



Trees



New Jersey
Streets



TREES FOR NEW JERSEY STREETS

Sixth Revision 2016

This sixth revision combines the professional expertise and creative minds of many talented individuals. Certainly the previous editions originating with the first publication in 1961 have had many nameless contributors as well. The individuals named below and those who have contributed to this publication in the past have volunteered their time and knowledge and shared their talents with us. For that, the Executive Board of the NJ Shade Tree Federation and I will be forever grateful.

I acknowledge with immense gratitude the contributions made by the following individuals:

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INTRODUCTION

**To plant a tree is to provide hope for the future.
If the right choice is made, then the future has a better chance.**

Since its first publication in 1961, “Trees for New Jersey Streets” has been a guide to planting the right tree in the right place. Developing a healthy and diversified tree resource includes planning, selection and maintenance. Planting a diverse number of species can help a community forest endure disease and insect infestation. The goal is to create a community forest that is both resilient and adaptable to a changing environment.

Serving municipalities throughout the State of New Jersey as well as New Jersey State Agencies, “Trees for New Jersey Streets” offers a means of providing information on selecting trees appropriate for a variety of different planting sites in order to maintain tree canopy and provide reforestation.

We hope this publication will guide you in your effort to continue to maintain and expand the tree canopy throughout the State of New Jersey. Please keep in mind that this publication is merely a guide and certainly NOT an all inclusive list for tree selection.

A properly selected tree, given a suitable location and proper care, will outlive the person who plants it, benefiting people and communities for generations to come. Go plant trees!

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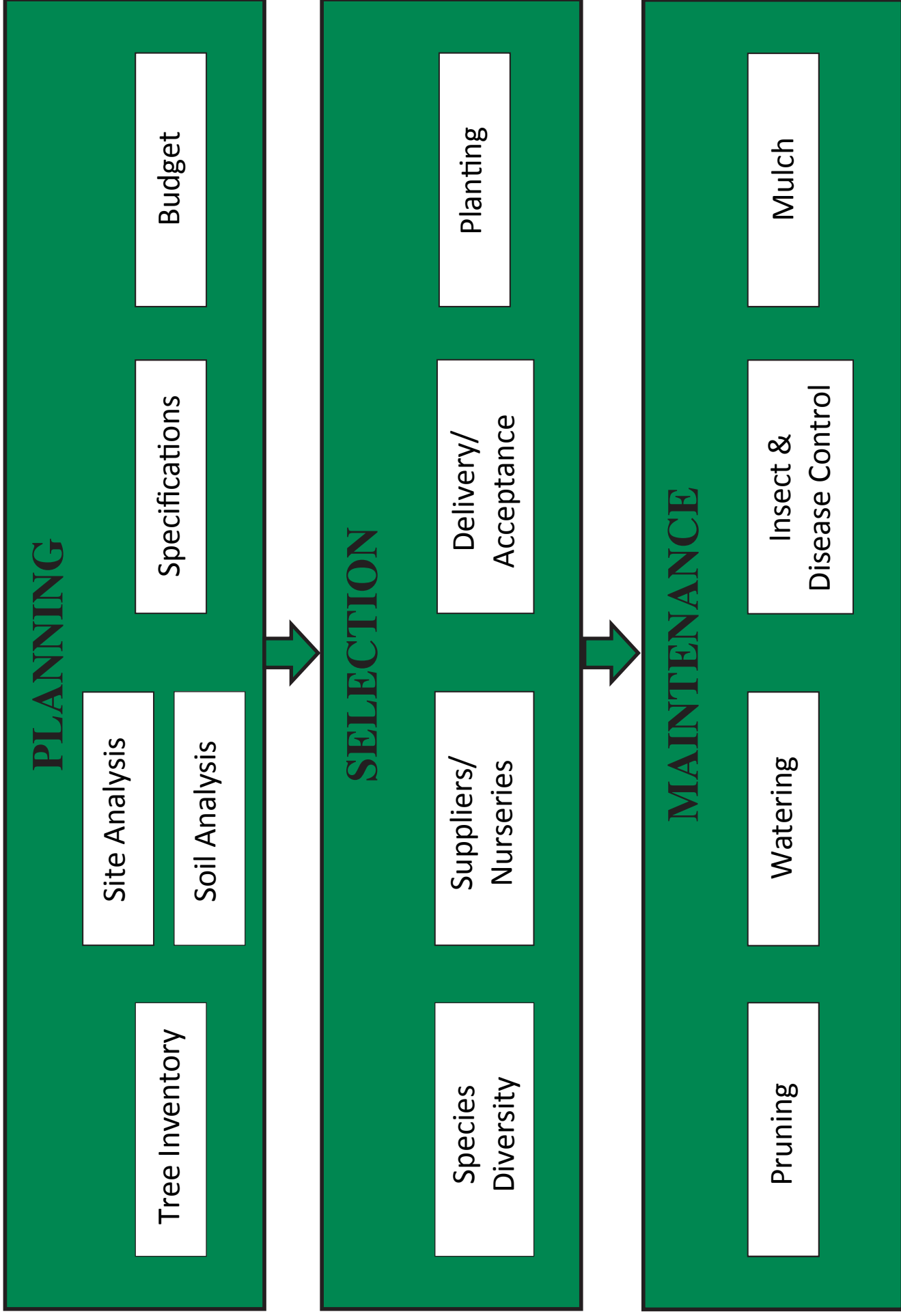
HOW TO USE THIS PUBLICATION

“Trees for New Jersey Streets” was created as a guide to help Shade Tree Commissions, committees, and environmental groups choose the right tree for the right place within their communities. The purpose of this publication is to provide basic information and guidance with regard to the planning, selection, and maintenance involved in the planting of shade trees. The reader is encouraged to explore the links that are referenced throughout the publication for a more detailed discussion of the topics presented.

The species of trees listed in this publication are suggested trees. These lists are not all inclusive. Diversity of tree species helps a tree canopy to endure disease and insect infestation. The reader is encouraged to develop a relationship with several potential nursery growers/suppliers. Trees take time to produce. If a planting project is large, it will take time to either source or grow the desired material to a marketable size. Allowing time for harvesting is often more limiting than organizing volunteers for the project or hiring professionals for the installation. The reader is wise to have clear and frequent conversations with local growers even before they are in the position to make a specific purchase in any given year for specific programs. If a community adds new species to their preference lists, it is likely local growers may require additional time to develop growing/production methods in order to provide inventories of appropriately sized nursery stock in order to meet the needs of the municipality. Getting to know your growers and sharing tree selection preferences with them allows the producers to have a better understanding of the concerns and purchase interests of the consumer which can be utilized in developing inventory stocking plans at the nurseries.

In this sixth revision of “Trees for New Jersey Streets,” we recognize that more information is available on the internet than we could ever provide in one single publication. Our goal is to provide an outline of critical steps to consider in any tree planting program, and then point you to quality additional resources to get you through the details. We hope you enjoy this new format, and wish you the best of luck in all your tree planting endeavors!

GUIDE TO PLANTING STREET TREES



PLANNING: TREE INVENTORY

An inventory is a powerful tool essential to your ability to make informed and effective management decisions regarding your tree resource. You cannot effectively modify your tree resource to increase species diversity and decrease risk and maintenance problems until you know what you have. Any level of inventory will improve your ability to manage. The benefits of having an inventory include increased tree care efficiency, improved communication with community residents, support for budgets, targets for replanting, informed and proactive planning, and knowledge of work history and environmental benefits. In addition, an inventory will provide you with the tools you need to improve the resilience of your community tree resource in the face of changing climate, increasing pressure from insect pests, and unpredictable storms.



There are several types of inventory; each requires a level of appropriate knowledge and training to ensure accurate results. First, clearly define your goals and objectives, and available resources, to determine which type is appropriate for your community's forestry program.

