeable to root penetration.

AIR GAPS

- ✘ These large air gaps are produced by layers or areas where large gravel ($> 2\text{cm}$ or $> \frac{3}{4}\text{in}$) **and coble-sized stones are deposited and then paved over**. This stone structure reduces rooting significantly.
- ✘ Clean, graded, medium-sized rubble (crushed brick remnants) provides an excellent gap material if it is **not covered or filled in with sand**

Tree Species





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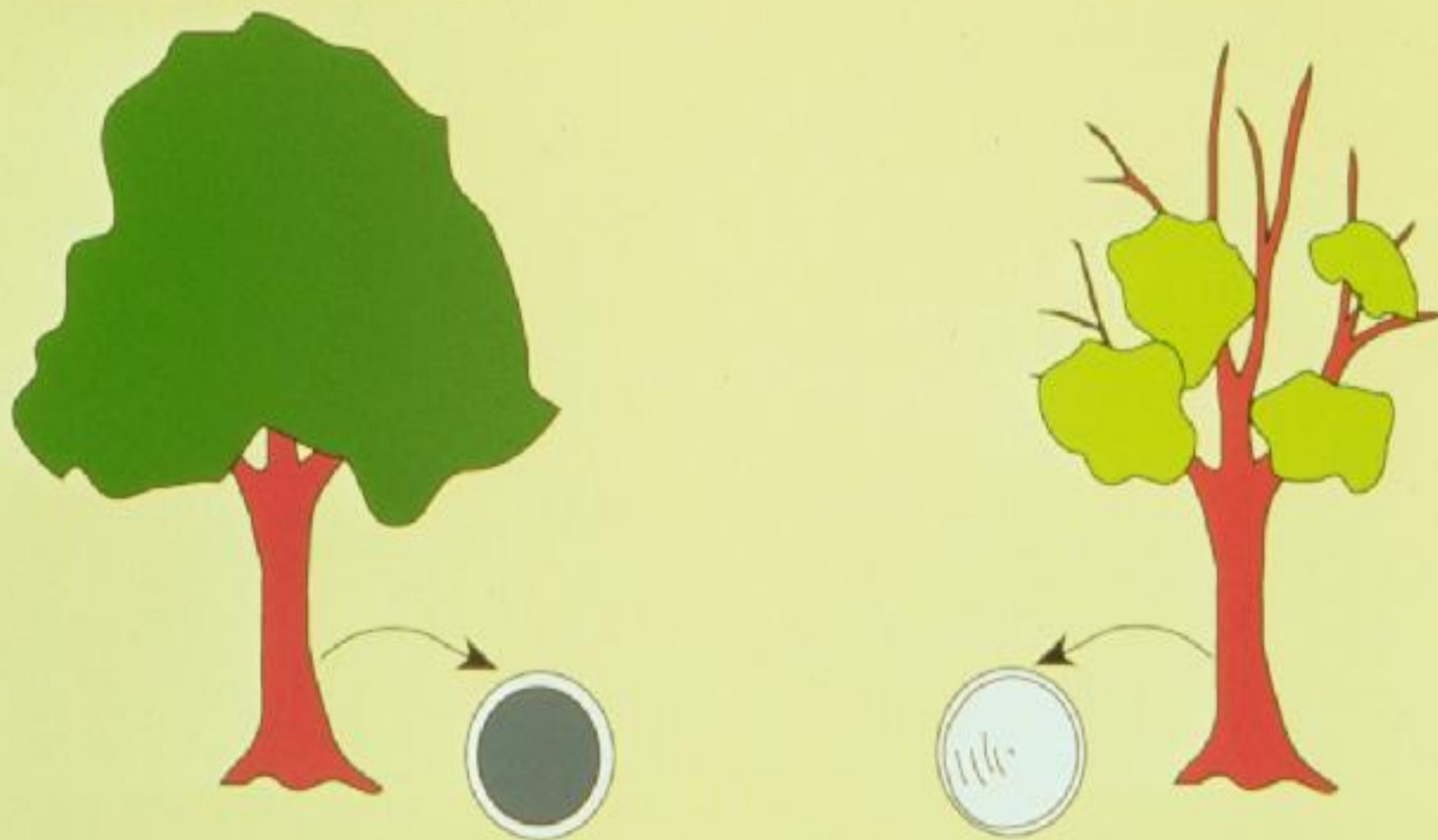


- ROOTS
- MATURE TREE CARE

DON'T RETAIN THE POOREST TREES ON YOUR COURSE



A Common Misconception



Crown condition reflects health
NOT
structural soundness!

