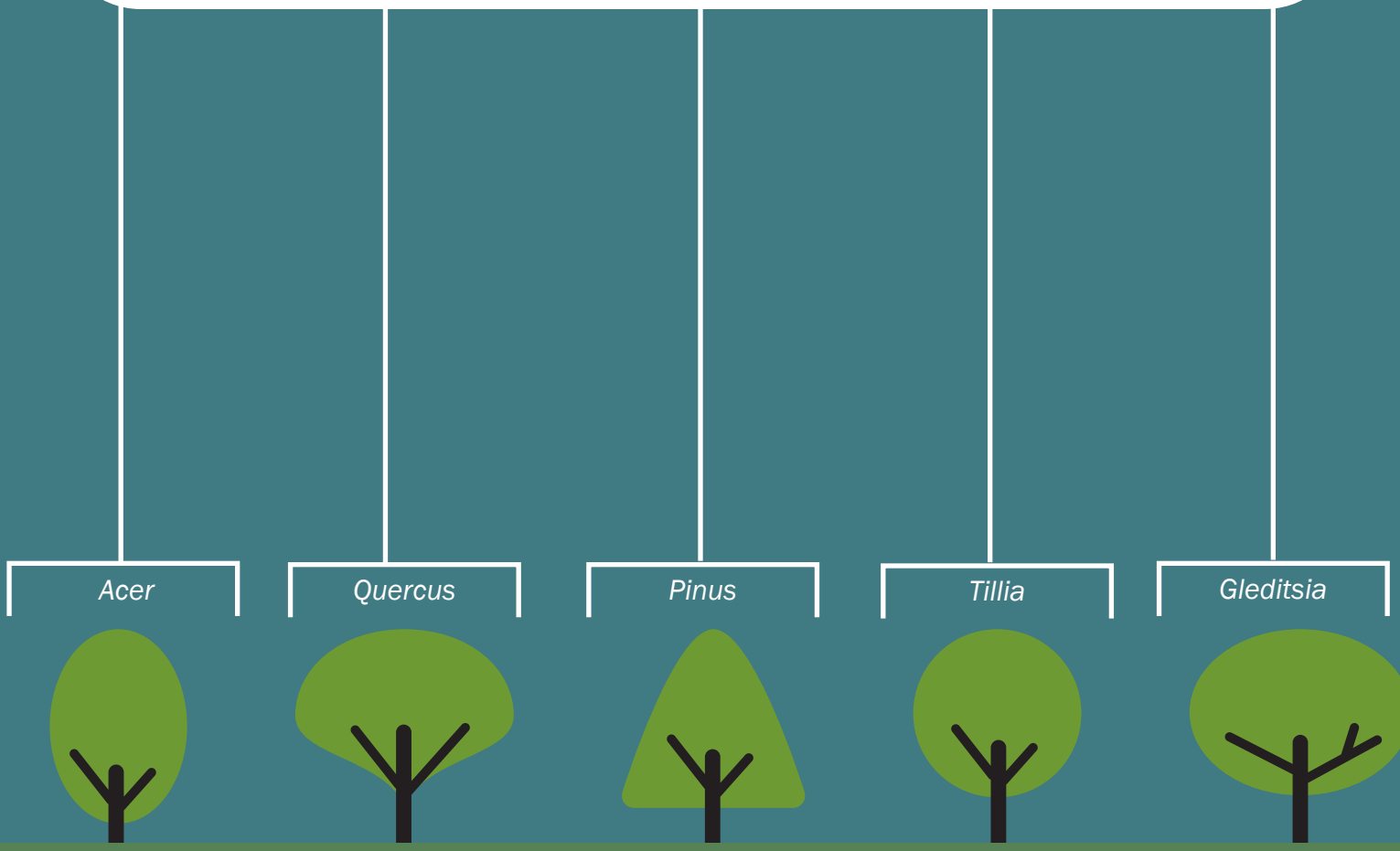
VERMONT TREE INVENTORY GUIDE



PLANT LIVE GROW

Vermont Urban & Community Forestry Program

part of the **Vermont Department of Forests, Parks & Recreation**

in partnership with the **University of Vermont Extension**

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Tree Inventory Overview

TYPES OF INVENTORIES

Why do we inventory community trees?

