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Planting for Change

ACER
Association for Canadian Educational Resources

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CLIMATE'S SAKE

Planting for Change Manual

ACER 2011©

This publication is part of ACER's Publications, Manuals Series.

This revised version of the manual focuses on the implementation of the Planting for Change program. It includes two sample school activities. More activities can be found from www.acer-acre.ca, under Resources - Resources for Teachers - Classroom Activities.

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Planting for Change

Introduction

This manual will guide you through the process of Planting for Change program, ACER's vision of creating tree research stations on schoolyards. We help schools create schoolyard planting sites in which to hold mini-climate change labs or classrooms that are an easily accessible teaching resource to complement curriculum. Students collect data on the health and yearly growth of their tree plantings as they explore issues surrounding climate change locally and globally. Hands-on involvement with the planting site throughout the process engages them and helps make the issues of climate change relevant to them at a level of complexity they can understand.

Teachers who want to address climate change and plant trees on their schoolyards can engage their students in this practical way. The outdoor classroom/lab supports geography, math, science, world studies and the new curriculum focus on climate change.

Objectives

All sites are treated in the same way on each schoolyard to minimize experimental variables. We can teach you how to participate and establish the plot with community support. These plots are part of a scientific experiment to study these trees. The sites are treated in this experiment to allow your students to compare results with other schools through the web. Planting for Change program will help you:

- √ Prepare the site according to ACER protocols
- √ Plant 15 trees to be measured annually
- √ Plant 45 shrub and 100 wildflower associates to protect the trees
- √ Monitor the trees annually to assess tree growth and success, and add to ACER database
- √ Link classroom activities to planting plot by encouraging the use of space by teachers
- √ Promote the program to other schools and encourage the reach of the experiment.



Deciding on Your Site

This is the most important decision. It will determine, not only the success of the project, but the ease in which it is implemented. Talk with administration and facilities managers/groundskeepers to make this decision. Check with future development plans of school, and with the physical education department regarding use of the area. Get permission from the school principal, who should contact the school board for permission (some may need to obtain a project approval from school board engineers – this can require months). Ask the facilities staff what areas of the schoolyard remain adequately moist during the driest season, and how to avoid high traffic areas. For the consideration of choosing a long-term monitoring site, the site should be:

- √ Free from shade by buildings or mature trees and shrubs
- √ Planned so that the planted trees do not obstruct views at intersections when mature
- √ Accessible by vehicle for deliveries of mulch and reachable by watering hose
- √ Relatively close to your building re: trips for forgotten equipment, washrooms etc.
- √ In an area where there is less wind exposure
- √ In the best soil and drainage available
- √ Away from overhead utility wires
- √ Checked for presence of underground lines - electricity, phone, cable, gas, water, sewer etc.
- √ A distance from the wires and road allowance to avoid pruning the mature trees.

Soil Testing

To determine which, if any, remediation measures should be taken, collect your samples using a soil auger and follow instructions of the professional labs, e.g. University of Guelph Laboratory Services. Each sample is a plug, which can be put into a separate labeled plastic bag until ready for mailing.

Field tests could be done using hand tests carried out by farmers and agriculture professionals to determine type, texture etc. Science lab lessons could include checking composition under the microscope, pH of water before and after filtration through sample, Petri dish swab for microorganisms, %moisture using crucible and %inorganic - weight of ash.

Preparing the Site for Planting

Plots in the Planting for Change experiment are a minimum of 400 m^2, but can be any shapes. Mark site boundaries with biodegradable paint, tent pegs, or a chalk line. Whatever you decide should not be dangerous to students. If the desired site includes existing trees and vegetation, leave adequate space for mature trees – at least as wide as tree/plant crown diameter, if not more. Order a site locate (time required for this is within 6-30 days of roto-tilling – locate lines will be washed off by lots of rain). Create a map to show the location and boundaries of the plot. Use in GIS or a sketch map with measurements of the schoolyard and site location. A scale map with legend can be created later.

Upon approval of site location, design the layout of the planting site. Be creative; ask for help from the city's parks and recreation department, local farmers, or contractors friendly to the project. One option is to use a roto-tiller to dig through the entire site at a depth of roughly 1 foot, and then turn the sod upside down. Grass competes with trees and shrubs for moisture and nutrients. Removal of grass is unnecessary; it will be mixed into the soil. After planting, mulch the whole plot. The other option is preparing the site as a park. Just dig holes at particular areas of the plot where the trees will be planted. The grass, which is dug out will be piled around the hole upside down. Leave the rest grass on site by covering it with newspapers or cardboard, and straw.

Species in the Experiment

The trees chosen for this experiment as indicators of climate change have a list of criteria to satisfy:

- √ Native to Ontario
- √ Able to grow in clay soils, in exposed, often dry areas
- √ Hardy to urban conditions
- √ Representatives of a range of species for teaching tree identification and taxonomy

The species chosen by our technical advisory team are basswood, hop tree, bur oak, sugar maple and white spruce.

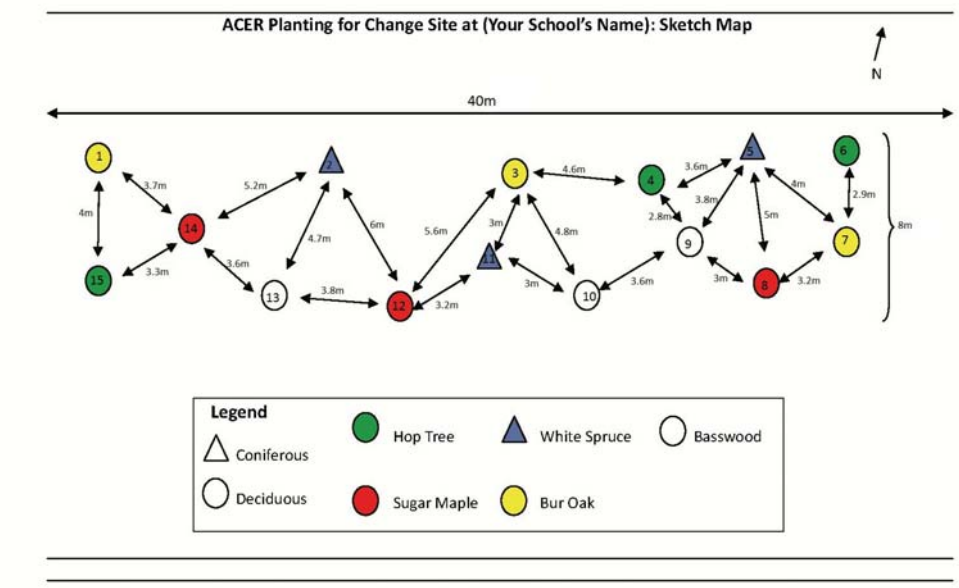
The hop tree was chosen because its native range ends at the northern-most tip of Ontario; white spruce was chosen as it is coniferous and thus representative of the tree group for teaching about trees, and it is also one that is expected to be sensitive to the warming climate predicted for southern Ontario. The other remaining species represent southern Ontario deciduous trees.

Fall planting is recommended as it avoids an intense summer maintenance program of watering and weeding. Watering is recommended for a few weeks after planting to allow the trees and shrubs to replace root hairs and prepare for winter.

Planting Design

Check the following charts of tree characteristics that we found important for designing the planting.

The suggested template for a plot is shown below. The measurements and coding are crucial to the planting teams and needed as the benchmark map for long-term data collection.



TREE ECOLOGY

Name	Flowering Time	Community Role	Forest community Membership	Notes
Basswood (*Tilia americana*)	June-July	Mixed stands, common on moist, NE facing slopes	Broadleaf forest of sugar maple, white ash, red oak and American beech	One of Ontario's most widely adapted species; tolerant of air pollution
Bur Oak (*Quercus macrocarpa*)	May	Dominant canopy species	Bur oak forest stands, common associates are northern pin oak, aspen, black ash, American elm, red maple, white oak, pin oak, sweet gum, and hawthorn	Fire resistant, often found on grasslands

Hop Tree (*Ptelea Trifoliata*)	June-July	Edge species	Shoreline communities in southwestern Ontario	Shrubby growth habit in harsh, exposed sites; good soils develop into tree form
Sugar Maple (*Acer saccharum*)	April-May	Dominant canopy species	Sugar maple bush, broadleaf forest dominant; common associates are basswood, beech, yellow birch, black cherry, red spruce	Does not like pollution, soil compaction, salt
White Spruce (*Picea glauca*)	May-June	Interior species; comfortable in open areas	Associates: white birch, trembling aspen, balsam fir, black spruce	Considerable genetic diversity (range of climates and growth forms). Found in almost all forested regions of Canada.

SITE PREFERENCES FOR TREES

Name	Moisture	Shade Tolerance	Soil Preference	pH
Basswood (*Tilia americana*)	Prefers moist areas	Very shade tolerant	Adapts to less desirable soil types but prefers moist drained, deep rich loam soils	Alkaline - neutral
Bur Oak (*Quercus macrocarpa*)	Drought tolerant, flooding intolerant	Moderately shade tolerant	Favors deep, rich sandy- loam bottomlands; can grow in limestone and in shallow soils	Alkaline - neutral
Hop Tree (*Ptelea Trifoliata*)	Drought tolerant	Moderately shade tolerant (only flowers in full sun)	Favors sandy soil; found in shore dunes and around woodlands in dry, rocky soil	Slightly alkaline - acid
Sugar Maple (*Acer saccharum*)	Prefers well-drained areas	Shade tolerant; quick release in sun	Deep, fertile, moist, well-drained soils (loamy sand); yet it does well on shield soils (likes lime); in clays only on dry uplands	Neutral - acid
White Spruce (*Picea glauca*)	Prefers moist areas	Shade tolerant; quick release in sun	Found in a variety of conditions; prefers rich moist soil	Acid - neutral

TREE GROWTH CHARACTERISTICS

Name	Bud Length (mm)	Height Median (m)	Height Range (m)	Spread (m)	DBH Median (cm)	DBH Range (cm)	Growth Rate	Life Span (yrs)	Anticipated Urban Lifespan
Basswood (*Tilia americana*)	5-8	26	18-35	13	100	40-60	Medium	140- 180	75 (based on stats for little leaf linden)
Bur Oak (*Quercusma crocarpa*)	3-6	16	12-30	26	90	60-120	Slow	200- 300	100 (based on stats for white oak)
Hop Tree (*Ptelea Trifoliata*)	n/a	7	4-8	3-5	15	8-20	Medium	Short-lived	Unknown
Sugar Maple (*Acer saccharum*)	6-12	28	18-35	13	90	50-150	Slow	150- 300	75 (away from compacted soil)
White Spruce (*Picea glauca*)	6	25	20-25	7	60	40-80	Slow - Medium	100- 200	75

