Task Breakdown

	Task Card	Number of Students	Description	Notes
	GPS	**2 + recorder**		**Good to have quality check on tree numbers half way through check for missing trees and repeated numbers**
	Mapper	**2-4**	**Can do 2 teams – one for perimeter, one for building and features, etc**	
	Swather	**1**		
	Gauger & Flagger	**1-3**		
Can be combined	**Status & Stance**	**1-2 + recorder**		
	Diameter	**1-2 + recorder**		**Tape should be level and flat**
Can be combined	**Tree Identification**	**1-2 + recorder**		**Both of these tasks will require a camera**
	Tree Health	**2-3 + recorder**		
	Locating	**3 + recorder**	**For doing quadrat studies only, not school yards**	
	Crown Width	**2-4**	**May be difficult in closed canopies – try your best**	
	Height & Compass (working together)	**3**	**This task will take the longest and should be performed last. Most variability with this measurement, so promote double/triple checking**	

I've arranged the tasks in order and in groupings that work well together; if you have a limited number of students or time, it will be easier to break it up this way.

"+ recorder" let's you decide whether you'll have individual recorders per task or one for the whole group, or one recorder for everybody – you decide. However, ensure that ALL DATA IS COMPILED onto one sheet before leaving the field – it's amazing how many mistakes can be found this way.

ROLE CARD ORGANIZATION

Recording:

Set up Study Area:
- Locating Trees - GPS
- Mappers
- Swather
- Tree Location (only if doing quadrat study)
- Tree Gauger & Flagger

Tree Identification, Status &Health:
- Identification
- Status &Stance
- Tree Health Check
- Crown Status (only when trees are fully leafed out)

Tree Measurement:
- Tree Diameter
- Compass Bearing
- Height/Crown Depth
- Tan Table/Height Calculation
- Crown Width Larger Trees

Measuring Younger Trees:
- Root Collar Diameter
- Small Trees Height or DBH
- Crown Width Young Trees

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BLACK TEAM

Locating Trees - GPS

Set-up

- Measure yourself with a metre-stick and determine where 1.3 metres is on you.
- Get a clear view of the sky.
- Press POWER button firmly and hold until GPS receiver turns on.
- You will see the satellite page containing the message ACQUIRING SATELLITES – you need at least four dark bars for accuracy.
- The GPS is ready to use.

Instructions – Introductory

1. Marking LOCATION of a tree (WAYPOINT)

- Go to NW side of first tree and hold device up 1.3 metres

2. Record your location on the spreadsheet.
3. **Turn off GPS unit** - Hold down POWER button

Instructions – Advanced use with GPS memory

1. Marking LOCATION of a tree (WAYPOINT)

- Go to NW side of first tree and hold device up 1.3 metres
- To record your location you can press MARK button on GPS unit regardless of what page you're on – the Mark Waypoint page will appear on GPS unit
- Use ROCKER button (up arrow) to move cursor to top of page where there is a number (e.g. 001) and press the ENTR button (this is spelling on GPS unit)
- An onscreen keyboard will appear. Use this to give a unique code to each tree location e.g. WSS01
- Use ROCKER key to move cursor around keyboard and press ENTR button to confirm the selection
- After typing your code for the location press OK (in middle of keyboard)
- Press ROCKER to go to OK button (at bottom of screen)
- Repeat step 3 for each tree

TIP: For mistakes press BACK button to erase each character

2. To FIND saved locations

- Press FIND button on unit
- Use ROCKER key to highlight the name you saved for your locations
- Press ENTR button to confirm selection
- The coordinates will appear
- You can copy the locations to your record sheet

3. **Turn off GPS unit** - Hold down POWER button

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FIND Key - Press and release at any time to view the Find Page.	PAGE Key - Press and release to **cycle through the Main Pages**. - Press when using the on-screen keyboard to close.

EQUIPMENT

- GPS Receiver, Recorder, measuring tape, clipboard, data entry sheet

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PINK TEAM

MAPPERS

In pairs…
To map and measure the property:

1. Use compass to find north.
2. Mark N on upper right corner of your page.
3. Measure dimensions of property with metric Trundle Wheel or Yellow 30metre tapes.
4. Tell Mapmaker. e.g. Call out "Length of east side of property 60.70 metres."
5. Help create the scale: calculate how many times measurements of property must be reduced to fit in the grid inside frame of the final map on graph paper.
6. Measure dimensions of features: buildings, streets, driveways, parking lots, playing field, yard and tell the Mapmaker.
7. Include locations of trees and types. See diagram.
8. Complete the Legend.
9. Use N to decide various sides of property and label them.
    - side one (north)
    - side two (east)
    - side three (south)
    - side four (west)
10. ASK GPS EXPERT TO WAY-MARK (get the coordinates) THE 4 CORNERS OF YOUR MAP!