Options include:

Specific Problem Inventory

- For collection of information to locate specific trees susceptible to an impending insect or disease problem. Will not address major management issues.

Sample (partial) Inventory

- Provides a statistical summary (such as species & size) based on a sampling (normally 10% - 35% depending on variability). If completed in a true random process, data collected can be extrapolated to represent your entire community.

Windshield Survey

- Generally the least expensive method with significant limitations on the amount and precision of data collected.

Complete Inventory / Census

- Generally more expensive and time consuming, this method can be designed to provide detailed information on a range of parameters for each tree. Surveys can be overlaid with both municipal block maps and GIS mapping. Detailed lists and spreadsheets can be generated. Data collection can be customized for your program goals.

A **periodic** inventory will provide current tree conditions, but will lose accuracy over time, as it is not designed to be updated or amended.

A **continuous** inventory allows for future updates as maintenance tasks are completed.

All types can be collected with mobile inputs to comprehensive software programs. Details can be adjoined to a municipal website for viewing by residents.

It is important to be realistic about the level of inventory and accuracy of data that can be expected from a volunteer effort. Sophisticated inventory projects should be completed by, or at least under the direction of, a competent and experienced N.J. Licensed (Certified) Tree Expert or other qualified tree care professional. Look for someone with experience in completing municipal inventories, and ask for (and check) references.

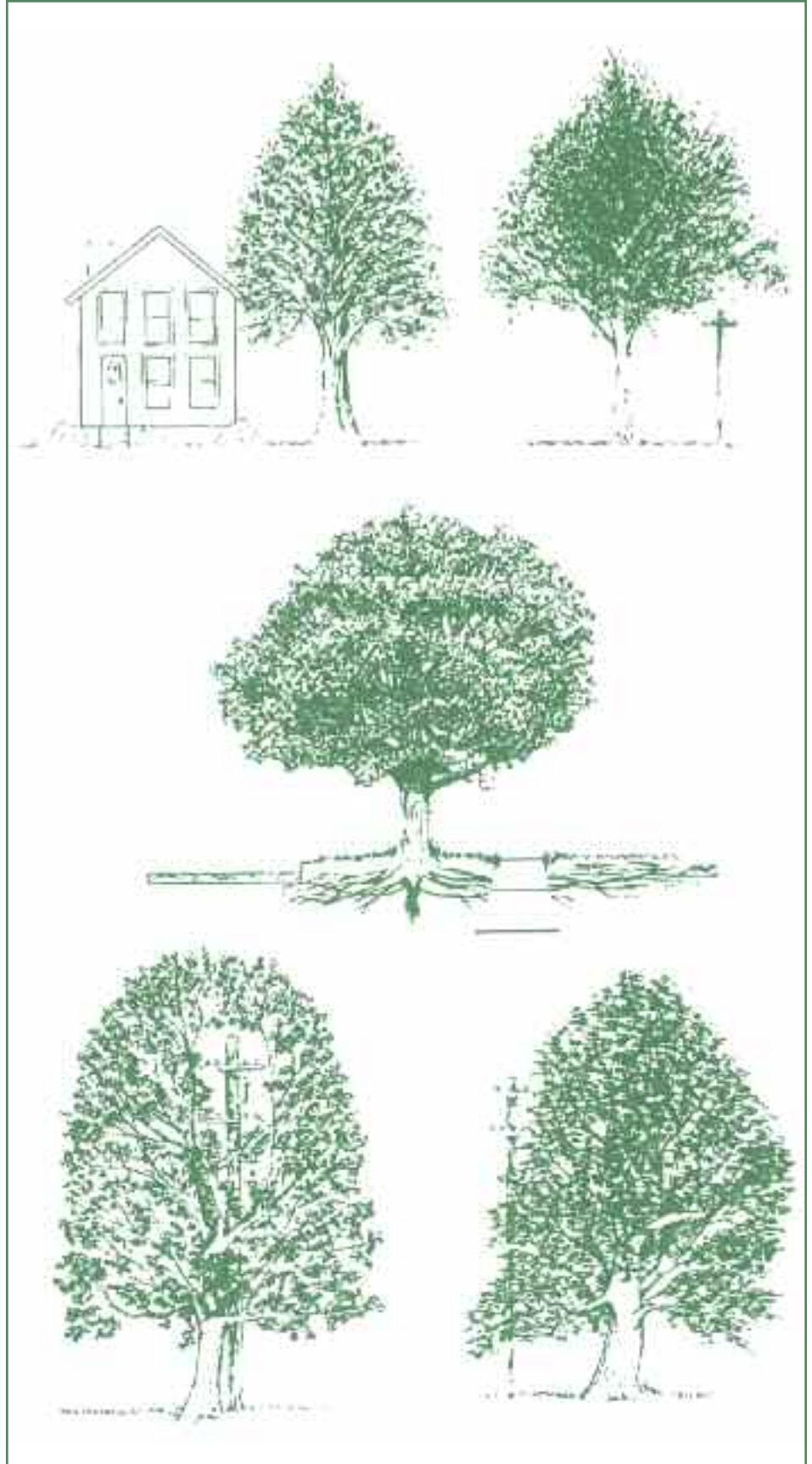
Additional information:

- Tree City USA Bulletin # 23 “How to Conduct a Street Tree Inventory”
<https://shop.arborday.org/product.aspx?zpid=723>
- “Best Management Practices - Tree Inventories”-Second edition 2013
<http://www.isa-arbor.com/store/product.aspx?ProductID=137>
- I-Tree free inventory software applications, www.itreetools.org

PLANNING: SITE ANALYSIS

While an inventory can tell you what you have, and possibly where you have available planting sites as opportunities to improve species composition, the species must be matched to a suitable site. Site analysis will help you to determine the right place to plant a tree, the right species for that place, matters that will impact the tree planting, and therefore the budget required. The analysis will include basic legal requirements, societal considerations, public infrastructure, private property, tree management, and existing tree inventory. Environmental factors include USDA hardiness zone, salt, water, sun and soil conditions as well as tree pests and tree species diversity.

In conducting your pre-planting site analysis, you are looking for anything that will affect the trees to be planted, as well as anything that these new trees may affect. Consider the time it will take for your new tree to establish, and the space it will require when it reaches its mature size (both above and below ground). Ask yourself or others in the community if there is any reason why a tree was not planted here already, and if one was planted, why it is not here now. Look up, look down, and look around while thinking about the maximum future size for a tree in this place.



Remember the following:

- Host a community meeting in neighborhoods where tree plantings are planned to determine local attitudes toward trees, compromise where necessary, educate regarding post planting care, and build enthusiasm and support for the planting project.
- Design your planting project to complement the site. Consider the shape of the crown and the seasonal interest when selecting species. Enhance and accent important views, screen and soften unsightly infrastructure.
- Consider the environmental factors that each species of tree will need to be successful. Plant trees compatible with the hardiness zone, soil and water conditions, sun exposure, environmental stresses, and pest pressures present at the planting location. Trees grown locally will generally be better suited to the local environment, and may be able to establish more quickly.
- Consider public safety. Avoid plantings that will obstruct visibility or clearance for vehicle or pedestrian traffic, present tripping hazards through surface root growth or excessive fruit drop, and interfere with electric (and other) utilities.
- Remember to consult with all the other groups and agencies within your municipality who play a role in your community tree resource. Plant in accordance with any municipal ordinances, your Community Forestry Management Plan, and with the support of your local government and department of public works. Plan for the future maintenance needs of the trees you will plant.
- Space your trees according to the surrounding infrastructure and their future mature size, and utilize New Jersey One-Call for mark-outs of underground utilities. Call Before You Dig! Dial 811 or 800-272-1000. It's free, and it's the law! <http://www.nj1-call.org/>

Additional Information:

- Site Assessment Considerations, Urban Horticulture Institute, Cornell University, Ithaca, NY
<http://woodyplants.cals.cornell.edu/collections/urbantrees/3b-site-assessment-guide.pdf>
- Tree City USA Bulletin Number 4 “The Right Tree for the Right Place”
<https://www.arboday.org/programs/treecityusa/bulletins/documents/004-summary.pdf>
- New Jersey One-Call for mark-outs of underground utilities. Call Before You Dig! Dial 811 or 800-272-1000. It's free, and it's the law! <http://www.nj1-call.org/>

PLANNING: SOIL ANALYSIS

Tree survival, growth and lifespan are largely determined by the volume and quality of soil provided to the tree. The composition of street side soils varies a great deal from location to location even in the same municipality. The success of a street tree planting depends a lot on the soil into which the trees are planted, since the soil provides the reservoir for water and source of all mineral nutrition for the tree.