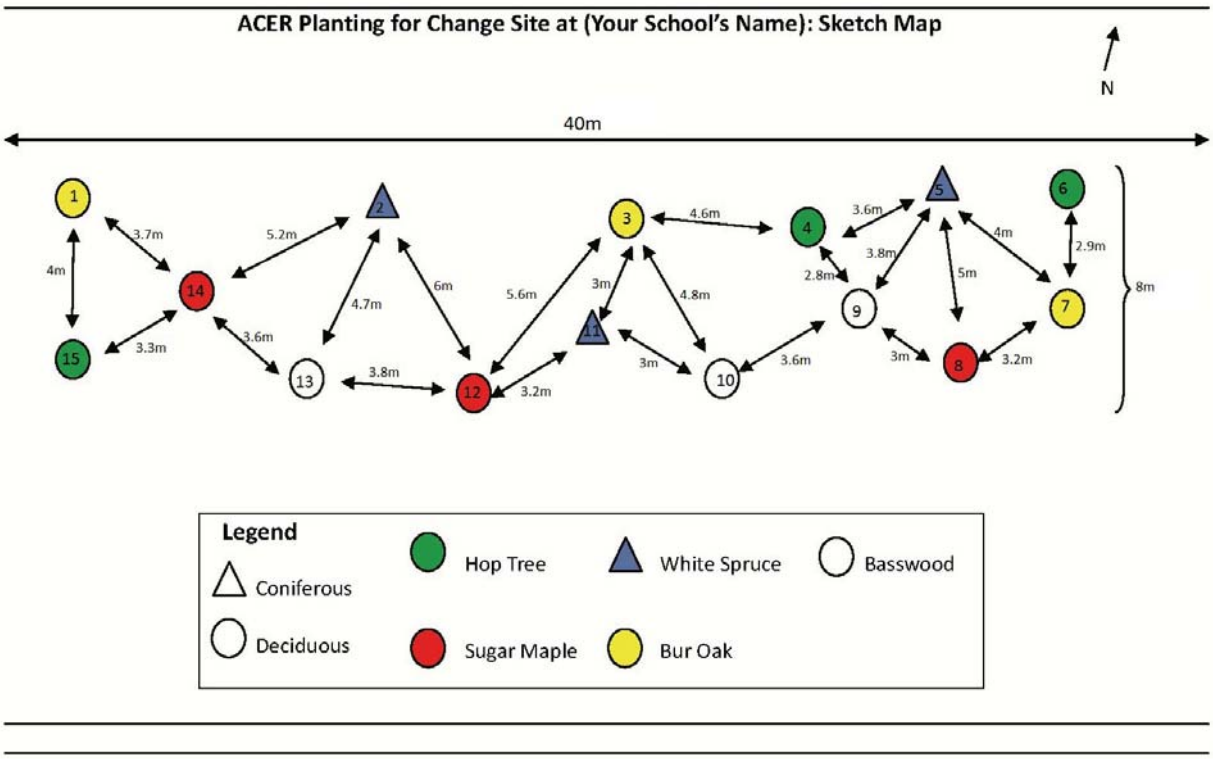
Species Arrangement

Create a mix of the 5 tree species. Have some groupings and generally stagger species position to create a mixed community. For example, group all white spruce together, but stagger maples and basswoods with hop trees, etc. ACER planting plots have used 5-8m spacing protocol.

Sugar maple should be placed in the middle as it is a sensitive tree to exposed conditions and is shade tolerant. Plant white spruce on north/north-west side of plot, they act as a windbreak for other trees. However, note that this can create areas for people to hide, which could be a safety concern if too close together depending on the plot's location on the schoolyard.

Another consideration is size - try mixing big and small tree groups – consider size in your planting arrangement. Crown canopies will overlap in the size of plot we're creating, that's fine, even desirable; tree crowns in forests always overlap. Lastly, your hop trees should be planted to the south if possible; however, they are a good understory tree, and if site size limitations call for it, separate and plant sporadically around site.

Your final planting diagram should look like the figure below. Make allowances for an obvious path through the plot for student traffic and to discourage stepping on flowers when one visits the plot.

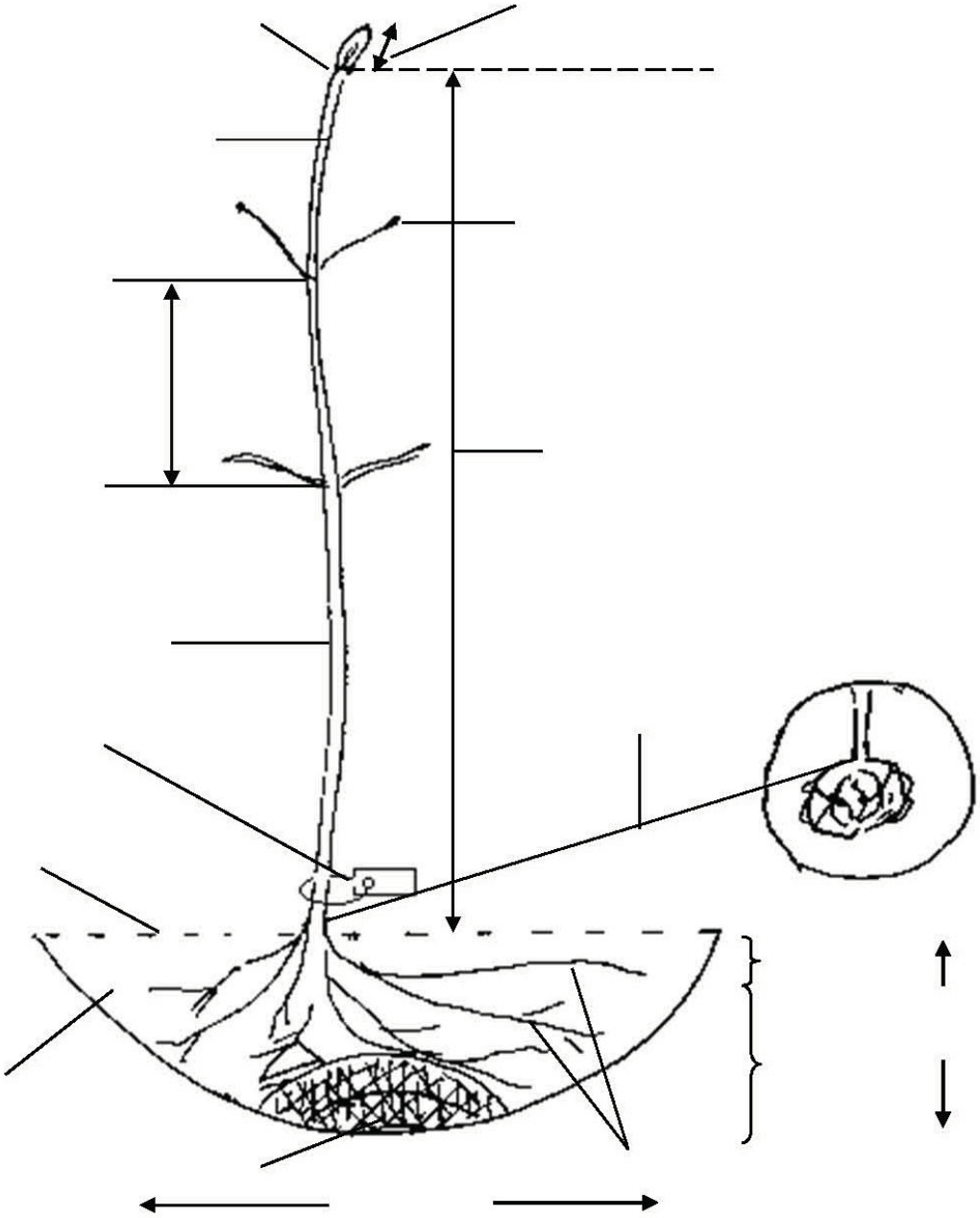


Background Activities on Tree Planting

Prior to participation in the planting event, students should have an understanding of:

- √ The anatomy of a plant, with particular attention to the root collar.
- √ Planting procedure: though this can be taught on the day of planting, your chances of having their full attention are much greater if you prepare them in the classroom first.
- √ Climate change: an overview of what the expected changes are, so that when they learn of the measurements taken, they have an idea of how expected climatic changes will link to a plant's desired climate envelope.
- √ Scientific method: the reason for the consistency and stringent planting requirements is to ensure a successful experiment.
- √ How to dress for the outdoors. You would be surprised at what students think appropriate attire is for working with heavy equipment and in muddy conditions.
- √ That what they are taking part in is an important experiment! It is incredible how many students come out to work on these sites and haven't been told why they are doing it, or their work is important.

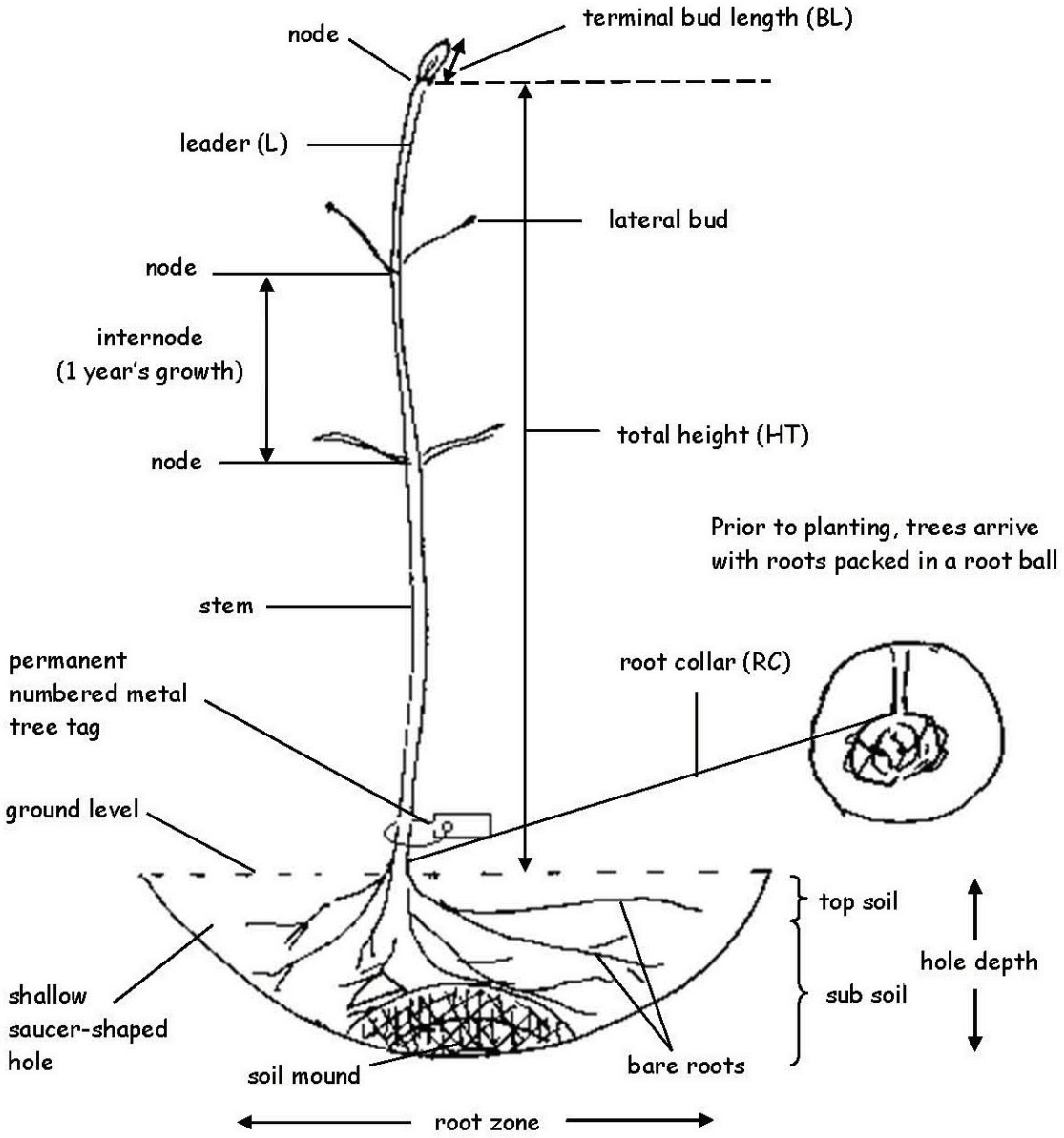
PARTS OF A NEW TREE - BLANK DIAGRAM



Here is a list of the parts for planting and measuring new trees.
Write down the labels in the proper spaces on the above diagram.

