

Tree Maintenance, Risk &Valuation

2014 Canadian International Turfgrass Conference

Vancouver, British Columbia

Verna Mumby

ISA Certified Arborist

Certified Tree Risk Assessor

Wildlife Danger Tree Assessor

Member, American Society of Consulting
Arborists

Mumby's Arboriculture Consulting

www.treelady.ca



Verna Mumby Bio

While Verna is sought after for her expert field work, she also has an extensive academic background in arboriculture and related fields. Leaving agriculture for her greater love of trees, Verna earned her ISA certification in 1990 and her Utility Tree Worker certificate in 1992. In 2004, she became the 15th Canadian member of the American Society of Consulting Arborists, and the 54th Pacific North West ISA Certified Tree Risk Assessor. Verna has advanced GPS/GIS training to further her tree inventory work and is the PNW-ISA regional education co-ordinator for ISA members on Vancouver Island.

Drawing on her field experience and academic training, Verna has provided consulting services, including inventories and assessments, as well as providing testimony as an expert witness, to golf courses, condo associations, colleges and universities, municipalities, governments and attorneys throughout western Canada and California.

Tree Maintenance, Risk & Valuation

Presentation Outline

- Tree Management Plan
- Tree Quality
- Tree Care
- Risk Assessment & Liability
- Tree Valuation

If 'trees' are a line item in your budget

You should have the following data:

INVENTORY: What you have, in what condition and where

COSTS TO PLANT / CARE FOR/ REPLACE /

HOW IMPORTANT TREES ARE TO YOUR MANAGER / MEMBERS /
PUBLIC

CAN YOU DO THE WORK IN-HOUSE / CONTRACT THE
WORK / TRAIN STAFF

WHAT'S YOUR LIABILITY ?

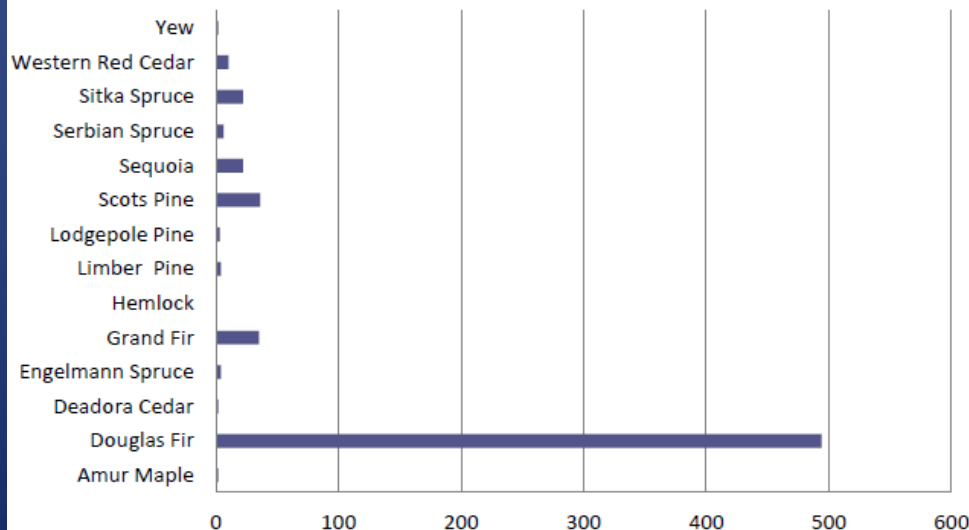
WHAT IS THE VALUE OF YOUR TREES

Tree Inventories

Software / Excel / Build your own / GPS / GIS / Access

tree type	address	Tag #	DBH	Hght	Sprd	Cond	Spec R	Site R	Contrib R	Place R	Reco Action	Remarks
Maple Red Armstrong	1898 baker street	5001	21	9	2	50	40	50	70	60	Prune & Monitor	phc
Maple Red Armstrong	1898 baker street	5002	28	11	5	50	40	60	70	70	Prune Thin	phc
Maple Autumn Blaze	1898 baker street	5003	21	8	2	50	40	60	70	70	Prune Thin	phc
Maple Red Armstrong	1898 baker street	5004	8	3	2	50	40	60	70	70	PHC	
Maple Red Armstrong	801a baker street	5005	7	3	1	50	40	70	50	50	PHC	
Ash Green	815 baker street	5006	25	9	5	45	40	50	70	60	PHC	water
Ash Green Patmore	815 baker street	5007	29	8	5	50	40	60	60	50		
Autumn Purple Ash	903 baker street	5008	28	4	2	55	40	50	60	70	PHC	white ash buds
Ash Green	cicb bank	5009	23	6	4	50	40	60	70	70	PHC	water
Maple Red Armstrong	cibc bank	5010	18	5	3	50	40	60	50	60	PHC	water
Maple Red Armstr								0	70	60	Prune Thin	prune in 2 years

**Comox Golf Course:
Coniferous Species and Abundance**



Tree Management Software

URBAN FOREST MANAGEMENT FOR THE CITY OF BUFFALO 

Tree Information

Existing Tree Information:	
Tree ID	51953
House#	14
Street	ABBOTTSFORD PLACE
Side	Front
Tree on Street	ABBOTTSFORD PLACE
Tree Type	STUMP
STATUS	Existing
DBH (in)	8
Condition	Other
Recommendation	Stump Removal
Comments	
Last Date Inspected	10/4/2007 1:29:49 PM
Last Information Change	10/4/2007 1:29:49 PM
Edit Tree Information	

Tree Photos

Photo / Document	Date
F-51953.pdf	2/5/2007
	2/16/2007
	10/4/2007

Complaints

Tree ID	Complaint ID	Date Inspected	Comments	Status
51953	248348	6/19/2007	PL - The City typically plants trees twice a year, once in spring and once in fall. The season in which your tree will be planted will depend on the type of tree to be planted which best suits the site. Your address will be added to the next appropriate spring or fall planting season.	CLOSED

Contracts

Tree ID	Contract Name	Type	Work Done	Comments	Date Inspected	Voucher Date	Voucher Amount	Status	Inspected	Crew
51953	2008 Planting Spring - COB	Planting						Open	Not Inspected	Delete
51953	2007 Stumps - COB	Stump Removal						Open	Not Inspected	Delete
51953	FEMA Stump Report	Stump Removal						Open	Not Inspected	Delete
51953	2007 Post Storm Removal - DreamCo	Removal	Cat 2 tree removed		6/15/2007	6/22/2007	85	Open	Inspected	Delete

Add Tree to contract
 01 audit oddities [Add this tree to the selected contract](#)

Contract Work Inspection

Tree ID	Contract	Desc Work Done	Date	Comments	Voucher_Date	Voucher_Amount	
Edit 51953	2007 Post Storm Removal - DreamCo	Cat 2 tree removed	6/15/2007		6/22/2007	85	Delete

Add Work Inspection
 2007 Post Storm Removal - DreamCo [Add Work Inspection Record](#)

DEVELOPED BY WENDEL DUCHSCHERER

Comparison of Urban Forest Inventory & Management Software Systems

Michael G. Andreu, Erin M. Brown, Melissa H. Friedman, Robert J. Northrop, and Mary E. Thornhill

<http://www.arborjet.com/docs/Comparing-Urban-Forest-Inventory-Software.pdf>

i-Tree software program
Urban Forest Effects (UFORE)
itreetools.org

The UFORE model is designed to provide accurate estimates of;

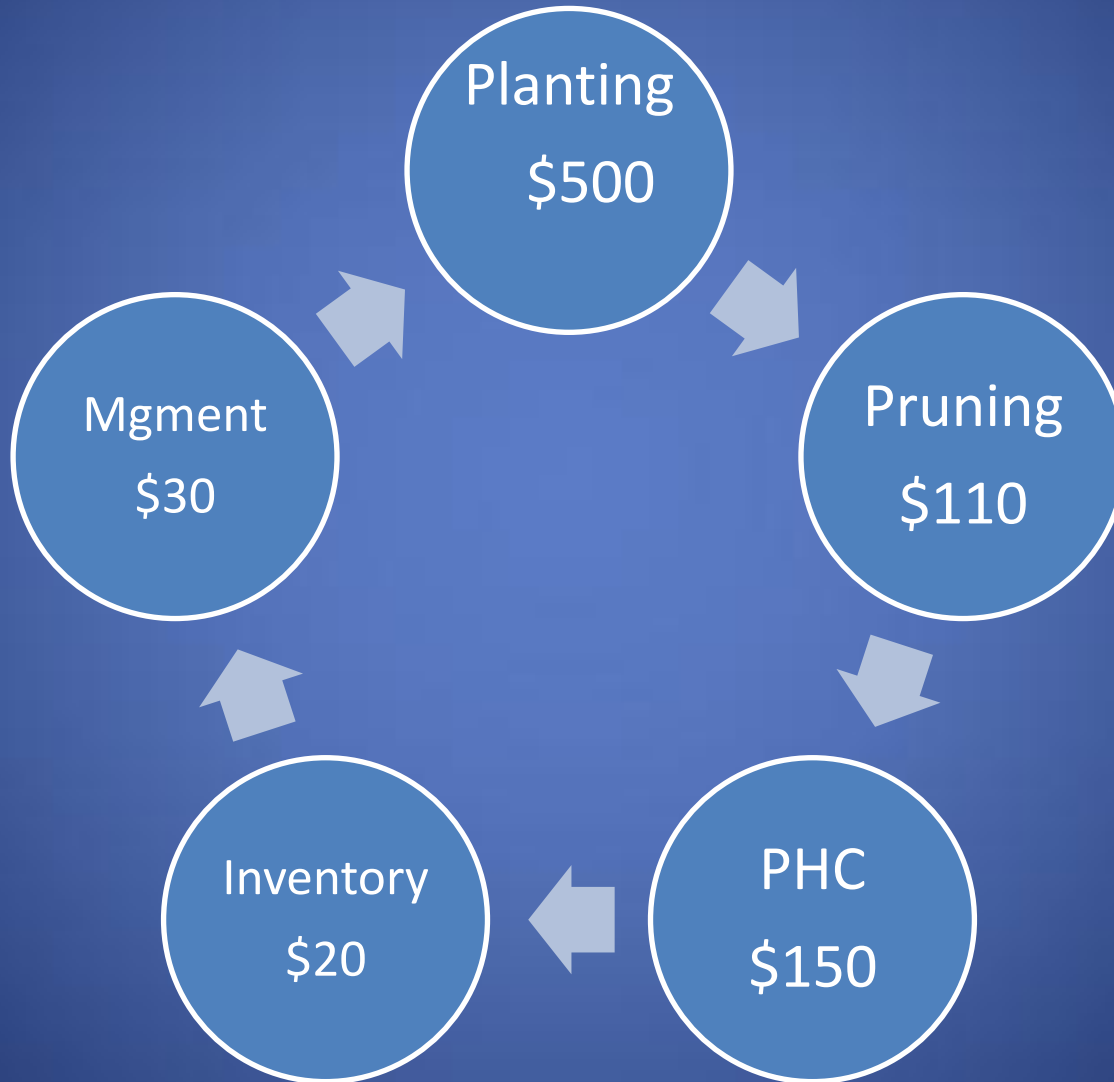
- Urban forest structure by land use type (e.g. species composition, number of trees, DBH distribution, tree density, tree health, leaf area, leaf and tree biomass, species diversity).
- Hourly amount of **pollution removed by the urban forest**, and associated percent air quality improvement over one year. Pollution removal is calculated for ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide and particulate matter (<10 microns).
- Hourly urban forest **volatile organic compound emissions** and the relative impact of tree species on net ozone and carbon monoxide formation throughout the year.

Royal Mayfair Golf Course



In 2004, 666 trees were inventoried on the tees & greens. In 2006, 86 fairway trees & 74 newly planted trees inventoried. 53 trees removed between '04-'08. Total tree inventory: 826.

