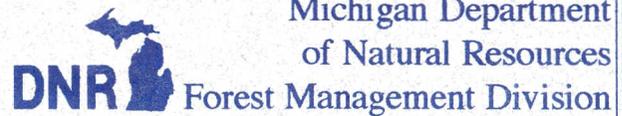


ORGANIZING A SCHOOL TREE PLANTING PROJECT



USDA Forest Service
State & Private Forestry
Northeastern Area



**ORGANIZING
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by
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Botanical illustrations of leaf, flower, & fruit from Barnes, Burton V. & Warren H. Wagner, Jr. *Michigan Trees: A Guide to the Trees of Michigan and the Great Lakes Region*. Ann Arbor: The University of Michigan Press. 1981.

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School Plantings

per class period.

If the children will be putting the trees into the holes themselves, use containerized rather than balled-and-burlapped trees. Containerized trees are smaller and lighter, and easier for children to handle. Save the balled-and-burlapped trees for high school students.

If you must plant balled-and-burlapped trees, see if the school maintenance staff or a local landscaping company will volunteer to dig the hole and site the tree in the hole for you. The students can then backfill the hole, and place the mulch. Try to see that each child has a chance to put dirt in the hole.

Bring hand trowels instead of shovels for the children to use. Put the backfill soil in a wheelbarrow in front of the hole, and have the children form a line on each side of the wheelbarrow. Everyone gets to put two trowels of dirt in the hole. This is particularly effective with children in the primary grades, and can accommodate the participation of handicapped children in wheelchairs. Older youngsters can place the mulch after the soil has been tamped down by an adult volunteer.

Middle School Plantings

Middle-school students can handle shovels and rakes. Allow them to backfill the hole themselves, tamp down the backfill with their shovels, and put the mulch in place. Caution them, however, about the possibility of rapping someone in the head with the shovel or rake handle if they get too close to one another. Again, see that all the kids have a chance to help.

Tool Safety

Many of today's students have little expe-

rience using shovels and rakes. Because they can hurt themselves and one another, discuss tool safety in class prior to planting day. Review and demonstrate on planting day.

Appoint one student as *tool manager*. Give the tool manager a clipboard with the "Equipment for Planting Day" form attached, and place him or her outside the planting area. The tool manager should check to see that all shovels and rakes are marked with the owner's name. Use a permanent marker if the tools haven't already been marked.

All **shovels and rakes**, when not in use, should be placed on the ground next to the tool manager, **face and tines down**. This gets idle tools out of the planting area, and limits the



possibility of students tripping over them.

When all the trees have been planted, the tool manager is responsible for seeing that all tools are returned for pick up by their owners.

When you discuss tool safety, explain the

importance of placing shovels and rakes with the face or tines down. If the tines of the rake or face of the shovel are facing up, a youngster can step on them, causing the rake handle to flip up and slam him or her in the forehead. When you demonstrate this as part of your planting demonstration, it makes a graphic impression on the students. You might, however, want to try it at home first to see just how fast the handle flips up when you step on the tines, as you must be prepared to catch it before it whacks **you** in the head!

Senior High School Plantings

Senior high school students are not as grown up as they want to believe they are. Sometimes ninth graders can't manage balled-and-burlapped trees without adult assistance.

If The Kids Dig The Hole

If it's not possible to get the holes dug ahead of planting day, the kids may end up performing this chore. If this will be the case, decrease the number of trees you plan to plant. *Hole digging is the single most exhausting part of tree planting.* The soil under the sod of most school buildings built within the last twenty years is a heavy clay, loaded with discarded pieces of broken brick, soil pipe, extra mortar, and other detritus of the building process.

If it befalls your senior high students to dig the holes, have them dig to the depth they think is adequate by comparing the hole depth to the depth of the root ball. When they think they have the two depths identical, tell them to come and get you (or another adult volunteer) for the final measurement **before** rolling the ball in the hole. This will provide a better chance for the trees to be planted at the proper grade.

The Classroom Presentation

Middle and senior high school students have a tendency to listen to half of the planting instructions (or listen halfheartedly to all instructions), and then run off in as many directions as you have trees to plant. Such are the vicissitudes of being neither child nor adult. You can counteract the short attention span of middle and high school students by making a classroom presentation before planting day.

Discuss proper planting procedures as part of your presentation, and simply review on planting day. Illustrations for overhead transparencies of the planting diagram in *Global ReLeaf of Michigan's Planting Guide* and other materials you may find helpful for a classroom presentation have been included at the back of this booklet.

During the classroom presentation, discuss the safety procedures that the students will need to know. Specifically mention placement of rakes on the ground with the tines down, the rotation of the trunk as the ball is rolled in the hole, the danger of cuts from the wire basket after the wire has been severed, removing the nails or staples used to hold the burlap in place around the ball, and so on. (See "Uncovering the ball," p. 13.)

A Landscape Plan

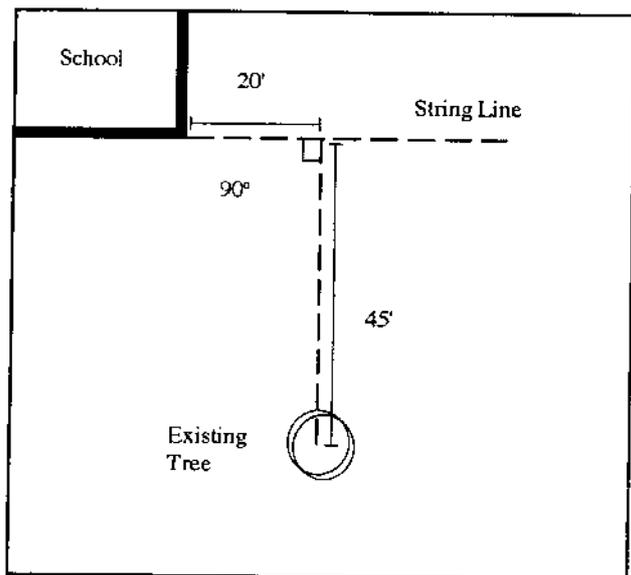
You may find that there is a landscape plan for your school that assigns particular species to particular spots, but the funds have not been available to implement all of the plan. If so, the landscape plan will limit the tree species you can choose.

If there is no landscape plan, the students have an opportunity to draw one up for either the entire grounds, or for the section they will be

School Plantings

planting. This requires some hands-on measuring with measuring tapes, and converting the measurements to gridded paper. It provides a real-world opportunity to teach ratio and proportion, and so can involve the math instructor. You may also wish to bring the art or drafting instructor on board to present a lesson on transferring the measurements, buildings, and existing vegetation to gridded paper. Developing a landscape plan could also be assigned as an independent study project for advanced students. (See Michel, 1983 for additional information.)

Senior high school student councils sometimes plan school tree planting projects as a one-time event. As the juniors become seniors, however, they often wish to continue the tree planting



project the following year. If the students develop a landscape plan for the high school grounds, a multi-year project can be seen in its entirety. Each class can plant one section of the plan, and at the same time see how their contribution fits in with projects past and future. Without a landscape plan, tree placement is often haphazard and an opportunity to apply math, art, and botany

concepts to a realistic, multi-disciplinary, multi-year project is lost.

Place sidewalks, play areas, ball fields, and buildings on the plan with the proper measurements. If you don't have access to long measuring tapes, the children can pace off the distances between street and sidewalk, sidewalk and building front, and so on. To place existing vegetation on the landscape plan, extend the building line out with string, and measure the distance of the tree at a 90 degree angle from the string base line.

Have the class determine what species of tree they want (or can) plant, and what is the diameter of the crown at maturity. For example, red maple's average mature height is 50' and crown diameter is 40'. This means that a red maple must be planted at least 20' (the radius of a 40' diameter) away from the side of a building. Red maple shouldn't be planted near or under 20'-high power lines either. Because trees have differing heights and widths at maturity, as well as differing soil requirements and salt-tolerance, it is important to have the students do some research before selecting the trees they want to plant. References listed in the appendix will help, or the class can contact the county soil conservation district or extension agent for assistance with species choice.

During your classroom presentation, if weather permits, walk the class around the school grounds pointing out overhead wires, fire hydrants (they signal buried water lines), and the species of trees already planted and doing well. (Tree species already sited and growing well indicate soil and irrigation conditions. The students may want to add other trees of the same genus.)

You can also point out the sizes of potential planting areas and suggest some appropriate species. If the students will be drawing up the planting plan, tell them what their budget is, and give them a range of tree costs. They can then determine how many trees to include in their plan.