EQUIPMENT

- Compass
- Masking tape
- Metric Trundle wheels or Yellow 30 metre tapes

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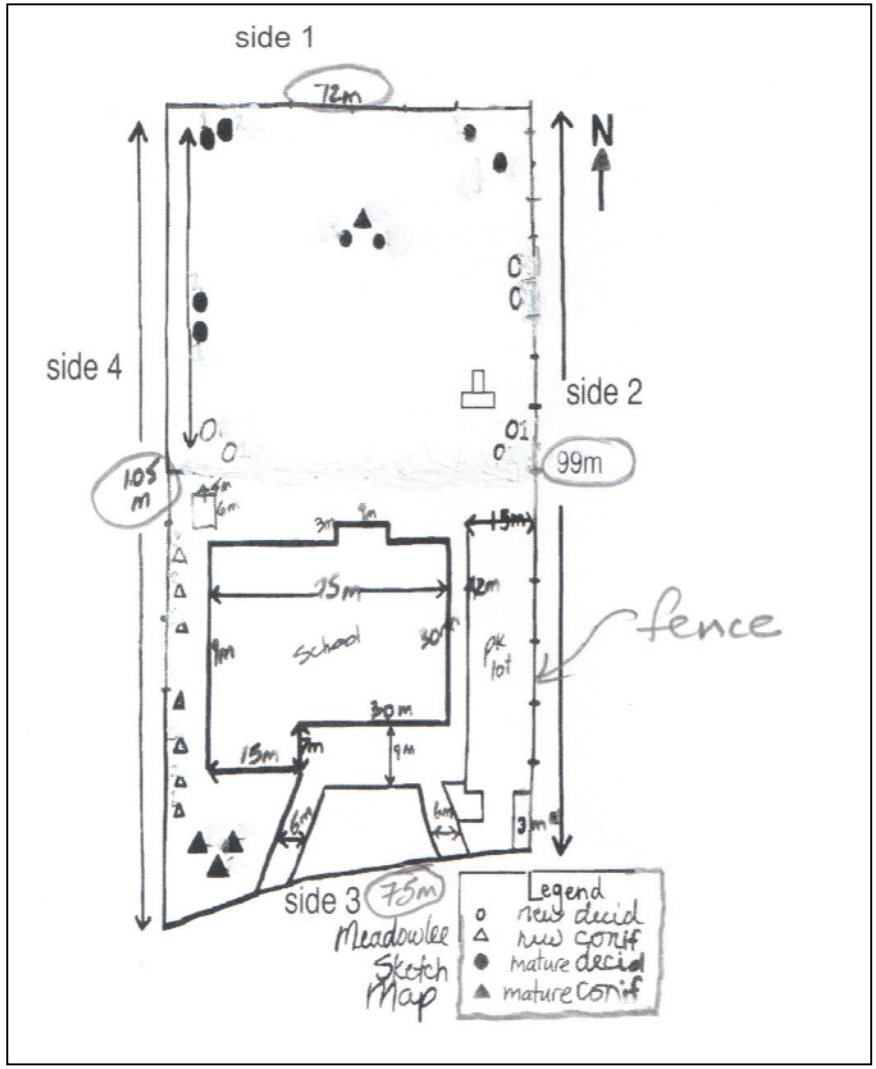

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PINK TEAM

SWATHER

Individually….
Working with Tree Gauger and Flagger of Pink Team

1. Find northwest corner post of quadrat.
2. Face north east corner post with Side #1 rope along your left side.
3. Open metre sticks and begin walking along side #1 rope to set the two-metre swath.
4. Fold metre sticks together to get past a tree.
5. The Tree Gauger behind you will check if small trees are big enough to be flagged – i.e. are they 4 cm DBH?
6. If Gauger gives the OK, then Flagger flags the tree with a number – increasing as team moves along.
7. When first two-metre swath is completed, the pink team members check, with opened metre sticks, where the two-metre swath line is and then begin the second round. This will be second layer in spiral toward middle.
8. Repeat for third spiral (4 metres in from the side ropes) to the middle after again checking this distance using the opened metre sticks.
9. Continue in spiral until all trees have been numbered.

TIP: tie flagging tape to side ropes to help keep your distance from the side constant as you walk. Aim for the tape on the opposite side rope.

EQUIPMENT

- Swather or hinged metre sticks i.e. two sticks hinged by duct tape so they reach **2 metres when open**.

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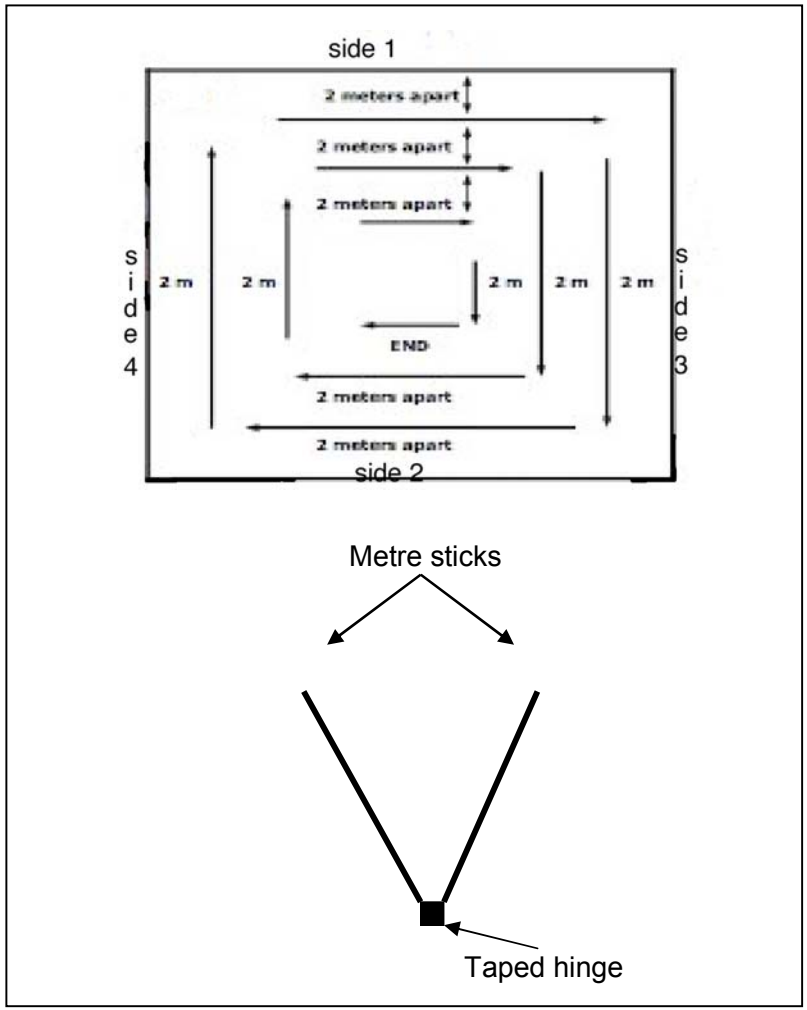