Costs to plant & manage one tree for 3 years : \$810.00



Municipalities
budget \$750 -
\$1,100 per
newly planted
tree

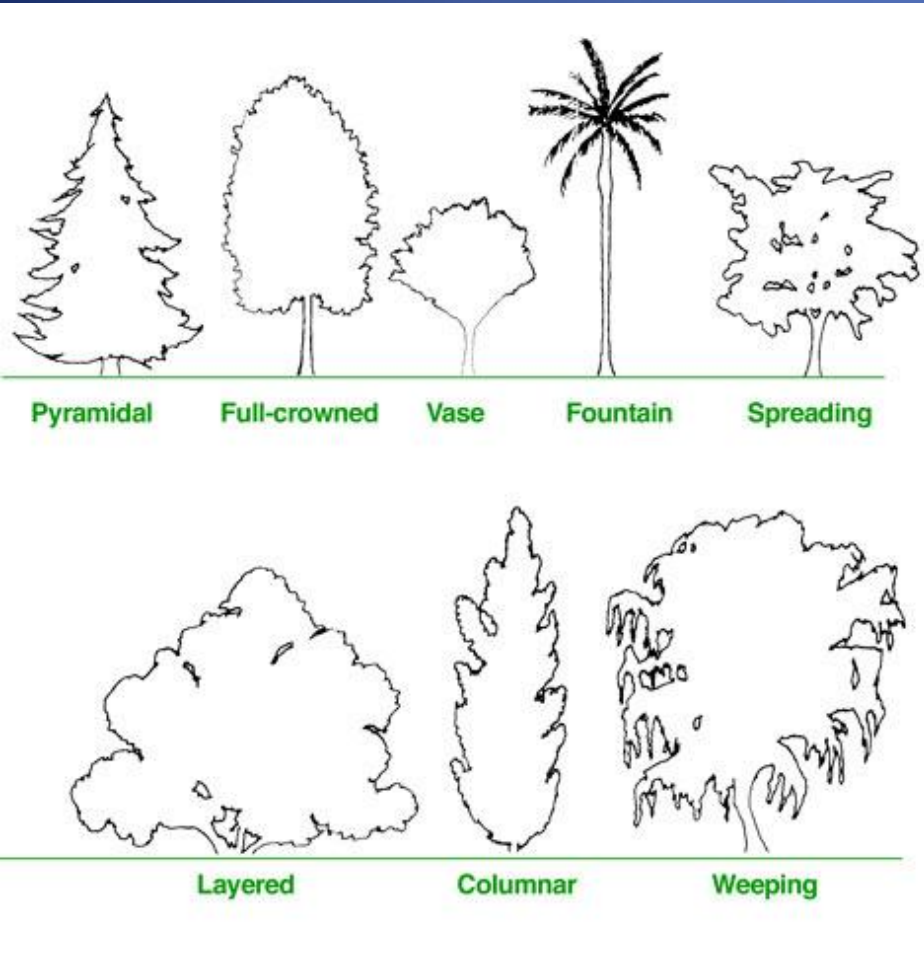
WHY DO WE PLANT TREES?

WHY DO WE PLANT TREES?

- members request
- replace trees removed
- it's the right thing to do



Consider tree form



Select trees that grow well in your local climate and soil.

Think about what the trees will look like at maturity. How tall will they grow? What shape will they be?

Are coniferous (evergreen) or deciduous species preferable?

Tree Planting Specifics

Tom Doak, a golf architect, lists some general guidelines about planting trees on a golf course in the book, 'The Anatomy of a Golf Course'.

- Plant trees in groups, never individually or alone.
- Within these groups, plant trees of different species, never all of the same species. Disease therefore may kill one but not the group itself.
- Never plant evergreens, such as low limbed pines, which block recovery shots and stymie the players swing.
- Avoid planting trees in formal arrangements, such as rows of trees between fairways. Rows look unnatural in a natural landscape. Plus, the loss of a single tree destroys the form created.
- Avoid planting trees to the inside corner of a dogleg hole or even near typical landing areas. These positions undermine the principles of strategy and shot making.

- Avoid planting trees too close to the playing areas, especially tees and greens, because of turf-grass issues.
- If necessary, plant trees between typical hitting areas and typical landing areas, so long as they do not affect playability.
- Avoid filling up every open space with new trees.
- Avoid planting new trees too close to sand bunkers or other hazards. Such would create a double hazard for the golfer to avoid.



When we plant,
think about the rooting space.



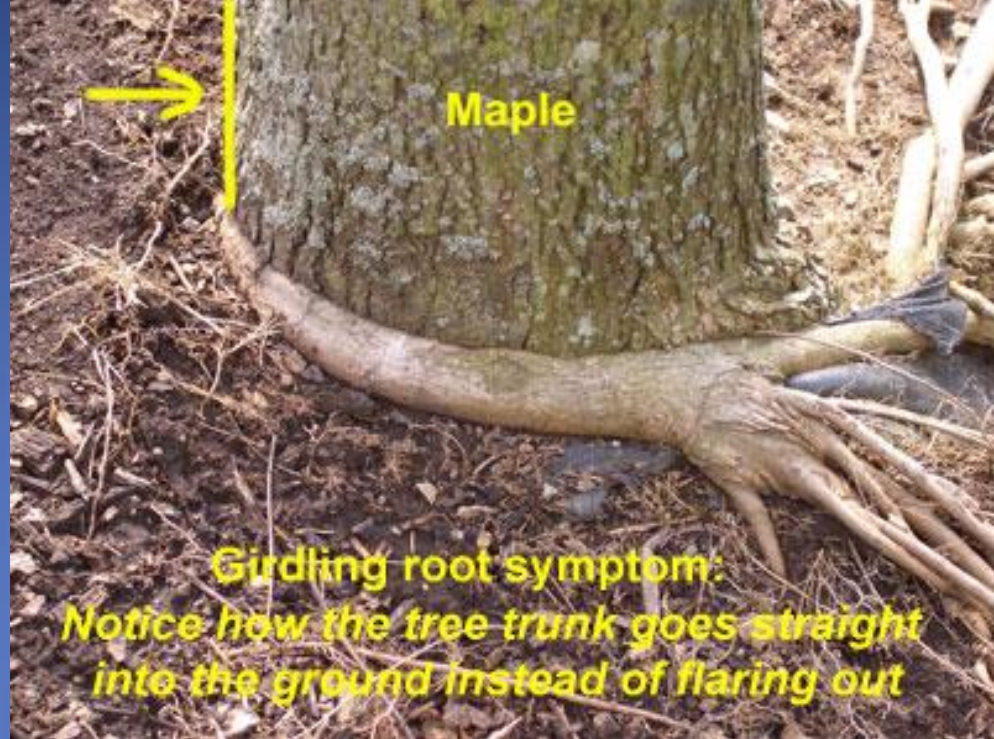
Ball & Burlap / Tree Spade



Ideal time to plant trees & shrubs

- during the dormant season
- in the fall after leaf drop or
- early spring before bud break.

Weather conditions are cool and allow plants to establish roots in the new location before spring rains and summer heat stimulate new top growth.



Incorporate Organic Material

- To maintain biologically active and healthy soil, replace what is lost.
- regularly incorporate organic matter, such as compost, into the soil.
- This procedure can totally eliminate the need for chemical fertilizers.



WATER PLEASE!

Dear Resident,

To get a good start, a healthy street tree needs at least **3 to 5 gallons of water, twice per week**. Although the Park Board waters this tree during its first summer following planting, additional water during hot, dry periods and in subsequent years would help. A slow running hose is best, or you can use a larger water can. Make sure that the water penetrates deep into the root zone. **The watering of trees does not contravene GVRD watering restrictions.**

Vancouver Board of Parks & Recreation
Phone 604-257-8600 for information



www.treelady.ca

Caliper Trees:
Watering
program for 2-3
years

Container Trees:
Watering
program for 2
years



\$129.00

6 ft. deodar cedar

\$60.00 install cost

Total: \$189.00

Photo: One year after
planting

*People think once a tree has
been in the ground for a
year it can make it on it's
own!*



- Off green color

- Few new buds

- Small drip irrigation system

-Compacted poor soil

purchased & installed:
\$110.00

survival ??

Poor tree care we repeat

- Plant in poor soils
- Plant too deep
- Allow grass to grow to the trunk of the tree
- Weed whip the bark off the tree
- Place landscape fabric around the base of the tree
- Under or over water
- Over prune



Trees are weed
whipped
to death.



‘Mower Blight’
caused by mowers
hitting the tree.



Sprouts



Topping trees promotes
bad structure!



Poor form



Good form



Principles of strong structure:

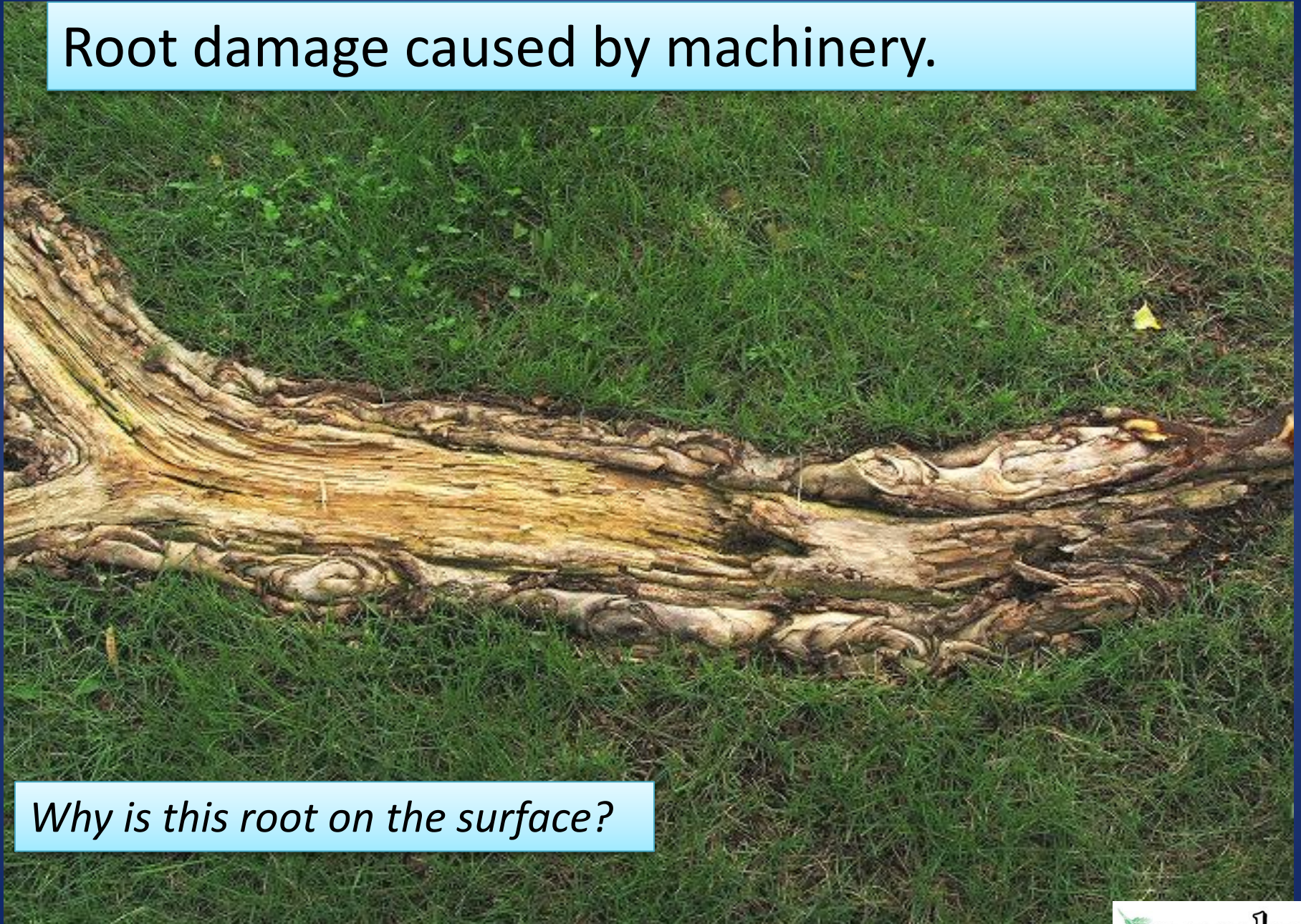
- One dominant trunk
- Strong branch unions
- Balanced canopy

Compaction is the biggest killer of all.