What Does One Wear to a Tree Planting?

Give the students some idea of what to wear for a tree planting beforehand. Digging and backfilling holes is dirty work. Suggest the students wear comfortable clothes that they won't mind getting dirty or wet. If the weather will be cool, remind the students to dress in layers. Try giving a small prize on planting day for the most appropriate tree-planting or "urban logger" costume. Let the students pick the winner.

Man

I keep you warm on freezing winter nights
I am your shade from scorching summer sun
The roof-joints of your house, your table's board
I am the bed in which you sleep at night
The wood of which your mighty ships are built
I am your pick axe shaft, your cabin's door
The wood of your cradle and your coffin
I am the bread of goodness, flower of beauty
Answer my prayer: Do not destroy me.

Unknown

A Schoolyard Does Not a Forest Make

Everyone knows that to get an oak tree, all you need do is plant an acorn. What could be simpler? Squirrels do it all the time! Fortunately for both squirrels and oak trees, this kind of natural planting usually takes place in forests untrammelled by 300 students running across the lawn at recess. There are some differences between forest and urban tree growing conditions.

Where The Roots Are

Not too long ago, we pictured the tree below ground as a mirror image of the trunk and branches above ground. Recent research by dendrologists (scientists who study tree roots) shows that our old mental picture was inaccurate. Tree roots grow in the upper 6 to 12 inches of the soil where oxygen and water are found, and where the soil structure is loose enough to allow root penetration. Instead of growing as deep as the tree is tall, the roots spread out in this upper layer, to a distance 2 to 3 times the diameter of the crown. The illustration below shows how the tree's roots relate to crown diameter.

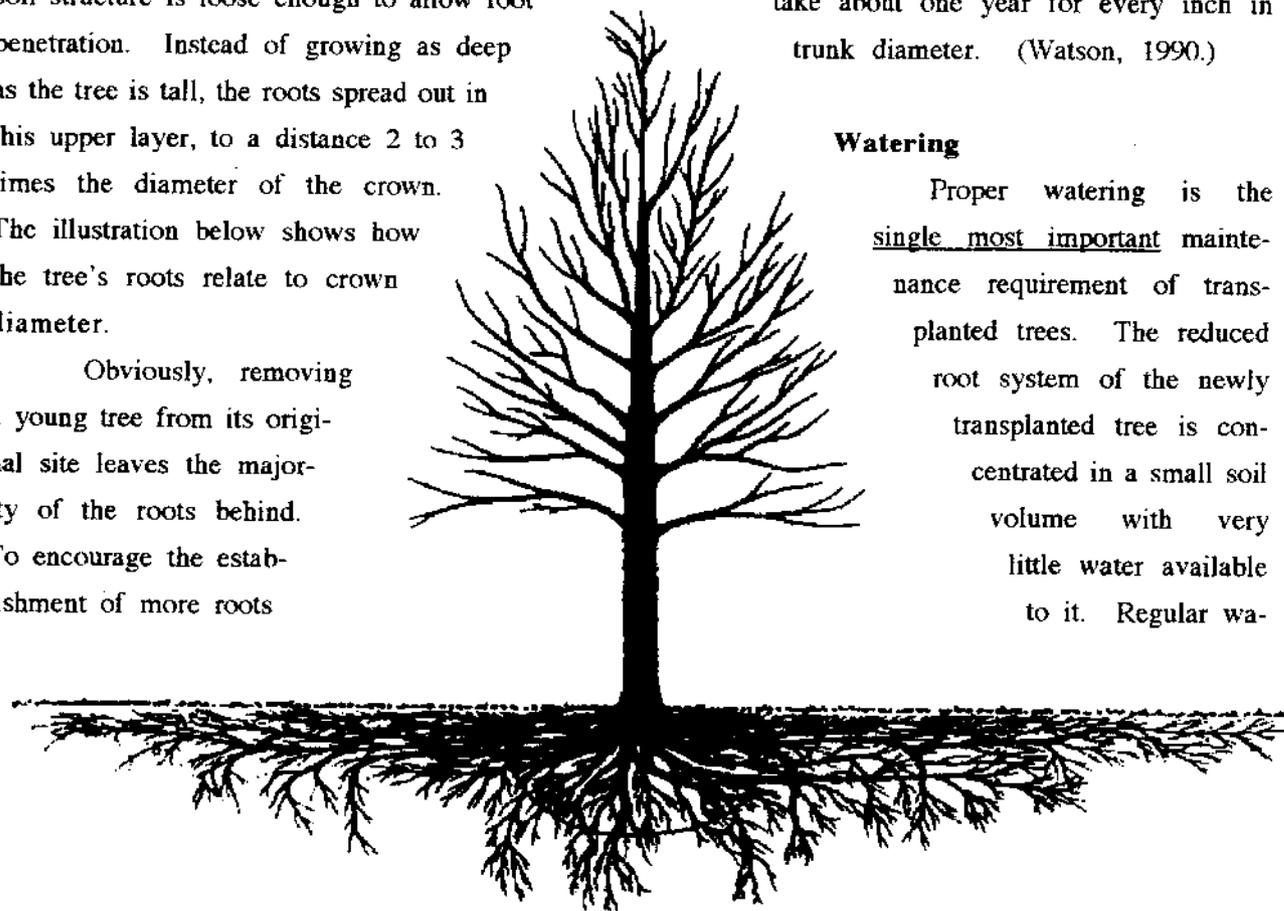
Obviously, removing a young tree from its original site leaves the majority of the roots behind. To encourage the establishment of more roots

near the base of the trunk, nursery growers root prune trees several times before digging them out of the ground. This stimulates the remaining roots to generate new growth. You get a similar effect from pinching the terminal buds on plants to make them bushy. While root pruning encourages some new root development during late fall and early spring, digging the tree out of the nursery leaves 95% of the original root system behind.

The reduced root system means there is less surface area to absorb the water and nutrients needed for growth. This results in slower annual twig growth for the first several years after transplanting. The tree is expending the majority of its energy re-establishing its root system in its new location. The tree is truly established in its new site when vigorous twig growth returns. This may take about one year for every inch in trunk diameter. (Watson, 1990.)

Watering

Proper watering is the single most important maintenance requirement of transplanted trees. The reduced root system of the newly transplanted tree is concentrated in a small soil volume with very little water available to it. Regular wa-



tering will be necessary during the first three summers after transplanting while the tree establishes adequate roots in its new location.

Many schools have no personnel on site during the summer. As a result, new trees planted on windy, sunny school grounds during Arbor Week have only a passing rain or thunder storm to water them during the summer months. Trees lose water by evapo-transpiration through their leaves. If little or none of the lost water is replaced, the tree can become desiccated and die.

If there is no maintenance staff at your school during the summer, arrange for weekly watering by a friendly school neighbor, or a local scout troop or the student council. If there is no rain, slowly pour three or four gallons of water around the tree's roots each week.

Young Trees Are Thin-skinned

The bark of a young tree is so thin that you can sever it with your thumb nail. Immediately under the bark is a layer of green cells called the *cambium*. The cambium layer is the tree cell generator (Shigo, 1986). The cambium produces the woody cell layers that make up the tree rings you see when you cut a tree down. Each year the tree's cambium adds another ring of cells right under the bark.

In an older tree, the bark is thick and rough, and somewhat difficult to damage. In a young tree with smooth bark, weed wackers and string trimmers, bicycle chains, and even the soles of your shoes can make wounds through the bark and cambium layer.

Remind your students that bark is the tree's skin, in a manner of speaking. It keeps important fluids (water and sugars) in and keeps infection out. When the bark is broken, sap oozes out,

adding to water and nutrient loss. Insects as well as bacterial and fungal infections can enter at the wound. If the cut in the bark is small enough, the tree can seal it off. If the cut goes entirely around (girdles) the trunk, the tree will die.

Bark damage also results from hanging on or breaking off branches. Discourage children from hanging book bags or coats on the branches of young trees. A young tree branch cannot support the weight of a heavy book bag or winter coat. Picking off branches of crabapples and other flowering trees to take the flowers home will also damage the bark.

Suggest the children chain their bicycles to metal fence posts or bike racks and not to trees. Bicycle chains can easily break young tree bark.

The damage children do to trees is often unintentional, resulting from lack of information. When children help to plant trees, and learn how trees grow and how easily they can be damaged, young tree planters become good tree stewards.

What Kind of Tree Is This Anyway?