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YELLOW TEAM

LOCATING BY TRIANGULATION

In pairs or trio…
For both mature and newly planted trees

AT THE TREES:

1. As first Locator put your back to the tree and FACE the closest side. Post A will be on the right.
2. As the second Locator, hold the zero end of the tape at waist height and at the tree centre.
3. Hold other end of tape, unwinding it as you walk towards post A. Keep the line straight and tight. Adjust tape until it is level from tree to post for accuracy.
4. Read measurement in metres using TWO DECIMAL PLACES. e.g. 5.23m.
5. Repeat step three and four for post B.
6. Tell Recorder the distance - reading Line "a" first.
   e.g. Call out "Tree #6, Line "a" is 16.07 m"
   and then "Tree #6,Line "b" is 4.60 m."

TIP 1: For team of three: one at each post and one at tree

TIP 2: A Line + B Line must equal a minimum of 20m and not be greater than 27m.

EQUIPMENT

- Two yellow 30m tapes
- Recorder, Clipboard

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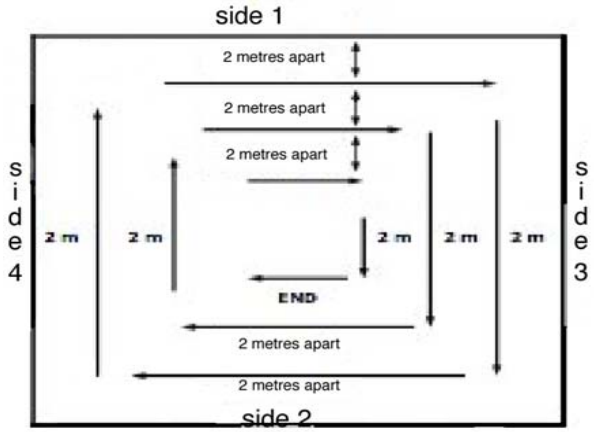
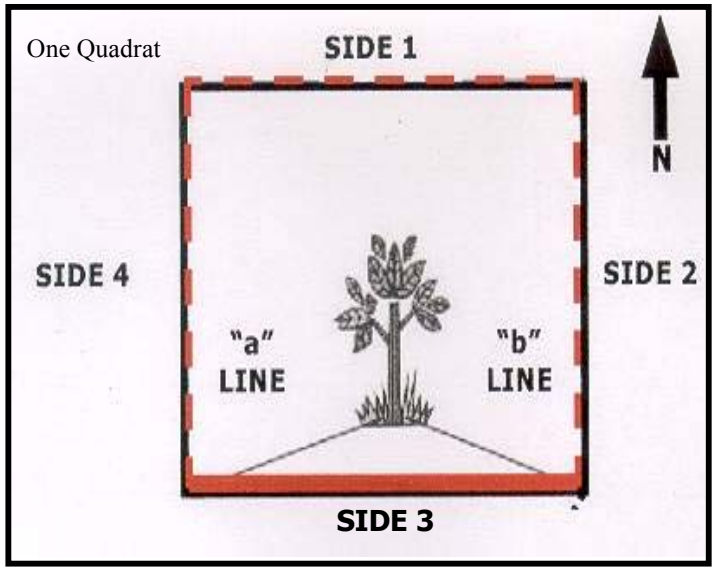
One Quadrat



● = post



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PINK TEAM

Tree Gauger & Flagger

Gauge the Tree Size – use this to determine which trees you will number!

1. Check the diameter of any smaller trees at 1.3m from the ground. **If tree gauge fits easily around the young tree at 1.3 metres, then it is too small to be included; otherwise tell the flagger to mark the tree.**

FLAG the Tree

1. Write the tree # of each tree on the **flagging tape** with a **black marker**

2. Tear off enough tape to fit tied around the tree trunk, to show the number of the tree for easy viewing. Tie it loosely around tree.

3. Tell the RECORDER: E.g.: Tree #3 tagged

EQUIPMENT

- **Permanent Marker**
- **Flagging Tape**
- **Tree Gauger**

Tree Gauger

How to Number a Tree

Write the plot #, quadrat # and tree # on flagging tape, then attach flag to tree securely

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GREEN TEAM

IDENTIFICATION

In pairs…

For both mature and newly planted trees:

1. Find a tree that has been flagged.
2. Decide if tree is Deciduous or Coniferous.
   TIP: If tree has broad leaves or no leaves at all use DECIDUOUS tree key. If tree has needles or cones use CONIFEROUS key.
3. For coniferous trees, see the back of the card and begin at number one. There are two number ones. READ BOTH e.g. 1a and 1b One will best describe your tree.
4. Select description that best fits your tree then.
5. Scan down the page for the paired numbers and locate the new number for you next choice.
6. Select the number that best describes your tree and read each description carefully.
7. Keep following through the key to the new numbers until you find a description that ends with the name of a tree species.
8. Tell recorder the species you have identified and say the tree number. e.g. Call out "Tree #6 White spruce."