Root collar Terminal bud length Leader Lateral bud
Permanent numbered metal tree tag Ground level Stem Node
Total height Root zone Bare roots Internode
Shallow saucer-shaped hole Soil mound Sub soil Top soil
Hole depth

PARTS OF A NEW TREE - LABELLED DIAGRAM



Items to mention:

Root Collar: if covered with soil or mulch, the bark will rot

Ground level: Plant so that root collar is even with the ground

Tree tag: Identified to compare yearly measurements

Terminal Bud: controls growth form (short and bushy vs tall and lean) and leans plant towards light, delicate

Root zone: Roots grow out more than down. Typically grow at least as wide as the crown, often 2-3x as wide

80% of roots grow within the first foot of soil; good to prune/remove encircling roots prior to planting to prevent girdling

NATIVE SHRUBS ADDITIONS

To complete a plot and to protect the trees, we plant three native shrubs around each tree. The shrub planting protects the trees from extra traffic, stretches the variety in plantings and gives you more to enjoy through each season, especially when the trees are very young.

Three shrubs are planted in a triangular fashion around each tree to create a spatial barrier around the tree, which could protect the rooting area of the trees and reduce the soil compaction by trampling. Strategically place shrubs where they will fill in the spaces around the trees, around 1-2m away from tree base.

When you incorporate shrubs into your planting design, please use the shrub growth characteristics chart. Here are four of our native favorites chosen for variety of bark, flowering and leaves.

SHRUB GROWTH CHARACTERISTICS

Name	Height (m)	Habit	Plant with	Avoid Planting With	DBH (cm)	Flowering Period
Chokecherry (*Prunus virginiana*)	2-3 (can reach 10m)	Spreads underground, thicket forming	Bur Oak	Hop Tree	5-10	May-June
Bush honeysuckle (*Diervilla lonicera*)	<1	Low, upright shrub	Hop Tree, Sugar Maple			June-July
Red osier dogwood (*Cornus stolonifera*)	Up to 6	Tall, ascending, loosely spreading, can form thickets	Bur Oak, White Spruce			Late June
Ninebark (*Physocarpus opulifolius*)	Up to 4	Spreading, multi-branched	Basswood			June-July

BUTTERFLY PLANT AND WILDFLOWER ADDITIONS

To complete the plot, plan to fill the spaces between the young trees and shrubs and to provide another habitat experiment that is pleasing to the eye and does not welcome extra paths across it, we recommend planting butterfly friendly plants and native sun-tolerant wildflowers.

See the reference list for the book recommended by the Canadian butterfly expert John Powell who helped Professor Fred Urquhart tag monarchs as a young man and worked with plant growers like Greenway Bloom.

SUGGESTED WILDFLOWERS

Common name	Latin name
Coral bell	*Heuchera*
Salvia	*Salvia*
Silver mound	*Artemisia schmidtiana*
Lavender	*Lavender*
Spiderwort	*Tradescantia*
Rue	*Rue*
Yarrow	*Achillea*
Purple coneflower	*Echinacea*
Swamp milkweed	*Asclepias incarnata*
Sedum	*Sedum autumn joy*
Goldmoss stonecrop	*Sedum acre*
Jacobs ladder	*Polemonium*
Bugleweed	*Ajuga*
Butterfly bush	*Buddleia*
Phlomis	*Phlomis*
Gayfeather	*Liatris*
Geranium	*Geranium*
Aster	*Aster*
Hardy mums	*Chrysanthemum*
Black-eyed susan	*Rudbekia triloba*
Phlox	*Phlox*
Fleabane	*Erigeron*
Spike speedwell	*Veronica*
Maltese cross	*Lychnis*
Lupine	*Lupine*
Thrift	*Armeria*
Columbine	*Aquilegia*

Arrange the wildflowers, which are perennials, to complete the site so it is pleasing to eye and leaves little room for extra paths. Choose butterfly friendly plants to include both feeding and egg-laying favorites. Early successional meadow or sun-tolerant wildflowers will bloom and flourish until the trees you have planted provide enough shade. A few years later, shade-tolerant wildflowers can be planted to replace the sun-tolerant species.

The list of wildflowers in the project is too extensive to include all of their characteristics. The rule of thumb is to space them at least a foot apart, and in color matched groupings of threes. Spend some time with the grower and have the students research these flowers. Look at what their sizes are, when they are mature, whether they spread, and their bloom color. The students can use colored pieces of paper to plan their plantings and make a sketch map or scale map of their plantings.

EARLY SUCCESSIONAL MEADOW WILDFLOWERS

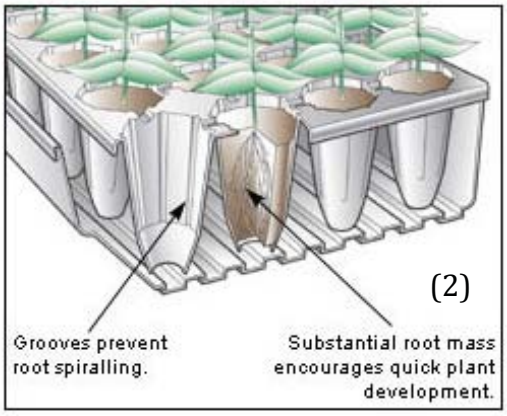
These may be purchased as seed and cultivated in the lab. This requires special effort as they are tiny seeds i.e. must be transplanted after germination and very regular watered (automated greenhouse) to cover holidays. Choose native wildflowers that are not on the invasive or exotic lists. The plants listed below may be purchased as seed from Pterophylla in our sources list. The deep-root seed starters from Lee Valley Tools are recommended since the plugs may be planted out in warm spring weather.

Deep-Root Seed Starters

(1)

Used by professionals in commercial nurseries, these deep-root seed starters have big cells with lots of rooting area to form transplants that grow faster than they would in regular cell packs.

The grooved sidewalls direct the roots straight down, discouraging root spiralling, which can happen in other containers. Each cell has an opening at the bottom that air-prunes roots and also lets you water from the bottom-up (from a capillary mat or flood table). Finished transplants slip out easily by pushing up through the bottom opening.



(2)

Note: (1) Sprinkle a layer of sand in the nursery tray.
(2) When the plants are big enough, they can be transplanted from the nursery tray.

EARLY SUCCESSIONAL MEADOW WILDFLOWERSGROWTH CHARACTERISTICS

Species	Description	Height	Color	Light	Water
Desmodium canadenese 	Showy tick trefoil is a tall native perennial. Leaves are clover-like, made up of 3 long-oval leaflets ½ - 4" long. Showy tick trefoil flowers are rose-purple and change to blue with age. The ½" blossoms occur in clusters atop hairy stems. This plant occurs in prairies and wet meadows and in open thickets.	4'	Rose-purple	Full sun/ Partial shade	Dry/ Medium
Oenothera biennis 	This biennial species commonly found in dry meadows and along roadsides gets its common name from its lemon scented yellow flowers that open at dusk and close by noon the next day. Seed will germinate upon sowing in a warm location. No pre-treatment is needed. Seed needs light to germinate so do not cover after sowing. Do not let soil dry out until seedlings are established.	2'-6'	Yellow	Full sun/ Partial shade	Dry/ Moist
Monarda fistulosa 	Noted for its fragrance this unusual and aromatic wildflower is a common inhabitant of sunny fields and woodland border areas. Bright lavender flowers are produced in clusters and attract lots of butterflies. Its strong stems are sometimes used by Indigo Buntings to build nests. Seed will germinate upon sowing in a warm location.	3'-5'	Lavender	Full sun/ Partial shade	Dry/ Medium
Ceanothus americanus 	This compact, dense shrub becomes covered with cylindrical clusters of tiny, fragrant white flowers. This is a great plant for attracting butterflies. The dried leaves were used as tea substitutes during the American Revolution, hence the common name. Hummingbirds are regular visitors, eating tiny insects that pollinate the flowers. Easily grown, the New Jersey Tea has thick, woody, red roots that go deep into the soil and help it withstand droughts.	2'-3'	White	Full sun/ Partial shade	Dry/ Medium
Rudbeckia hirta 	This is the best known of all wildflowers and is the easiest to grow. A single plant can produce an extravagant floral display over much of the summer, and planting is simply stunning in mass. A self-seeding biennial, it is not picky about soil conditions and will grow just about everywhere. It is excellent for butterflies. Rudbeckia grows best in full sun, but will tolerate partial shade. It prefers moist but not soggy soil and accepts a full range of soil types and pH levels. It grows naturally in prairies, dry fields and open woods.	1'-3'	Yellow	Full sun/ Partial shade	Dry/ Medium

Planting for Success

Trees may be purchased as bare root, ball and burlap or potted trees. The following photographs and planting instructions include techniques for all three. Please read through the entire sequence to see the techniques used to ensure the greatest success.

Remember that tree roots are relatively shallow and root hairs need water and air to survive. Planting to the depth of the root collar for the pot and burlap ball, or shallow bowl for bare root trees is a great guide to use while digging. Remember the root collar must end up level with the ground.

To prevent the rotting, soil and mulch should NOT touch the bark. Think of donuts and leave space around the root collar as a rain catcher. Load on the mulch to a depth of 10cm to prevent droughts and slowdown the weeds.

To protect the plant from rodents, deer, or other agents, wrap a tree guard around the base of the stem. When the trees are young, tree guards should be kept on site in all seasons, so that the small trees can be recognized by students to prevent trampling. When they are big enough, put on for the fall and winter. Remember to remove the tree guards and store them during the spring and summer seasons. Otherwise, in summer, bark will rot, and there tends to be insect eggs laid under the tree guards.

Planting Specifications

Planting Area & Depth:
•Actual hole is to be 2x as wide as pot, or 3x as wide if in clayey soils.
•Depth of hole is no deeper than depth of root mass in pot from root collar down.
•Root collar should be at ground level.

Rootball, Burlap, Twine:
•Cut and remove all wire, rope, burlap and twine from around trunk, and tuck burlap under root mass with a shovel (if not made of biodegradable material, remove entirely).

Planting Soil:
•Scarify edges of hole.
•Even mix of topsoil and soil from site.
•Hole to be backfilled and concurrently tamped (tucking in tree) to eliminate air pockets.

Watering Well/Soil Rim:
•Create a ring or donut of packed soil at edge of current tree roots.
•Donut should be around 10 cm high and thick.
•Soil level inside donut should be level/flat.

Mulching:
•7-10cm high, no closer than 3cm from root collar.
•Cover one-meter wide circle around tree.

Watering on Day of Planting:
•One bucket of water, after donut has been created.

Watering Schedule:
•Once a week in dry/well-drained soil until all leaves are dead in fall.
•Once every two weeks in clayey soil/sopping wet times.
•1 bucket of water per tree; fill soil mote completely and let water sink in.

Tree Tagging:
•Tag is loosely attached using cable ties.
•Measuring happens the day of planting, and every year following at same time of year.

Trunk Protection
•Wrap tree guard around tree in fall; remove in spring.
•Repeat every year.