Tree roots need a balance of air and water in the soil. A thorough examination by an experienced plantsman of the soil observing its texture, drainage and relative availability to the tree of adequate water and oxygen is often sufficient for first estimates of soil suitability. A complete soil analysis is not generally necessary or practical, but some species of trees have specific pH requirements and an acidity/alkalinity test might be necessary. When surrounded by concrete, it is best to select tree species tolerant of elevated soil pH.

Replacement of existing soils with good top soil that is appropriate for the species of tree or amending existing soils with humic materials (organic matter) are two methods most usually used. Addition of soil elements or fertilizers is not generally recommended during planting or for the first year of growth. In any event, follow the recommendations of the nurseryman, a N.J. Licensed (Certified) Tree Expert, or other qualified tree care professional, but request documentation of diagnostic tests or specific deficiency symptoms which drive any recommendation for soil fertilization or amendment.



PLANNING: SPECIFICATIONS

Specifications are the specific details of the agreement between you and your nursery supplier and planting contractor. Specifications are important so that you have a written and agreed upon standard to hold your contractors to, and will give you the power you need to reject poor quality trees or tree work. Ideally, having thorough and detailed specifications will help to ensure that everyone involved is in agreement on the quality and scope of work expected so that disappointment and/or the need for rejection of stock or work can be avoided. However, occasionally bad things happen, and having specifications will give you control over the outcomes. Developing specifications can be fun if you are detail oriented and enjoy that kind of work, but it can also be very challenging.

Regardless they are an essential component of any tree program. Developing mature Tree Purchase, Planting, and Maintenance Specifications will require purchaser decisions and preferences, keeping in mind that you may have to make do with this year's available resources. You will also need to gain some familiarity with typical public-law-bidding-jargon in order to ensure that your specifications will require "the lowest qualified bidder" to conduct the tree purchase and planting process to the quality standards you expect. Each purchasing entity (Shade Tree Commission, etc.) has its own concept of how the purchasing process is applied. For example, local purchasing requirements may be more rigorous than a neighboring town, which may be more rigorous than an industry standard; all of which can impact the contract costs.



Tree specifications developed by qualified professionals in the industry relate to tree purchase and planting, planting soil, irrigation, tree protection, and nursery tree quality. In addition, your specifications should include guarantees and maintenance requirements. Talk to neighboring communities or other members of the NJ Shade Tree Federation to share ideas and advice.

Additional Information:

- International Society of Arboriculture:
<http://www.isa-arbor.com/education/onlineresources/cadplanningspecifications.aspx>
- Urban Tree Foundation:
http://www.urbantree.org/details_specs.shtml
<http://www.treevitalize.net/Grant2013/Guideline%20Specs%20for%20Nursery%20Quality.pdf>
- Wisconsin Department of Natural Resources:
<http://dnr.wi.gov/topic/urbanforests/documents/eabtoolbox/treeplantingguide.pdf>

PLANNING: BUDGET

A successful community forestry program requires funding to accomplish goals and objectives.

Your budget should consider costs for training and certification / recertification for volunteer members and municipal staff, Arbor Day events, public education, and contracted tree care, planting and management planning. Sources of funding can include municipal budgets, reforestation ordinances for new developments, and grants.

It is important to realize that even without any specific storm event or insect or disease problem, it should be expected that some percentage of the municipal tree population will require removal and replacement each year. To have a truly sustainable program you must plan for this, and maintain sufficient funding for tree removal and replacement on at least a 1:1 basis. Funding for a sustainable program should not rely solely on grants, but be built into the municipality's annual budget.

Municipal Budget: Support of local government officials is needed. A management plan based on an inventory will provide justification for funding. Develop a partnership with your Public Works/Parks Department for "in-house" labor to help defray costs.

Reforestation Ordinances: Establish a local ordinance (see our publications "Laws for NJ Trees" and "Forms for NJ Trees" which will have sample ordinances and notifications). The local ordinance should require any developers (prior to approval) to survey all trees to be removed and provide a payment for trees that are not replaced. This can be a significant source of funding for your program.

Grants: Competitive annual forestry grants for both management planning and tree care/planting are available from the NJ State Forest Service, Community Forestry Program. Often, grants allow for "in-kind" volunteer services to support matching fund requirements.

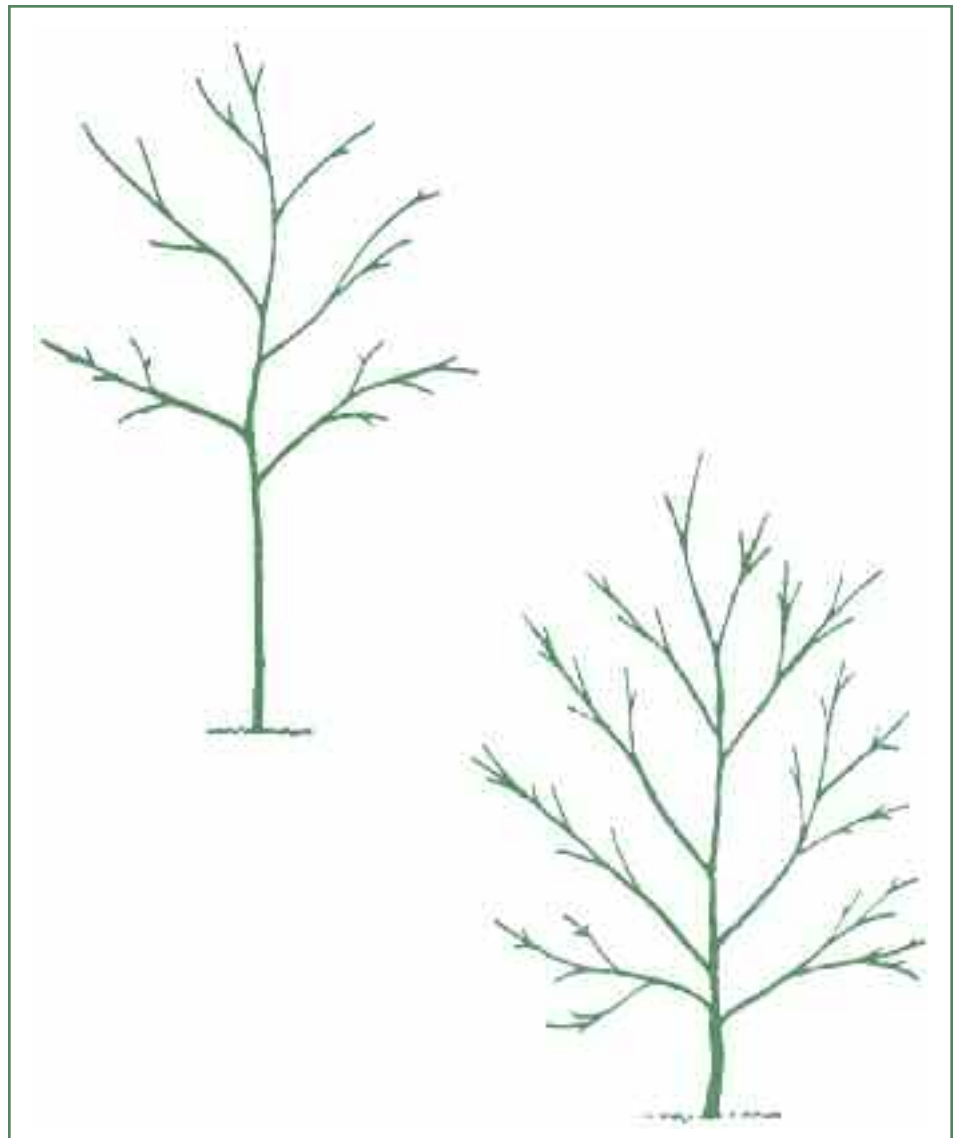
See the NJ State Forest Service, Community Forestry Program website for information on developing a Community Forestry Management Plan, available grants programs, and other community forestry resources: www.communityforestry.nj.gov