Children always ask what kind of tree they are planting. It's easy to tell them, "It's an oak," but much more rewarding if you can tell them something else about the tree. Are the leaf edges smooth or toothed? Is the leaf simple or compound? What kind of seed does it have? Do any animals eat the seeds? What animals might nest in this tree? How big will the tree be in twenty years? What color do the leaves turn in the fall? Where might the student expect to find others of its kind? Up on a hill? Down in a swamp? Near a river? Up north where winter is colder and longer? There are several references listed in the appendix to help you to discover this information.

Table B: Small Upright & Small Spreading Trees --
The height and ball diameter relationships to caliper, for most of these trees, will be as follows:

Caliper	Average Height	Average Ball Diameter
1/4 in.	2 ft.	10 in.
1/2 in.	3-4 ft.	12 in.
3/4 in.	5-6 ft.	14 in.
1 in.	6-7 ft.	15 in.
1 1/4 in.	7-8 ft.	16 in.
1 1/2 in.	8-10 ft.	17 in.
1 3/4 in.	10-12 ft.	20 in.
2 in.	12-14 ft.	22 in.
2 1/2 in.	12-14 ft.	27 in.

is generally less than 40 feet. This category includes such trees as hedge maple (*Acer campestre*), Eastern redbud (*Cercis canadensis*), hawthorn (*Crataegus* spp.), most crabapples (*Malus* spp.), and Japanese tree lilac (*Syringa reticulata*). These trees are smaller at maturity than shade trees and, when planted near power lines, don't require massive pruning to provide the necessary clearance from the line. [Note: do not plant under power lines if at all avoidable. Try to maintain a planting distance of at least 10 feet from any power line.]

Small, Spreading Trees

Small spreading trees have the same general height at maturity as small, upright trees. However, they tend to grow out, rather than up. Consider the width of these trees at maturity when siting them near buildings or streets with heavy traffic in the right-hand lane. Trees covered in this table include the dogwoods (*Cornus* spp.), star magnolia (*Magnolia stellata*), saucer

magnolia (*Magnolia soulangiana*), some of the crabapples (*Malus sargentii*, for example), and black haw viburnum (*Viburnum prunifolium*).

Specimen Trees

Landscape architects use the term *specimen tree* to refer to characteristics formally stated in landscape specifications that deviate from the standard minimums for caliper, height, fullness of branching, size of the root ball, etc. In other words, specimen trees are taller, wider, fuller, and in picture-perfect condition.

Horticulturists and gardeners use *specimen tree* to refer to trees of distinctive habit, planted singly as a focal point, or to visually break up a large expanse of lawn. Specimen trees are intended to capture the eye. Therefore, landscape architects pay special attention to the balanced shape of the crown, and the absence of wound marks of any kind on the trunk.

Park Grade Trees

A *park grade tree* may have an uneven or unbalanced branching pattern, making the crown look a bit out of kilter. A small wound in the trunk's bark, caused by the jostling of mechanical equipment in the nursery, will also relegate a tree to park grade. Neither the lack of balance in the crown nor the small wound in the bark will cause the tree to die. It will give adequate shade or beautification in a park setting, where specimen tree qualities are not essential. Park grade trees are used for their economy.

Ball Size

Ball size depends on the type of tree and

The Planting Hole

If you've ever painted your house, you know that a quality, long-lasting paint job results from careful preparation. In painting or tree planting, the devil is in the details.

The city or school representative may ask how big a hole you want. The answer is: the planting hole should be two- to three-times as wide as the ball, and as deep but no deeper than the ball. This is not much help unless you know how big the rootball will be.

The American Association of Nurserymen has establishing standard sizes for balls relative to trunk diameter and tree height. Tables A and B detail these relationships.* Before referring to the tables, you may want to refer to the discussion of terminology below.

Diameter Breast Height

Foresters often refer to *diameter breast height* (DBH) to describe the size of a tree, and you may run into the term in your reading. However, this measurement is for standing trees (*i.e.*, forest trees not intended for transplantation), not nursery stock. DBH is taken 4.5 feet above the ground by measuring around the trunk with a special tape calibrated to translate the circumference of the trunk into its diameter.

Caliper

Nursery stock, grown to be transplanted, has its trunk diameter measured with a caliper. Caliper, the measurement referred to in the tables,

* The information and Tables A and B in this section have been adapted from page 5 of American Standard for Nursery Stock, American Association of Nurserymen, 1250 I Street NW, Suite 500, Washington, DC 20005.

is measured 6 inches above ground for trees up to and including 4" caliper size. For trees whose caliper diameter is larger than 4", the measurement is taken 12" above the ground.

Shade Trees

The tables refer to shade trees, small upright trees, small spreading trees, and specimen trees. *Shade trees* are our tallest trees, used in landscaping primarily to screen sunlight. They include most of the maples (*Acer* spp.), oaks

Table A: Shade Trees -- The relationship of height and ball diameter to caliper, for most standard shade trees, will be as follows:

Caliper	Average Height Range	Maximum Height	Minimum Diameter Ball
1/2 in.	5 to 6 ft.	8 ft.	12 in.
3/4 in.	6 to 8 ft.	10 ft.	14 in.
1 in.	8 to 10 ft.	11 ft.	16 in.
1 1/4 in.	8 to 10 ft.	12 ft.	18 in.
1 1/2 in.	10 to 12 ft.	14 ft.	20 in.
1 3/4 in.	10 to 12 ft.	14 ft.	22 in.
2 in.	12 to 14 ft.	16 ft.	24 in.
2 1/2 in.	12 to 14 ft.	16 ft.	28 in.
3 in.	14 to 16 ft.	18 ft.	32 in.
3 1/2 in.	14 to 16 ft.	18 ft.	38 in.
4 in.	16 to 18 ft.	22 ft.	42 in.
5 in.	18 ft. +	26 ft.	54 in.

(*Quercus* spp.), honeylocust (*Gleditsia* spp.), and ashes (*Fraxinus* spp.). Mature shade trees reach heights of 40 feet or more and should never be planted under power lines.

Small, Upright Trees

The mature height of *small, upright trees*

Keys

If you want your students to learn how to identify trees by using a key, start with a tree they already know. If it's a maple, then they know they should end up at some kind of maple after working their way through the key.

Tree Finder: A Manual for the Identification of Trees by Their Leaves, by May Theilgaard Watts is a fairly easy key for middle school and high school students and covers most native and introduced trees of North America east of the Rocky Mountains.

Better bookstores, and arboreta such as Fenner Arboretum, Nichols Arboretum, and the Chicago Botanic Gardens have gift shops that offer even simpler keys. Suggest the students bring a magnifying glass from home to make it easier to see the details of leaf and twig.

MISS DIG

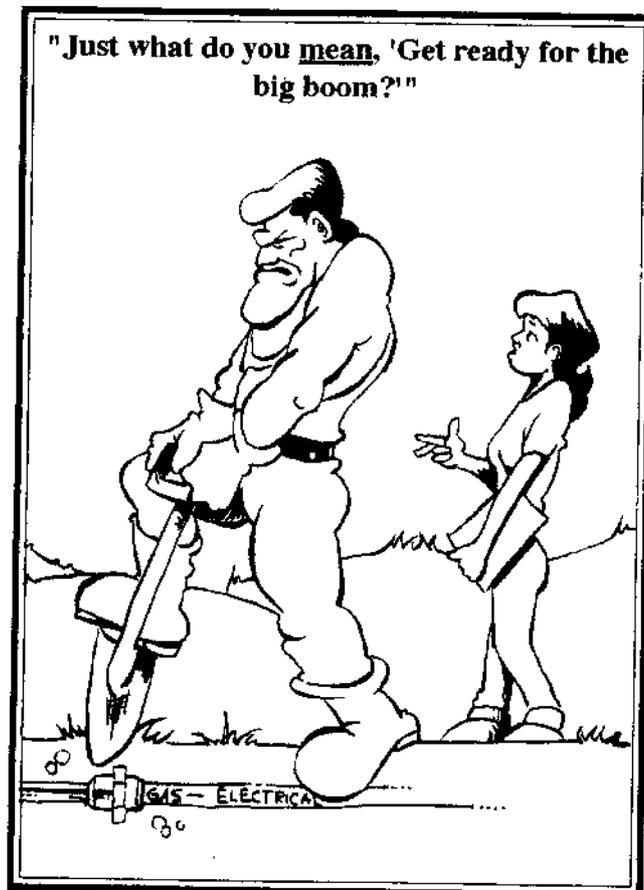
Michigan Public Act 53 of 1974 requires any contractor or other person who plans to dig, drill or blast with explosives to notify the utilities by calling "MISS DIG" at 1-800-482-7171 at least 3 full working days (72 hours), 6 AM to 7 PM, before work begins. Any utility with underground cables or equipment at your planting site will send someone to mark the equipment's presence and the direction of their lines. There is no charge for this service. If you fail to call MISS DIG you may be liable for any damages incurred if an underground utility is disrupted in any way, and for above-ground damages resulting from an explosion caused by the digging.