Stakes and Ties:
•Stake immediately.
•Orient stakes to be in line with westerly winds, and drive in stakes just outside root zone.
•Tie trees with burlap, secured on post using a staple gun.

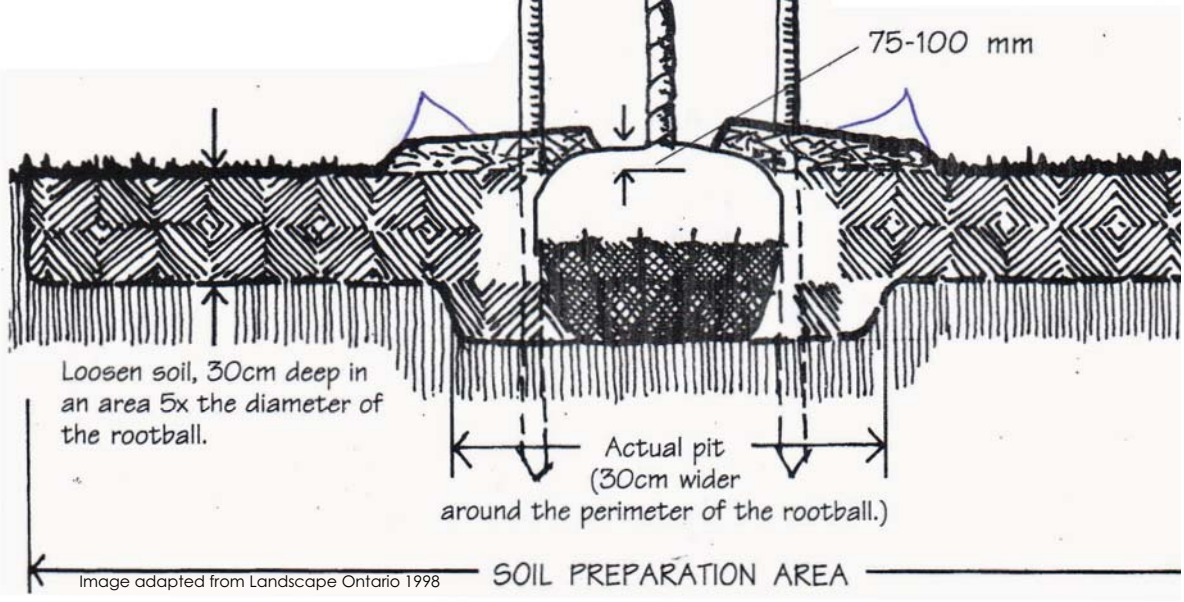
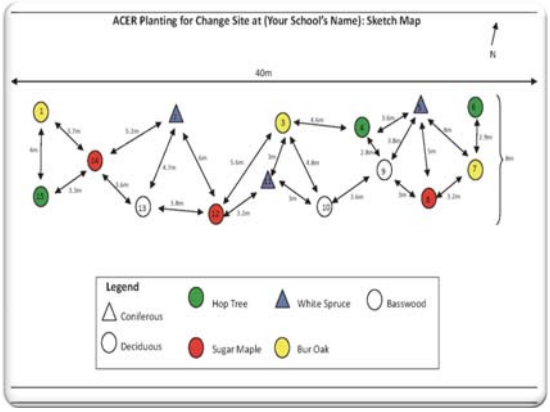
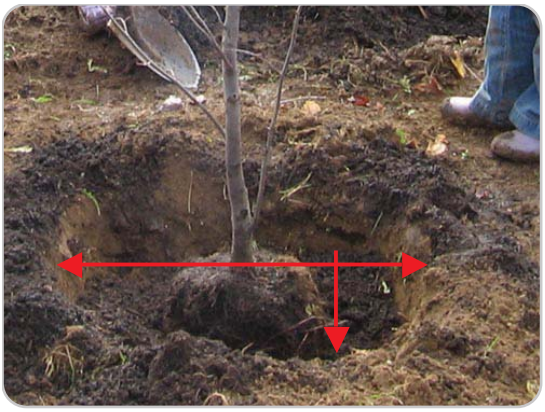


Image adapted from Landscape Ontario 1998



1. Ensure you are planting tree in proper spot. Check tree species and tree planting diagram; **Label** tree with species name and specimen #.



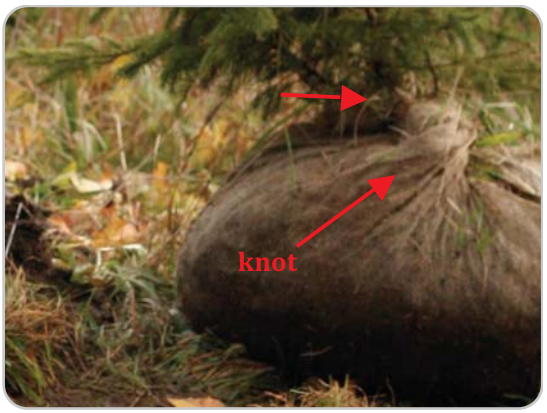
2. Dig a saucer-shaped shallow wide hole that is no deeper than root collar but at least twice as wide.

3. If the site has heavy clay soils, scarify hole by chipping slits in sides and base of saucer. Before putting the root ball back into the hole, fill the hole with a mix of site soil and topsoil.

4. A a) POTTED TREES To remove the tree from pot, turn the pot on its side, and gently press on pot with your foot to loosen the pot from the soil.

4. A b) POTTED TREES Hold the root collar firmly and lift pot up to tip the tree out.

4. A c) POTTED TREES Hold it by **root mass.**



4. B a) BALL AND BURLAP TREES Keep burlap on until you move tree into the hole. Hold one **hand on knot in burlap, the other on the root collar** above. Heave!

4. B b) BALL AND BURLAP TREES **Cut** burlap once in hole, **and tuck** under tree roots using your hands or shovel.

4. B c) BALL AND BURLAP TREES Prepare for planting **loosen roots.** Break apart/cut large encircling roots. **Spread roots out in hole as with BARE ROOT TREES.**

5. Back fill the hole, with an even mix of topsoil and site soil.

6. At halfway depth, **gently pack** the soil around the root carefully with the feet or fists, then continue filling the soil.

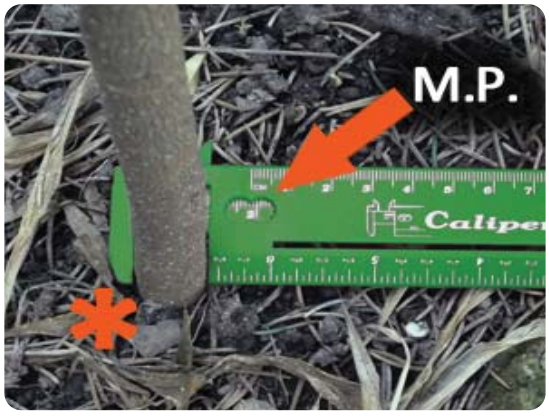
7. Check that tree is planted **straight up**, and **root collar will be level with the ground level**. **Create a soil rim 30 cm** out from root collar to retain water. Rim should be 7-10 cm high.

8. Water well: use a whole bucket for trees, less for shrubs and wildflowers. Fill each well with at least 3 inches of water.

9. Create a mulch circle 1m wide around the tree approx. 5 cm thick. Keep mulch from touching the trunk.

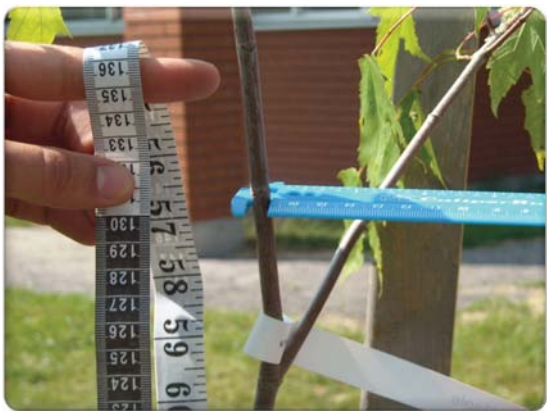
10. Protect the plant from rodents, deer, or other agents by wrapping a tree guard around the base of the stem. Attach tag.

11. Orient stakes to be in line with westerly winds, and drive in stakes just outside root zone. See Instructions for staking on pg 23.



12. Measure Root Collar Diameter (RC, in mm). Use graduated calipers. Read the measurement point (MP) in between the two circles. **Be gentle** so you don't scrape the bark.

13. Measure Total Height (HT, in cm). If tree is **shorter** than 1.3m tall, use the 1.5 meter tape to measure from root collar to base of terminal bud on the tallest leader. **If >1.3m tall, measure DBH instead.**



14. Measure Trunk Diameter (DBH, in mm) 1.3m from the tree base. Use the graduated calipers as seen in the root collar measurement above.

15. Measure Crown Diameter (W1, W2, in cm). Use the 1.5m tape and measure 2 widths at right angles horizontally. Choose the widest points of the tips of the branches.

16. Create a sketch map of your trees, using a measuring tape and trundle wheel. Determine plot size, tree spacing, and distance from prominent features. Write # of each tree in map.

Anecdotal Report

Date: _____
Photo #:_____
Teacher:_____

# of students:_____
# of adult volunteers:_____

Cloud condition:		cloudy/rainy/sunny
Temperature:		numerical or simply hot/cold
Animal sightings:		such as birds, or their presence (i.e.: droppings, nests, etc.)
Site conditions:		E.g.: Grass on site is brown and dry, evidence of drought conditions
Notable weather conditions:		Eg.:Early snowmelt this year – could mean drier spring conditions for trees. Very dry fall lead to early browning of leaves.
Tree status		Trees removed or replaced, new plantings, tag replacement, etc.

17. Write up **Anecdotal Report** to record how day went and weather conditions.

18. Take a group shot to commemorate the event!

19. On the anniversary of planting day, measure the tree growth and hold a **birthday party!**

NUMBERING PREPARATION FOR TREE TAG

Please check to make sure every tree will be accounted for. Tree numbers are spiral toward the center of the plot so that the highest tree number is in the middle of the plot.

Customized tags are made by ACER, e.g. HC 2008 11= Herb Campbell P.S., planted in 2008, tree number 11.

TAGGING THE TREE

When the planting is finished, permanent tags will be put on to replace the temporary color-coded wire flags.

The aluminum tag can be placed on a small plastic cable tie and then onto a larger one. The small ties need to be color coded for your planting. When the larger cable tie is placed at the base of the young tree, lots of room can be left for growth. The key is to keep replacing the cable tie as the trunk grows wider.

The tag will be seen in the donut of soil left next to the bark of the root collar.

Instructions for Staking Trees

Equipment

- √ Post pounder (ask grounds crew if they have one) - see it in the photo on left stake
- √ Staple gun
- √ Good scissors to cut burlap
- √ Ruler/measuring tape
- √ Burlap
- √ 2 stakes per tree

Orient stakes to be in line with westerly winds, and drive in stakes just outside root zone.

INSIDE PREPARATION

Use a roll of burlap from Timms, or cut strips of burlap that is sold by the yard 20cm x 1m then fold twice to a narrow, long strip to be tied about 2/3 of the height of the tree.

OUTSIDE WORK

1. Place posts just outside root ball of tree.
2. Orient posts in line with NW, to best protect from westerly prevailing winds.
3. Have one person tilt the post while in place to help person(s) lift post pounder over stake. Raise the post till it is vertical.
4. Lift approximately ½ foot and let drop repeatedly, until stake is a minimum of 1 foot deep in ground.