There are a number of reasons to conduct an inventory of public trees. The data collected in a community tree inventory provides essential information to:

- Profile the species, size, and age composition of the community forest.
- Provide information about individual trees and groups of trees.
- Summarize and analyze condition of individual trees and of the entire forest.
- Record information about significant trees.
- Reveal planting needs.
- Monitor planting success rates.
- Identify potentially hazardous trees.
- Identify potential tree health issues.
- Set priorities for maintenance.
- Develop maintenance schedules based on those priorities.
- Identify budget needs.
- Create budget requests to municipal government
- Establish a foundation for keeping continuous records.
- Create public reports of trees planted, pruned, and removed
- Build public support for protecting and expanding the community forest.
- Establish individual tree or entire canopy dollar value of benefits public trees provide.
- Set benchmarks for future planning.

Types of inventories

The decision of what type of inventory to undertake will be based upon the need identified by the community; options include:

- Windshield survey
- Specific problem inventory
- Inventory of parks and natural areas
- Tree cover assessments
- Complete (public) shade tree inventory
    - *Periodic*
    - *Continuous*
- Backroads vegetation survey

Tree Inventory Overview

Windshield survey

A windshield survey is used to collect tree information while riding in a vehicle. It offers the advantages of being both quick and inexpensive. Although it is not a feasible method for precise data collection, it is helpful for identifying readily visible problems such as dead trees or hanging limbs.

Specific problem inventories

A specific problem inventory is used to assess how many trees in the community are affected by one or more specified conditions. For example, a specific problem inventory might be conducted:

- To inspect all ash trees for signs of emerald ash borer infestation.
- To identify potentially hazardous trees

Inventory of parks and wooded areas

In feature parks and town greens that are heavily used, it may be important to collect detailed data on individual trees, and to map the tree locations precisely. In forested areas like town forests, a sampling method may be sufficient to collect data and generalize results without measuring individual trees.

Tree cover assessment

A tree cover assessment uses aerial imagery to analyze the extent and distribution of tree canopy cover. Canopy cover is the land area covered by crowns of trees. The goal of tree cover assessments are to provide decision makers with detailed information regarding the tree canopy that exists in the urban forest. This allows an understanding of the urban forest in its current form, but to plan feasible approaches to protect or enhance tree cover.

Sampling method

A tree survey of a sample as small as ten percent can be sufficient to create statistical summaries about species and size composition. Results of such samples are reasonably accurate to draw generalized conclusions about the overall tree population.

Two keys to accuracy are essential:

- The sample must be strictly random.
- The overall tree population must be reasonably homogeneous

For example, if the community consists of established residential areas and others that are newly built, entirely random samples should be taken from each type of area. Sample surveys are best done on foot, since a windshield survey lessens accuracy considerably.

Complete shade tree inventory

A complete inventory is implemented to examine and record comprehensive data about each tree, including:

- Genus and species
- Location
- Size
- Condition
- Maintenance need(s)

The inventory may also include identification of potential planting sites (vacant sites).

Tree Inventory Overview

INVENTORY PROGRAMS OFFERED BY VERMONT'S URBAN AND COMMUNITY FORESTRY PROGRAM

The goal of Vermont's Community Tree Inventory Program is to engage citizens in the care and management of their trees and forests, and help them to identify, prioritize, and take action on the management needs identified in their inventory. Inventories can be completed relatively quickly and simply or can be very detailed depending on the needs and capacity of your community. The Urban and Community Forestry (UCF) Program provides two basic inventory templates for Vermont communities to use:

The Vermont Roadside Tree Assessment: A "windshield survey" of back roads to identify hazardous trees and forest health issues. The roadside inventory is an inexpensive, quick, and effective procedure whereby a cursory visual inspection and count can be made by trained volunteers or municipal staff from a vehicle. Trees with hazardous defects and pest and disease concerns can be flagged for a follow-up inspection by a qualified professional. Inspection may include all public trees in the town right-of-way (ROW) or a representative sample.