An accident occurred in Rochester, Michigan, several years ago when a landscaper's back hoe severed a gas main. The blast destroyed or damaged almost one entire block of the downtown business section, and the landscape foreman died.

The MISS DIG operator assigns a *ticket number* to each call. If the planting area does not show evidence of having been staked or marked for the presence of underground utilities (as happens on occasion), call MISS DIG again with the number in hand. The operator will know that the initial call was made, and the lack of follow-up was on the part of the utilities.

Point out the location of the MISS DIG marks on planting day and mention that the trees are being planted well away from the underground utilities.

In case you are asked, in Michigan red paint or flags indicate the presence of buried electric lines; yellow indicates gas, oil, or dangerous material pipelines; orange indicates telephone, telegraph, police, and fire communications; blue indicates water; brown indicates cable TV; and green indicates sewer or storm drains.



the diameter of its trunk. The American Association of Nurseryman standards state: "Ball sizes should always be of a diameter and depth to encompass enough of the fibrous and feeding root system as necessary for the full recovery of the plant." These standards are for nursery-grown stock, not trees dug out of the wild. A rough reference for *ball diameter* is: 1 inch of caliper diameter equals 10 inches of ball diameter. Tables A and B list ball widths for trees of various diameters.

Ball depth relates to ball diameter. If the diameter is less than 20 inches, the depth of the ball should be at least 75% of the diameter (for a 20-inch ball, this means at least 15 inches).

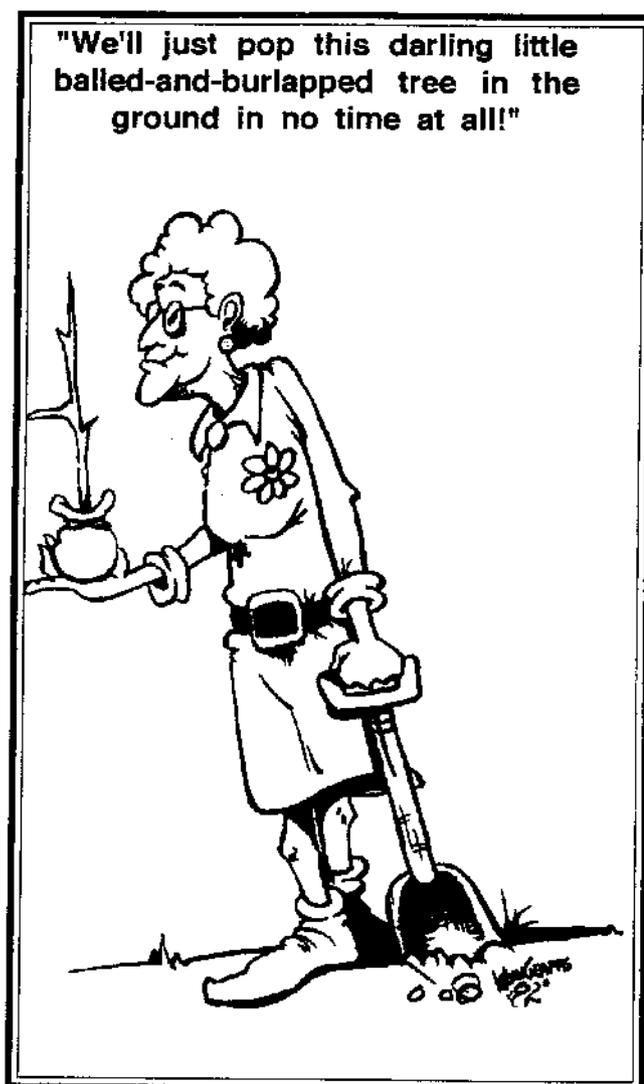
Balls with diameters of 20 to 30 inches should have a depth of not less than 66 2/3% of ball diameter. A 25-inch diameter ball should have about 17" of depth.

Balls with diameters of 30 inches to 48 inches inclusive should have a depth of not less than 60% of diameter. For a 35-inch ball diameter, depth should be about 21 inches. Trees with larger balls than this cannot be planted with volunteers, regardless of how much community money is available to buy them. Planting trees of this size requires a professional landscaper with proper equipment.

Back to the Beginning

Now you can answer the city representative's question. To determine the required size of the planting hole, choose a tree type, find out what caliper diameter is being ordered, and consult the appropriate table for the depth and width of the ball. Multiply the ball diameter by at least 2.5. (Remember, the hole

should be two- to three-times the diameter of the ball.) Those are the dimensions of the hole you want.



The Hole is Dug -- Now What?

Make sure that pre-dug holes are roped-off until planting day. A "reasonable and prudent person" should be able to see the hole easily at all times, to avoid falling into it. Pay particular attention to roping off holes when planting on school grounds or near sidewalks.

On planting day, see that the hole ends up at a proper depth and width for the size of the ball you're planting *before* the tree is placed in the hole. If the hole is too narrow, peel the sides back with a shovel. It's impossible to have a hole that's too wide.

M & M - Measurement is Mandatory

Ask the nursery when you place your order if you will need a front-end loader to meet the nursery truck at the delivery location. If the school system cannot provide one, try a local landscaper or public utility. Have the front-end loader place the

balled-and-burlapped tree next to the hole (**not** in the hole) before the students are scheduled to arrive.

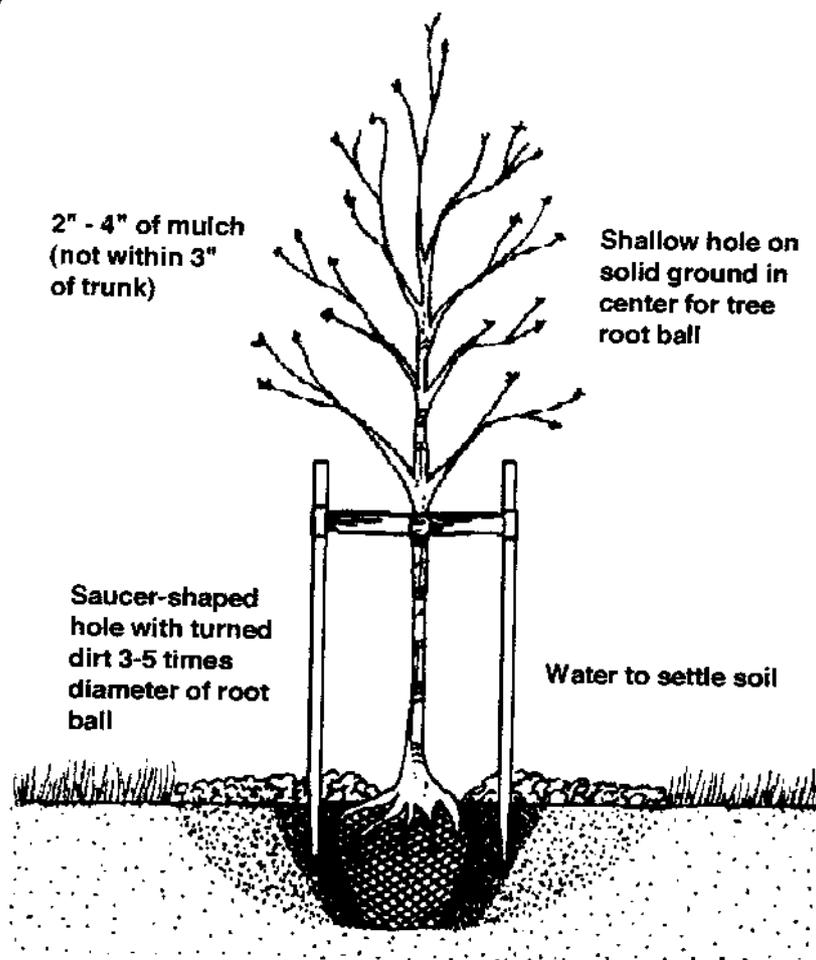
Determine the hole's depth with a measuring tape or the handle of your shovel. Compare that measurement to the depth of the tree's ball. If the hole is too deep, put some soil back in and measure again until the depth is correct. If not deep enough, dig some more soil out.