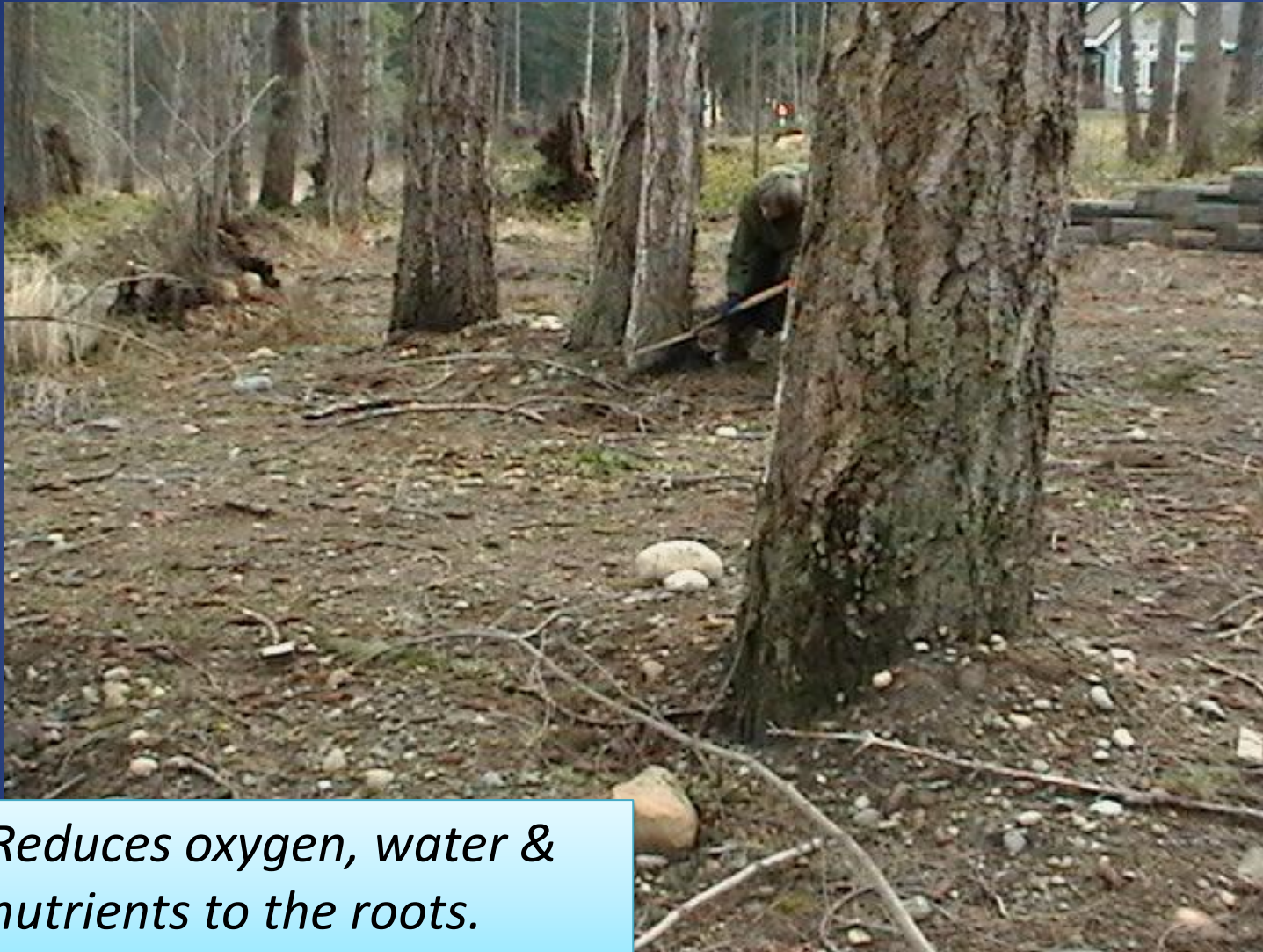
What can be done to minimize this?

Root damage caused by machinery.



Why is this root on the surface?

Extra fill over the root zones.



Reduces oxygen, water & nutrients to the roots.

Factors promoting infection:

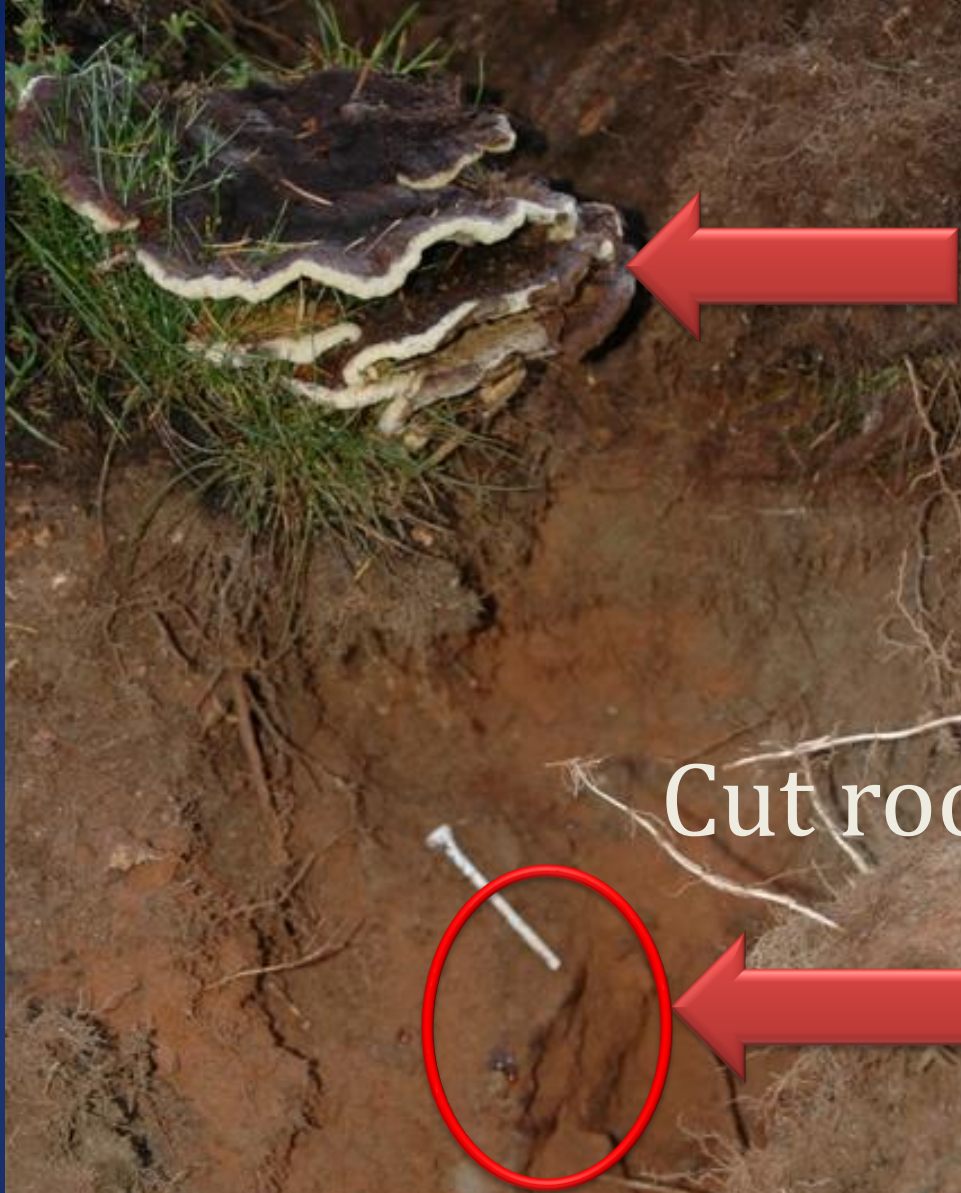
Biotic

- Age of host
- Nutrient deficiency
- Insect attack
- Wood anatomy

Abiotic

- Injuries
- Soil searing
- Soil water logging





*Phaeolus
schweinitzii*
fruiting body.

Cut root to build tee box.

Many wood decay fungi penetrate the stem or roots via injuries.

Discovering Root Spread

- 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.



Club Members Learn to Swing More Than 5-Iron

Members bought the financially distressed Timberlake Country Club in Chapin, S.C., and removed ailing trees themselves.

By [BILL PENNINGTON](#)

Published: May 26, 2012



Tree Management Plan

FERTILIZING:

Fifteen trees are flagged for fertilizing. Tree #781, 310, 799, 801, 506, 417, 419, 393, 534, and 566. Trees with no tags were also flagged for fertilizing. They are the three elms on the north side of Fairway #12 and two pine trees north of Green #9.

PRUNING:

Repairs to the willow on Fairway #17 are required. Cabling, pruning and bracing will retain the tree for a number of years. Along the west side of Green #5, the spruce trees require the deadwood removed within a year. On the east side of Fairway #14, prune out the large dead lateral in one of the poplar trees.

TREED AREAS:

The removal of natural debris from under the trees in the rough areas may result in stressing the trees. Picture 3 shows an example of an exposed root zone of a tree on the course. Physical damage and compaction to the root zone by golfers can become a common occurrence. Root damage can result in decay or disease entering the root zone.



Exposed
root zone

Picture 3



Tree Management Plan

Over 800 trees located on the golf course, parking lots and driving range previously inventoried, were re-assessed over a three day period in May, 2008.

RISK ASSESSMENTS:

Sixteen trees were assessed for risk potential using the Resistograph¹ machine and following the International Society of Arboriculture (ISA) Tree Hazard Evaluation Form. This form gathers information about the tree characteristics, health, defects, site conditions and potential targets. The risk rating is calculated by determining the failure potential of the tree (present health and structural stability), the size of the part of the tree that may fail and if there is a target. Picture 1 is a poplar decaying at the base. Picture 2 is white rot fruiting bodies at the base of a willow tree. See Appendix A for example of a Resistograph result. Of the 16, thirteen are listed for removal (see Appendix A).



Storey Creek Golf Course



Plants are living things engaged in the most profound creativity in the world.



When plants are viewed in terms of their functional benefits (engineering, environmental, architectural) the practice of valuing plants in monetary terms is quantifiable.

History of Tree Appraisal

1800's to 2000

1800

Europeans began assessing and assigning a monetary value to their trees in the 1800's.

1905

University of Michigan assigned a value of \$5 plus compound interest @ 5% over a 25 year period.

1905-1938

Dr. Stone from U of Massachusetts and Dr. Felt from Barlett Tree Research Laboratories developed the first valuation format.

1947

The formula was improved with assistance of the National Shade Tree Conference and of the National Arborist Association.

1957

Land values removed from the formula. The Location rating was added. The *Basic Value* was established @ \$5/inch² or \$0.78cm².

History of Tree Appraisal

1800's to 2000

1975

→ *A Guide to the Professional Evaluation of Landscape Trees, Specimen Shrubs and Evergreens* 4th edition was written by the ISA, AAN, ASCA, NAA and National Shade Tree Conference.