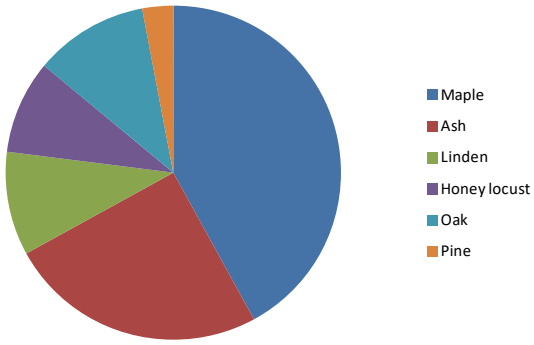
Shade Tree Inventory: A more detailed, systematic inventory of public shade trees within a specified area or along high use roads or densely settled neighborhoods to identify species diversity, size class diversity, hazardous trees, structural or tree health concerns, and maintenance needs.

Periodic or continuous

A periodic inventory should be updated on a 3-5 year maximum cycle. Continuous updating involves ongoing entry of tree work requests and completed work histories. A complete, continuous inventory is the most time-consuming and expensive type, but also the most useful and accurate.

Tree inventory analysis

Information collected in a complete inventory allows the entire tree population to be analyzed. Results may then be summarized in reports and visually depicted in graphs and charts. For example, an analysis of inventory data might reveal a genus distribution such as the one illustrated in the pie chart below. This graph could also be labeled with the actual percentages of each genus.



The results of a tree inventory may also be used to create GIS maps and even link to Google maps so anyone can find information about the town's public trees.

Backroads vegetation survey

Managing roadside vegetation in the ROW backroads/rural roads is also the responsibility of the municipality. A simple windshield survey can provide a lot of information, including identifying hazards trees, maintenance needs, and/or planting opportunities. Other items to note include overall tree health and invasive plant populations. These surveys are best completed in partnership with municipal road crews or public works departments.

DEFINING A STREET TREE

Street tree definition

Street trees are defined as trees that are located within the public right-of-way (ROW) or the layout of a public road. Vermont's Tree Warden Statutes grant local municipalities authority over public shade and ornamental trees within their own geographical areas, including street trees.

Public street trees should be identified because they are usually the focus of maintenance efforts by the municipality. Street trees have to be pruned to keep branches from interfering with vehicles, pedestrians, and utility wires. Potentially hazardous trees must be removed for public safety and property protection.

Under some local laws, public trees may sometimes be planted set back from the ROW on private property to benefit all citizens. These trees then become the maintenance responsibility of the individual property owner, unless the municipality has an easement to assume responsibility.

Determining the ROW

Most towns don't own the land under the road or alongside of it; the landowner does and the town owns an easement – a right to use the land for highway purposes. These easements are a public ROW, usually three rods (49.5 feet) wide, and designate authority to manage the trees within the ROW. They may also permit others—including power, telephone and cable companies—to use the ROW, or may use the easement itself for sewer or water lines.

The public ROW can take any of five forms in a town highway system. Town highways may be classified as 1, 2, 3 or 4. Class 1 highways carry a state highway number and are part of the state highway route. Class 2 are well-traveled routes carrying traffic to and from class 1 highways. All other traveled town highways are class 3. Class 4 highways are usually the most marginal town highways. A fifth class, trails, aren't highways at all; they are little more than the bare public ROW, sometimes including a foot path. One way to tell types of highways apart is by how they are maintained. Class 1, 2, and 3 town highways are supposed to be maintained throughout the year. They are plowed when it snows and kept in good enough repair throughout the year so that anyone can pass over them without trouble, except perhaps during mud season. Class 4 highways need to be maintained "to the extent required by the necessity of the town, the public good, and the convenience of the inhabitants of the town," as the law states, and that usually means not a lot of attention; rarely are they plowed in the winter.

Knowing the extent of the ROW is important for the roads on which you are conducting a tree inventory. This tells you who will be responsible for the management of the trees. If a tree is in the public ROW, it is town's responsibility; if it is a state road it is the State's responsibility; if it falls outside the ROW it is the landowner's responsibility. To determine the ROWs, you should work with public works officials, road crews, or the town clerk. When in doubt, go back to three rods – 49.5' or about 25' from the road center line.

Community resource trees

If the tree is not a public tree (within the public ROW), and is not located on town-owned land, but it is providing value to the streetscape, it may be deemed a "Community Resource Tree." These trees should be inventoried as a Community Resource Tree and so noted in the comments section.

GIS

Definition of GIS

A Geographic Information Systems (GIS) is a computer system comprised of electronic hardware and software. A GIS holds and uses data that has been linked with specific places on the earth's surface.