While trained landscapers can eyeball these measurements, students don't have years of landscaping experience. Demonstrate how

to measure and make sure that the students are measuring each hole versus ball depth as they plant.

Do the measuring after the soil in the bottom of the hole has been tamped down. Jump in the hole and use your feet. The bottom of the hole must be firm and at the correct depth. If the soil at the hole

How to Plant a Tree



Backfilling the Hole

Use the original soil to refill the hole. When you have 3 or 4 inches of soil shoveled back around the ball, tamp that loose soil down using the end of the shovel's handle. This will remove large air pockets that may have formed. Large air pockets around the ball will dry out and kill roots. Don't use your foot to tamp down the soil around the ball. Your weight will provide too much downward pressure and compact the soil. Repeat the process of filling and tamping until the soil around the ball is level with the surrounding ground.

Planting in Heavy Clay Soil

Heavy clay soils do not drain well. Water, from either rain or irrigation, will fill the hole and any pore spaces in the adjacent soil making the soil waterlogged and anaerobic. *Anaerobic* means there is no air (therefore no oxygen) in the soil. You couldn't live under waterlogged, anaerobic conditions, and neither can trees.

Planting in heavy clay requires a wide, flared hole that looks more like a saucer than a cup. The hole can be 1 or 2 inches less deep than the ball. This is called *planting above grade*. When planting above grade, make sure that the backfill slopes gently down from the ball's top to the hole's outer edge. Don't leave a "cliff" at the edge of the ball. The ball's outside edge should not be noticeable once the backfill is in place.

Mulching

The mulch should completely cover

the top area of the hole, and be from 4 to 6 inches thick. Once the mulch is in place, use your hand to pull it back an inch or so from around the base of the trunk so that the bark will remain dry. Mulch snuggled up against the bark keeps the bark soft and moist. Bacteria and fungi can easily penetrate soft, moist bark, infecting the tree. You're mulching the *soil*, not the bark.

Wood chips make the best mulch because they decompose slowly. Slow decomposition trickles the nutrients locked up in the wood chips into the root area. In addition, the proportions of nitrogen, phosphorus, and potassium in wood chips are identical to the proportions of these elements that growing trees require. The wood chips were, after all, trees at one time.

Grass clippings, unless well composted, make a very poor mulch. Because grass clippings are small, they decompose rapidly. As they decompose, they dump too much nitrogen in the soil around the tree's roots, and liberate too much heat. Too much nitrogen at one time will kill tree roots. Second, grass clippings pack down too much. Compacted grass clippings don't allow as much oxygen to penetrate to the soil.

Staking

There are different opinions on the necessity of staking. The latest research indicates that staking is not required. Sometimes new trees are staked to protect them from mowers or to make them more visible to children. Some cities require the staking of newly planted trees in their tree ordinances. The

local city forester can tell you ahead of time if the city requires staking. If so, order stakes and webbing at the same time you place your tree order.

Planting in heavy clay sometimes requires staking. In this situation, rain or irrigation water can "grease" the hole's outer boundary, and the ball can rotate in the hole just as your thigh bone rotates in its hip socket. Use stakes to stabilize a new tree subjected to strong winds because of its exposed position on a playground or school yard.

Staking keeps a new tree in a windy location or one with a large crown from being toppled by heavy winds. However, the stakes and webbing should not hold the tree rigidly in place. Proper staking allows the upper part of the trunk to move back and forth a bit. Flexing of the tree by the wind stimulates the trunk to form tough wood.

Place the stakes in the hole before you backfill and backfill around them. This is much easier than trying to drive stakes into the ground after the hole is filled. When the hole is backfilled and the wood chip mulch is in place, loosely tie the tree to the stakes using a soft webbing.

Improper staking can severely injure newly transplanted trees. Wire, ropes, string, or metal bands attached to the tree's trunk can cut into the bark, injuring or severing the cambium layer immediately below. (The *cambium* is the layer of tissue between the inner bark and the wood. It is from this layer of cells that the tree grows.) The supporting device used should not injure the bark. A hose over a wire does not reduce the cutting

force of the wire. Ropes can girdle a tree. Wide straps make a safe binding material. Staking young trees lower on the trunk helps the tree to get tougher, faster (Shigo, 1986).

Remove the stakes one year after planting. Once the roots have penetrated the surrounding soil, staking is no longer necessary.

Tree Wrap

The latest research on paper tree wrap indicates it does not buffer temperature, as previously believed. Tree wrap may unintentionally produce a dark, moist environment conducive to the development of fungal infections, and habitat for insect borers and wasps.

If you are interested in protecting the tree trunk from rodent damage, use plastic tree protectors instead. These are available at many local nurseries. All trunk protective materials should be checked at least once a year to make sure they are not constricting the trunk.

Pruning

The only pruning necessary at planting time is the removal of dead, broken, or crossing branches. Have the children **point** to the branches that may have broken during delivery or planting and the adult volunteer can cut them off just above the branch collar with a sharp pair of hand pruners.

Finally, remember to remove all tags that the nursery has placed on the branches. These are usually plastic labels detailing tree species and price. They don't deteriorate over time and will bind the branch as it grows.

Appendix

Understanding Urban Tree Growing Conditions

Useful information about the selection and care of urban trees can be gained by observing the natural growing conditions of forest trees, according to George Ware, dendrologist at the Morton Arboretum in Lisle, Illinois.

Tough trees for tough urban situations may be found by examining nature's own testing places, such as floodplains, swamps, savannas, limestone regions, mountains, and disturbed areas that have been re-colonized. Tree species that tolerate adverse growing conditions in nature have inherent capacities to cope with adverse urban landscapes. Certain attributes of stress-tolerant trees are thick, leathery leaves and a genetically high root/crown ratio.

The soil environment of the natural forest is usually sheltered, shaded and tempered. Each year leaves are deposited on the forest floor and as they decompose, they replenish organic matter. This improves soil porosity, releasing nutrients and acidifying soil.

Urban landscapes are usually not created on undisturbed soil sites, but are more likely to be the result of large-scale modifications of fill soil, sub-soil and various combinations that do not resemble the natural soil environment in which trees have genetically adapted themselves. Modified urban landscape soils have little of the porosity associated with undisturbed soils. In urbanized soil, there is often poor regulation of moisture, poor aeration, obstacles to root growth, alkalinity, salinity, compaction and widely fluctuating surface temperatures. Prolonged retention of moisture may lead to anaerobic conditions and accumulation of toxic compounds, which inhibit root growth or are even lethal to roots.

An axiom that has great significance

for urban tree selection, planting, and management is that "urbanization leads to alkalization." Concrete surfaces tend to alkalize rainwater that runs over them. Soil pH levels commonly are 7.5 to 8.0 in downtown areas. Nutrient uptake of most trees is optimal at pH levels between 6.0 and 7.0.

Chlorosis (yellowing of leaves) is commonly seen in urban trees. There are certain species called calciphytes that tolerate alkaline soils. Some examples of calciphytes that tolerate soil pH levels of 8.0 or higher are bur oak, chinquapin oak, Shumard oak, hackberry, black maple, hedge maple, amur corktree, honeylocust, Kentucky coffeetree, and most ashes, elms and hawthorns.

Urban soils are a difficult media to transplant trees in because rapid lateral root regeneration is often hard to accomplish. The roots of transplanted balled-and-burlapped trees may not readily enter the surrounding dense soil. This is true because there are actually two interfaces which roots must grow across to leave the root ball and enter the surrounding existing soils: the root ball/backfill interface and the backfill/existing soil interface.

Transplanted trees undergo severe physiological shock, because their capacity for water adsorption is greatly diminished while their demands for water continue. The challenge is to induce rapid rootlet growth into the soil so a favorable root/crown ratio can develop before a stress event (*i.e.*, heat, dry soil) occurs. Since inducement of roots is most effective in the upper six inches where oxygen is adequate, the depth of the outer backfill material need not be very great.

Planting trees on low berms and mounds overcomes some of the drainage problems of flat areas. However, care must be taken not to produce a barrier interface where

newly added berm soil meets the original flat surface. The soil in mounds or berms provides excellent horizontal space for spreading root systems.

Using mulch beneath urban landscape trees offers several advantages: exclusion of grass, which competes for root-space, water, and nutrients; moderation of soil water evaporation and soil temperature; addition of organic material to the soil and lower pH levels; reduction of the potential for bark damage

from mowers and string trimmers.