DANGER: There have been many injuries due to excessive lifting, over-enthusiastic lifts of post pounder so that it lifts off stake and injures user. Have two people remove post pounder, as this is also a dangerous time – grab your tallest participants to do this. People overestimate strength and lift it too high above their heads, letting the pounder fall behind them. **Very dangerous!**

5. Wrap burlap strips around tree; choose a spot approximately 2/3 height of the tree i.e. high enough to warrant stabilizing and low enough to prevent snapping with strong winds (see diagram on Page 17).
6. Twist burlap to form a figure 8 or tie a loose knot in between stake and tree.
7. Wrap around post and attach to post with a staple gun. You may use the goggles provided in the BioBag to protect your eyes.

Congrats! You have staked your tree! Remember tree guards are put on for the fall and winter and removed and stored for the spring and summer.

LAUNCH

Make this a big party for everyone to celebrate the beginning of a long-term commitment to climate change.

To involve the school and community, plan a public launch for planting day. Invite all the people who helped make the program possible. Include other teachers, custodial staff, volunteers, suppliers, clubs, organizations and elected officials. Give credit where credit is due. Invite the local press so that they can tell the story.

A portable podium, a red ribbon to cut, one tree to finish planting and a birthday cake all make for great pictures. Take pictures by yourself and have student photograph team take more. The students like to pose to celebrate their great work. Include yourself and those who helped in your pictures.

Make sure that photo waivers are obtained for all the students involved so the best pictures can be posted on the web with your school data.

BIRTHDAY PARTY - ONE YEAR LATER AND BEYOND

Each year on the anniversary of your planting day, the last year's growth is measured and recorded. On this day hold a birthday party to celebrate another successful year's growth.

Enter the data and use the calculations to determine the changes in growth. Analyze the differences overall and by species. Check the website to compare with other schools.

Celebrate the seasons with photo contests or other events that support school activities and invite the community volunteers to help at each opportunity. Planting for Change is a community-learning center for hands-on learning about climate change.

Mark the calendar each year at the first sign of green leaves and first bloom to start tracking the phenology. Timing data for the long-term monitor is vital to climate change modeling to predict our future.

Maintenance

Watering after planting is crucial to success. Choice of location includes access to water. A hose might be purchased if there is an outside tap within range; otherwise it is bucket brigade or rain barrel.

The level of mulch on top of the plot is critical to retaining moisture so more may be needed. Have the mulch delivery drop it as close as possible to the plot. Make arrangements to have summer care through sign ups of volunteers – e.g. one student/staff/family per week over the summer. Fall and spring clean up days are useful to keep interest and ownership alive. The school-designed plaque for the plot enhances this as well. Seating for outside classes can be incorporated in or beside the design, and this makes short assignments in weeding possible.

Weed Recognition and Removal

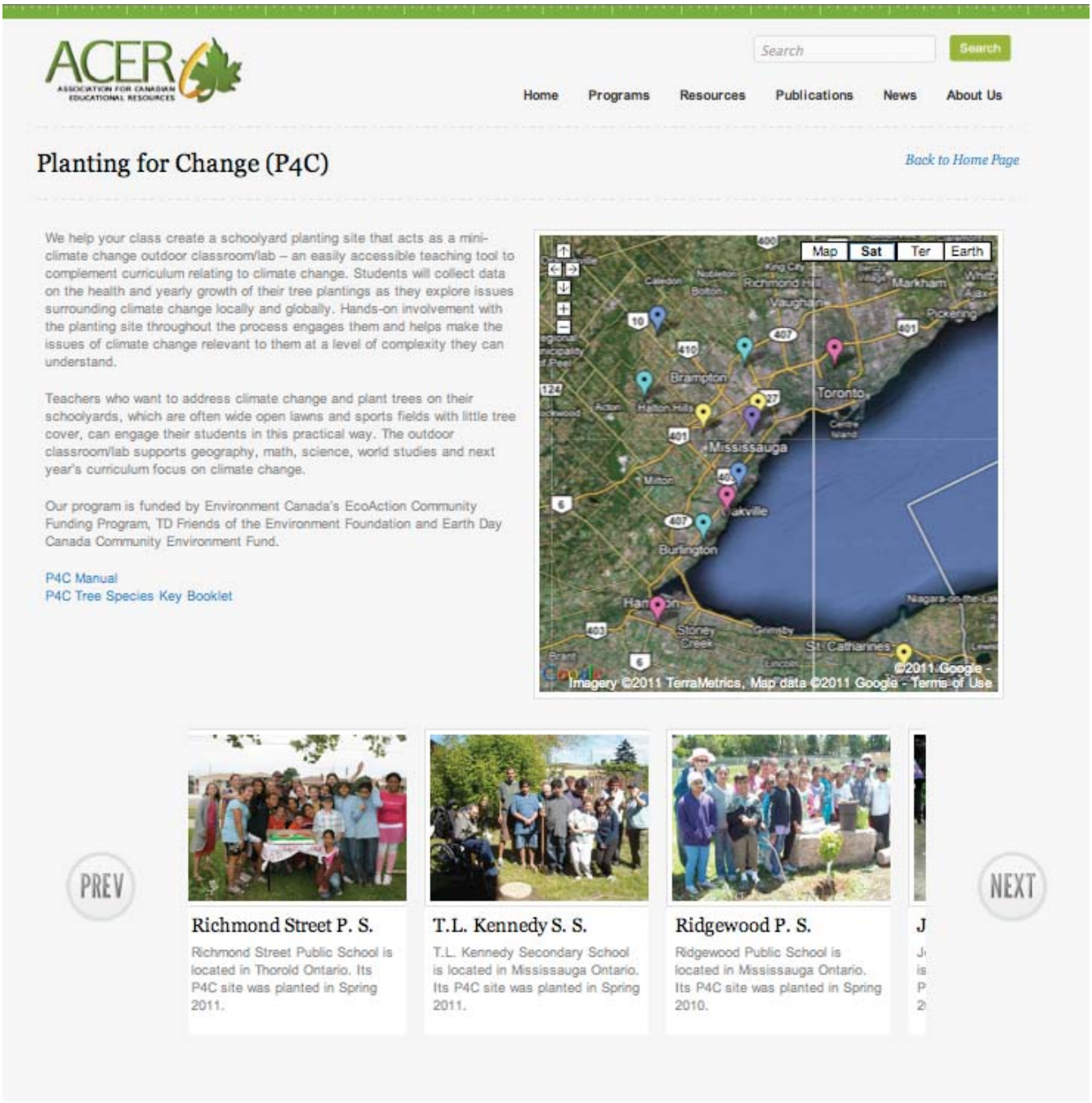
Before seed pods are ripe or flowers go to seed, pull by the root collar and ensure that the entire root is removed. It may be necessary to dig out the root to ensure you have it all e.g. dandelions.

Place whole weed in black garbage bag and leave to cook in the sun to kill the seeds.

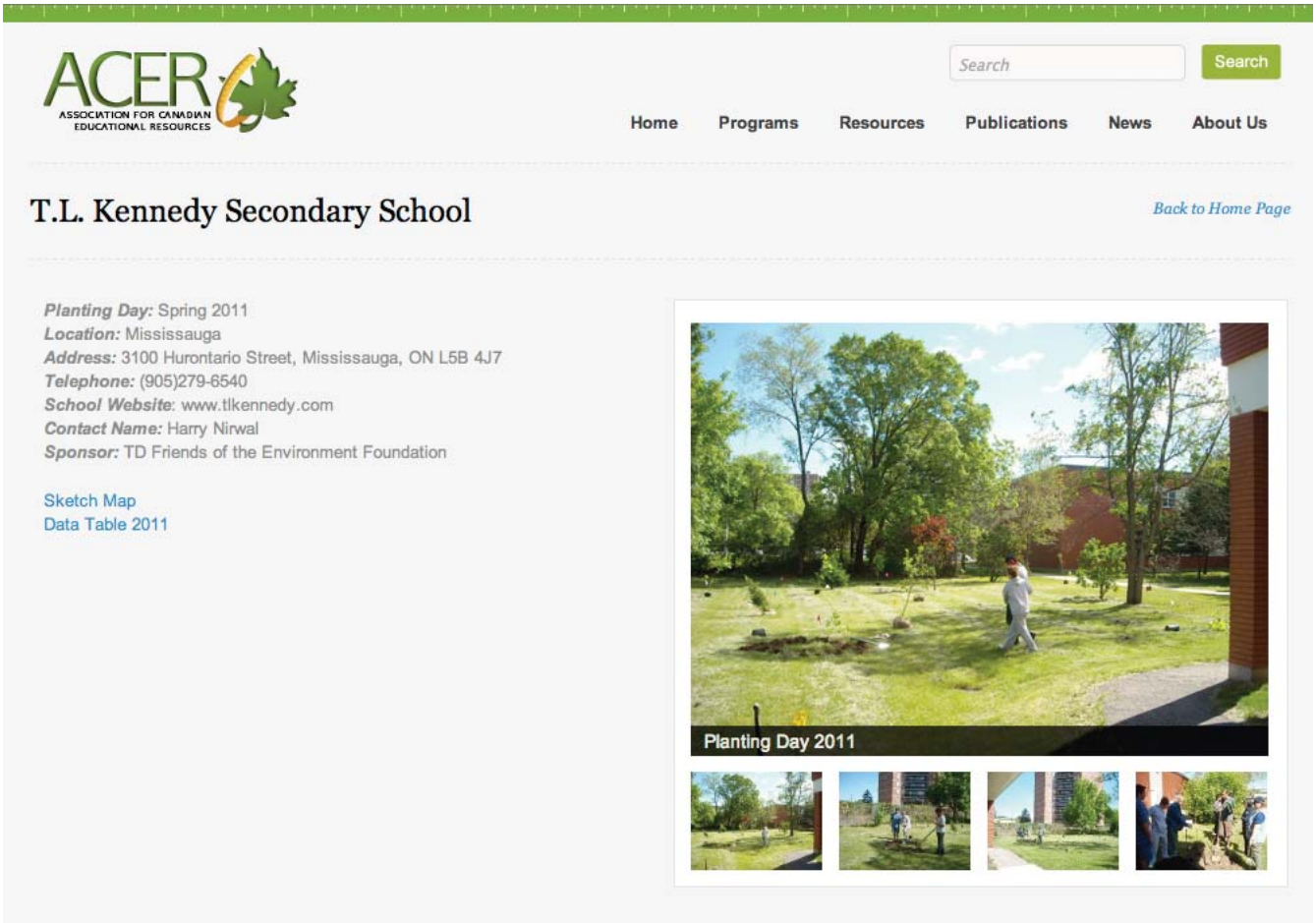
Never put in your compost pile until cooked over the summer as seeds may still germinate.

Planting for Change Website

Below is the snapshot of Planting for Change website at acer-acre.ca.



Each school involved in Planting for Change program, will have its own sub webpage, where specific planting information, photos, data and data comparison are posted and shared globally.



REGULAR DATA SHEET

Students can download the data collected from their schoolyard. They can also compare their data with other schools.