1979

→ Council of Tree & Landscape Appraisers (CTLA) was developed & included ISA, AAN, ASCA, NAA, NSTC, ALCA

1979-1992

→ The CTLA wrote 3 more editions. The 8th edition renamed the publication to *Guide for Plant Appraisal* and included a workbook. Basic value was now at \$27/inch² or \$4.19/cm².

1995

→ Field report Guide for Trunk Formula developed.
Cost of Cure Field Report Form developed.

1997-2000

→ CTLA added 2 more associations to their council. Association of Consulting Foresters & American Society of Landscape Architects.
9th edition published in 2000.

Reasons for Plant appraisals

Settlement for damage or death to plants through arbitration or insurance claims.

Real estate appraisals.

Establishing value of plants that may be damaged during construction.

Proactive reasons: justification for approving tree care budgets, saving a tree, calculate bonding fees for trees.

Functional uses of plant materials

Screening for Privacy

Erosion control

Traffic Control

Enframement

Enhancing architecture

Bringing nature to the urban setting

Acoustical control

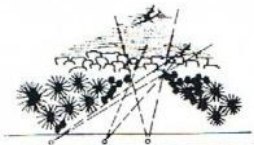
A. ARCHITECTURAL



SPACE ARTICULATORS



SCREENING OBJECTIONAL VIEWS



GRADUAL UNFOLDING OF A VIEW



PRIVACY CONTROL

B. ENGINEERING



AIR CONDITIONING



GLARE & REFLECTION REDUCTION



ACOUSTICAL CONTROL



TRAFFIC CONTROL



EROSION CONTROL

C. ESTHETIC



DECORATIVE WALL



SCULPTURE



PATTERN



SOFTENING ARCHITECTURE



LINE CALLIGRAPHY



ENFRAMEMENT



COMPLEMENTING ON ENHANCING ARCHITECTURE



BACKGROUND



ATTRACTING BIRDS OR ANIMALS



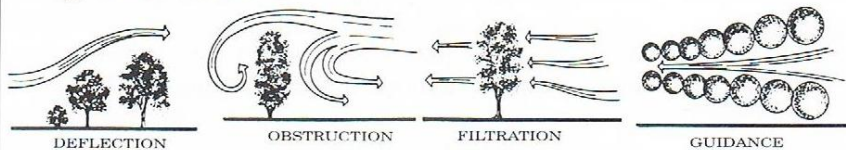
"TYING TOGETHER" VARIOUS ELEMENTS

BRING NATURAL ELEMENTS INTO URBAN SURROUNDINGS

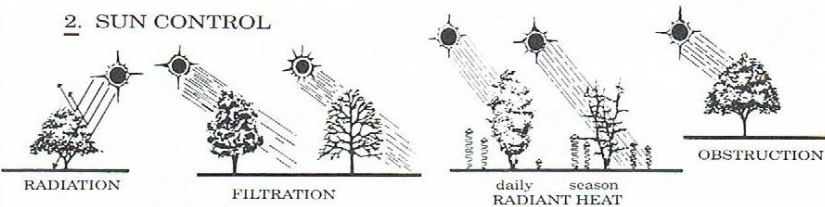
FIGURE 1.1. Functional uses of plant materials (Robinette 1968).

D. CLIMATE CONTROL

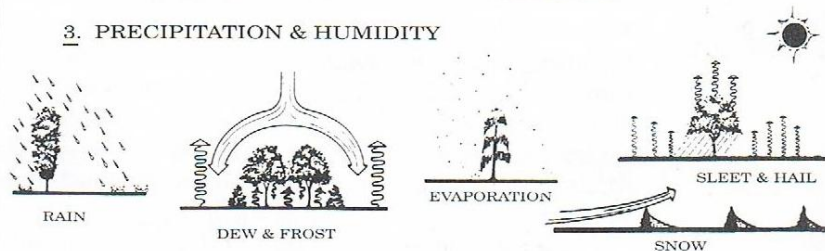
1. WIND CONTROL



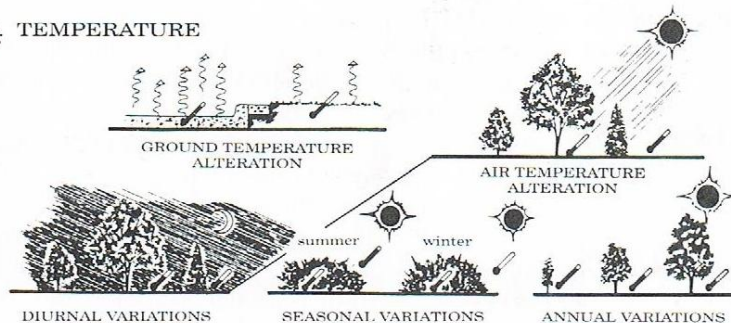
2. SUN CONTROL



3. PRECIPITATION & HUMIDITY



4. TEMPERATURE



5. TOPOCLIMATOLOGY & PLANT MATERIALS



Functional uses of plant materials

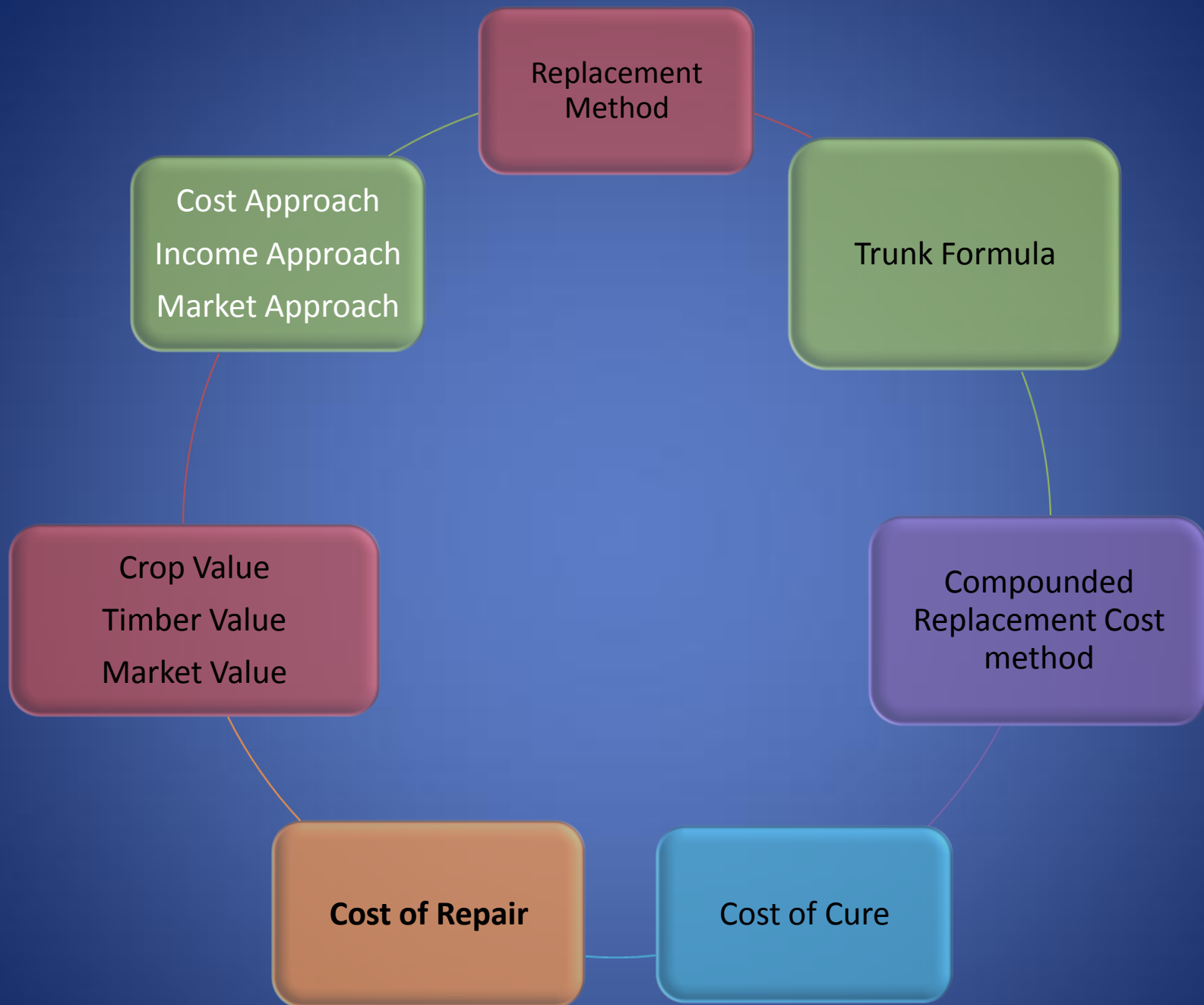
Wind control

Sun control

Precipitation &
Humidity

Temperature controls
(air, ground)

Topoclimatology





When plants are viewed in terms of their functional benefits (engineering, environmental, architectural) the practice of valuing plants in monetary terms is quantifiable.



Conducting an appraisal in the field

Tools:

- DBH tape
- Clinometer
- Binoculars
- Notebook
- Camera



Identify the tree species. Take a photo. Take a sample.



Measure the diameter @ 1.4 meters from ground level using a diameter tape.



Assess the health of the tree.



Assess the Site / Contribution / Placement factors to determine the Location rating.

Conducting an appraisal in the field

GUIDE FOR JUDGING THE CONDITION OF LANDSCAPE TREES

(Refer to Chapter 6 of the *Guide for Plant Appraisal*)

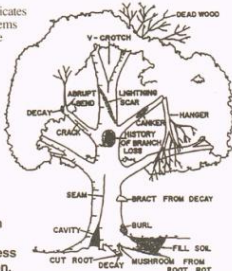
Note: A separate hazard tree evaluation may be required for trees in poor condition.

SCORING SYSTEM	
No problem.....	5
No apparent problem(s).....	4
Minor problem(s).....	3
Major problem(s).....	2
Extreme problem(s).....	1 or 0

Factors ¹	TREE NUMBER									
	1	2	3	4	5	6	7	8	9	10
ROOTS	POINTS									
Root anchorage S.										
Confined relative to top S.										
Collar soundness S.H.										
Mechanical injury S.H.										
Girdling & kinked roots S.H.										
Compaction or water-logged roots H.										
Toxic gases & chemical symptoms H.										
Presence of insects or diseases H.										
TRUNK	POINTS									
Sound bark & wood, no cavities S.H.										
Upright trunk (well tapered) S.										
Mechanical or fire injury S.H.										
Cracks—frost, etc. S.H.										
Swollen or sunken areas S.H.										
Presence of insects or disease H.										
SCAFFOLD BRANCHES	POINTS									
Strong attachments S.										
Small diameter than trunk										
Vertical branch distribution										
Free of included bark										
Free of decay and cavities S.H.										
Well-pruned, no severe heading back S.H.										
Well-proportioned—tapered, laterals along branches S.										
Wound closure H.										
Amount of dead wood or fire injury S.H.										
Presence of decay, insects or diseases H.										
SMALLER BRANCHES & TWIGS	POINTS									
Vigor or current shoots, compared to that of 3–5 previous years H.										
Well-distributed through canopy H.										
Normal appearance of buds—color, shape & size for species										
Presence of weak or dead twigs H.										
Presence of insects or diseases H.										
FOLIAGE AND/OR BUDS	POINTS									
Normal appearance—size & color H.										
Nutrient deficiencies H.										
Herbicide, chemical or pollutant injury symptoms H.										
Wilted or dead leaves H.										
Presence of insect or diseases H.										
TOTAL POINTS										
CONDITION %										
Condition % = total points divided by 25 possible points.										
Evidence of previous care (pruning, cabling, bracing, etc.)										
ADDITIONAL NOTES										

¹ Give one rating for each factor. The items listed under each factor are to be considered in arriving at a rating for that factor.
S. = item is primarily structural
H. = item is primarily health
S.H. = item may involve both structure and health

² A rating of “5” indicates no apparent problems found having done a root-collar inspection and/or climbing the tree to inspect the trunks and major limbs.