Selecting the right tree for the right place should be based upon possibilities for survival and enduring health. Attractive trees can be selected from lists of rugged, durable, and ecologically appropriate trees, but simply choosing from lists of beautiful trees provides little basis for selections with good survivability.

Adapted from articles by George Ware, Morton Arboretum, Lisle, Illinois.

Provenance Is Not a City in Rhode Island

Provenance is the Anglicized version of a Latin word that means roughly, "from whence it came." At this point, you're probably thinking, "Who Cares?" Well, if you buy plants and you want them to be healthy, you should care a lot.

When we talk about the provenance of, for example, a live oak, we aren't referring to the species as a whole, *Quercus virginiana* and about six others depending on whose nomenclature you follow, we're talking about one particular live oak tree. We're talking about the one at your local nursery, the one over by the fence, the one you're thinking about buying. You may know that live oaks in general are native from the southern Atlantic coast to central Texas and Oklahoma. But that isn't the same as knowing that this particular live oak tree, with its own unique set of genes, is native right around Savannah, Georgia. In other words, its provenance is Savannah.

Why is this important to know? Well, if you don't mind my using Dallas as an example, we had a heck of a winter back in 1983-84. We were deep-freeze city. (I don't expect any sympathy from you folks in Montana and Minnesota, but believe me, for Texans, it was coooold!) Half of our live oaks popped their bark and died. That half included those trees sent here from growers in Houston and southern Louisiana. The other

half — the ones that were totally undamaged — came from our neighbors in Fort Worth.

If you're getting ready to spend about \$1,500 for a live oak or a maple or whatever, it sure would be nice to know that your tree had the right provenance for your brand of winters.

But provenance affects more than winter-hardiness. Drought and summer-hardiness are also important. Possumhaw (*Ilex decidua*) is a gorgeous ornamental tree that is native from Virginia to Illinois and down to the Gulf of Mexico; the female is ablaze with red berries from November through March, when the new leaves appear. There are a number of selections of Possumhaw found in our local nurseries. Some have yellow berries, some orange, some have bigger berries, and so on.

But, all of these nursery clones were developed from possumhaws that are native to the Carolinas, where the rainfall averages up to thirty inches a year *more* than it does in that tree's western range. Do you think those Carolina possumhaws are going to appreciate arid summers and be in the pink of health? Not likely. They will be drought-stressed and hurt by insects and diseases. But the possumhaws whose provenance is western will not. Unlike the imported ones, *our* natives require no maintenance except for an occasional bit of cosmetic pruning. And they

School Plantings

are equally varied and pretty.

The calendar itself can spell disaster for a plant of the wrong provenance, specifically during the first norther in the fall and the first false flush of spring. This is because plants have two main mechanisms for figuring out when winter and spring are coming for real.

Some plants are light sensitive. As the days become shorter, they quit growing, send sap down to their roots for safekeeping, and get all battened down for winter. A red oak from hardiness Zone 7 should certainly be winter-hardy in Zone 8, right? Maybe not, because the days get shorter earlier in Zone 7. This red oak will keep growing and waiting for the short-day signal and get caught by a blue norther. It will never get a chance to have beautiful red fall color, and it might suffer severe freeze damage, even though it could endure much colder winter temperatures.

Northern-selected fruit trees get their flowers nipped in the spring for the same reason; longer days in the South fool them into thinking that spring is further along than it really is.

The other way plants try to tell the seasons is by temperature. If they expect 40°-50° F nights to give them a clue that winter is coming, they can be caught entirely by surprise in the Great Plains area.

For a plant (especially a tree) to withstand all of the vagaries that the weather might produce, it needs to be from the same latitude, from the same altitude, the same distance from the moderation of the ocean, and the same distance from the mountains that affect rainfall patterns. Also, it must have the same kind of soil porosity, with the same range of alkalinity or acidity. Otherwise, some norther or drought will damage it.

So, before you buy, make sure your plant is right for your climate. Purchase a plant whose provenance is within one hundred miles of where you live. Ask the people at your nursery. If they don't know, they

should be able to find out for you.

From *Requiem for a Lawnmower and Other Essays on Easy Gardening With Native Plants* by Sally Wasowski with Andy Wasowski (1992). Published by Taylor Publishing Company, 1550 West Mockingbird Lane, Dallas Texas 75235. Used with permission.

[Ed. Note. Although the author is from the Southwest, her comments are applicable to any region. The climate in Michigan, for example, runs from hardiness Zone 4 to Zone 6, and annual mean precipitation ranges from 28 to 36 inches. Our growing season extends from 60 days in the northern upper peninsula to 170 days in the southern lower peninsula. The author's suggestion to purchase trees grown within 100 miles of the planting site is an excellent one.]

Helpful Books

Akbari, Hashem, Susan Davis, Sofia Dorsano, Joe Huang, & Steven Winnett, Editors. *Cooling Our Communities: A guidebook on Tree Planting and Light-colored Surfacing*. Washington, DC: U.S. Environmental Protection Agency. 1992.

Emphasizes energy conservation in the Southwest; includes a comprehensive explanation of the urban heat island effect. Explains how to use trees and other plant material plus light-colored surfaces to cool urban areas and save energy.

Barnes, Burton V. & Warren H. Wagner, Jr. *Michigan Trees: A Guide to the Trees of Michigan and the Great Lakes Region*. Ann Arbor: The University of Michigan Press. 1981.

A comprehensive guide to Michigan's trees, both native and introduced. Explains the woody plant characteristics used to classify and identify trees. Discusses Michigan's climatic zones and associated weather patterns and the forest habitat regions they produce. Complete summer and winter keys. Two-page discussions of individual tree species with line drawing illustrations of leaf, flower, and fruit.

Boon, Bill & Harlen Groe. *Nature's Heartland: Native Plant Communities of the Great Plains*. Ames, Iowa: Iowa State University Press. 1990.

While the title of this book may lead you to think it's about prairie communities, it also covers much of the midwestern deciduous forest. There are two reasons for recommending this book: one is the way it weaves together the trees, shrubs, and flowers of each community (Oak-Hickory, Maple-Linden, River-Lake Margin, etc.). The second is the color photographs of the plants in spring, summer, fall, and winter; plus the flower and fruit; terminal winter bud; and bark.

Eastman, John. *The Book of Forest & Thicket: Trees, Shrubs, and Wildflowers of Eastern North America*. Harrisburg, PA: Stackpole Books. 1992.

For the general reader who is interested in finding out how the forest fits together. Lists native species and associated plants and animals. It tells you that white ash, for example, is commonly found in Oak-Hickory forests growing singly or in small groups along streams, and is a favorite host of the fall webworm (*Hyphantria cunea*), a tiger moth caterpillar that builds communal, tentlike nests enclosing the foliage at the branch tips. In early spring, look for morel mushrooms underneath it.

Elias, Thomas S. *Field Guide to North American Trees*. Danbury, CT: Grolier Book Clubs, Inc. 1989.

A key to the identification of our native trees, as well as some of the introduced

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species that have naturalized in the landscape. Includes illustrations, range maps, comments on timber and wildlife value.

Gerhold, Henry D., Willet N. Wandell, Norman L. Lacasse, & Richard D. Schein, Editors. *Street Tree Factsheets*. Municipal Tree Restoration Program, School of Forest Resources, The Pennsylvania State University, University Park, PA 16802. 1993.

Lists cultivars of shade and ornamental trees that grow well under difficult urban conditions, and orders them by size and species. Color photographs of the tree and close-ups of leaf, flower, and fruit, if appropriate. Includes planting directions and a hardiness zone map.

Lipkis, Andy. *The Simple Act of Planting a Tree: A Citizen Forester's Guide to Healing Your Neighborhood, Your City, and Your World*. Los Angeles: Jeremy P. Tarcher, Inc. 1990.

The best summation of this book is provided on the back cover by Jay D. Hair, President of the National Wildlife Federation: "This book is more than just a guide for improving the urban landscape. It is an important blueprint for getting people together who care about their environment and for making community efforts blossom. Simple acts can produce so many positive results!"

Michel, Timothy M. *Homeowner's Guide to Landscape Design*. Woodstock, Vermont: The Countryman Press. 1983.

An easy-to-follow guide to developing a landscape plan. A little too detailed for middle school, but Chapter 3, "Preparing Your Base Map," explains how to measure your parcel of land, how to site buildings and pre-existing vegetation on the map, and explains the concept of scale. Reading level: 11th grade.