SMALL TREES DATA SHEET (<4 CM DBH) TRIANGULATION

DATE: June 28, 2011 SCHOOL: Richmond St Public School STUDY AREA: _____

NAMES: _____ GPS NW CORNER N _____

Tags: RS-01-2011 W _____

** If tree is > 1.3 m tall, measure diameter at 1.3 m high (DBH) instead of height. If tree is <1.3 m, take height measurement and omit DBH

Description		Location			Measurements						Diagnosis	
Equipment & units used		Side #	Line a (0.00m)	Line b (0.00m)	Calipers (0.00 cm)	30 Meter Tape (0.00 cm)	Calipers (0.00 m)	1.5 Meter Tape (0.00 cm)		Ruler (0.00 mm)		
Tree #	Common Name Latin Name				Root Collar	Total Height **Ht	Diameter at 1.3 m **Ht	Crown Diameter W1	Crown Diameter W2	Bud Length	Health Check (See codes below)	Comments
1	Bur Oak				19		9	43	37		A	
2	White Spruce				38		8	78	80			
3	White Spruce				45		8	69	55		A	
4	White Spruce				44		12	62	54		A	
5	Basswood				24	126		51	48		A	
6	Bur Oak				18		10	41	44		A	
7	Bur Oak				19		7	61	37		A	
8	Hop Tree				26	126		47	63		A	
9	Sugar Maple				17		5	39	30		A	
10	Basswood				24		3	49	33		A	
11	Sugar Maple				22		5	39	43		A	
12	Hop Tree				37		5	141	124		A	
13	Hop Tree				30		14	67	53		A	
14	Sugar Maple				24		7	26	26		A	
15	Basswood				27		5	38	41		A	
16	Red Maple				14		5	41	35		A	

S = basal sprouting **Tag M** = tag missing **Tree M** = tree missing

CUMULATIVE DATA SHEET

Cumulative data sheet is prepared for the data collection, i.e. each column has blank space next to first measurement column for entering in the new data beside it. The students can immediately see how their measurements compare to the previous year.

SMALL TREES DATA SHEET (<4 CM DBH)

DATE:_____ SCHOOL: Guido De Bres C.S STUDY AREA: _____

NAMES:_____ GPS NW CORNER_____

W _____

** If tree is > 1.3 m tall, measure diameter at 1.3 m high (DBH) instead of height. If tree is <1.3 m, take height measurement and omit DBH

Description		Location		Measurements										Diagnosis		Comments	
Equipment & units used		(GPS) UTM UPS units		Calipers (0.00 mm)		1.3 Mr Tape (0.00 cm)		Calipers (0.00 mm)		1.5 M Tape (0.00 cm)							
Tree #	Common Name/Latin Name	North	West	Root Collar		Total Height **Ht		Diameter at 1.3 m **Ht		Crown Diameter				Health Check (See codes below)			
				2010	2011	2010	2011	2010	2011	W1 2010	W2 2010	W1 2011	W2 2011	2010	2011	2010	2011
GDB-1-2010	Basswood			29				15		35	37			A		2 Little Branches Missing	
GDB-2-2010	Hop Tree			58				21		175	160			A			
GDB-3-2010	Sugar Maple			39				18		96	104			A			
GDB-4-2010	Basswood			30				16		34	24			A			
GDB-5-2010	Bur Oak			34				17		68	68			A			
GDB-6-2010	Hop Tree			29				14		119	100			A			
GDB-7-2010	White Spruce			42		58				54	60			A			
GDB-8-2010	Sugar Maple			32				21		61	42			A			
GDB-9-2010	White Spruce			42		100				64.5	63			A			
GDB-10-2010	White Spruce			33		88				59	56			A			
GDB-11-2010	Bur Oak			17				21		26	47			A			
GDB-12-2010	Basswood			29				16		54	29			A			
GDB-13-2010	Sugar Maple			34		96		19		94	60			A			
GDB-14-2010	Hop Tree			32		123				119	126			A			
GDB-15-2010	Bur Oak			28				16		55	43			A			

S = basal sprouting **Tag M** = tag missing **Tree M** = tree missing

CUMULATIVE DATA MANAGEMENT SHEET

The cumulative data management sheets can be used to facilitate the data analysis. Students can do some calculations to answer questions about the data collected so far, e.g. average the 3 trees of each species, which species have grown the most? The least? Put them in order of greatest to least growth. What could be some of the reasons that there is a difference between individual trees in one species as well as between species? Finally, they can understand the growth condition of their tree plantings and what species are quite successful to survive through the global warming.

Herb Campbell P.S. Planting for Change 2008/2009 Tree Data Comparison

Tree #	Common Name	Scientific Name	RC 2008 (mm)	RC 2009 (mm)	Difference (09-08) (mm)	Height 2008 (cm)	Height 2009 (cm)
HC1	Basswood	*Tilia americana*	42	30	-12	*	*
HC2	White Spruce	*Picea glauca*	34	39	5	*	*
HC3	White Spruce	*Picea glauca*	39	34	-5	120	*
HC4	White Spruce	*Picea glauca*	41	36	-5	119	*
HC5	Basswood	*Tilia americana*	21	26	5	*	*
HC6	Basswood	*Tilia americana*	31	30	-1	*	*
HC7	Sugar Maple	*Acer saccharum*	25	27	2	*	*
HC8	Bur Oak	*Quercus macrocarpa*	31	35	4	*	*
HC9	Bur Oak	*Quercus macrocarpa*	17	15	-2	*	*
HC10	Hop tree	*Ptelea trifoliata*	22	23	1	*	*
HC11	Basswood	*Tilia americana*	36	40	4	*	*
HC12	Hop tree	*Ptelea trifoliata*	31	34	3	*	*
HC13	Hop tree	*Ptelea trifoliata*	17	15	-2		126
HC14	Sugar Maple	*Acer saccharum*	16	20	4	*	*
HC15	Sugar Maple	*Acer saccharum*	29	30	1	*	*

Legend
RC= Root Collar
HT= Height
* (HT >130cm) then do DBH at 130 cm
BL= Bud length
Cw- Crown Width
DBH = Diamter at Breast Height

Year Planted 2008
First year growth = (2009-2008)

Data Analysis Activities

ACER prepares some data analysis activities for schools, so the students can learn and practice the data analysis before planting. After acquiring data from their own planting site, they could analyze them in the same way.

BACKGROUND

Trees are living organisms. They grow upwards and outwards, adding new wood each year, expanding in volume. Trees add new tissue at the tips of their branches, which is called primary, or extension growth. They also expand outwards, adding another annual ring to the entire outer layer of the tree, which is called annual growth. The data gathered in this exercise must be gathered over long periods of time (3 or more years), in order to draw conclusions. Long-term data gathering is not unusual as trees mature at 20-40 years depending on species.

ACTIVITY

The following data were collected for 3 years. To determine the health of your schoolyard forest, we will analyze the collected data.

First, fill in the height column for each monitoring year. Calculate the height of the tree by using the Angle – Tangent - Height table. Find the correct degrees on the chart under the

"Angel' column. Find the upper angle height and lower angle height and add the two heights together.

Fill in the cumulative data sheet to analyze the status of the schoolyard forest. Group all tree species together, and record tree height, diameter and health status.

INFORMATION TO HELP WITH ACTIVITY

Health Assessment Codes

Category	Codes
Status (ST)	(5) healthy/alive, (3) dying, (1) dead
Stance (STN)	(5) erect, (3) leaning, (1) prone
Mechanical damage (MD)	(5) none, (4) bark, (3) broken major limbs/root, (2) top breakage
Defects (D)	(5) none, (4) minor, (3) animal browsed, (2) insect damage, (1) diseased
Foliage state (FS)	(5) all green, (4) mostly green, (3) half green, (2) few green, (1) none

Angle – Tangent – Height Table at a Horizontal Distance of 20 Meters

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	1.000	20.00
4	0.070	1.40	18	0.325	6.50	32	0.625	12.50	46	1.036	20.72
5	0.087	1.60	19	0.344	6.88	33	0.649	12.98	47	1.072	21.44
6	0.105	2.10	20	0.364	7.28	34	0.675	13.50	48	1.111	22.22
7	0.123	2.40	21	0.384	7.68	35	0.700	14.00	49	1.150	23.00
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	24.70
10	0.176	3.52	24	0.445	8.90	38	0.781	15.62	52	1.280	25.60
11	0.194	3.88	25	0.466	9.32	39	0.810	16.20	53	1.327	26.54
12	0.213	4.26	26	0.488	9.76	40	0.839	16.74	54	1.376	27.52
13	0.231	4.62	27	0.510	10.20	41	0.869	17.38	55	1.428	28.56
14	0.249	4.98	28	0.532	10.64	42	0.900	18.00	56	1.483	29.66

1ST MONITORING

Description		Location Coordinates			Height (clinometer and tangent table)			DBH	Health				
Tree #	Common name	N	W	Eye-tree Distance (30m tape)	Upper angle /Ht (0.00m)	Lower angle /Ht (0.00m)	Total Ht (0.00m)	Diameter tape (0.00 cm)	ST	STN	MD	D	FS
13	Oak	14° 50.223'	007° 32.653'	20m	24 / 8.90	17 / 6.12	15.02	20.30	5	5	5	5	5
1	R. Oak	43° 56.708'	087° 12.591'	20m	23	15		20.40	5	5	5	5	5
2	R. Oak	43° 56.708'	087° 12.590'	20m	21	13		19.30	5	5	5	5	5
3	R. Oak	43° 56.708'	087° 12.589'	20m	29	19		22.50	5	5	5	5	5
4	S. Maple	43° 56.708'	087° 12.585'	20m	15	9		16.20	5	5	5	5	5
5	S. Maple	43° 56.706'	087° 12.583'	20m	17	10		17.60	5	5	5	5	5
6	S. Maple	43° 56.704'	087° 12.583'	20m	16	8		15.50	5	5	5	5	5
7	S. Maple	43° 56.696'	087° 12.583'	20m	13	7		10.90	5	5	5	4	5
8	R. Oak	43° 56.690'	087° 12.585'	20m	31	15		23.20	5	5	5	5	5
9	S. Maple	43° 56.690'	087° 12.588'	20m	17	8		15.40	5	5	5	5	5
10	R. Oak	43° 56.690'	087° 12.590'	20m	33	17		25.10	5	5	3	5	5
11	W. Pine	43° 56.690'	087° 12.591'	20m	8	4		8.40	5	3	5	5	5
12	W. Pine	43° 56.690'	087° 12.592'	20m	7	3		7.50	5	3	5	3	5
13	W. Pine	43° 56.700'	087° 12.593'	20m	9	5		9.20	5	3	3	2	5
14	R. Oak	43° 56.705'	087° 12.593'	20m	23	15		18.30	5	5	2	4	5
15	W. Pine	43° 56.709'	087° 12.583'	20m	8	1		6.40	5	5	3	4	5