SELECTION: SPECIES DIVERSITY

One of the most powerful tools we have to strengthen the sustainability and resilience of our community forests is to increase the diversity of tree species. Every species has different strengths and weaknesses – which can be matched to the planting sites available. Most insect and disease predators are species, or at least genus, specific. The greater the variety of species we have, planted in appropriate locations, the less devastating any one incident or infestation will be to the overall urban / community forest.

The abundance and diversity of species is the overall goal of the selection process, a reason for having a good inventory of existing trees. We suggest the “10-20-30 diversity” as a goal; your tree resource should consist of no more than 10% of trees of any one species, 20% of any one genus, and 30% of any one family. Beyond that, you should also work to diversify cultivars within a species. Some species are rare and hard to find while others are readily available, another reason to have a working relationship with several nursery growers/suppliers. If you have reached the 10-20-30 benchmark, keep going! More diversity is always better – work toward 5-10-15!

Increasing diversity in your community forest does not necessarily mean that every tree along one street must be a different species. Consider diversity in terms of your entire community forest, not just one street at a time. Or, you could plant trees of similar texture and size together. Most people won't notice subtle differences. In addition, consider trees on private property and in your neighboring municipalities and counties in your species diversity goals. Storms, insects, and disease are not contained by municipal boundaries; we are wise to keep that in mind.



SELECTION: SUPPLIERS/NURSERIES

Proper selection of species and cultivars is one of the most important tasks in a tree planting program. The old adage "the right tree in the right place" is paramount. Poor choices can result in excess litter from seeds and fruit, interference with wires, lifting of sidewalks, or simply sickly looking trees. You may want to seek the advice of a qualified and experienced tree care professional such as a NJ Licensed (Certified) Tree Expert, an urban forester, or a university to consult with during the selection process.

On average it takes 3 to 5 years to produce a proper size street tree. Adding new species to your preference lists may require additional time in locating the desired trees. The importance of developing a relationship with your potential nursery grower/supplier cannot be overemphasized to achieve this goal. Getting to know your growers/suppliers enables understanding on your part while informing and guiding inventory stocking plans on the producer's part by better understanding the concerns and purchase interests of the market. Visiting nurseries/suppliers six months to a year in advance is recommended to ensure availability of trees that meet your standards. Reputable nurseries welcome visitors and will spend time tagging trees with you in the field. Harvesting/digging trees is typically done in March and April and again in September and October. However some trees are not recommended for fall digging (especially oaks) as they do not regenerate roots before going dormant in winter. As long as trees have been properly dug and stored in the spring, they can be safely planted any time of year (provided adequate irrigation). The most common sizes of community trees are 1 1/2 to 2 1/2 inches in caliper measured six inches from the ground. The American Standard for Nursery Stock published by the American Horticulture Industry Association (AmericanHort) is an essential reference guide for specifications on tree measurements and root ball sizes.

American Standard for Nursery Stock:

http://americanhort.org/documents/ANSI_Nursery_Stock_Standards_AmericanHort_2014.pdf

Nursery Stock Selection

<http://hort.ifas.ufl.edu/woody/selecting-trees.shtml>

SELECTION: DELIVERY/ACCEPTANCE

Delivery of your trees is the part of the plan that often does not get much thought yet is the part where many mistakes can be made. Recommended shipping procedures for bare-root (BR), ball-and-burlap (B&B), or container grown stock should be followed. Deliveries should be scheduled with your supplier at the time of ordering or as far in advance as possible. If deliveries have to be postponed for some reason, it is important to verify that your supplier can properly water and maintain the trees until the new delivery times. Some nurseries may not have the capabilities to maintain trees for any extended period of time; therefore you may have to make arrangements to water and care for the trees on your site. The root ball must never be allowed to dry out. Just minutes of exposure to sun and wind will damage the fibrous roots. Specifications must include that fibrous roots are protected when trees are dug and shipped. A closed truck or trailer must have cooling capacity to prevent heat buildup during transit. Open truck shipments should be protected by complete coverage with a mesh tarpaulin, securely fastened in the front to protect against rushing air from the moving truck.

Once the trees arrive at your site, each tree should be carefully inspected for adherence to your specifications and nursery standards, and proper care must be taken to unload the trees. This may require supervision on your part or someone you have hired to oversee the delivery process. Keep in mind that most municipal employees and volunteers handle trees infrequently, and may not be trained in the proper care and handling of trees. Look for scrapes on the trunk and branches as well as cracked or loose root balls. Damaged trees often will be replaced by nurseries; another reason to have a relationship with your suppliers, and specifications in your planting contract. Equipment for unloading must have padding or other protective covering so the trees do not come in contact with metal parts potentially damaging the bark and branches. Be careful not to drop or crush the root ball.

If the trees are not going to be planted within a few days, the branches should be untied, and the trees set upright and kept well-watered. Cover the roots to keep them wet. In the absence of complete cover (such as a closed, cool building that protects against sunlight and wind), bury the roots in water-saturated wood chips, saw dust, shavings, etc. The trunks, leaves and branches should be sprayed to prevent wilting and reduce drying. For bare root plantings, dipping the roots in a loam or hydrogel slurry is a helpful way to protect from drying. These root protection precautions must be continued until the tree is planted.

SELECTION: PLANTING

One satisfaction of tree planting is to see newly planted trees leaf out, develop robust twig growth, and to have the trees well established and thriving within the first few years. The goal is to establish fast recovery from transplanting and thereby renew growth. This is best accomplished with care and attention to watering in the year(s) following transplanting. We refer you to the “Maintenance: Watering” section of this publication. Only with careful handling, planting and repeated seasonal care can these results be attained. Trees are living organisms, and transplanting is a radical change of environment and location which has consequences for the biology of any given tree. With good care the expected planting losses can be kept to a minimum.