EQUIPMENT

- Coniferous Tree Key
- Deciduous Tree Key

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Key To Native Evergreen Trees

After Forest Trees of Ontario, MNR, by J.H. White and R.C. Hosie

1a. Leaves **scale-like**, gen. less than 0.3cm long, in opposite pairs covering twig
2a. Leaf-covered twigs flattish; successive leaf pairs not alike in shape; cones
WHITE CEDAR
2b. Leaf-covered twigs 4-sided, fine, cordlike, successive leaf pairs alike; berries
RED CEDAR
1b. Leaves **needle-like** or linear, not scale-like.
3a. **Clustered** leaves present, needle-like.
4a. All leaves clustered, not more than 5 in a cluster.
5a. Clusters with 5 leaves in each……...WHITE PINE
5b. Clusters with fewer than 5 leaves in each
6a. Leaves in 3-leaved clusters……PITCH PINE
6b. Leaves in 2-leaved clusters
7a. Leaves 15cm long…….RED PINE
7b. Leaves about 3cm lo……. JACK PINE

4b. Leaves on short side of branchlets in cluster of more than 5; leaves on the end shoots singly places (deciduous)……...TAMARCK
3b. All leaves **singly placed**, linear.
8a. Leaves **flat**.
9a. Branchlets roughened by persistent woody bases of fallen leaves……..HEMLOCK
9b. Branchlets smooth, leaf-scars circular (note bark blisters of resin)……..BALSAM FIR
8b. Leaves **4-sided**, branchlets roughened.
10a. Twigs **hairless**; closed cone cylindrical, blunt; open cone with thin, flexible, mostly entire scales……WHITE SPRUCE
10b. Twigs densely short **hairy**, closed cone ovoid, pointed; open cone with stiff scales having more or less toothed margins.
11a. Leaves **dark**-green, dull; cone 2cm long, persistent on the tree for many years……...BLACK SPRUCE
11b. Leaves **yellow**-green, shiney; cone @ 5cm long, deciduous within a year after seed dispersal …..RED SPRUCE

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ORANGE TEAM

STATUS & STANCE

Analyze Status of tree.

1. Determine whether or not the tree is either
   - (A) ALIVE: lots of buds or leaves
   - (B) DEAD: symptoms include:
     - No leaves or buds!!!
     - Bark peeling excessively, or is absent
     - Excessive insect or animal damage
     - If tree's been uprooted
     - Dry/brittle appearance

Take a photo of the symptom!!!

Tell the RECORDER to write the photo's # on the data sheet!

Analyze Stance of tree.

2. Determine whether the tree is
   - (S) STANDING
   - (L) LEANING *
   - (P) PRONE

   Check pictures on the other side of this card.

3. Tell the recorder the tree status – don't forget to say the tree number! e.g. Call out "Tree # 6, Alive, Leaning."

EQUIPMENT

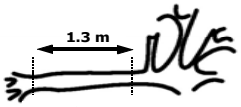
- HEALTH CHECK FIELD SHEET

STANCE

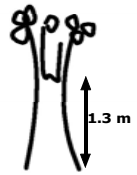
STANDING (S)

LEANING (L)

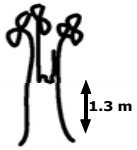
PRONE (P)



PRONE AND SPROUTING (PS)

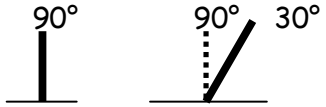


CUT / BROKEN ABOVE (BA)



CUT / BROKEN BELOW (BB)

***TIP: A TREE IS *"LEANING" WHEN IT IS MORE THAN 30° OFF CENTER.**



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ORANGE TEAM

Tree Health Check!

Assess the Health of the Tree:

1. Check to see if the tree shows any damage or defects (see diagrams on back of card)

2. Shout Back to the Recorder all that apply

Prove it!

3. Set Camera to show date on photos

4. Take a photo of the defect or damage

5. Write down the photo number beside the tree # on the data sheet

EQUIPMENT

- Health Check Data Sheet
- Camera (set to print the date on photos)

Health Code!	
Mechanical Damage	
None	NN
Bark Damage*	BD
Significant Top Breakage	TB
Visible Root Damage	RD
Complete Girdling	CG
Defects	
None	NN
Minor Damage/Vandalism	DV
Animal browsing	AB
Insect Infestation	II
Symptoms of disease	SD

*Bark Damage examples: Partial Girdling, Frost Cracks, Evidence of Deer rubbings, etc.

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Animal browsing = snacked on by animals! Think of the damage beavers do, or deer. Do your tree branches or trunk look like they have been eaten?