2ND MONITORING

Description		Location Coordinates			Height (clinometer and tangent table)			DBH	Health				
Tree #	Common name	N	W	Eye-tree Distance (30m tape)	Upper angle /Ht (0.00m)	Lower angle /Ht (0.00m)	Total Ht (0.00m)	Diameter tape (0.00 cm)	ST	STN	MD	D	FS
13	Oak	14° 50.223'	007° 32.653'	20m	24 / 8.90	17 / 6.12	15.02	20.30	5	5	5	5	5
1	R. Oak	43° 56.708'	087° 12.591'	20m	24	16		21.30	5	5	5	5	5
2	R. Oak	43° 56.708'	087° 12.590'	20m	22	14		20.90	5	5	5	5	5
3	R. Oak	43° 56.708'	087° 12.589'	20m	31	20		23.10	5	5	5	5	5
4	S. Maple	43° 56.708'	087° 12.585'	20m	16	10		16.80	5	5	5	5	5
5	S. Maple	43° 56.706'	087° 12.583'	20m	19	11		17.90	5	5	5	5	5
6	S. Maple	43° 56.704'	087° 12.583'	20m	17	9		16.10	5	5	4	5	5
7	S. Maple	43° 56.696'	087° 12.583'	20m	15	8		11.30	5	5	5	4	5
8	R. Oak	43° 56.690'	087° 12.585'	20m	33	16		24.30	5	5	5	5	5
9	S. Maple	43° 56.690'	087° 12.588'	20m	18	10		16.10	5	5	5	5	5
10	R. Oak	43° 56.690'	087° 12.590'	20m	34	18		26.20	5	5	3	5	5
11	W. Pine	43° 56.690'	087° 12.591'	20m	8	5		8.50	5	5	5	5	5
12	W. Pine	43° 56.690'	087° 12.592'	20m	7	3		7.50	3	3	3	3	3
13	W. Pine	43° 56.700'	087° 12.593'	20m	9	5		9.20	3	3	3	3	3
14	R. Oak	43° 56.705'	087° 12.593'	20m	25	17		19.40	5	5	2	4	5
15	W. Pine	43° 56.709'	087° 12.583'	20m	8	1		6.30	5	5	3	4	5

3RD MONITORING

Description		Location Coordinates			Height (clinometer and tangent table)			DBH	Health				
Tree #	Common name	N	W	Eye-tree Distance (30m tape)	Upper angle /Ht (0.00m)	Lower angle /Ht (0.00m)	Total Ht (0.00m)	Diameter tape (0.00 cm)	ST	STN	MD	D	FS
13	Oak	14° 50.223'	007° 32.653'	20m	24 / 8.90	17 / 6.12	15.02	20.30	5	5	5	5	5
1	R. Oak	43° 56.708'	087° 12.591'	20m	26	18		22.10	5	5	5	5	5
2	R. Oak	43° 56.708'	087° 12.590'	20m	25	16		21.10	5	5	5	5	5
3	R. Oak	43° 56.708'	087° 12.589'	20m	33	22		23.90	5	5	2	2	4
4	S. Maple	43° 56.708'	087° 12.585'	20m	18	11		17.50	5	5	3	2	4
5	S. Maple	43° 56.706'	087° 12.583'	20m	20	12		18.40	5	5	2	4	3
6	S. Maple	43° 56.704'	087° 12.583'	20m	18	10		16.90	5	5	2	5	1
7	S. Maple	43° 56.696'	087° 12.583'	20m	17	10		12.50	5	5	3	2	1
8	R. Oak	43° 56.690'	087° 12.585'	20m	35	18		25.60	5	5	4	4	1
9	S. Maple	43° 56.690'	087° 12.588'	20m	19	11		18.10	5	5	5	3	1
10	R. Oak	43° 56.690'	087° 12.590'	20m	35	19		27.30	5	5	5	5	1
11	W. Pine	43° 56.690'	087° 12.591'	20m	8	5		8.60	5	5	4	4	5
12	W. Pine	43° 56.690'	087° 12.592'	20m					1	1	1	1	1
13	W. Pine	43° 56.700'	087° 12.593'	20m					1	1	1	1	1
14	R. Oak	43° 56.705'	087° 12.593'	20m	27	19		19.70	5	5	5	4	4
15	W. Pine	43° 56.709'	087° 12.583'	20m	8	1		6.30	5	5	4	4	5

CUMULATIVE MONITORING SHEET

Tree #	Latin Name	Common Name	Height 0.00m				Diameter 0.00 cm				Status Score /25				Healthy?
			1st	2nd	3rd	G?	1st	2nd	3rd	G?	1st	2nd	3rd	G?	y

- √ √ indicates growth from the 1st to 2nd and 2nd to the 3rd monitoring periods for each set of data; a blank indicates stability or decline
- √ to decide the health status, a score of 20-25 score very healthy; 15-19 fairly healthy; 10-14 borderline healthy; 4-9 is stressed; 3 dead
- √ y (yes) indicates the overall growth (G?) and health of the tree.

REFLECTION QUESTIONS

1. Is there any pattern to the data? If yes, what is the pattern that you see? Give 3 explanations for why this pattern might exist.

2. Which of these species is healthy? Which species is in decline?

3. What kind of problems does the Urban Forest have to contend with, in order to survive?

WORK PLANS

Planting for Change First Steps	Respon-sibility
1. Locate a teacher who is passionate about this project – a "green spark".	A
2. Meet with teachers. Talk and walk with them through the project - on site tour of possible locations, the criteria, e.g. water source should be near enough to the street, truck is able to reach it, easily seen by all in the community and the school, not too far from your classroom, access to shovels, gloves, wheelbarrow etc.	A
3 Have the teacher check who else in their school would be a partner in responsibility - caretaker, principal, other teachers in departments or divisions, parents, environmental clubs, etc.	S
4. Hold a meeting with presentation to allow other participants to ask questions, including master gardeners, etc.	S
5. Appoint an official photographer to track the events at the plot. Set up a site binder as a diary of activities to build the site history. Include photos, media, clippings and data etc.	S
6. Research the other resources available – shops, parent council, master gardens, municipality forestry or parks and recreation etc.	S
7. Choose best 2 locations – pace off 20mx20m or equivalent 400m^2 to make sure you have enough room – you may stake it or mark it with washable paint – have "Locator One" and other utilities checked it out. If OK, then proceed – if not then check out second site.	AS
8. Design your site planting plan - remember these will be large mature trees in an area of 20mx20m - but any shape. Trees at the edge of the plot can offer a large shade area.	S
9. Line up soil or seasoned compost and mulch from the school board, city forestry, or local tree company for wood chips. Have delivery included.	S
10. Prepare site for planting. Remove the grass by digging to turn the sod upside down. Or leave the grass on site by covering it with newspapers or cardboard, and straw; only dig out the grass where the trees will be planted. The grass competes with the trees and shrubs.	S
11. Report back your plans to ACER.	S
12. Soil delivery day – if possible put the soil in the middle or at the edge so it is easier to spread in area. Have equipment ready for each class to help during the day. The equipment list is provided in the manual.	S
13. Place the mulch on the side by the middle of the plot so less carrying to do for each class after planting.	S
14. Train the staff/adult volunteers to plant properly. Remember the tug test! Photocopy the plot design, pace off the distances or use the trundle wheel and use wire flags - color coded by species - to mark where the trees are to be planted. Cable ties are	A

color coded so use same color for the 5 indicator species. These species were chosen by the ACER technical advisory committee to be planted at all participating schools so that the results can be reported, compared, analyzed and shared each year.	
15. Three shrubs will be planted around each tree leaving space to put in wooden 2x2x6 feet stakes for burlap ties for the winter.	AS
16. Several layers of newspaper will be put in before the mulching. Mulching should leave central hole of the donut for rain catchment and for easier tree guard installation.	AS
17. Planting day/Launch party. Organize the school effort; check the photos and instructions in the manual. Add photos and testimonials to the binder as you go.	AS
18. If you have a spring planting, please order enough mulch – lots – to retain moisture for the summer months. And more for the fall winter months – best results to date have been double mulched due to our intense summer heat and snow reduced winters. Changing climate is here! If you have a fall planting, order more in the spring so again a double mulch program in the early years.	S
19. Train the staff and students to have measurements taken and recorded in ACER's template. These are emailed to ACER along with the 3 best photos. Make sure the photo waiver(s) has been signed.	AS
20. Invite the VIPS from school, school board, city, parent groups, local newspapers etc. for cutting the red ribbon, serving cake etc. cup cakes would be a good idea to same more trees. Lots of photos. Plan afternoon photo-op so most of the work is done.	AS
21. Set up summer maintenance program with watering and weeding with students. One family or team per week. Ensure they can identify the weeds vs. shrubs. Picture books may help as well as your site binder documents.	S
22. Advertise your accomplishments to the school and community and know why this is being undertaken. Check out ACER's website to ensure photos, testimonials and data are posted.	S
23. Make sure you check the mulch levels, and order more for the second season.	S
24. Document the event in the site binder, and include how you organized it, for future use.	S
25. Prepare data entry sheets for cumulative data collection, i.e. each column has a blank space next to the first measurement column for entering in the new data beside it. The students can immediately see how their measurements compare to the previous year.	AS
26. Organize a one-year birthday celebration when carrying out the measurements of the first year's growth. Invite everyone so all may enjoy the work to date and envision the future.	S
27. The cumulative data management sheets have some calculations to be done for analysis to answer questions about the data collected so far, e.g. average the 3 trees of each species, which species have grown the most? The least? Put them in order of greatest to least growth. What could be some reasons for differences between individual trees in one species as well as between species? Research the needs and potential of each species.	A
LEGEND A: ACER S: SCHOOL AS: ACER and SCHOOL	

6 MONTHS BEFORE

Complete	Date	Tasks	Notes
		Site selection according to ACER criteria (ask everyone affected – including physical education and maintenance staff)	See Page 4
		Find project partners in school	
		Organize permissions from school board	
		Measure and mark plot generally minimum 400m^2	You can use chalk line or tent pegs, and even biodegradable spray paint to demarcate plot
		Alert office about locater request to map underground cables and pipes	They will have to direct locaters to tree planting plot.
		Soil test (consider texture and drainage more than fertility)	Use sampling protocol and send it to the lab

1 – 2 MONTHS BEFORE

Complete	Date	Tasks	Notes
		Start volunteer supervisor recruitment	Through school's PTA, school newsletter, etc.
		Tell local city councilor and other green organizations that that you are organizing event	Consider on site supervision support, and assistance with mulch and roto-tilling
		Arrange for mulch donation for the day of planting	Ask city parks departments, local hardware stores, and city councilors
		Arrange roto-tilling for digging out grass in the whole plot, as deep as possible (approx. 1 foot desired)	Cannot be done by hand, grass is mixed in; the alternative option is just digging holes where the trees will be planted.
		Create planting diagram using size constraints of trees involved; determine path	See Page 8-9 for size constraints
		Decide on path and materials	Check map and distances
		Decide on delivery dates for soil, mulch and plants	Plant and mulch on the same day

2 WEEKS BEFORE

Complete	Date	Tasks	Notes
		Read over description of tasks to be performed	
		Send home parent info regarding clothes and event	Work boots (no sandals, will get mucky)
		Plan supervisor training in planting techniques and safe equipment handling	
		Invite yearbook to take photos of event. Sign the waivers for the photos	
		Plan ribbon-cutting ceremony	Set aside last tree to be planted, and invite all press, important guests
		Let custodians know of event a few days before and ask for their help preparing for mess/clean up	Set up mats, have a hose by the door to wash shoes, etc.

DAY BEFORE

Complete	Date	Tasks	Notes
		Ensure plants delivered; water plants	Make sure there is a safe place to lock them overnight
		Ensure soil delivered next to the site	Place is so easy to get spread
		Arrange planting equipment and teams	
		Organize tree measuring clipboard and sketch map clipboard; pack BioBag& camera	
		Read over planning documents for tomorrow; copy plot design	Design the site by placing color-coded wire flags. Make team copies of planting design

PLANTING DAY

Complete	Date	Tasks	Notes
		Organize jobs and equipment according to checklist	
		Trees planted, mulched, tagged and measured	
		Wrap tree guards, stake trees and install burlap ties	

POST-PLANTING

Complete	Date	Tasks	Notes
		Set up watering system and weeding schedule	

Equipment Checklist

Determine your equipment needs based on the teams of students you've organized, and use the job list. If it's a hot day, please consider the need for water, and if you could have a couple of chairs nearby for exhausted volunteer supervisors, that might be a good idea. Gloves are especially important on cold days, and it may be a good idea to bring a few extra pairs of boots. Often there are extras in the lost and found box.