Four distinct points are critical to rapid recovery from transplanting. The tree planter must be aware that failure in any one area may result in failure of the planting:

A. Handling of Trees from Nursery to Planting Site

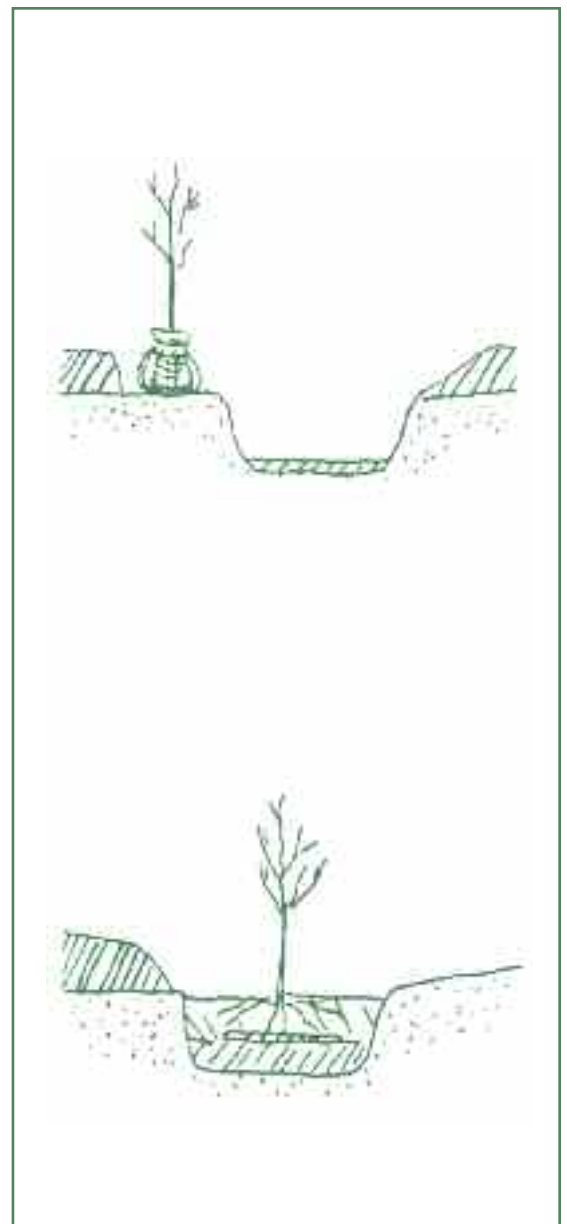
Delivery of your trees is the part of the plan that often does not get much thought yet is the part where many mistakes can be made. We refer you to the “Selection: Delivery/Acceptance” section of this publication.

B. Size, Vigor and Condition of Trees

Trees must be of good size for street planting. Trees that have smaller than 1 inch caliper are easily broken. Select and accept only healthy nursery-grown trees with full terminal buds, normal previous year twig growth, bark free of damage and without signs of drying or insect damage. Slight crooks in the stem are rarely objectionable since they disappear with the growth of the tree. The tree needs to be firm in the soil ball. A viable tree will support itself without the need for staking.

C. Size of Planting Pit

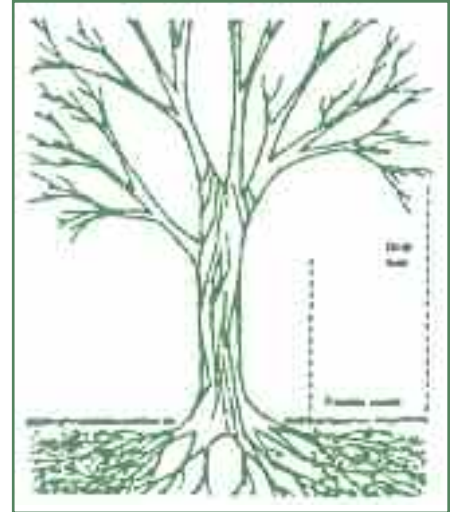
Proper planting brings good results. A good rule is to dig an extra foot of diameter greater than the root spread or root ball. Provide an even wider pit in compacted soils. The pit needs to be wide enough to remove any root ball wrappings (wire basket, twine, burlap, etc.) once the tree is in the pit. The most common mistake is to plant the tree too deep in the ground. When planting is finished, the first true root (root flare) must be visible at or slightly above the soil surface. The use of crushed rock in the bottom of pits to remedy poor drainage is not recommended. The better answer to this drainage problem is planting species that are tolerant to wet soils. We refer you to the “Planning: Soil Analysis” section of this publication.



D. Seasonal Care

We recommend seasonal care for at least two years including watering, insect control, replenishing of mulch, and pruning and refer you to the “Maintenance” sections of this publication.

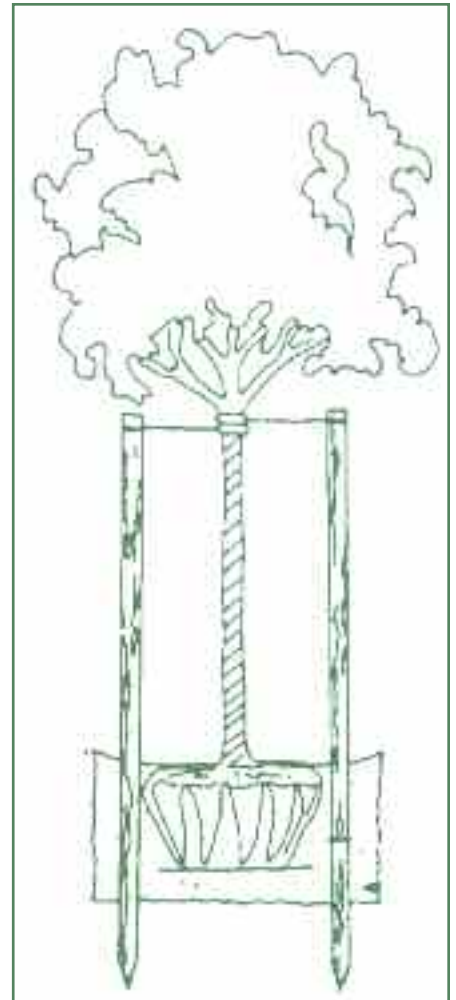
Planting Bare Root - Depth of planting is very important. Correct placement is 2 inches higher than in the nursery to allow the tree to settle. Work the planting soil thoroughly between the roots by hand or with a stick having a smooth rounded end, and by shaking the tree. Take care to spread roots out evenly. Avoid tangled roots, which may later cause girdling of the root system or trunk. Tamping should be light to moderate in loam soil and heavier in sandy soil. Fill the hole with water to settle the soil around roots and assure sufficient water at time of planting in sandy well-drained locations. In loamy and clay soils with average to poor drainage, less water should be used.



Planting Ball-and-Burlap - Locate the first true roots in the root ball by loosening the top of the ball and using your fingers. Some trees may have several inches of soil above the first root. The best quality stock will have the first roots within 2 inches of the top of the ball. Do not dig the hole deeper than the distance from the bottom of the root ball to the depth of the first root, it is wasted effort and will result in settling and deep planting. Once dug, place the tree in the hole and move it to its final position. Use a small amount of soil to brace the tree so it will not move. Use bolt cutters and a knife to remove any basket and burlap coverings for at least the top 2/3 to 3/4 of the root ball. Backfill with soil, use water to help work out any air pockets that have formed during the soil replacement process. When complete, the first root (root flare) needs to be at or slightly (within an inch) above final grade. Mulch should be added to cover the transition from root ball to surrounding soil, but not placed against the stem of the tree.

Container Grown – Once the tree is removed from the container, roots need to either be manually worked out to be sure they extend outward from the tree rather than spinning around the tree, or cut. An alternative is to backfill the pit, then use a digging spade to shave off the outer 2 inches of roots for large container stock (1 inch from a smaller container) to cut any potential girdling roots. It may be advisable to write root form specifications for the purchase of stock, and buy a few more than needed to use as inspection plants to verify the root system before acceptance of a large purchase of containerized stock.