Note: Inspection may require climbing to assess canopy condition.

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5 factors to assess

Roots

Trunk

Scaffold branches

Smaller branches & twigs

Foliage or buds

Scoring System:

5: no problem

4: no apparent problem

3: minor problems

2: major problems

1: extreme problems

LOCATION CHART

SITE / CONTRIBUTION / PLACEMENT FACTORS TO CONSIDER IN DETERMINING LOCATION VALUES

(Refer to Chapter 7 of the *Guide for Plant Appraisal*)

LOCATION The **Location** rating considers the **Site** of a property, the plant's functional and aesthetic **Contribution** and the **Placement** of the plant in the landscape.

SITE The rating of a **Site** is determined primarily by:

- The quality of development, the general appearance and the intensity of use of the area in which the **Site** is situated.
- The design and quality of structures and landscapes in the area; and the landscape design and quality of the planting and maintenance of the **Site**.
- The type of area (residential, mall, etc.) is not particularly helpful in rating a **Site**.

CONTRIBUTION The functional and aesthetic **Contribution** of a plant influences its value in a landscape. Tree characteristics largely determine **Contribution** and value.

TABLE 7.1. Functional and Aesthetic Contribution Factors Suggested Rating Range 10–100%
(Found in Chapter 7 of the *Guide for Plant Appraisal*).

Functional Attributes ¹	Aesthetic Attributes
<i>Environmental & Engineering</i>	<i>Architectural and Plant Characteristics</i>
Sun radiation & reflection control	Attractive bark, flowers, foliage, fruit, fragrance
Wind control	Accents structures
Drifting snow	Screens undesirable views
Safety barrier	Frames view
Light and glare shield	Defines space
Privacy	Creates vistas
Erosion control	Attracts wildlife
Dirt and dust absorption	
Traffic control	<i>Other Considerations</i>
Noise attenuation	Historic, rare or unusual specimen
Air purification	Unusual site situation
Transpiration cooling	

¹Listed in suggested order of importance. Attributes grouped together are similar in importance.

PLACEMENT The position of a tree in relation to how effectively it provides its functional and aesthetic attributes determines the **Placement** rating of the tree. A single specimen tree has greater value than would the same tree as one of many. The placement of a tree can also have an unfavorable as well as a favorable effect on its contribution, such as proximity to overhead wires, street lights, and buildings.

TREE NUMBER

	1	2	3	4	5	6	7	8	9	10
Site %										
Contribution %										
Placement %										
Total Location Avg. %										

EXAMPLE Average the **Site**, **Contribution** and **Placement** ratings to determine the *average* location %. For example, the ratings for a tree screening a local landfill (dump) would be represented the following way:

- **Site** Quality (low), appearance (low), use (low) **Site rating 20%**
- **Contribution** Screens undesirable views (moderate) **Contribution rating 70%**
- **Placement** Tree planted on dump property line (high)
Dust reduction for neighbors (high) **Placement rating 90%**

(AVERAGE LOCATION PERCENT = 20% + 70% + 90% = 180 ÷ 3 = 60%)

Site rating : Quality,
Design, Appearance &
Intensity

Contribution rating:
Function, Aesthetics
and Benefits

Placement rating : how
effective does the tree
provides the functions
& aesthetic attributes

Rating

Large mature spruce
at large educational
centre.

- Very high 90 –100%
- High 80 –89%
- Average 70 –79%
- Low 60 –69%
- Very Low 10 –59%



Ratings

American elm located under power lines.

- Very high 90 –100%
- High 80 –89%
- Average 70 –79%
- Low 60 –69%
- Very Low 10 –59%



Ratings

Large poplars on golf course

- Very high 90 –100%
- High 80 –89%
- Average 70 –79%
- Low 60 –69%
- Very Low 10 –59%



Ratings

Medium sized
spruce located
at acreage

- Very high 90 –100%
- High 80 –89%
- Average 70 –79%
- Low 60 –69%
- Very Low 10 –59%



Ratings

Schubert chokecherry located in front yard

- Very high 90 –100%
- High 80 –89%
- Average 70 –79%
- Low 60 –69%
- Very Low 10 –59%



Classroom Work



- Species Rating
- DBH converted to TA and ATA

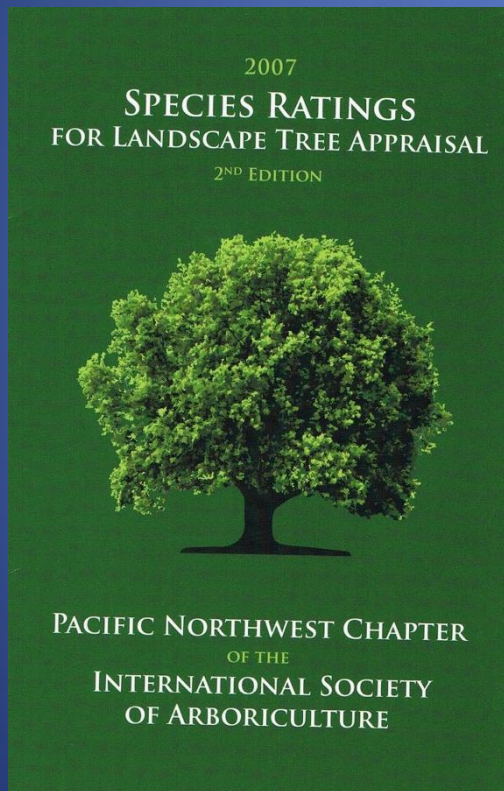


TABLE 4.6. Metric units. **Trunk Areas (TA)*** and **Adjusted Trunk Areas (ATA)**** based on trunk diameter (*d*) at 1.4 m (4.5 ft).

<i>d</i> cm	TA cm ²	<i>d</i> cm	TA cm ²	<i>d</i> cm	TA cm ²	ATA cm ²	<i>d</i> cm	TA cm ²	ATA cm ²
5	20	41	1320	76	4584	4421	112	9847	8490
6	28	42	1385	77	4654	4545	113	10024	8590
7	38	43	1451	78	4726	4670	114	10202	8690
8	50	44	1520	79	4899	4793	115	10382	8790
9	64	45	1590	80	5024	4916	116	10563	8888
10	79	46	1661	81	5150	5038	117	10746	8986
11	95	47	1734	82	5278	5159	118	10930	9083
12	113	48	1809	83	5406	5280	119	11116	9180
13	133	49	1885	84	5539	5400	120	11304	9276
14	154	50	1963	85	5672	5520	121	11493	9371
15	177	51	2042	86	5806	5638	122	11684	9466
16	201	52	2123	87	5942	5756	123	11876	9560
17	227	53	2205	88	6079	5874	124	12070	9653
18	254	54	2289	89	6218	5990	125	12266	9746
19	283	55	2375	90	6359	6107	126	12463	9838
20	314	56	2462	91	6501	6222	127	12661	9929
21	346	57	2550	92	6644	6337	128	12861	10019
22	380	58	2641	93	6789	6451	129	13063	10109
23	415	59	2733	94	6936	6564	130	13267	10199
24	452	60	2826	95	7085	6677	131	13471	10287
25	491	61	2921	96	7235	6789	132	13678	10375
26	531	62	3018	97	7386	6900	133	13886	10462
27	572	63	3116	98	7539	7011	134	14095	10549
28	615	64	3215	99	7694	7121	135	14307	10635
29	660	65	3317	100	7850	7230	136	14519	10720
30	707	66	3419	101	8008	7339	137	14734	10804
31	754	67	3524	102	8167	7447	138	14950	10888
32	804	68	3630	103	8328	7554	139	15167	10971
33	856	69	3737	104	8491	7661	140	15386	11054
34	907	70	3847	105	8655	7767	141	15607	11136
35	962	71	3957	106	8820	7872	142	15829	11217
36	1017	72	4069	107	8987	7977	143	16052	11298
37	1075	73	4183	108	9156	8081	144	16278	11377
38	1134	74	4299	109	9327	8184	145	16505	11457
39	1194	75	4416	110	9499	8287	146	16733	11535
40	1256			111	9672	8388	147	16963	11613

$$*TA = 0.785d^2$$

$$**ATA = -0.835d^2 + 176d - 7020$$



More classroom work...



REPLACEMENT PLANT COST

Wholesale price for the largest transplantable tree of the same species

- 3 prices
- 3 local nurseries

INSTALLATION COSTS

- Transporting the tree
- Planting the tree
- Monitoring the tree and maintaining it
- Guarantee
- Profit margin

TRUNK FORMULA METHOD

This method is used when appraising a tree that is too large to replace.

ISA TRUNK FORMULA METHOD

Date: May 4/09

Case #:

Property:

Appraiser: VM

Species: Cornus nuttallii

Condition %: 80.0

Trunk Circumference: 80.0 cm

Trunk Diameter: 78.0 cm

Use ATA_R Table - Y/N y

Site %: 50.0

Contribution%: 30.0

Placement %: 50.0

Location %: 43.0

Species rating%: 60.0

Replacement Tree Size (diameter) 6.0 cm

TA_R 28.0 cm²

Replacement Tree Cost: \$250.00

Installation Cost: \$450.00

Installed Tree Cost (#7+#8) \$700.00

Unit Tree Cost: \$8.85 Per cm²

Appraised Trunk Area: TA_A (use this one for up to 75 cm DBH) 4670.0 cm²

ATA_A (use this one for < 75 cm DBH) 4670.0 cm²

Appraised Tree Trunk Increase (TA_{INC}) = TA_A or ATA_A (#11) - TA_R (#6) 4642.0 cm²

Basic Tree Cost - (TA_{INC}) (#12) x Unit Tree Cost (#10) + Installed Tree Cost (#9) \$41,781.70

Appraised Value - \$8,623.74

Basic Tree Cost (#13) x Species rating (#5) x Condition (#2) x Location (#4)

If the Appraised Value is \$5000 or more, round it up to the nearest \$100; if it is less, round up to the nearest \$10.

Appraised value = (#14) \$8,700.00

[Guide for judging plant condition](#)

[DBH tape; metric](#)

[Attributes for Site, Contribution and Placement = Location](#)

[PNWISA Species Rating booklet](#)

[Table 4.6 Guide for Plant Appraisal](#)

3 estimates for line 7 & 8

$\$250/28 \text{ cm} = \8.85 *deciduous
 $\$13.18/\text{cm}^2$ conifers $\$12.55/\text{cm}^2$

$4670 - 28 = 4642$

$4642 \times \$8.85 + \$700 = \$41,781.70$

$\times 60\% \times 80\% \times 43\% = \$8,623.74$

Replacement Method

Use this method when the tree can be replaced with the same size , in the same location and the same species. Example Green Ash .

Plant Cost (wholesale):
\$308.33

Installation Cost: \$650.00

Species Rating: 80%

Condition: 70%

Location: 75%

Removal Cost: \$250.00

$$\begin{aligned} & (308.33 + 650.00) \times \\ & (80\% \times 70\% \times 75\%) + 250.00 \\ & = \$652.49 \\ & \text{Rounded up to } \$660.00 \end{aligned}$$

Compounded Replacement Cost method

Determine the replacement and maintenance costs plus the compounded interest for an estimated number of years until the tree reaches parity.

Cost of Repair

Determine the cost to repair a tree. These costs could include cabling , bracing, pruning, fertilizing, watering , aeration, wound treatment and plant health care.

- Flowering cherry tree 'pruned':
- 12 m height to 5 meters
- 10 m spread to 5 meters

Trunk Formula
method

- The value of the tree
before pruning:
\$2,090.00.