Equipment	Contact	Source	Phone	Ordered date	Delivery Date
Broom (to sweep up mud tracked onto school pathways)					
Mats (to clean shoes before tracking mud into school)					
Gloves (each pair per participant plus a few extra)					
Buckets (for spreading mulch and watering)					
Watering hose					
Regular shovels (pointed) to dig holes					
Square tipped shovels (for cutting through the sod)					
Trash cans					
Wheelbarrows					
Metal rakes (comb-like head)(to spread soil and clean up grass edges)					
Water for volunteers					
Trowels (if extra digging equipment is needed - flower holes are small enough that we can use these)					
First aid kit					
Post pounder					
Stakes					
Burlap					
Staple gun					
Good scissors (to cut through burlap)					
Tree tags & cable ties					
Clipboard with data sheet & sketch paper					
BioBag					
Camera					

Jobs in Planting for Change

Initials	Jobs: in order of occurrence	Number of participants	Who	Job Description
	Organizers	2 minimum	supervisor	
	Planting instructor	1	supervisor	
	Flag trees and write sp. name on flag	2	supervisor	
	Flag spots where trees go	2	supervisor	Mark out tree planting positions with color-coded wire flags
	Arrange trees	4-6	students	
	Wheelbarrow runners, to dump wheelbarrow of soil by flag	5 (including shovelers)	students	Strong to balance and push it. Two wheelbarrows full of soil brought to tree planting spot. One wheelbarrow for creating raised bed level to dig towards and one for infilling and creation of tree well.
	Rake soil to be 1/2 foot deep	1	student	Level 1st load to ½- ¾ foot high soil mound at the site of tree planting hole. Dig hole to level of root collar including added soil.
	Tree planters	majority	students	Plant trees according to planting arrangement diagram; create soil donut around trees and water.
	Organize shrubs in sp. groupings	2	students	Facilitate distribution of shrubs by organizing species
	Place shrubs in threes around each tree	4-6	students	Use shrub arrangement chart to determine planting locations
	Waterers	6-8	students	1 bucket of water per tree; water only after soil rim has been created
	Arrange flowers and place where hole is to be dug	3	students	The soil can then be spread starting from center of plot, working in tandem with flower planters, ensuring there is enough soil to plant flowers properly
	Flowers Planters	majority	students	Arrange flowers spaced at least a foot apart, according to expected sizes; water.
	Mulchers	6-8 (including bucket fillers)	students	Spread mulch first around trees, shrubs and fill in gaps after.
	Tree taggers	3	students	Follow ACER protocol for tree numbering; Make sure entered on data sheet by ID
	Mappers	3	students	Clip board and accuracy needed; include tree #s.
	Rakers	1	student	Spread soil and clean up grass edges
	Tree guard installers	4	students	Careful not to break off buds and branches
	Stake pounder	2 minimum	supervisor	To depth of one foot or 1/3 meter min
	Tie burlap strip on tree to form a figure "8"	2	students	To hold trees in place in wind - 2 years

How to Make a Sketch Map

Here is the rubric for a proper sketch map.
Ratings are done by (I) Individuals, (P) Peers, and (T) teachers.

Map Rubric for Quality	**I**	**P**	**Comments**	**T**
Criteria				
Title •Neatly printed title at the top of the page •Highlighted inside a box or underline •Clearly stated purpose of the map				
Frame •Correctly drawn with a ruler •Accurately joined right angled corners with no joining marks				
Outline Shape •Accurately drawn to true likeness				
Labels •Neatly printed horizontally •Accurately done •No missing or misspelled words				
Compass Rose •Accurately pointed compass •Rose oriented to North •Effectively measured				
Scale •Clearly visible and easily understood • Accurately measured				
Legend • Logically positioned legend frame within the map •Correctly capitalized centered title				
Legend Set of Colors •Appropriately used to indicate area/feature				
Legend Text •Neatly completed words •Accurately aligned to symbols and colors				
Appearance				
Correctly used colors throughout				
Carefully done coloring/shading to be consistent				
Creatively stimulates interest and captures attention				

ACER Planting for Change 2011

Teacher's Package

Welcome to ACER's **Planting for Change** program. Thank you for volunteering! To best prepare the planting, we send you this confirmation package with all that is needed to get ready for the planting.

This ACER project is **unique** because it is a science-based monitoring program with the species and design of the planting chosen specifically to monitor climate change. As part of the program your class will plant 16 trees and 45 shrubs for the use of further growth monitor. After the planting, your class will be taught how to measure the trees they have planted. The data they gather will be entered into ACER database and shared globally. Your work is very important and highly valued.

PRE-PLANTING PREPARATION

Before the planting, the teacher should:

1. Make sure that the students know they will be in the field all day carrying out planting, tree care work and measurements as part of the climate change monitoring program.

2. Make sure the students have some basic skills, know the vocabulary and have or be prepared to learn these skills:

- √ How to measure in mm, cm, meter with a measuring tape and caliper
- √ How to record data in a table according to the headings
- √ How to observe and record comments on the status and health of these trees.

Note: All the school activities can be found at acer-acre.ca website, under Resources-Resources for Educators-Classroom Activities.

3. **Write a letter** to parents providing them with necessary information about this planting event: purpose, date, times, location, transportation mode and cost (if any). The permission form requesting a consent signature and medical information (i.e. allergies, health number, etc.) should include a **photo waiver** so that pictures of the activities can be posted.

4. **Inform the students** to pack a knapsack with a water bottle and lunch and to dress in **appropriately** for the weather conditions and for working outdoors for the full day. (waterproof shoes or boots, mitts, hats, lightweight and/or windproof jacket, layered tops, warm pants etc.). Remember, clothes get dirty from kneeling, digging and measuring.

NOTE: No gum, food (other than lunch), MP3 players, or iPods allowed on site.

I hereby give the Association for Canadian Educational Resources (ACER), its licensees and legal representative the irrevocable right to use my picture (with parental consent if under 18 years of age) and photograph and video in all forms and media and in all manners for advertising or any lawful purpose for the benefit of ACER only. ACER disclaims any responsibility for such unauthorized use of my published image. I understand that I will receive no compensation, should any photographs of me be used.

I have had sufficient time to review and seek explanation of the provisions contained above, have carefully read and understood them, and agreed to be bound by them. I voluntarily and irrevocably give my consent and agree to the release.

_____

Date

_____	_____	_____
Name of Student (please print)	Signature	Email
_____	_____	_____
Parent's Name (please print)	Signature	Email

MEASURING OUR RESOURCES

This is a project in which the students measure trees in their schoolyard as well as monitor the local effects of a globally changing climate. ACER developed a set of field activities and assessments as a second cross curriculum program in which teachers are helped to map their own school property using GPS coordinates to create QGIS digitized maps. Our program enhances curriculum in mathematics, literacy, science and geography by involving core learning in grades 7-12. It builds interpersonal communication skills, as the project requires extensive teamwork by the students.

Students participate in a field study to collect and manage authentic data, which enhance knowledge of climate change.

This program can be incorporated into lesson plans and meets the academic standards in the Ontario Curriculum. For example:

- √ Develop map-making skills
- √ Use GPS technology to locate trees
- √ Measure perimeters and diameters; understand graphs and tables
- √ Plant growth and adaptations, ecosystem functions, weather and climate
- √ This program is adaptable to small green spaces, such as boulevards, parks, churches and naturalized areas.

LET'S PLANT, MEASURE AND MULCH

This project offers teachers and community groups a chance to relate science to technology, society and the environment at an "Outdoor Climate Change Laboratory" located at the Humber Arboretum. The project includes planting new trees in restoration areas, maintain the existing forests, monitor their progress, record and report data. Over 3000 students have been involved in planting, measuring and mulching in ACER's urban Climate Change Laboratory in the Humber Arboretum below Humber College North Campus in the northwest corner of Toronto. Beginning in 2002, trees representing 76 species and 2100 specimens were chosen and measured annually during May and October. These trees were planted by students and volunteers in scientific biodiversity-sensitive designs to study the success rate over the long term in a warming global climate.

Students from Grade 7 to Grade 12, environmental club members, new Canadian professionals and recent university graduates work with ACER to collect data for analysis. Data are provided to students, scientists, foresters and the public.

Let's Plant, Measure and Mulch provides a unique opportunity for students beginning with Grade 7 to broaden their understanding of scientific investigation.

Students are encouraged to participate and relate their experience to the fields of biology, geography, mathematics, science and technology, environmental studies or world issues.

GO GLOBAL

This program is a network of one-hectare plots, which demonstrate the effectiveness of local monitoring and reporting of environmental change in long-term forest biodiversity monitoring programs. Community groups are helped to establish their own one-hectare forest plots and taught to measure locally and report globally. This is an international program that uses standardized methods to better understand global ecology.

Since 1996, ACER has helped school groups and communities set up permanent forest monitoring plots in Ontario with a variety of partners.

Monitoring what is changing, and how fast it is changing in our forests puts climate change in context.

ACER is currently establishing 2 hectares with the Niagara Parks Commission as part of "Yes, We CAN" project.

YOUTH STEWARDSHIP PROJECT

This is a project created to hire and train local youth under supervision to maintain and enhance natural areas by learning the protocols to remove invasive species, inventory the remaining native species and their regeneration followed by a fall event of community planting of native species to restore the area. Data collected track the growth and health of the trees.

Useful References

Bissonnette, Dan. *Native Seed Identification & Cultivation Guide*. Windsor: The Naturalized Habitat Network, 2009.

Calkins, Carroll. *Illustrated Guide to Gardening in Canada*. Canada: Readers Digest, 1975. Print.

Farrar, John L. *Trees in Canada*. Markham: Fitzhenry & Whiteside Limited, 2006.

Heimburger, Margaret L. & Soper, James H. *Shrubs of Ontario*. Toronto: Royal Ontario Museum, 1982.

Newcomb, Lawrence. *Wildflower Guide*. New York: Little, Brown & Company, 1977.

Stokes, Donald & Stokes, Lilian. *Butterfly Gardens*. United States: Library of Congress Cataloging-in-Publication Data.

Waldron, Gerry. *Trees of the Carolinian Forest*. Toronto: Boston Mills Press, 2003.

SOURCES OF PLANTING STOCK AND ACCESSORIES

- √ Buckets - School cafeteria
- √ Butterfly Plants - Greenway Bloom: flowers@greenwaybloom.ca
- √ Burlap, Tree Guards - Timm Enterprise Ltd.: sales@timmenterprises.com
- √ Soil, Triple Mix - Earth Co. Soils: 416-789-4749 www.earthcosoils.com
- √ Mulch - local forestry department
- √ Mulch - Ontario Hydro: customercommunications@hyrdoone.com
- √ Soil Testing – University of Guelph: www.labservices.uoguelph.ca
- √ Shrubs, Wildflower Seeds - Petrophylla: 519-586-3985
- √ Stakes - Cooksville Lumber: 905-279-6101
- √ Trees - Baker Forestry Services: bakerforestryservices@hughes.net
- √ Trees - Maple Leaves Forever: 416-255-0385