A GIS enables a user to link an attribute (such as a tree) to its geographic location (latitude and longitude coordinates). Information that describes the attribute is contained in a table in a computer database. The geographic location for that same attribute is entered in a different table.

The table with the geographic locations of the attributes (trees) is then joined to the table with the information (data) collected about that attribute, to create a system that holds both types of information. Maps can be created from this joined information.

For example, a data collector may use a spreadsheet to record the number of sugar maple trees and characteristics about each one such as size, condition, etc. When this information is entered into a computerized GIS, the GIS allows the user to analyze the information spatially.

In this example, a GIS can describe how many, and where, the sugar maples are located by:

- Neighborhood
- Census tract
- Planning area
- Road type

The information can be further refined to analyze how many and where the sugar maples in good, fair, and poor condition are located. This information can be displayed either in spreadsheets, or on graphic maps, or both.

Layers of data

A GIS consists of various data sets called layers. Many communities begin building a GIS by starting with separate layers for roads, parcels, and building footprints.

Additional layers may include underground utilities, fire hydrants, and overhead wires. These may be part of the initial GIS, or added later as data.

Adding a tree layer data

When the tree inventory data has been processed, each tree record will be in a database and will be related to its real world geographic location. The community will actually be able to determine an individual tree's latitude and longitude on the planet's surface. This information will form the tree layer in a community's GIS. As trees are planted and maintenance work is performed, the database can be continually updated to keep the information current.

The significant advantage of a GIS is that it contains all the information necessary for the various municipal departments to manage both the grey and green infrastructure together in a map-based system.

GIS map with tree, building, and road layers.

VOLUNTEER RECRUITMENT

How many volunteers are needed?

The number of volunteers required to complete a street tree inventory will vary by community, depending upon the total number of road miles and the estimated number of trees per mile. Communities have found that it is reasonable to expect that:

- most volunteers can comfortably work on data collection tasks for about 3 hours.
- a team of 2-3 volunteers working one day should be able to complete data collection within an assigned area that covers 2.5-3 miles of streets.

Who can volunteer?

The most important requirements for a data collection volunteer are:

- a strong degree of interest.
- a willingness to commit the time and effort necessary for training and actual inventory tasks.
- Tree identification skills.

People with many different work experiences make excellent volunteers, and it is recommended that they be at least 16 years old. Better results are often achieved when younger people are paired with older participants on inventory teams.

The training workshop leader

A volunteer inventory training session is best conducted by a person with experience in the “green industry,” preferably a trained, certified arborist or urban forester. Such a person may possibly be willing to donate services. Members of the following professional organizations may be sources to help communities enlist a trainer:

- State Urban and Community Forestry Program staff
- Regional chapter of ISA-International Society of Arboriculture
- Tree Wardens or Municipal Arborists
- American Society of Landscape Architects

Identifying sources of volunteers

Local colleges, community colleges, universities, and high schools that offer programs in urban forestry, arboriculture, forestry, landscape horticulture and design, environmental science, and other related fields may be good sources of both potential data collection volunteers and trainers.

Other sources include additional professional and private organizations who

se active members have an interest in trees and other plants. Seek out “green industry” associations that represent

- Nursery or greenhouse professionals
- Landscape contractors
- Landscape designers and architects
- Professional horticulturalists
- Private tree care companies
- Conservation Commissions

Organizing Volunteers

Volunteers with an interest in plants may also be found through:

- SOUL Tree Stewards
- Forest Pest First Detectors
- Master Gardeners
- Garden clubs
- Audubon Society
- Local nature centers

Tapping into social media can also help recruit volunteers such at Front Porch Forum, and local listservs.

Recruiting volunteers

Volunteers may be recruited through advertisements in newsletters published by organizations such as those listed on this page and the next one. Another way to generate interest is to submit informational articles about your project for publication in those same newsletters. One of the community inventory organizers might offer to make a short presentation to a monthly meeting of organizations. Press releases to the local newspaper and public service announcements on radio are other ways to get the word out. A sample press release for recruiting volunteers may be found in the next section, Publicity.

PUBLICITY

Publicizing the inventory

A volunteer tree inventory offers excellent opportunities for citizen engagement and can help a community:

- educate residents about the benefits of the community forest.
- build a citizen advocacy base committed to tree maintenance and protection.