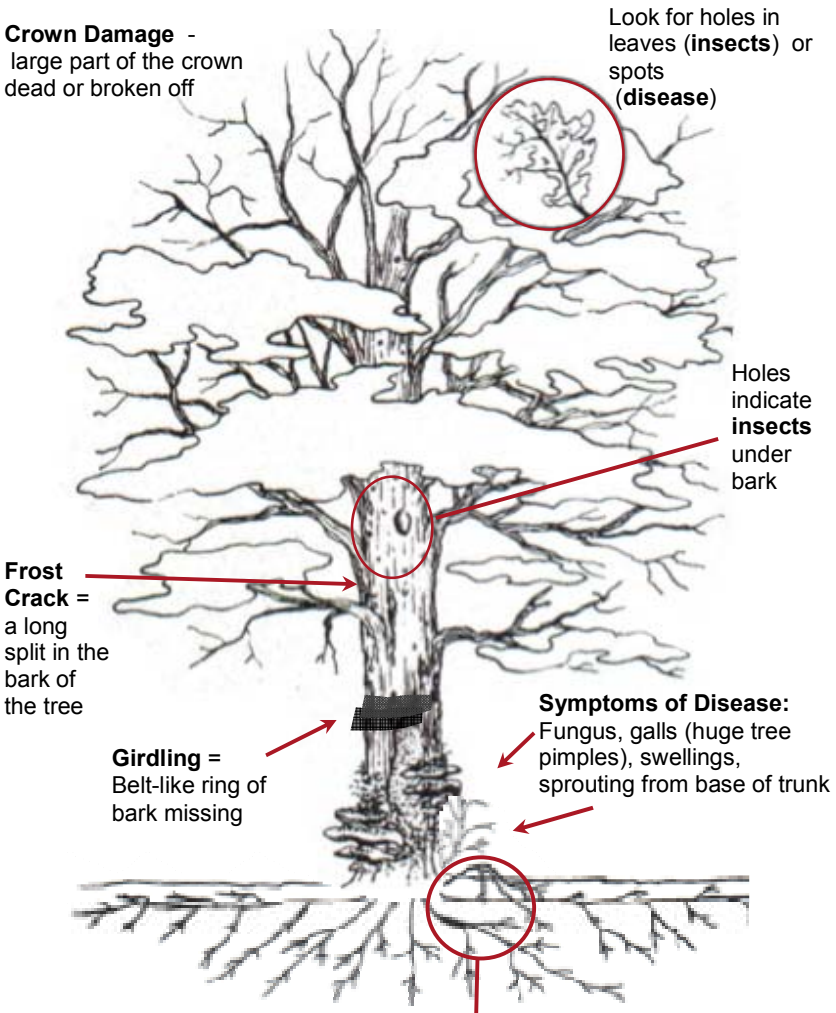

Image Adapted from Focus on Forests (1989)

GREEN TEAM

Crown Status

***Only perform this in Summer & Early Fall, when all the leaves are out!**

Assess the Status of the Tree's Crown (leaves):

1. Stand back from the tree so it is easy to see the whole crown (20m is best).

2. Determine the percentage of leaves growing on the tree (see diagrams)

3. Tell the Record the Foliage Status. Don't forget to say the tree # (e.g.: call out "Tree #6, All leaves present!")

4. Hypothesize if water shortage, salt damage, frozen/compacted roots or disease has affected your tree

EQUIPMENT
- **Health Check Data Sheet**
- **A good pair of eyes!**

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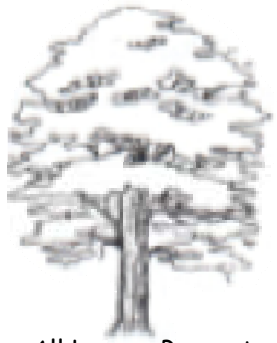
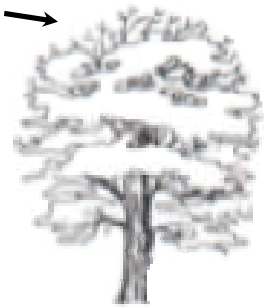
Tree Crown/Foliage Diagnosis



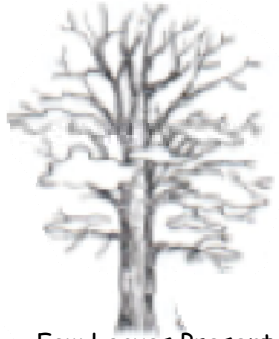
All Leaves Present

Look for Dieback at top of Crown!



Most Leaves are Present

Half the Leaves are on the Tree



Few Leaves Present

No Leaves Present

Images Adapted from Focus on Forests (1989)

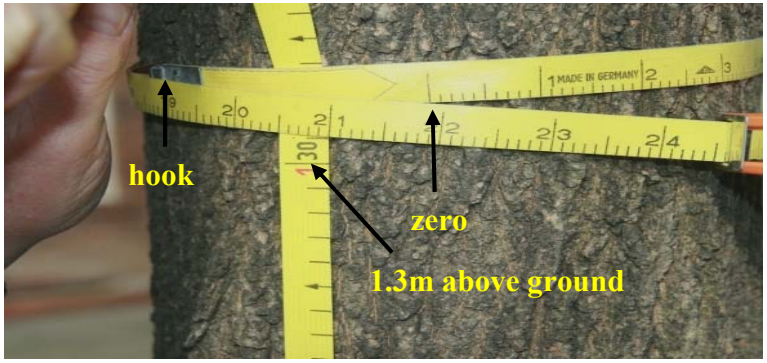
ORANGE TEAM

TREE DIAMETER

For mature trees over 4 centimetres DBH:

1. Find a tree that has been numbered.
2. Use the distance side of the ORANGE diameter tape with RED numbers to measure 1.3 m UP the trunk.
   - TIP: Put the tape on the SHORTEST side of the tree.
3. Use the diameter side of the ORANGE diameter tape.
   - TIP: It is the side without red numbers and says "DIAMETER" near zero metres.
4. Put hook into tree at 1.3 m to your left and wrap it around ready to read diameter at the 0 mark.
5. Have another team member make sure it is level and untwisted.
6. Read diameter at the zero mark in centimetres to two decimals.
7. Tell the recorder the DBH and tree number. e.g. Call out "Tree #6, diameter is 8.60 cm"

DIAMETER OF TREES > 4 cm DBH, Using Diameter Tape



Read at ZERO 1.3 m above the ground for diameter in centimetres (cm) e.g. above reading is 21.90 cm diameter