CROWN CONDITION INDICATES HEALTH NOT STRUCTURAL STABILITY



ASSESSING YOUR MATURE TREES

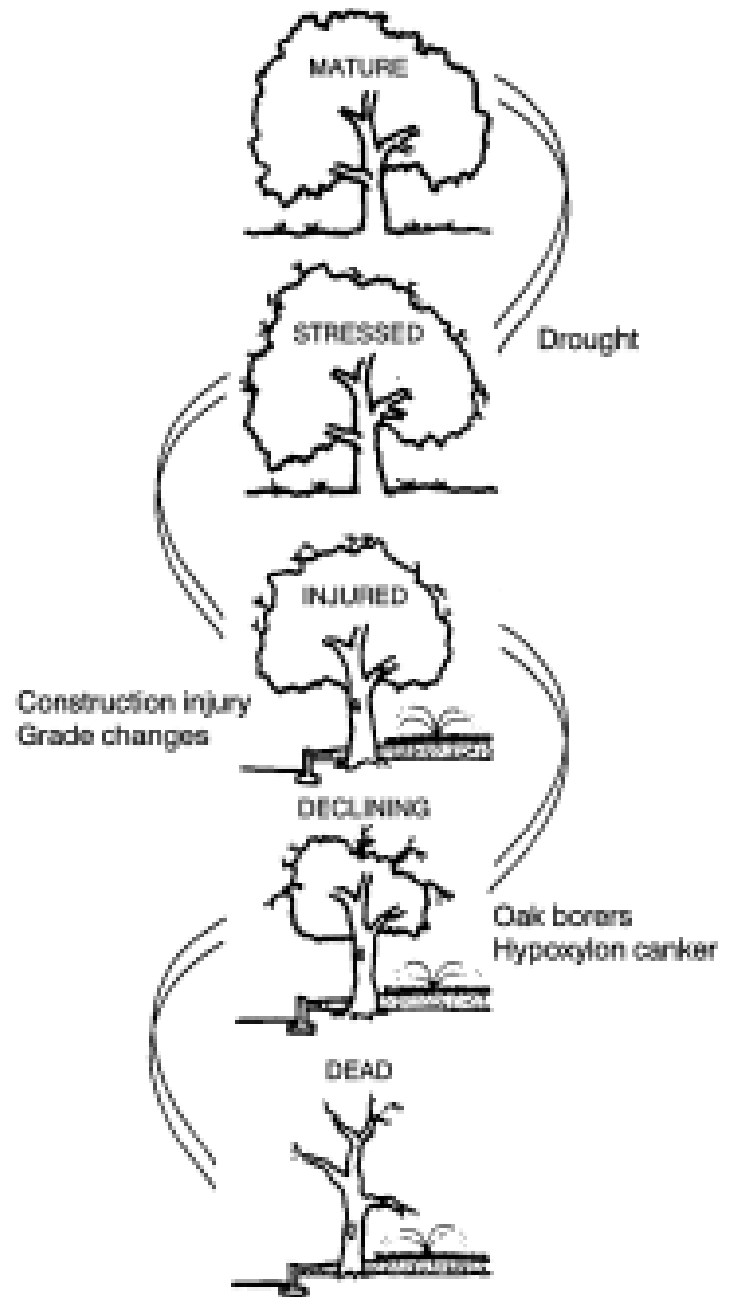
All wounded trees do not become infected.

All infected trees do not become decayed.

All decayed trees do not fail.



Fig 2 The Edgbaston golf course includes veteran trees like this sweet chestnut. The root zone of these important trees needs protecting and ideally furniture, such as benches, should be re-sited well away.