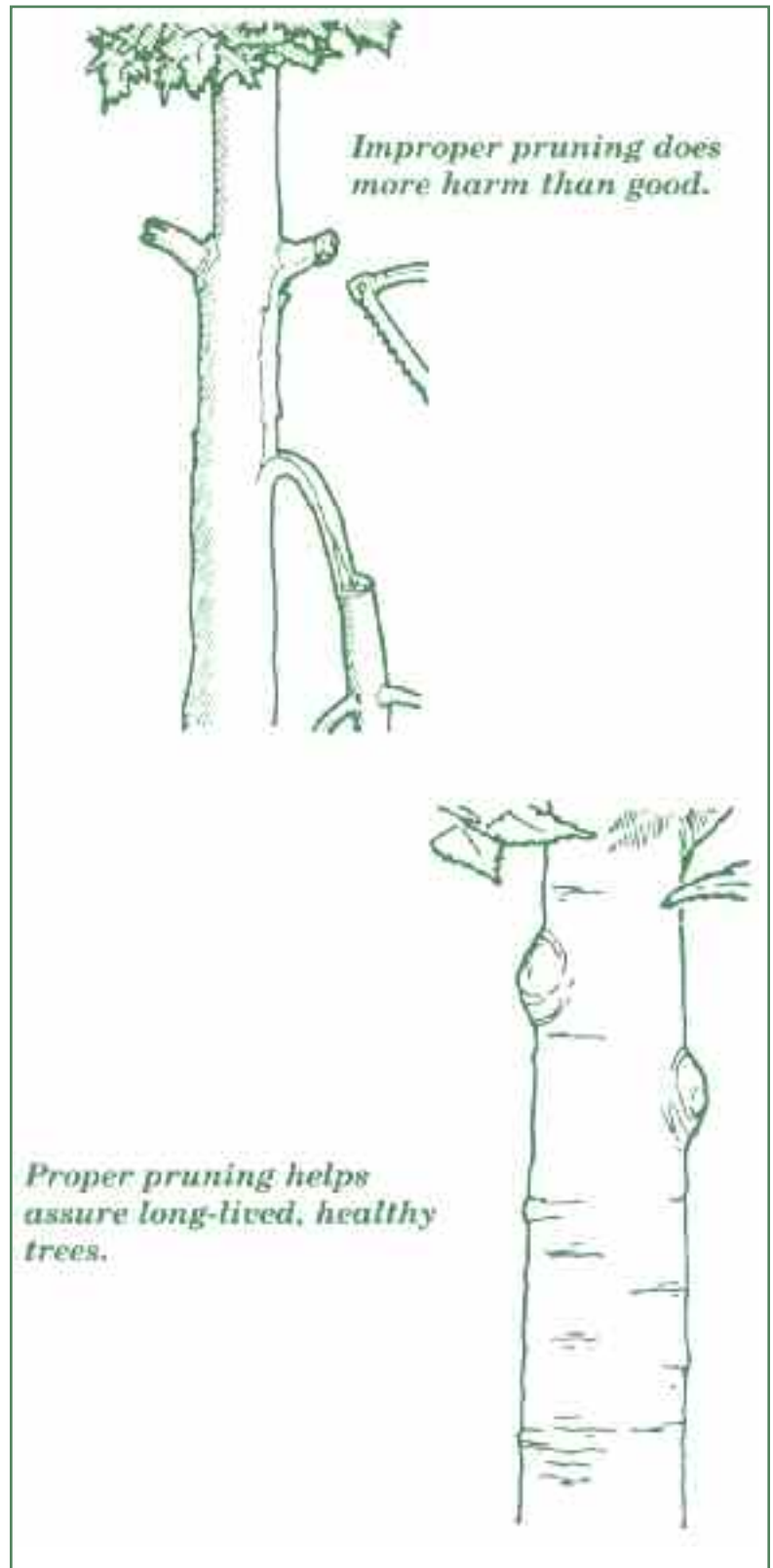
Staking – A quality tree that is installed properly does not need staking. Bare root trees may be an exception when there is an expectation of people or animals leaning on the tree. *If a tree is staked it must have the staking removed in the year after transplanting.* For tree stakes, white cedar, 8 to 9 feet long, which last about 3 years, are the best. Common garden hose and wire binding is satisfactory to secure the tree to the stakes, but new types of tree ties now available are superior. All types, if neglected, may girdle the tree. One stake may be sufficient, but two stakes should be used if considerable buffeting is expected. Some arborists prefer iron posts as tree stakes. Include staking requirements, *and removal*, in your specifications and contract payment schedules.



MAINTENANCE: TREE PRUNING

Trees are pruned for many reasons. To ensure that the work results in the desired outcome, no tree should be pruned without first clearly defining the pruning objectives. For the purposes of this guide, the most important objective is to reduce the risk of tree or branch failure while maintaining the natural form of the tree. Since many branch failures are the result of structural defects that develop when trees are young, the best way to reduce the risk of future failure is to improve tree structure starting shortly after the tree is planted. Depending on the species each tree may need to be reassessed and pruned again on a 2-5 year basis through the first 25 or more years. Pruning to promote a strong framework is a sound investment. It will reduce the need for more expensive pruning later.

Little, if any, pruning is needed at the time of planting other than removing dead or broken branches and the subordination of a co-dominant leader (if one exists). Since new transplants need as many leaves as possible to provide energy for root and branch growth, there is no need to try to “balance the top to compensate for root loss.” Once the tree is established the arborist should envision what the tree should look like at maturity. If the lower branches could eventually interfere with pedestrians, vehicles or structures, they may need to be removed or subordinated on the lower one-half of the tree. Temporary branches should be removed by the time they reach one inch in diameter. Removal of healthy live branches should be limited to less than 25% of the foliage so as not to slow tree development.



Pruning cuts should be made to minimize tree damage. This is done by positioning the cut just beyond the branch collar and slanted slightly away from the trunk at the bottom. The cut should not be made flush with the trunk or parent branch. Larger branches require three cuts to prevent bark from tearing.

An under-cut and a through cut are made about one foot out from the final cut, which is made next to the branch collar. Use sharp tools that leave smooth surfaces. A sharp hand tool is preferable to a chainsaw when pruning a young tree.

Wound dressings are unnecessary and can be detrimental. For more information please refer to the ANSI A300 Part 1-Tree, Shrub, and Other Woody Plant Maintenance-Standard Practices, Pruning and the companion publication Best Management Practices, Tree Pruning.

ANSI A300 Part 1: <http://www.isa-arbor.com/store/product.aspx?ProductID=124>

Best Management Practices, Tree Pruning: <http://www.isa-arbor.com/store/product.aspx?ProductID=58>

MAINTENANCE: WATERING

Adapted from Colorado State University Extension, Master Gardner Program, Yard and Garden Publications, CMG GardenNotes #635

The soil occupied by the roots should be watered thoroughly when a tree is planted. The only way to know the watering needs of non-established trees is to check soil moisture levels. A useful tool is a soil moisture sensor; a decent quality unit can be purchased for less than \$100. Water should be distributed uniformly to all roots, which may extend to a depth of 12-18 inches. Watering of trees, unlike the watering of lawns, should be less frequent but of longer duration, especially as the tree starts to become established. This can be accomplished with tree watering bags or simple 5 gallon buckets with drilled holes. The attached chart is a guideline for trees based on size and is intended to include any local rainfall in the totals. Decrease these estimates in heavy clay soils; consider increasing the rate in very sandy soils.

Estimated Irrigation of Newly Planted trees (during the growing season) – Check soil moisture and water as needed:

Size of Nursery Stock

Irrigation Need for Vigor

<2 inch Caliper

Daily for two weeks – Depending on temperature and wind, apply 1-2 gallons per inch of trunk diameter. **Every other day for rest of season** – Depending on temperature and wind, apply 2-4 gallons per inch of trunk diameter (5 gallons in sandy soil). **Weekly until established** (one to two or more seasons).

2-4 inch Caliper

Daily for four weeks - Depending on temperature and wind, apply 1-2 gallons per inch of trunk diameter. **Every other day for rest of season** – Depending on temperature and wind, apply 2-4 gallons per inch of trunk diameter (5 gallons in sandy soil). **Weekly until established** – (two to four or more seasons).