EQUIPMENT

Orange Diameter Tape

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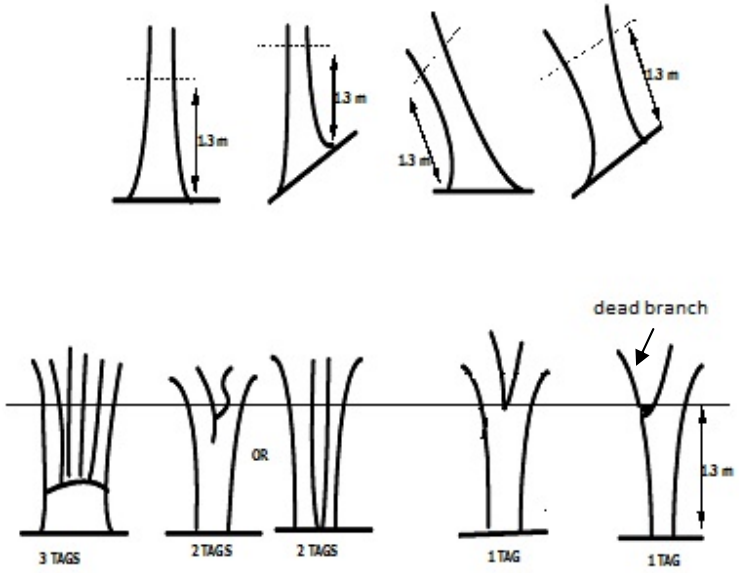
To determine:

a) Where to measure DBH

b) How many tags should be used

c) How to attach the tag. See the tag protocol.

NOTE: Tags will be attached at 1.3m.



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BLUE TEAM

COMPASS BEARING

Individually as Compass Bearer, **work with Blue Team** for **height**.

For Measuring Height of mature trees only:

1. As Compass bearer, stay at the tree, place a light coloured object at the base of the tree, and guide the other BLUE team members in a straight line away from the tree.
2. Place string of compass around neck. Hold compass flat at your stomach and have the string end pointing towards the clinometer.
3. Turn the housing so that the red end of the needle is inside the black hollow arrow ("The house").
4. Read the compass bearing at the mark below the string to the nearest degree. This is the "degrees from north" or Bearing.
5. Tell the recorder – Don't forget to say the tree number!
   e.g. Call out "Tree #6, 27 degrees." This bearing will allow the next measurement to be taken at the same spot.

EQUIPMENT

- Compass

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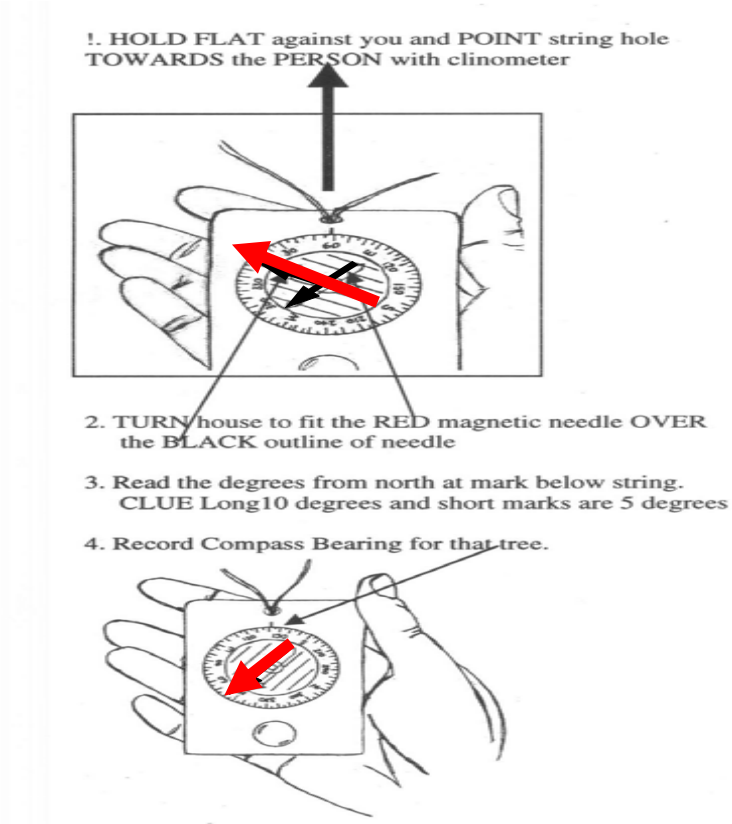

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BLUE TEAM

HEIGHT/ CROWN DEPTH

TIP: *All height measurements are taken at 20 METRES from the tree so EYE to TREE DISTANCE is always 20 METRES*

1. Find the best line of sight to tree top from 20 metres.
2. Hold blue CLINOMETER with a straight arm, one hand on the trigger, the other hand opened FLAT underneath for support and not touching the scale.
3. Line up sights of clinometer with the tip of top branch.
4. Squeeze trigger and hold. Your partner will say "LOCK" when needle stops. Release the trigger to lock it in place.
5. Read the angle° from zero at the needle.
6. Redo this until you get two same readings. Then tell the recorder. e.g. Call out "Tree #6, upper angle 27 degrees".
7. Repeat these steps for LOWER ANGLE – point clinometer at base of tree where the trunk meets the ground. e.g. Call out "Tree #6, lower angle 3 degrees".
8. Repeat these steps for CROWN DEPTH- point clinometer at the first branch (Horizontal) from the ground. e.g. Call out "Tree #6, First Branch angle 5 degrees".

TIP: Ask COMPASS BEARER to put a light-coloured object (e.g. sneakers or data sheets) at the tree base.

TIP: To measure crown depth, add the upper and lower angles and use the tan table to figure out the total height. Find the height of the first branch angle and subtract it from the total height to get the crown depth.