Settlement: \$2,090.00 for the value of the tree, removal of tree & planting of a new 8.5 cm cherry tree.

Mountain Ash:

Death due to chemical trespass.

Trunk formula method
\$1,339.00

The cost for the largest available tree is added to the difference in size between the replacement tree and the appraised tree. This is calculated on a cost per unit of trunk area.

Trunk
Formula
method



Cost of Cure method

The treatment necessary to return the property to a reasonable level of its original condition where there has been damage to or loss of trees.

1. Remove debris, stumps and clean the site.
2. Replace the trees and restore the property to its pre-casualty condition.
3. Calculate post -restoration maintenance.



Chemical trespass damage on willow

Cost of
Cure



Calculation of \$105 per willow shrub.

1. Remove debris, stumps and clean the site.
2. Replace the trees and restore the property to its pre-casualty condition.
3. Calculate post restoration maintenance.

¼ mile length (26,400 square feet) of
native plant material removed

\$205,000.00



Compounded Replacement Cost

Determining the replacement cost and its maintenance costs plus the compounded interest for an estimated number of years until the tree reaches **parity**.

Valuation for Shrubs, Hedges & Vines

Replacement Cost & Cost of Repair methods



Compounded
Replacement
Cost method

Hedge Valuation using Cost of Cure

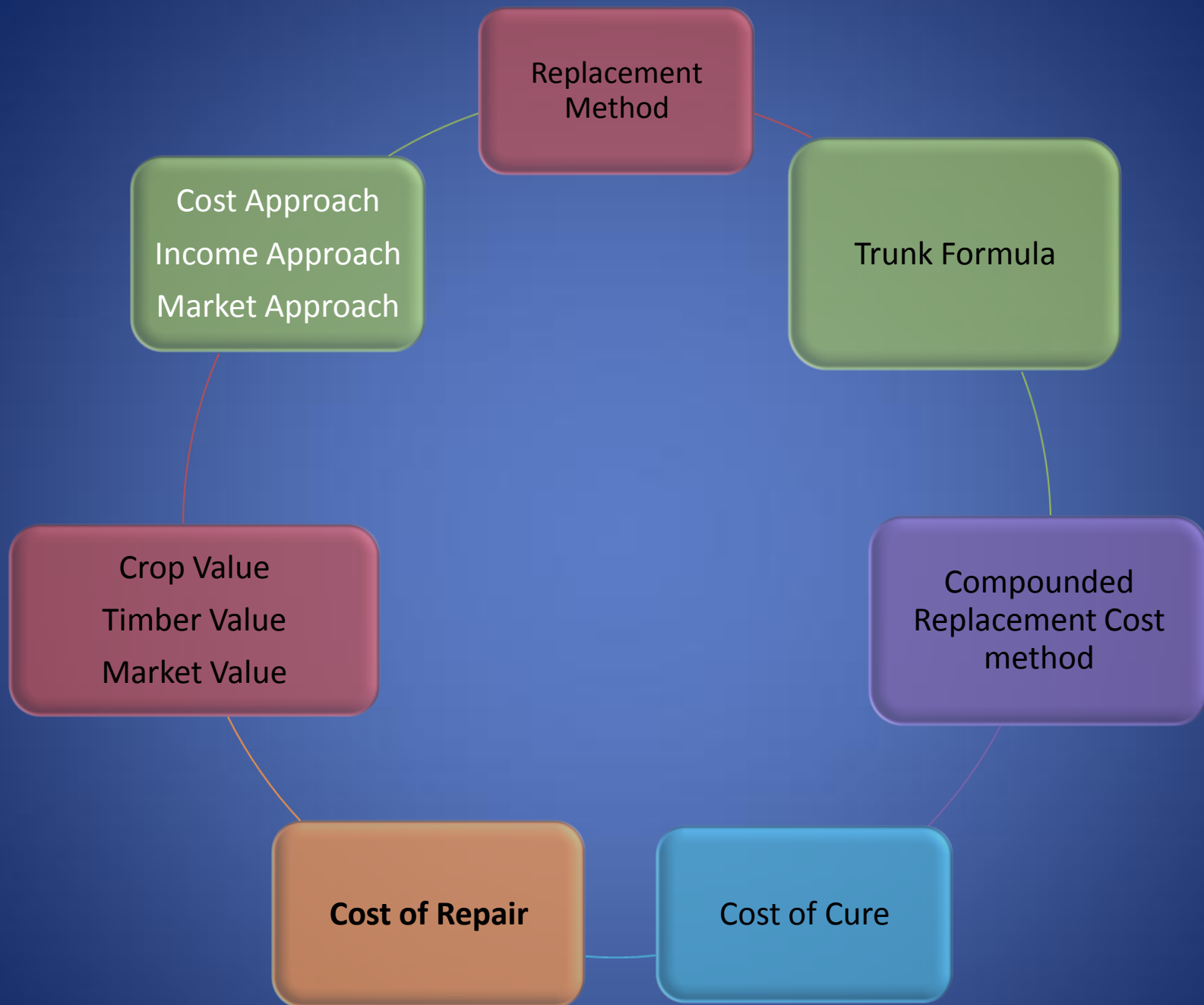


Cost Of Cure method

- Remove and haul 18 damaged trees,
- Excavate stumps & root structures,
- Supply & install replacement growing medium,
- Supply & install seven 4 meter tall *Thuja occidentalis* following BCLNA standards,
- Clean affected work area.

$\$3,978.00 + \text{GST} = \$4,176.90$



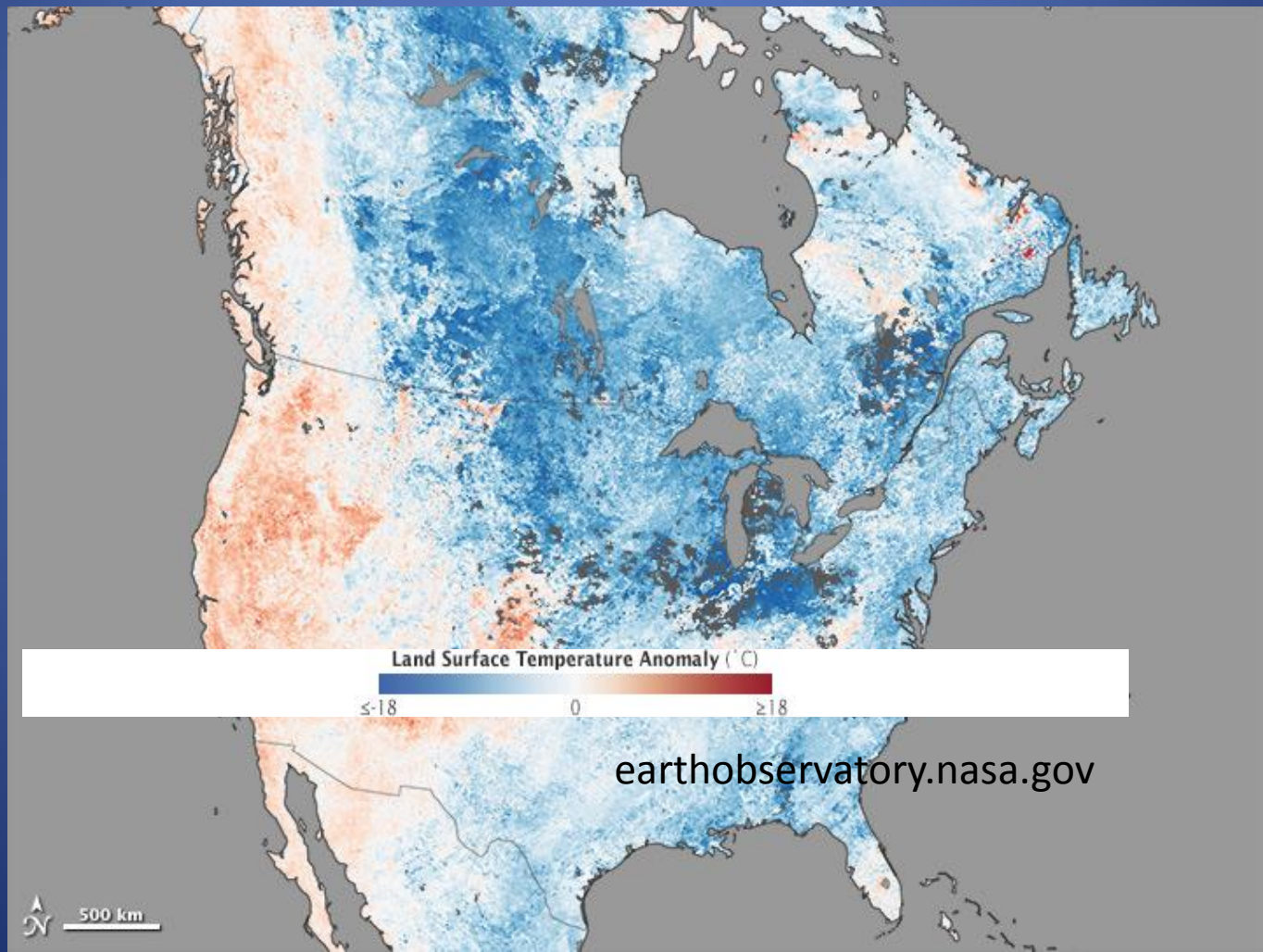


Based on 2001 Impacts, Adaptation and Vulnerability. *Institute for Catastrophic Loss Reduction (2007)*

- Higher maximum temperatures .
- More intense precipitation events implying increased floods and landslides, avalanche, and mudslide damage.
- Increased summer drying over most mid-latitude continental interiors leading to decreased crop yields, decreased water resource quantity and quality.
- Increase in tropical cyclone peak wind intensities, and average and peak precipitation.

http://www.iclr.org/images/Climate_change_and_local_government.pdf

NASA Earth Observatory land surface anomalies in North America for January 1–7, 2014 compared to the 2001–2010 average for the same week



Managing urban forests in a changing climate.

Trees provide a multitude of valuable ecological services;

- keeping neighbourhoods cool,
- improving air quality,
- providing wildlife habitat,
- removing carbon dioxide from the atmosphere,
- retaining storm water run off,
- preventing erosion,
- adding substantial aesthetic, recreational and economic value.



Climate Change & Trees

- Drought stresses trees.
- Stressed trees are an invitation to secondary pests.
- Reduction of natural eco-systems decreases the beneficial insects that can control secondary pests.



Before

❖ Removing understory reduces moisture retention at the trees' root zones.

❖ Removes beneficial insects.

❖ Reduces bio-diversity.

❖ Allows invasive plants to establish.



After

Can we retain the big trees?



Hong Kong Ficus tree

Crown condition indicates health not structural stability.