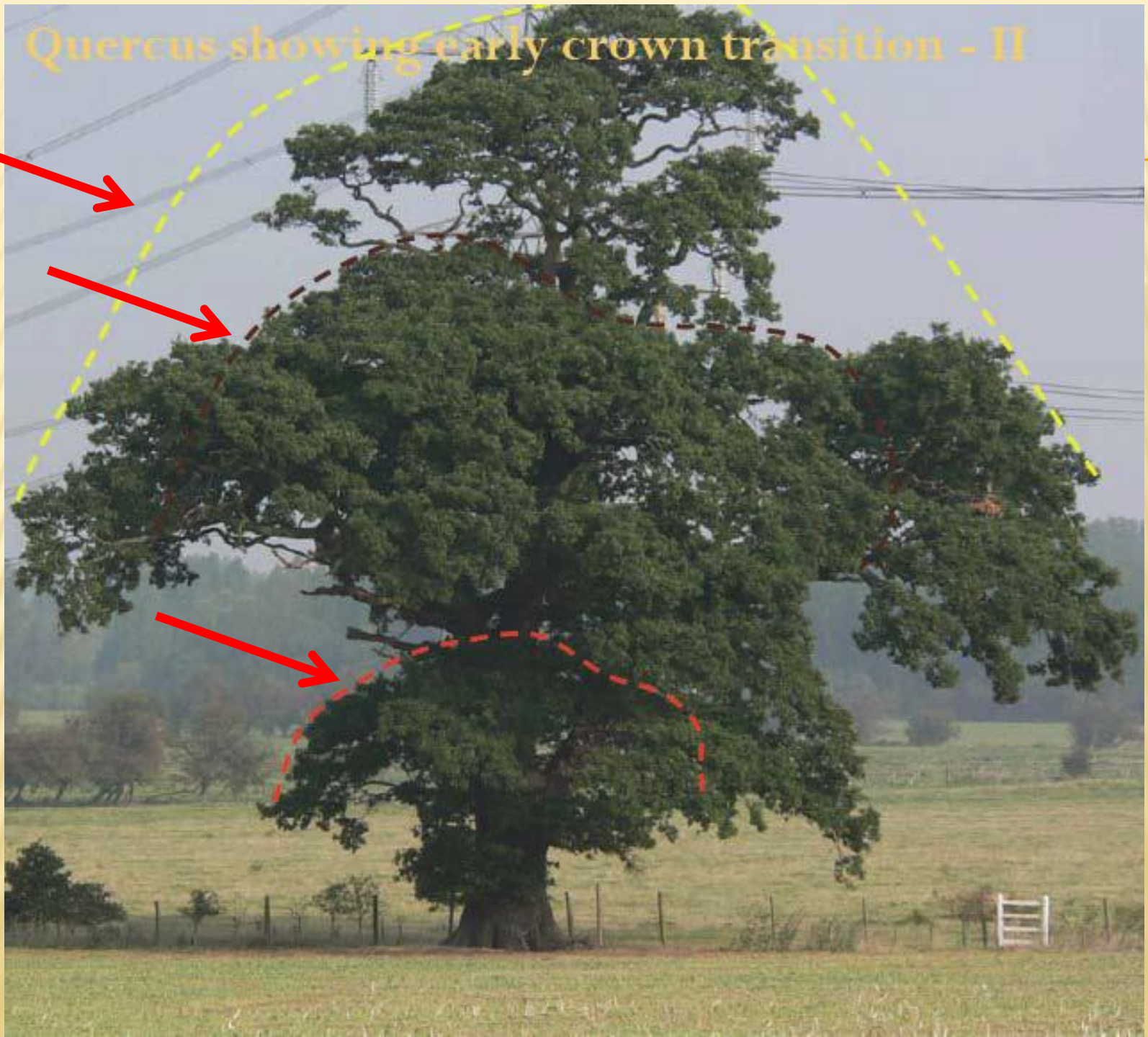
Survival Mechanisms:

- **Defensive Dieback**
- **Compartmentalization**



**Compartmentalization extends
the amount of time a tree can
survive with defects and decay.**

Quercus showing early crown transition - II





The Official
Publication
of CGSA

NOVEMBER/
DECEMBER
2009

GREENMASTER

"We asked the arborist to go through the course — focusing on eight of the most wooded holes — and take a look at every single tree to identify which ones needed to come down right away and which ones could wait and we could reevaluate in a couple of years," Lecour explains. "The arborist gave us the reason, whether it was structural or disease, for each tree he identified as being a problem."

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GREENMASTER

This project began in 2007 when a few trees were taken down that Lecour says were “clearly hazardous and no longer of this world.” Some of the homeowners on the property couldn’t understand why these trees were being cut, so the club sent a letter to all Lora Bay homeowners explaining the situation; then, they hired an arborist to identify any decaying and diseased trees on its property, mark them out, and provide the club with a report. This was done in the late summer and fall of 2008.

INVENTORY / ASSESS / PLAN / BUDGET



Some of the slides in this presentation are from Dr. Kim D. Coder; professor School of Forest Resources University of Georgia (Athens, Ga.) and Ed Gilman, University Florida





www.treelady.ca

*2010 Western Canada
Turfgrass Association
conference @ Nanaimo,
B.C.*