EQUIPMENT

- Clinometer, 30 meter tape

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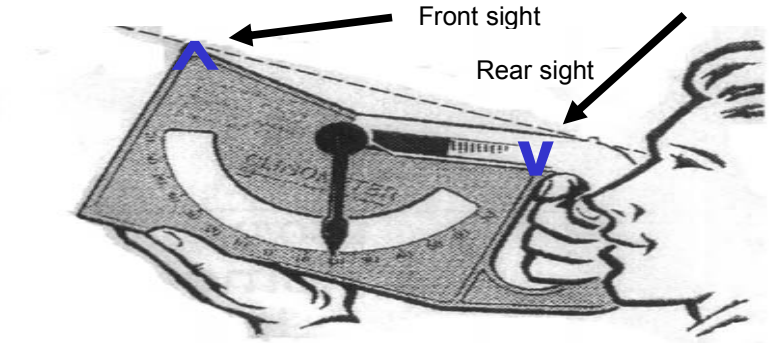
IN POSITION FOR UPPER ANGLE

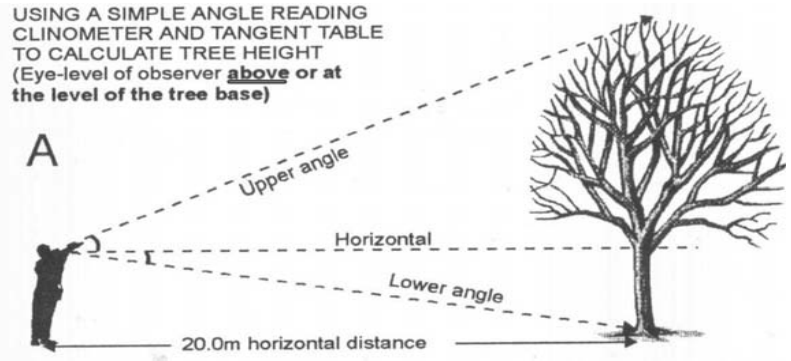
➔ CLUE: **Front sight** is the blue Peak indicated by the arrow ("^")

Rear sight is the Valley next to the hand ("V")

➔ CLUE: Lower hand is open and flat

- Always repeat readings until two are the same angle.
- Make sure you can clearly see where the tree meets the ground before reading the LOWER ANGLE.





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BLUE TEAM

TAN TABLE/ HEIGHT CALCULATION

ANGLE - TANGENT - HEIGHT TABLE (measurements taken at eye-tree distance of **20** metres)

Angle	Tan	Height m	Angle	Tan	Height m	Angle	Tan	Height m	Angle	Tan	Height m
1	0.017	0.34	15	0.268	5.36	29	0.554	11.08	43	0.933	18.66
2	0.035	0.74	16	0.287	5.74	30	0.577	11.54	44	0.966	19.32
3	0.052	1.04	17	0.306	6.12	31	0.601	12.02	45	1	20
4	0.07	1.4	18	0.325	6.5	32	0.625	12.5	46	1.036	20.72
5	0.087	1.6	19	0.344	6.88	33	0.649	12.98	47	1.072	21.44
6	0.105	2.1	20	0.364	7.28	34	0.675	13.5	48	1.111	22.22
7	0.123	2.4	21	0.384	7.68	35	0.7	14	49	1.15	23
8	0.141	2.82	22	0.404	8.08	36	0.727	14.54	50	1.192	23.84
9	0.158	3.16	23	0.424	8.48	37	0.754	15.08	51	1.235	24.7
10	0.176	3.52	24	0.445	8.9	38	0.781	15.62	52	1.28	25.6
11	0.194	3.88	25	0.466	9.32	39	0.81	16.2	53	1.327	26.54
12	0.213	4.26	26	0.488	9.76	40	0.839	16.74	54	1.483	27.52
13	0.231	4.62	27	0.51	10.2	41	0.869	17.38	55	1.483	28.56
14	0.249	4.98	28	0.532	10.64	42	0.9	18	56	1.483	29.66

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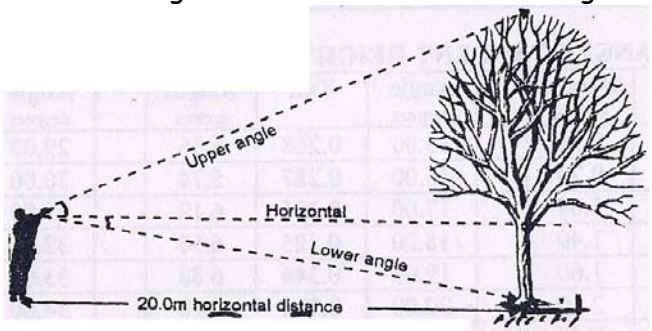
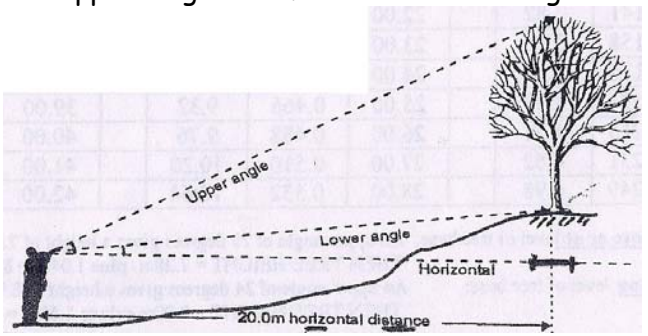
1. Find upper angle - note height.
2. Find lower angle - note height.
3. If your eye level is ABOVE or at BASE of tree ADD upper and lower heights to calculate total tree height.