Newspaper articles, public service radio announcements, posters at local businesses, community email listservs, and other tools can be effective publicity. The sample press release found on the next page can be edited and formatted to fit your community tree inventory's context to announce the event.

There are other good reasons for generating publicity prior to the start of the inventory. In addition to education and public relations, it helps make residents aware of the reasons why there are volunteers out on their streets. The advanced awareness may help to limit question-and-answer interruptions that tree data collectors often experience.

ANNOUNCEMENT OF COMMUNITY'S VOLUNTEER TREE INVENTORY

LIKE TREES? You can help! (NAME OF COMMUNITY) will be conducting a street tree inventory beginning (DATE). The inventory will help the town manage its tree population more efficiently.

Public street trees are a significant part of the community forest. Preserving those trees will enhance air quality, improve the appearance of neighborhoods, and strengthen community by supporting the town's maintenance efforts.

PARTICIPANTS
Volunteers of all ages have recently completed a training course to prepare them to collect information about the trees. They have a lot of work to accomplish in a very short time. Residents with further questions may request an informational brochure from a volunteer, or they may call (DEFINED CONTACT.)

DATES
The inventory will take place on (DATE 00, 0000, at 0:00 ?.m. – 0:00?.m.)

Feel free to thank the volunteers who will be out collecting information, and give them a wave of appreciation.

PRESS RELEASE

CAN'T SEE THE FOREST FOR THE TREES? Come take a closer look at those trees and help save that forest!

(NAME OF COMMUNITY) is seeking volunteers for a street tree inventory planned for (MONTH OR SEASON, YEAR). The inventory results will be used to help (NAME OF COMMUNITY) manage its tree population more efficiently. In addition, detailed tree information that identifies planting and maintenance needs will be used to support municipal budget requests, and to create applications for funding from outside sources.

The (NAME OF COMMUNITY) street tree inventory offers participants excellent opportunities to learn new skills. Volunteer training sessions will provide instruction on tree identification, tree health assessment, data collection, mapping tree locations, and more.

Volunteers will be expected to complete a short training course and are asked to commit to working at least one six-hour session to collect tree data along (NAME OF COMMUNITY) public streets and roads.

Trees in the community forest enhance neighborhood appearance, improve air quality, reduce noise pollution, cool the environment, and reduce air conditioning costs. Volunteering for the street tree inventory will give all who participate the satisfaction of playing a significant role in helping to preserve and expand that forest.

Inventory data collection teams are ideally made up of 2-3 people. The quality of the data is often improved when volunteers who are also industry professionals are teamed with those with less plant experience, and when youth participants are teamed with older volunteers.

DATA COLLECTION

Inventory data collection teams are ideally made up of 2-3 people. The quality of the data is often improved when volunteers who are also industry professionals are teamed with those with less experience, and when youth participants are teamed with older volunteers.

Forming data collection teams

Safety of inventory participants is paramount. It is important that volunteers maintain awareness for their personal safety during the inventory. Reminders should be given about cars and other traffic.

If some trees are in a location that does not seem safe, such as a traffic island in the middle of a busy street, volunteers should be advised to skip those trees.

Volunteers should take care, however, to note the map location when any such area is omitted from their data collection.

Volunteer needs on inventory day

Essential items that volunteers should bring:

- Footwear - appropriate and comfortable
- Hat
- Rain gear
- Water
- Lunch and snacks

Optional items that volunteers may find useful:

- This guide
- Backpack
- Cellular telephone
- Brouchures explaining inventory work

Brouchures are useful to explain the purpose of the inventory and describe the benefits of trees to the community. They enhance the community education aspect of the inventory, and they also free volunteers to concentrate on data collection.

Materials and equipment

Materials and equipment provided to each volunteer team may include the following:

- Forestry cruiser vest
- Instrument to measure trunk diameter (DBH) in inches
- Tree ID guide
- EAB/ALB/HWA signs and symptoms field guide
- Pest sample tools (knife, collection vial, forceps)
- Binoculars
- Flagging
- Extra paper inventory sheets, clipboard, paper and pencils
- First aid kit
- Maps

Organizing Volunteers

The day of the inventory

Volunteers should be reminded that the success of the inventory depends upon their performance. It is reasonable to expect that

- Volunteers will arrive at the designated location on time.
- Volunteers will work up to six hours in one day. Data collection that lasts longer than six hours may result in data errors and volunteer burnout.