Moll, Gary & Stanley Young. *Growing Greener Cities: A Tree Planting Handbook*. Los Angeles: Living Planet Press. 1992.

Explains what the urban forest is, and what it does. Contains excellent directions for tree planting and maintenance. Also discusses how urban areas stress trees.

Moll, Gary & Sara Ebenreck, Editors. *Shading Our Cities: A Resource Guide for Urban and Community Forests*. Washington, DC.: Island Press. 1989.

Compiled essays on urban forestry for the general reader. Tells what can be done to preserve and extend the urban forest in both large and small communities; how to set up citizen action groups. Contains over 30 pages of resource references, books, pamphlets, and organizations.

Pellett, Harold, Nancy Rose & Mervin Eisel. *The Right Tree Handbook*. The University of

Minnesota. 1991.

Emphasizes tree selection in reference to power lines. It also includes many species and cultivars that are particularly hardy in the north, and is valuable for helping choose species for our upper peninsula.

Sands, Margaret. *Planting for Energy Conservation in the North*. Minnesota Department of Natural Resources. 1991.

A brochure that shows how to position trees to change winter wind patterns and to shade air conditioners and homes during the summer for energy conservation. Available from the Minnesota DNR at 1-800-766-6000 (MN toll free.)

Schein, Richard D. *Street Trees: A Manual for Municipalities*. State College, PA: TreeWorks. 1993.

An easy-to-read manual for the non-professional interested in planting and maintaining trees in small towns. Discusses the history of tree planting in America's small towns, municipal tree ordinances, tree inventories, site evaluations, tree selection and planting, and the administration of a municipal street tree program.

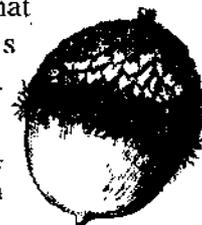
Shigo, Alex L. *A New Tree Biology: Facts, Photos, and Philosophies on Trees and Their Problems and Proper Care*. Durham, NH: Shigo and Trees, Associates. 1986.

A somewhat technical reference, but it will explain how trees seal off wounds, how they become diseased, and proper pruning methods. Written for the student of arboriculture, but an interesting read if you can borrow a copy.

Voss, Edward G. *Michigan Flora: A Guide to the Identification and Occurrence of the Native and Naturalized Seed-plants of the State*. Parts I & II. Cranbrook Institute of Science, Bulletin 59. 1985.

An excellent, somewhat botanically technical reference on all Michigan's plants including trees. Species are listed by Latin names in the text, but indexed at the back by both Latin and common name. Gymnosperms (the pines, spruces, and other conifers) are covered in Volume I, and the dicots (the broad-leaved deciduous trees) in Volume II. For the tree planter, the most helpful item is the small state map attached to each species that indicates the presence of the species within the state. A glance at page 77 shows you that while red oak has been found in almost all of Michigan's counties, black oak is found only in the lower peninsula.

Bur Oak (*Quercus macrocarpa*) Acorn



School Plantings

Shingle oak is found only in a few of our most southern counties.

Walker, Laurence C. *Forests: A Naturalist's Guide to Trees & Forest Ecology*. New York: John Wiley & Sons. 1990.

The author served as the Dean of Austin State University's School of Forestry for 13 years. In this book he explains the natural history and management of the major timber trees of the United States and other useful trees as well. At the end of each chapter are "Projects for the Amateur Naturalist," many of which are adaptable for use in middle and high schools.

Watson, Gary W. *Selecting & Planting Trees*. Lisle, Illinois: The Morton Arboretum. 1990.

This little brochure is specific to Illinois, but the information on soils, planting, and maintenance is excellent. The Morton Arboretum has pioneered a saucer-shaped planting hole for planting trees in heavy clay soils, such as are very common to southern Michigan. Contains good diagrams, and a list of helpful books for the general reader. Available by mail from the Morton Arboretum, Lisle, IL, 60532, or phone 708/968-0074.

Wyman, Donald. *Trees for American Gardens: The Definitive Guide to Identification & Cultivation*. New York: Macmillan Publishing Co. 1990.

This book looks at trees from the standpoint of horticulture. It emphasizes their suitability as street trees and specimen trees for urban landscaping. It includes both native and non-native species, and gives a great deal of information on the attributes of species' cultivars. If you need the specifics on 'Bob White' crabapple as opposed to 'Red Jade' crabapple, this reference will provide it.

Children's Books About Trees and the Forest

Arnosky, J. *Crinkleroot's guide to knowing the trees*. New York: Bradbury Press. 1992.

Everything you wanted to know about the forest, how it works, and its inhabitants, explained to you personally by Crinkleroot, an eminent but fabricated naturalist. Well illustrated in color. Good science. For middle school and beyond. Reading grade level is 6.1.

Behn, H. *Trees: a poem by Harry Behn..* New York: Henry Holt & Company. 1977.

Reading level is 5th grade. Due to the simple concepts presented in the text, this is definitely a "read aloud" book for the primary grades. Little science but what there is, is accurate.

Brenner, B. and M. Garelick. *The tremendous tree book*. Boyds Mills Press, Inc. 1979.

Simple rhymes for early elementary school children.

Davol, J.W. *The heart of the wood*. New York: Simon & Schuster. 1992.

A cumulative tale of a tree that is home to a singing mockingbird, and continues to be a source of music after it is fashioned into a fiddle. Written along the line of "This is the house that Jack built." Beautifully illustrated, the amount of text builds from page to page, repeating the previous page's material. Reading grade level 7.3, but could be read aloud to younger students.

Florian, D. *Discovering trees*. New York: Macmillan Publishing Company. 1986.

Reading grade level 5.8. GOOD science! Explains the anatomy of a tree, including flowering and seed production. Will require some vocabulary development beforehand (i.e., chlorophyll, carbon dioxide, pollinate, habitat, for example). Soft cover; illustrated with color drawings. At \$3.95, contains enough detail and good illustrations to warrant considering for a classroom set.

Hickman, P. *Plantwise*. Toronto: Kids Can Press Ltd. 1991.

Middle school. Good science. Discusses plant parts, explains that trees are plants too. Explains some plants "up close." Includes plant investigation projects. Indexed.

Hindley, J. *The tree*. New York: Clarkson N. Potter, Inc. 1990.

Reading grade level 7.3. Written and published in Britain. Discusses hawthorn, ash, sycamore, horse-chestnut, willow, the conifers generally under "fir," and a few others with a view to giving their importance in medieval culture (May poles, etc.) and their human use (church pews, ax handles, and so on). Most of the trees covered are native to Europe. Fanciful color illustrations that lack botanical accuracy.

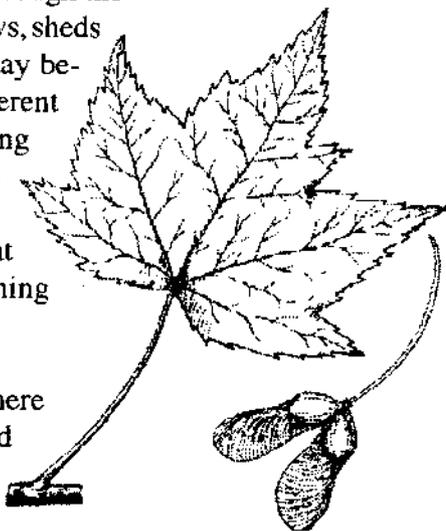
Hiscock, B. *The big tree*. New York: Macmillan Publishing Co. 1991.

Reading grade level 5.7. Intertwines botany and history to trace the germination in 1775 of a sugar maple in a northern New York State forest, and its growth to the present day. Discusses photosynthesis, the function of sap and related water needs of the tree, the progression of rising sap to bud swell, to flowering, and leaf out in early May.

Because the growth of the tree is correlated to events in history (clearing the land for farming in the early 1800's, the Civil War) children get a graphic demonstration of the potential life span of a tree. Color illustrations with good anatomical detail.

Jeunesse, G. & P. de Bourgoing. *The tree, a first discovery book*. Scholastic, Inc. 1989.

Originally written and published in France, this English translation is by Karen Backstein. The "chestnut" referred to is the horsechestnut (*Aesculus hippocastanum*) native to southeastern Europe. Follows a chestnut tree through the seasons as it sprouts from its seed, blossoms, grows, sheds leaves, and drops new chestnuts that will one day become trees, too. Includes a description of different types of trees and how to recognize them. Reading level is probably at least second grade, although the publisher lists it as appropriate for children 3 to 6. Good illustrations with acetate overlays that show what's inside the bud, and the flowers becoming chestnuts.