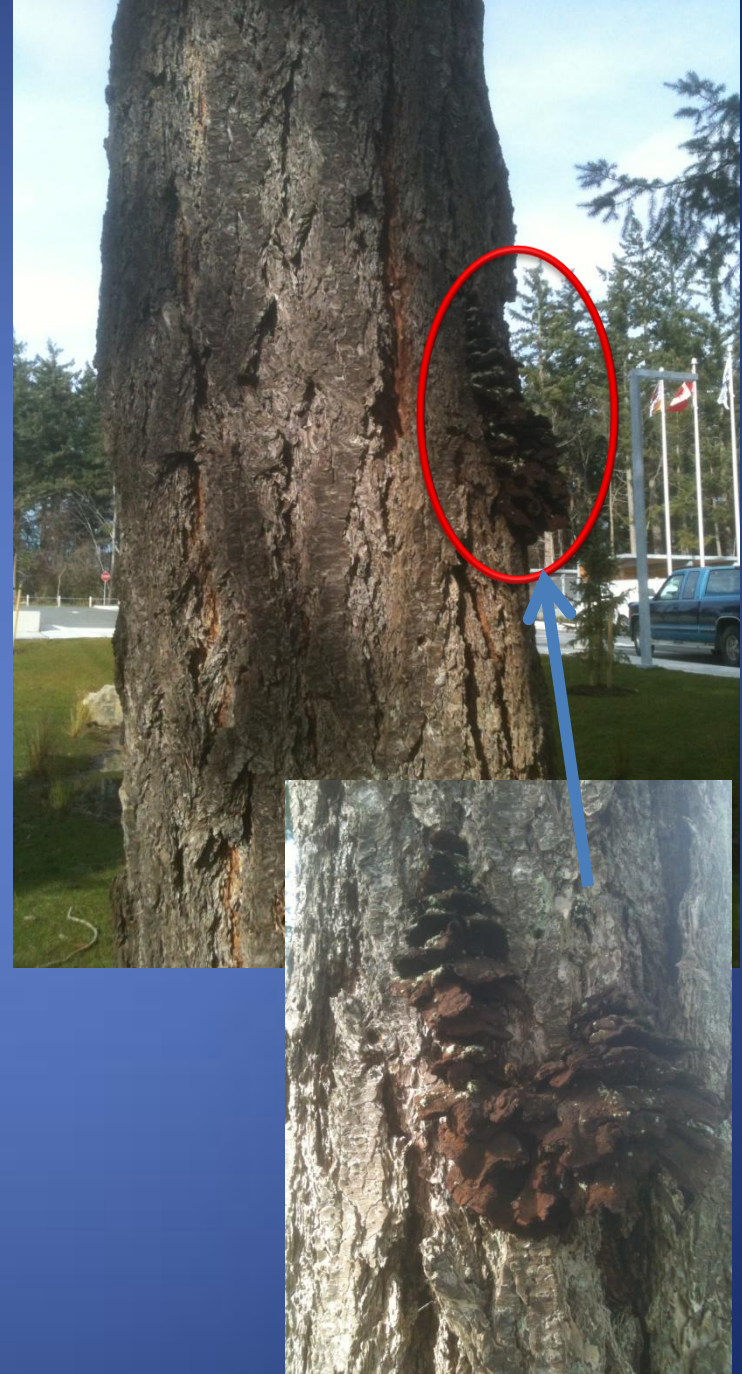


Duty of Care

- n. a requirement that a person act toward others and the public with watchfulness, attention, caution and prudence that a reasonable person in the circumstances would. If a person's actions do not meet this standard of care, then the acts are considered negligent, and any damages resulting may be claimed in a lawsuit for negligence. (See: [negligence, standard of care](#))
- Copyright © 1981-2005 by [Gerald N. Hill and Kathleen T. Hill](#). All Right reserved.

Duty of Care

- For owners of trees the Duty of Care means as an owner they have a legal responsibility to ensure that their trees are reasonably safe
- that means the owner must have all reasonable efforts to identify anything that can foreseeably cause harm to people or property.



Standard of Care

-that degree of care which a reasonably prudent person should exercise in same or similar circumstances. If a person's conduct falls below such standard, he may be liable in damages for injuries or damages resulting from his conduct. Black 1990

The Standard of Care
determines how the Duty of
Care is measured.

Dunster & Murray 1997

Our love-hate affair with trees

- Since 2005 communities in London (England) have removed 40,000 street trees. 40% because of insurance claims. 1% of the removals were justified.
- In England 147 communities surveyed their urban trees. 11% were between 50-100 years old and only 2% over 100.
- “Insurance companies demand trees be cut down and councils cave in to their demand. Which means when trees get big, they get chopped down.”
- London Tree Officers’ Association developed Capital Asset Value for Amenity Trees (CAVAT) to assess a tree’s worth.
- The higher the tree’s value, the more proof the insurers will need to chop it down.

Tree Risk Assessment courses define the Standard of Care. The risk manager can reasonably expect the assessor to provide the best possible advice.



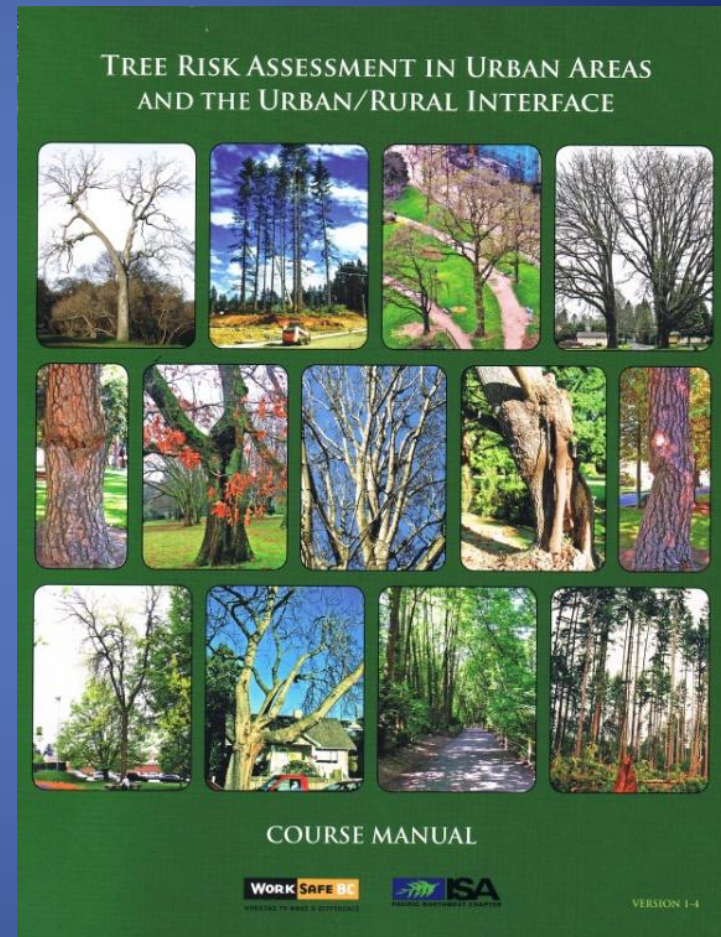
BCTS WINDTHROW MANUAL:

*A Compendium of Information and Tools for
Understanding, Predicting and Managing Windthrow
on the BC Coast*



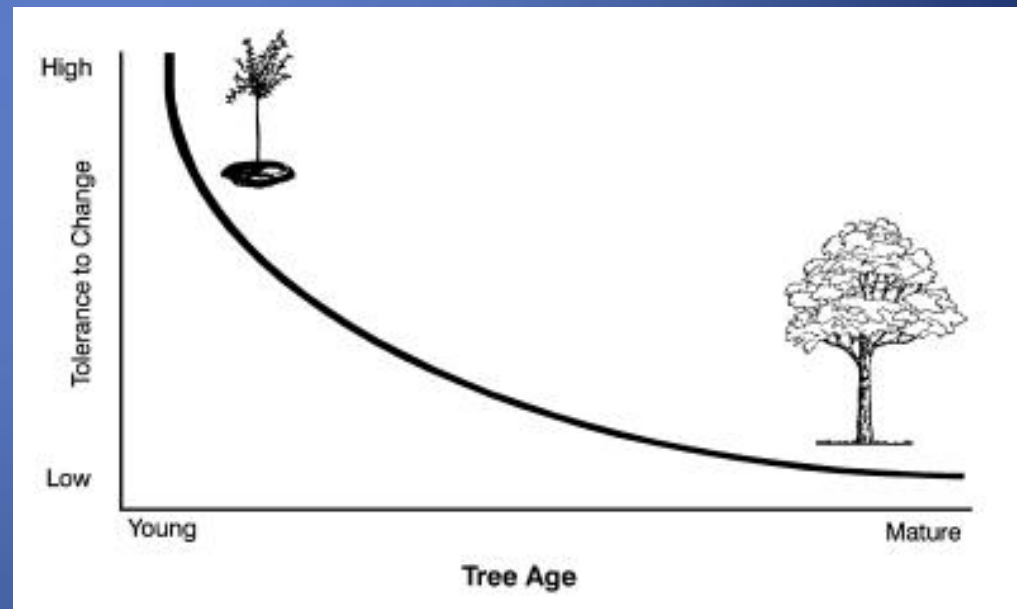
Wildlife Danger Tree Certification

Parks & Recreation Module



Assessing your mature trees:

- All wounded trees do not become infected
- All infected trees do not become decayed
- All decayed trees do not fail.



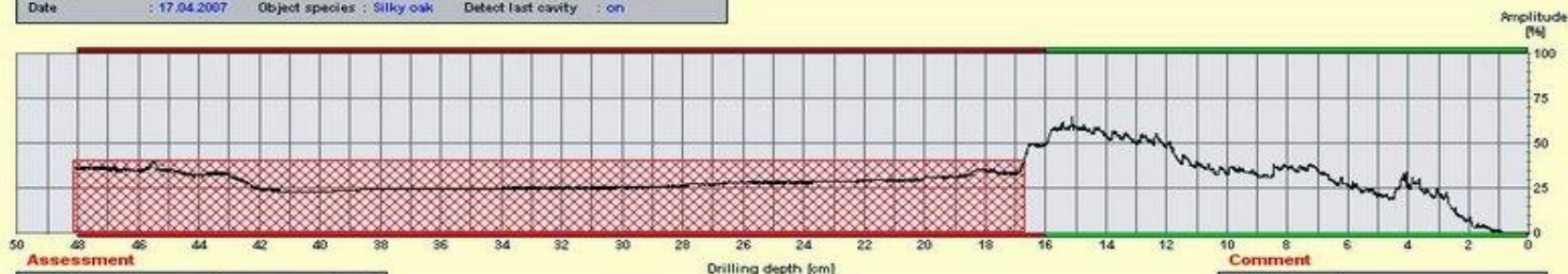


The **Resistograph** machine precisely detects and measures decay and defects in trees and wooden structures.

A fine steel drill is fed into the tree. As the drill enters the wood, the Resistograph records variable amounts of resistance encountered.

Measuring / object data

Measurement no. : 1	Time : 08:47:50	Location : City Hall
Drilling depth : 48.14 cm	Aug. curve : off	Name : pb
Wood species : Soft (1)	Diameter : 65.0 cm	Length of cavities : 31.42 cm / 36 %
ID number : 00001	Level : 10.0 cm	Min. width / height : 1.00 cm / 40 %
Advance : 38.4 cm/min	Direction : south/west	Start of detecting : 16.00 cm
Date : 17.04.2007	Object species : Silky oak	Detect last cavity : on



Assessment

From 0.0 cm to 16.0 cm	Appears Sound
From 16.0 cm to 48.0 cm	Decay
From 0.0 cm to 0.0 cm	
From 0.0 cm to 0.0 cm	
From 0.0 cm to 0.0 cm	
From 0.0 cm to 0.0 cm	

Comment

Wall thickness 16 cm.
Fungi on base
Decay in Base & Root Crown

Tested at 30 degrees down at 10 cm level on base.