Recogniztion and rewards

Remember to have fun! The principal rewards that volunteers receive are their own personal satisfaction and the public recognition that they have accomplished a worthwhile goal.

Free t-shirts or baseball caps (possibly provided by a generous private donor or local sponsor) will readily identify volunteers to residents, and they will help create team spirit during the inventory. They are also a lasting reminder and ongoing publicity for the community-wide effort.

Food is always good too, as a midday break or at the end of an inventory day. Consider the possibility of a picnic recognition lunch or barbecue for volunteers, trainers, organizers, municipal leaders, sponsors, and donors, possibly a week or two after the inventory is completed.

Use your imagination to come up with ideas and with ways to fund them!

Data collection items

The first step in inventory data collection is to identify the tree genus and species. The next step is to note the important items or characteristics about each tree. These usually include size (DBH), condition, planting site, and maintenance need(s). This section will discuss each of these last four items, in order to help volunteers learn definitions and techniques for tree assessment.

DBH

The urban forestry tree measurement standard for size is the trunk diameter, measured in inches, at breast height. This measurement is usually abbreviated as DBH (all capital letters). Breast height is defined as 4.5 feet (4.5') above ground level.

Data collectors and others using the DBH measurement find it most convenient to locate 4.5' on their own bodies and make a mental or tangible note of that spot. This eliminates the repetitive step of measuring each tree 4.5' up from the ground in order to find the correct spot to measure diameter.

Using a DBH tape

A diameter tape (DBH tape) differs from a standard measuring tape in that it has measurement numbers on both sides of the tape, but the sides are scaled differently.

One side

- Measures distances in feet and tenths of a foot (NOT inches)
- May be used to measure where 4.5' is located on human body

Other side

- The numbers are further apart, converted to measure tree diameter
- Is used to measure DBH

The procedure to measure DBH with a diameter tape is as follows:

- Wrap the tape around the tree at 4.5' above ground, until zero on the tape reaches the tape again
- Read the number where the zero meets the tape. This is the tree diameter.
- Be sure to read the correct side of the tape!

Using a Biltmore stick

Another tool to measure DBH is a Biltmore cruiser stick, similar in appearance to a yardstick but with four sides. One side of the stick is marked "tree diameter." Holding the stick at arm's length, at 4.5' above the ground, and against the tree, the user aligns the left side of the stick with the left edge of the tree trunk. The user reads the number on the stick's right end that is aligned with the right edge of the tree trunk. It is important to use only one eye; close the other eye, and hold your head still.

Unusual situations

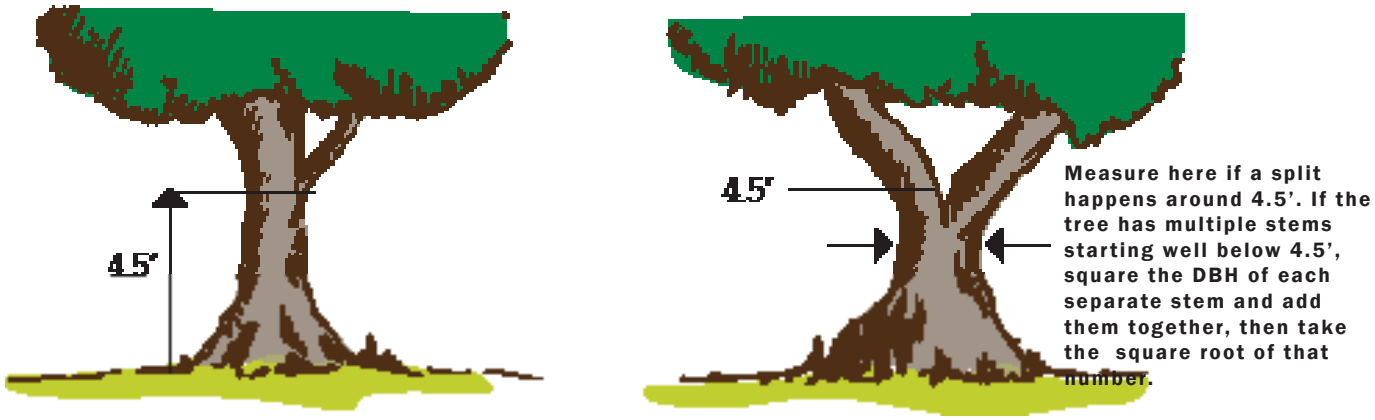
The height at which the diameter is measured may have to be adjusted if an odd growth or interrupting object interferes with measuring at the 4.5' height. A tree that has a large root flare should be measured as any other tree. If the root flare extends as high as 4.5', then the diameter should be measured above it. The height at which the DBH is actually taken should then be entered