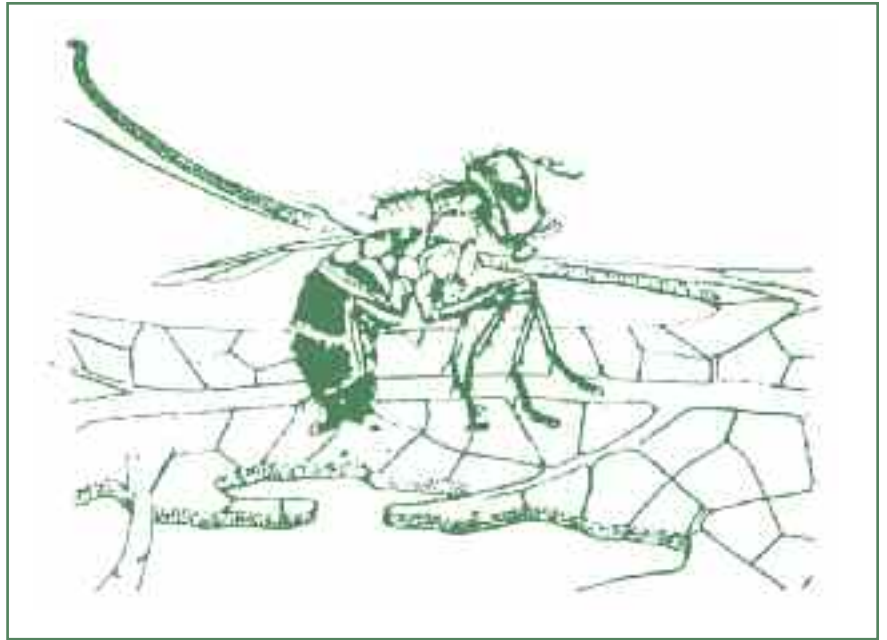
>4 inch Caliper

Daily for six weeks - Depending on temperature and wind, apply 1-2 gallons per inch of trunk diameter. **Every other day for rest of season** – Depending on temperature and wind, apply 2-4 gallons per inch of trunk diameter (5 gallons in sandy soil). **Weekly until established** – (four or more seasons).

MAINTENANCE: INSECT AND DISEASE CONTROL

Trees in urban settings are subjected to an array of problems that may affect their survival. Insects and diseases are typically opportunistic and will frequently attack stressed or weakened trees (all recent transplants should be considered stressed and weakened). Maintaining vigorous growth by optimizing soil properties, watering, and minimizing construction activities near trees and tree roots will reduce the challenges faced by trees in the urban environment.

Prevention is the most practical line of defense against insects and diseases. Proper selection of resistant varieties that are well adapted to local soils and climate will lower the likelihood of a serious pest problem. A diverse selection of species is also a strong wall of defense against a serious insect or disease outbreak. Losses from epidemics such as Bacterial Leaf Scorch (BLS) and the Emerald Ash Borer (EAB), while distressing, can be managed if the susceptible species make up only a small percentage of the total tree population.



Proper and timely diagnosis of insect and disease problems is essential. In today's world we refer to an "action threshold" as the point where the pest population causes diminished quality to the community's street trees requiring control measures. Cultural control, biological control, and chemical control are all tools to be considered. More information on control methods can be found in the ISA publication, *Best Management Practices: Integrated Pest Management*.

Advice, publications, and current recommendations can be obtained from such agencies as the Cooperative Extension Service (County Agent or Rutgers University Extension Specialist) and the NJ Department of Agriculture's Entomologist or Pathologist. It may also make sense to have a source of specialized expertise and qualified applicators available on short notice in the event of an infestation or pest outbreak.

Best Management Practices: Integrated Pest Management:
<http://www.isa-arbor.com/store/product.aspx?ProductID=79>

Rutgers Cooperative Extension: <http://njaes.rutgers.edu/extension/>

NJ Department of Agriculture, Division of Plant Industry: <http://www.nj.gov/agriculture/divisions/pi/>

NJ Emerald Ash Borer Task Force: www.emeraldashborer.nj.gov

MAINTENANCE: MULCH

Used with permission: Tom Smiley, Ph.D. Bartlett Tree Research Laboratories - Bartlett Tree Expert Co., Technical Report, Mulching Guidelines

Mulches provide many benefits for trees and shrubs. They moderate soil temperatures, reduce soil moisture loss, reduce soil compaction, provide nutrients, improve soil structure, keep mowers and string trimmers away from the trunk. These benefits result in more root growth and healthier plants. When applying mulch the following guidelines should be observed:

1. The best mulch materials are wood chips, bark nuggets, composted leaves or pine needles. Plastic, stone, sawdust, finely shredded bark, and grass clippings should be avoided. Do not use redwood or walnut mulch due to allelopathic effects.

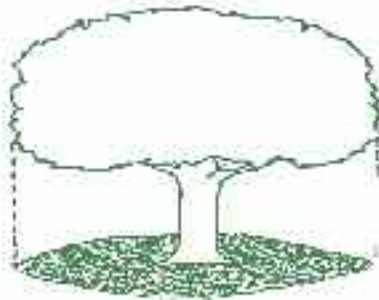


Figure 1. Mulch should be applied from the trunk to the dripline.

2. Mulch should be applied from the dripline to the trunk (Figure 1). If this is not practical, minimum mulch circle radii should be 3 feet for small trees, 8 feet for medium trees and 12 feet for large trees.
3. When applying mulch it is not necessary to kill or remove existing ground cover. However, turf should be mowed very short and clippings removed prior to application. Mulch should be applied directly to the soil surface, do not use landscape fabric to separate the mulch from the soil.

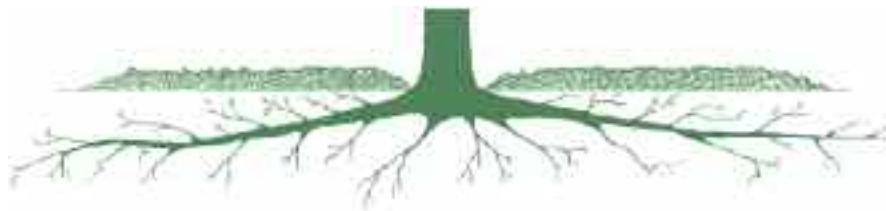
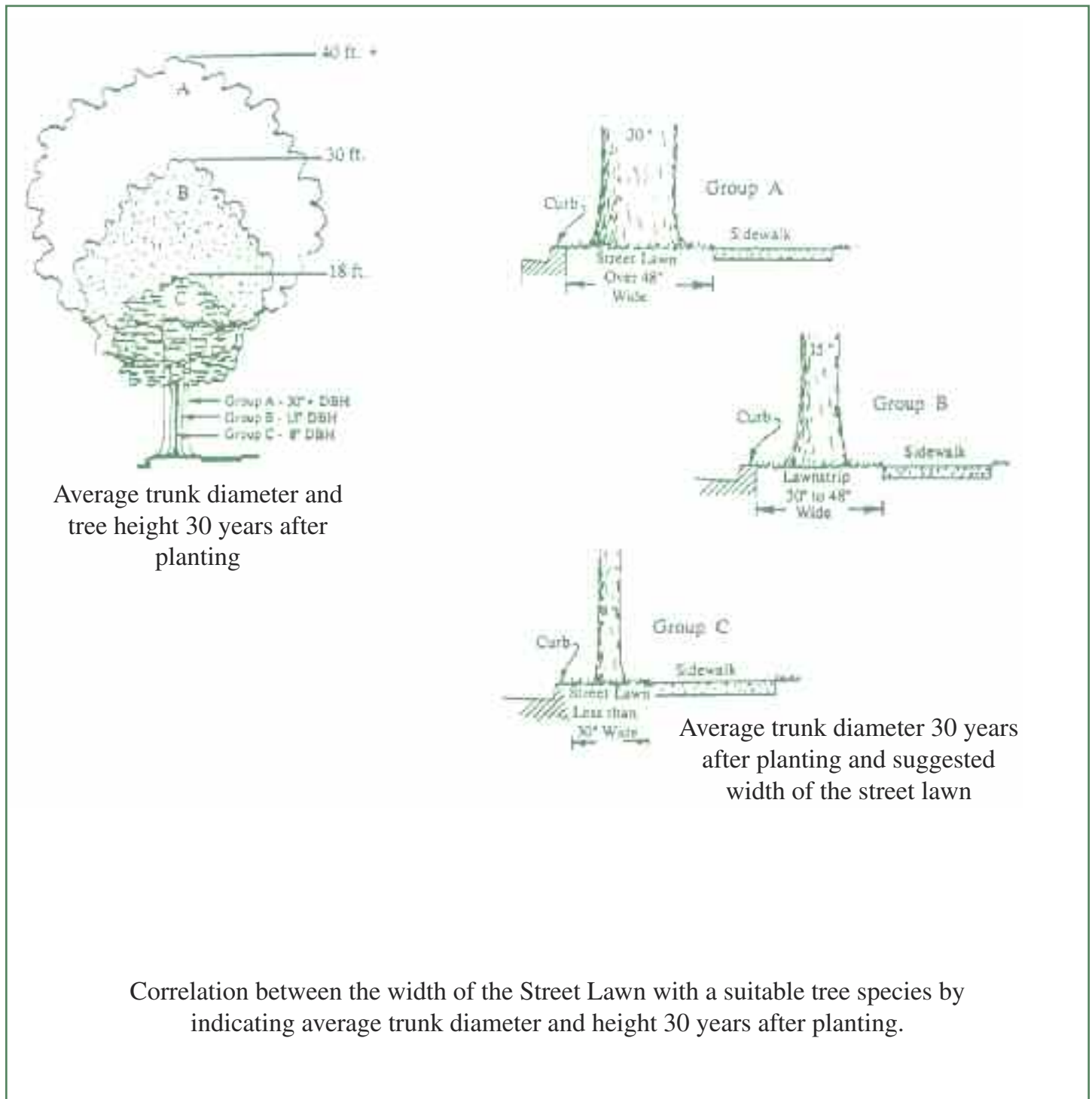