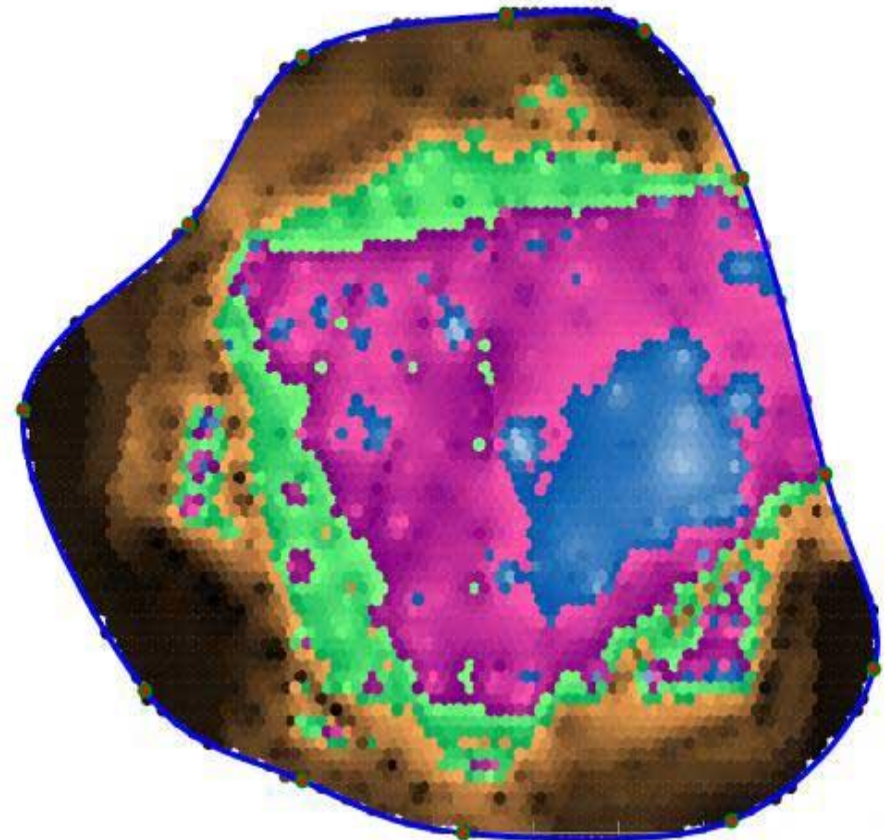


Picus Sonic Tomograph measures the speed at which a sonic pulse travels through a tree from various points.



The sonic pulse is generated by contact with pins with an digital hammer, around the tree's circumference.

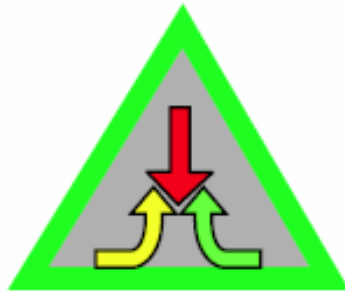
Sensors, attached to the pins, measure the time sound takes to travel through the wood.



Static Load Analysis

The triangle of statics

(Wind) load



Geometry of load bearing structure/
Degree of hollowness

Material properties
of green wood

GEOMETRY OF THE LOAD-BEARING TRUNK

$$M_{crsec} = d^3 \times \pi/32 \text{ or } M_{crsec} = d^3 \times 0.1$$

Wind force on the tree:

$$F = f \times c_w \times \rho/2 \times \Sigma(u(z)^2 \times A(h(z)))$$

Bending/tipping moment:

$$M_t = M_{bmax} = f \times c_w \times \rho/2 \times \Sigma(u(z)^2 \times h(z) \times A(h(z)))$$

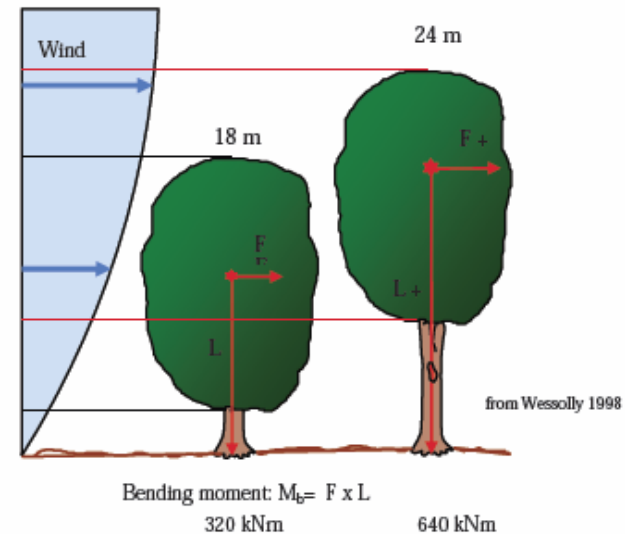


Figure 4. Static influence of crown raising on trees. In this example the taller tree (right) has the same crown surface as the smaller one. Due to the difference of height the taller tree is exposed to twice as high bending moments than the smaller. Experienced arborists should consider these facts before pruning.

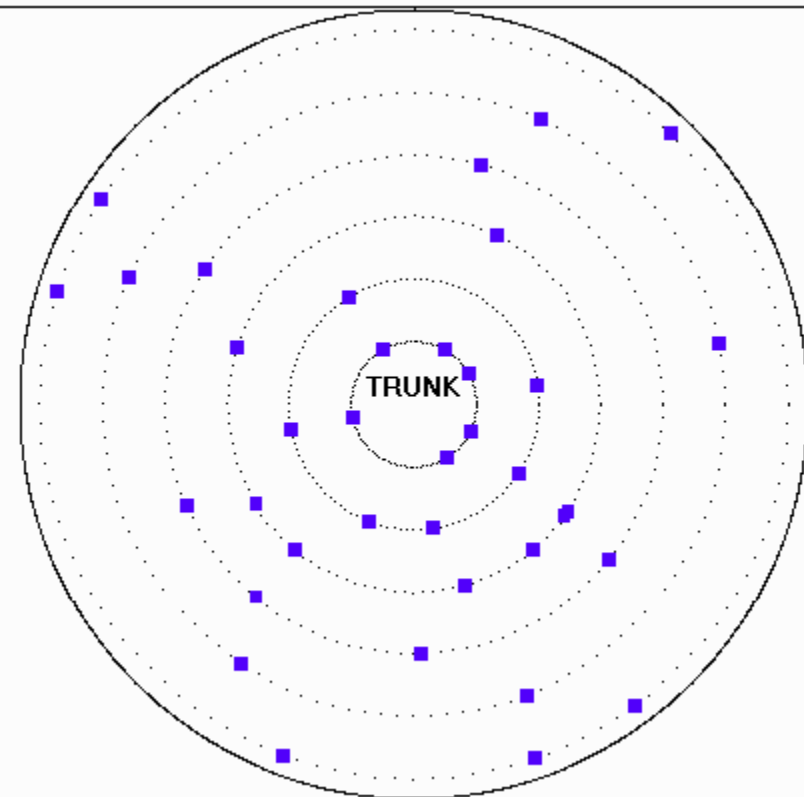
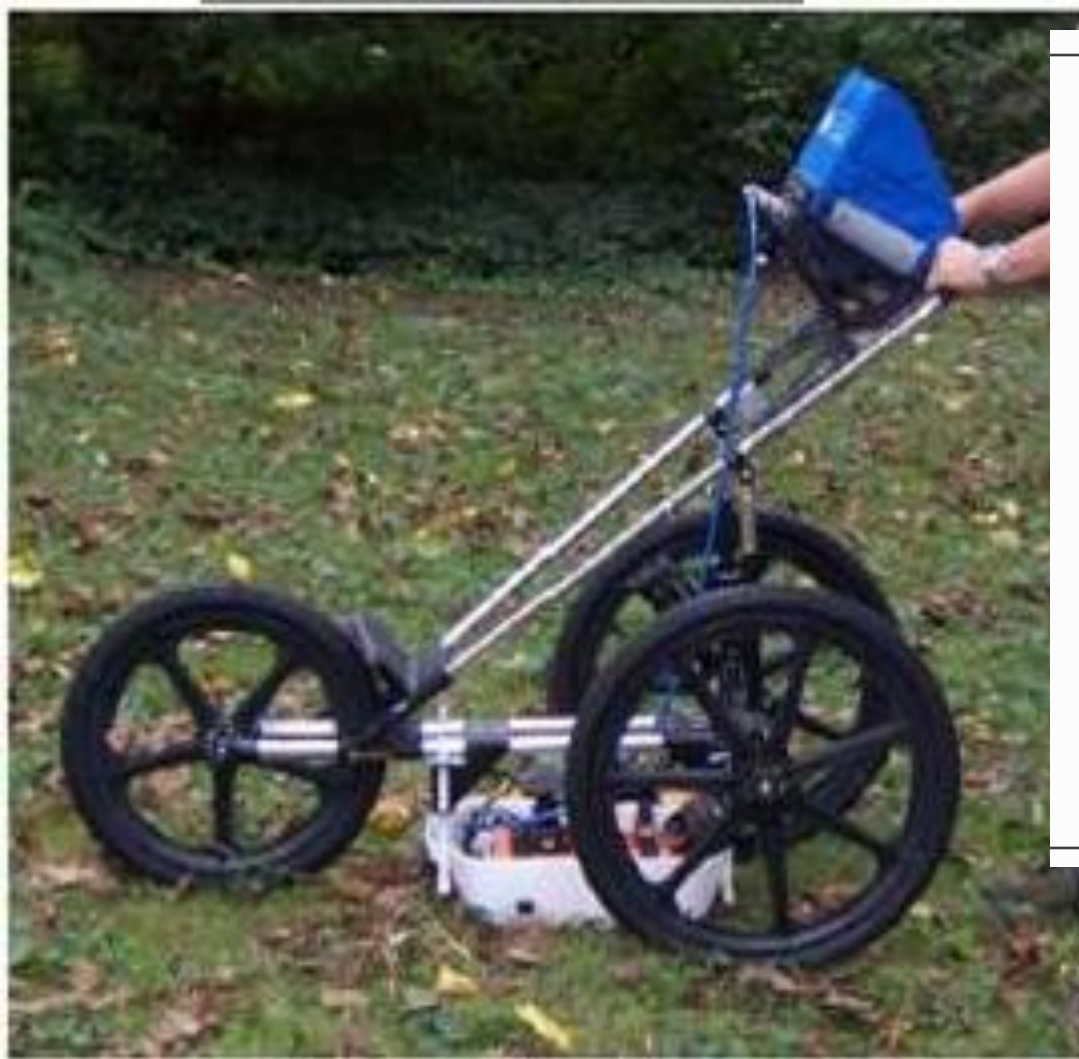
An engineered approach integrating wood strength, tree geometry and applied loads.

-SIM Static Integrated Method (advanced).

-SIA Static Integrated Assessment.

TRU™ (Tree Radar Unit)

MRI for Trees



"Virtual Excavator" - Top-Down 3D
Image of Root Layout and Density



Tree Roots

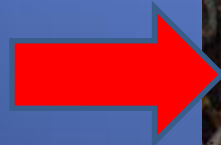




Decayed
structural roots



Irrigation
system



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

Tree Root Barriers



They paid 15% more for the lot because they
love the trees.











Steps to take to retain trees on building sites.



1. Tree survey & inventory,
2. ID trees suitable for preservation,
3. Review the site plan,
4. ID tree protection zone, install tree protection fencing
5. Build the house.

Tree survey: \$850.00 versus risk assessment & tree work: \$2,500.00

What happened.

They built the house....
causing damage to the
trees..

a risk assessment is done..
12 trees are removed.



- Mature Trees

“Save
Every
Possible
Tree –
Even Just
One.”

Page 57
Sustainable
Landscape
Construction
2nd edition



Garry oak at Victoria Airport

80 year old Douglas fir trees in Courtenay.





100 year- old
Douglas fir
with eagle
nest.

Grove retention between residences near the ocean.



Grove of trees retained on new residence building site.



Closing

A well- planned and executed tree maintenance program can gain quick acceptance. Under the direction of the superintendent, golf course architect and arborist, tree maintenance can be executed with the results being barely noticeable to the keenest eye.

In the end, all benefit as turf quality improves, safety is enhanced and the course plays in the manner in which it was intended.

www.gcsaa.org



Tree Maintenance, Risk &Valuation

2014 Canadian International Turfgrass Conference

Vancouver, British Columbia

THANK YOU

Verna Mumby

ISA Certified Arborist
Certified Tree Risk Assessor
Wildlife Danger Tree Assessor
Member, American Society of Consulting
Arborists

Mumby's Arboriculture Consulting

www.treelady.ca