If you teach in an older community where horsechestnuts were planted as street trees around the turn of the century, you should be able to find ample numbers of the nuts on front lawns and sidewalks in autumn for your students to investigate.

Kalman, B. & J. Schaub. *How trees help me*. New York: Crabtree Publishing Co. 1992.

Reading grade level 6.7. One of the books in the Primary Ecology Series. Tells what trees are and what they do. Discusses coniferous and broadleaved trees, how a tree is born and dies, and how you can help trees.

Illustrations for the most part are color photographs. Contains suggestions for bark rubbings, and other tree investigations. New words are printed in bold in the text, and defined in the glossary at the back. Indexed. Soft cover.

Kennedy, P.E. *Fun with leaves stencils*. Mineola, NY: Dover Publications, Inc. 1991.

Six pre-cut stencils of tree leaves, all native to the United States. Sturdy cardboard — would probably stand up to repeated use in the classroom. Perhaps useful in the primary grades to trace leaf outlines, and then compare the outline to the actual leaf. Feeling the

actual leaf allows the children to sense the waxy outer coating (there to help control water loss), the veins and the stem. No text.

Lavies, B. *Tree trunk traffic*. New York: E.P. Dutton. 1989.

Discusses the comings and goings of various animals on the trunk and branches of a 70 year old backyard maple tree. Illustrations are color photographs.

Sabin, F. *Wonders of the forest*. Mahwah, NJ: Troll Associates. 1982.

Explains and illustrates the canopy, understory, shrub, and herbal layers of the forest. Also discusses animals and plants that live in the forest.

Sohi, M.E. *Look what I did with a leaf*. New York: Walker & Co. 1993.

Reading grade level 6.8. Actually an art project book that uses leaves at different seasons as its medium. Provides examples of different kinds of animals that can be made out of leaves and suggests various uses for the finished product. Color photograph illustrations. Helps students to see the fine detail in and differences between leaves from various trees and shrubs.

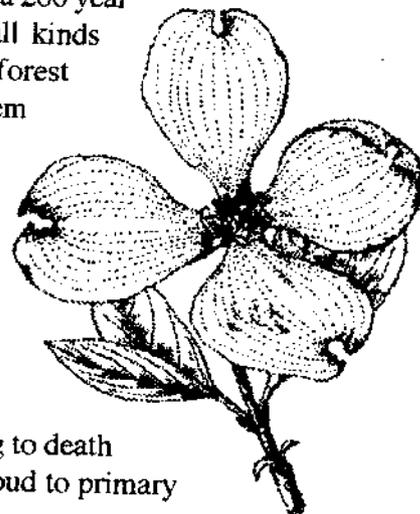
Also discusses the life cycle of a leaf using a stylized diagram. Explains why leaves change color in the fall, and how the abscission layer forms. Good line drawings of leaf scars and bud scale scars. Includes a simple field guide for tree and shrub identification at the back, using drawings of leaves in their fall color.

Thomson, R. *Trees: Usborne First Nature Series*. Tulsa, OK: EDC Publishing. No copyright date.

Packed with good science; excellent illustrations. Grades 3-5.

Thornhill, J. *A tree in a forest*. New York: Simon & Schuster Books for Young Readers. 1991.

Reading grade level 7.7. Presents the life history of a 200 year old maple tree in the forest, and the animals of all kinds associated with it. An excellent presentation of the forest as an ecosystem, and the changes to the ecosystem brought by time. I would recommend this to young readers as a reference. Not really organized as a text book. Illustrations are in color, and biologically accurate.



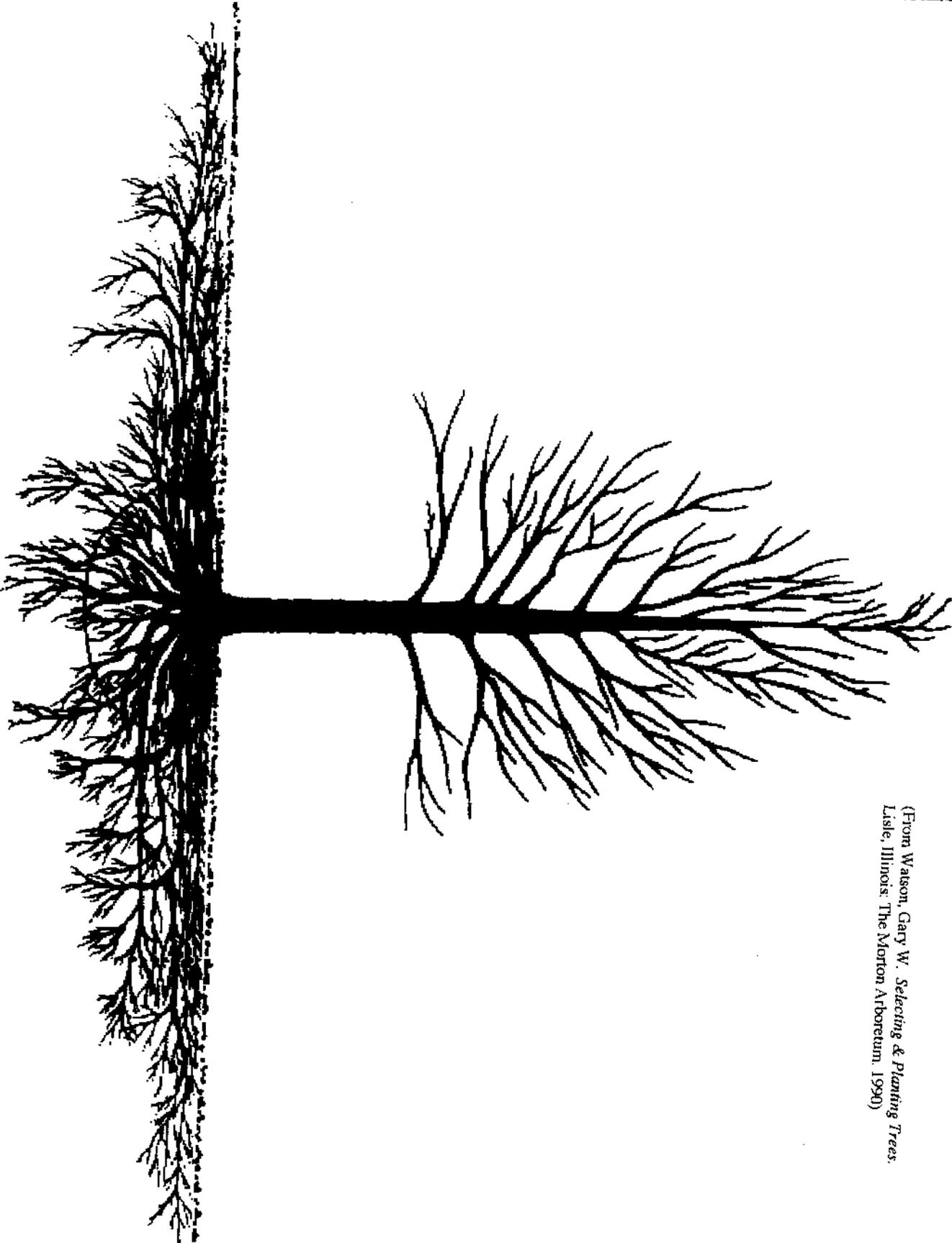
Tresselt, A. *The gift of the tree*. New York: Lothrop, Lee & Shepard Books. 1992.

Presents the life history of a forest oak from seedling to death and decomposition. Middle school. Can be read aloud to primary grades.

Flowering Dogwood (*Cornus florida*)

Equipment for Planting Day

Equipment:	Notes:	Number:	Returned?:
Shovels	W/ owner's name on handle - 1/tree		
Garden Rakes	W/ owner's name on handle		
Water Buckets			
Wheelbarrows	At least one		
Hand Pruners	For adult use only		
Pocket Knives	For adult use only		
Wire or Bolt Cutters	Elem/Middle School: adult use only		
Pliers			
Masking Tape			
Tree Wrap			
Stakes			
Webbing			
Other			



(From Watson, Gary W. *Selecting & Planting Trees*.
Lisle, Illinois: The Morton Arboretum, 1990)

How to Plant a Tree

2" - 4" of mulch (not within 3" of trunk)

Shallow hole on solid ground in center for tree root ball.

Saucer-shaped hole with turned dirt 3 - 5 times diameter of root ball.

Water to settle soil.



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