Figure 2. Mulch layer should be 2-4 inches thick and not be against the trunk.

4. Mulch layer should be 2-4 inches thick depending on tree species and mulch (Figure 2).
5. Additional mulch should be added to maintain a 2-4 inch depth.
6. Mulch should not be placed against the trunk (Figure 2). Mulch will retain too much moisture against the trunk, potentially resulting in disease problems.

SUGGESTED TREE SPECIES: SPECIAL PURPOSE TREES

Also see insert in back cover pocket.



APPENDIX 1: NO NET LOSS PROJECTS

The No Net Loss Reforestation Act, P.L. 1993, c. 106 (C.13:1L-14.2), was originally passed in 1993 and amended in 2001 to help conserve forested land in New Jersey by requiring State entities to replant forest areas that they remove. The Act applies to land that a State entity owns or maintains. The legislation mandates that any State entity planning to deforest a minimum of .5 acre must obtain approval of a reforestation plan prior to beginning the project. State entities include all the State departments, commissions and authorities, as well as the State universities and colleges. The NJ Community Forestry Program has developed guidelines to implement this legislation and is responsible for its administration and regulation.

For No Net Loss reforestation plantings where funds are awarded and utilized for planting trees on state, county, or municipal lands along streets and in parks or park-like settings, the legislation recommends that this publication, “Trees for NJ Streets,” be used as a reference to guide selection of trees suitable to the specific planting locations.

Additional references are listed below for help in tree selection for reforestation of forested areas through the NJ NNL Reforestation program.

NJ NNL Reforestation Program:

http://www.state.nj.us/dep/parksandforests/forest/community/No_Net_Loss.htm

The State of New Jersey maintains a list of invasive non-indigenous plant species to avoid. We refer the reader to the Appendix to Policy Directive 2001-02 found at:

<http://www.nj.gov/dep/commissioner/policy/pdir2004-02.htm>

We also refer the reader to Forestry BMPs for reforestation at:

http://www.state.nj.us/dep/parksandforests/forest/nj_bmp_manual1995.pdf

APPENDIX 2: ADVANTAGES AND DISADVANTAGES OF MAINTAINING A MUNICIPAL TREE NURSERY

For most street tree planting applications, municipalities are looking for single stem, balled and burlaped tree form trees with branches elevated to a minimum of 4.5’ that comply with the current edition of “American Standard for Nursery Stock” published by the American Horticulture Industry Association.

Generally speaking, it is more cost effective to purchase quality street trees from a reputable commercial tree nursery.

- Establishing a municipal tree nursery requires a significant capital investment, and there is a high risk of failure.
- Municipalities considering establishing their own nursery must realize that success will depend upon dedication of significant resources in land, fencing, irrigation, supplies, and stock, as well as reliable professional staffing.
- Municipalities must also recognize that this is a long-term investment, and that each year’s purchases will require several years of maintenance before they yield returns.

The decision to establish a municipal tree nursery is not to be made lightly; however, some municipalities choose to grow at least a portion of their replacement trees from a municipal nursery for one or more of the following reasons:

- The municipality has qualified personnel or volunteers capable of pruning, watering, fertilizing, and maintaining a year round municipal tree nursery and delivering those services in a timely manner and is prepared to make a long term commitment in making the nursery a success. It takes a minimum 3-5 years for a whip (liner) to reach a size where it can survive on the street.
- Having a municipal nursery provides a jump start on the planting season. Quite often commercial nurseries cannot access their fields in the spring as they are too wet. Municipalities with their own tree nurseries are often finished with their spring planting before other municipalities even start.
- Municipal nurseries enable trees to be dug in the field in the morning and planted on the street on the same day insuring that they are fresh, thus potentially increasing their rate of survival.
- Sometimes commercial nurseries cannot provide a desired or specialized species in the sizes, quantities, or at the time needed.
- In some municipalities, budget constraints do not consistently provide annual funding for tree planting. The growing of trees in a municipal nursery assures that at least some trees will be available for tree replacement each year.
- The municipality already owns property protected by fencing with access to water and electricity and has an abundant supply of leaf compost and woodchips.
- Having a tree nursery provides each municipality with the flexibility of growing trees as either balled and burlaped, bare root, or container grown - whichever is more suitable for their choice of species.

A very popular container grown method among municipal tree nurseries is the pot-in-pot system due to its simplicity and controlled maintenance.

Trees are grown in rows of containers filled with an organic soil mix. The containers are sunk into larger stationary (permanent) pots in the ground. Trickle irrigation systems provide water and nutrients to each pot individually. Trees are easily removed from the stationary pots when they are ready to be planted and promptly replaced with new potted liners. Root growth and stem stability is readily controlled in container grown situations and trees grown in containers can be readily transplanted year round as there is minimal root loss in the process.

Container grown trees may require slightly more frequent watering following installation than balled and burlaped or bare root trees since they are grown in an artificial, highly organic, and porous soil medium.

Container grown trees often form a solid mass of roots inside the container which necessitates trimming back and spreading out roots to promote adaption to the planting site soil conditions.

APPENDIX 3: ADDITIONAL RESOURCES

- “Northern Trees” tree selection tool: <http://lyra.ifas.ufl.edu/NorthernTrees/>
Tree Fact Sheets: http://hort.ifas.ufl.edu/database/trees/trees_scientific.shtml
- Cornell University – Recommended Urban Trees: <http://www.hort.cornell.edu/uhi/outreach/recurbtree/>
- International Society of Arboriculture (ISA) ANSI Standards and Best Management Practices: <http://www.isa-arbor.com/store/product.aspx?ProductID=121>
- Planting and After Care of Community Trees: <http://extension.psu.edu/publications/uh143>
- 10 Commandments of Tree planting, Robert Cox, Colorado State University Cooperative Extension Agent: <http://www.colostate.edu/Dept/CoopExt/4dmg/Trees/command.htm>
- National Arbor Day Foundation, www.arborday.org
- Manual of Woody Landscape Plants by Michael A. Dirr
- Street Tree Factsheets – Pennsylvania State University



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