4. If eye level is BELOW base of tree SUBTRACT lower from upper heights to find actual tree height.



5. Find the height of the first branch angle and subtract it from the total height to get the crown depth.

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YELLOW TEAM

CROWN WIDTH
Larger Trees

1. Stand UNDER the tree and look UP!
2. With helpers, determine the outer edge of branches and buds.
3. Measure the widest part of leaf cover or crown with the 30 m tape. Check to ensure the tape touches the bark of the tree.
4. Now stand at the right angle to the first position and repeat measurements.
5. Record both crown readings in METRES. e.g. 6.50 m

EQUIPMENT

- Two metre tapes (30 m)

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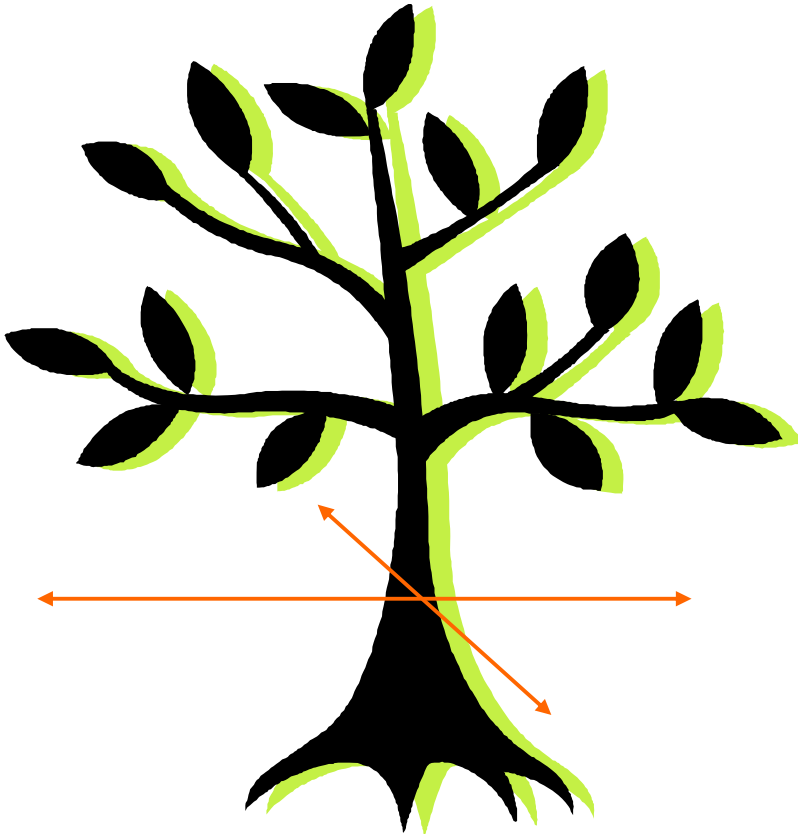

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WHITE TEAM

ROOT COLLAR Diameter

*Test this measurement technique on your finger first to learn how to **not hurt the bark** of the young stem.*

1. Open mouth of Caliper.
2. GENTLY place the jaws around the root collar (where the stem meets the ground).
3. GENTLY slide jaws closed. Not too tight so as to not hurt the bark.
4. Hold the slider firmly.
5. Without scraping the bark, gently remove the Caliper sideways.
6. Read the measurement point (MP) in between the two circles to nearest whole millimetre and record under the column heading RC (mm).

EQUIPMENT

- Graduated Calipers

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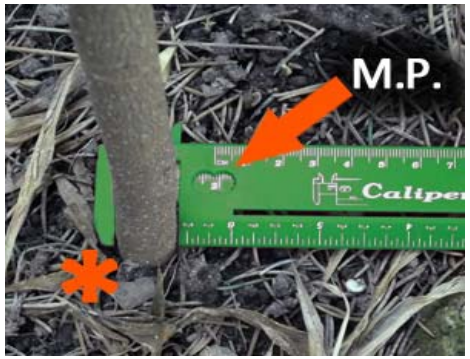
Root Collar Measurement Young Trees (mm)



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WHITE TEAM

SMALL TREES
Height or DBH

IN GROUPS OF 3

Newly planted tree - measure HEIGHT (HT)

1. Measure

A. Tree Height: If tree is **less than 1.3m (130cm)**, Use small tape to measure height of tree from root collar (RC) to base of terminal bud (TB) in cm, and get a number with two decimals.

B. DBH: If tree is **taller than 1.3m (130cm)**, measure tree diameter at 1.3m (DBH) with calipers and record that measurement with one decimal. DBH = Diameter at Breast Height

2. Tell the recorder!
   Call out "Tree #6, total height 1.15 cm" and/or "DBH 6.00 mm".

EQUIPMENT

- Calipers
- 1.5 metre tape

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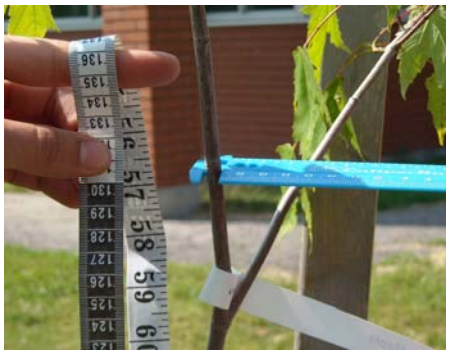
Figure 1: Measuring young tree Height

Figure 2: Measuring tree DBH when tree is taller than 1.3m



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WHITE TEAM

CROWN WIDTH
Young Trees

1. Stand close to the young tree so you can stretch the metre tape over the centre of the tree.

2. Find widest part of tree growth – the most space occupied. Remember to measure through centre of tree.

3. Measure horizontal distance across tree to outermost buds.

4. Repeat across tree at right angles to first measurement.

5. Record both crown readings in centimetres. e.g. 27.20 cm

EQUIPMENT

- One Metre Tape (1.5 m)

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Deciduous

Coniferous

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