under Comments during data collection.

To measure a tree trunk that is not round at 4.5", two diameter measurements will be necessary. These should be taken at right angles along the center of the trunk axis. The average of the two measurements will be the DBH.

A tree that has an abnormal growth that encompasses 4.5' should be measured above or below the growth. If a tree has two or more leaders (stems), each leader (stem) should be measured separately, squared, and then added together; take the square root of that number and record that as the trees' DBH. If the tree has leaders (stems) that start right around 4.5 feet, take the DBH right below the split. The height at which the DBH is actually measured, or the number of leaders (stems) measured, should then be entered in the Comments during data collection.

The diameter of a tree on a slope should be measured at 4.5' above the ground on the uphill side. A tree that has a branch growing out of the trunk at 4.5' should be measured above that branch and the measured height noted in the Comments during data collection.



Measuring DBH

PROBLEM TREES

During the inventory, volunteers will encounter trees that have many different types of problems. Sometimes the problems are insignificant. In other cases, the visible signs may be indications of serious underlying problems. The experience of a professional arborist is required to distinguish between the two. This section is designed to teach volunteers to recognize signs that indicate that particular trees should be further evaluated with consultation by a professional arborist and/or their local Tree Warden.

When a tree is inventoried that exhibits a potential problem, that problem should be flagged by indicating "yes" in the **Consult** field in the inventory system, with further explanation in the **Comments** section. This will alert inventory analysts that there is a need to have a professional re-examine that particular tree.

A tree may appear healthy even when it has extensive internal decay in most of its supporting wood. This section is designed to help volunteers learn to recognize the potential problems that require professional evaluation.

Tree problems may result in:

- Structural weakness
- Vulnerability in high winds, snow, and ice storms
- Potentially serious hazards to people and property.

Problem indicators that will be discussed below include the following:

1. Cavities, wounds, and internal decay in the trunk or large branches
2. Cankers
3. Root failure
4. Weak forks in the trunk or large branches
5. Canopy density
6. Balance

Cavities, wounds, and internal decay. Shade trees in populated areas are constantly under threat of being wounded. The most common causes of wounds in trees include:

- Construction
- Automobiles, trucks
- Bicycles
- Mowers, string trimmers
- Snowplows
- Vandals

The most serious effect of wounding is that it creates an opening for fungi and bacteria to enter the tree. These microorganisms decay wood. Columns of decayed wood may result, thus compromising health and structure of the entire tree. Most wounds are small and heal over quickly by themselves, but severe wounds require attention in order to seal properly.

Trees often exhibit the physical evidence of wounding. Just as frequently, however, they have internal decay whose presence is not visible on the outside.

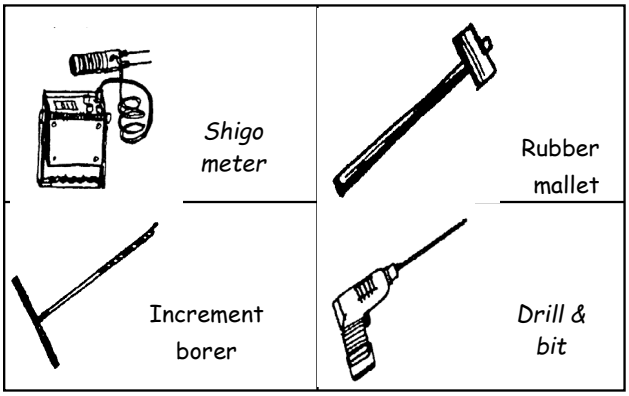
Even though the decay itself may not be visible, trees readily show external signs of internal decay:

- Large dead or dying branches throughout the crown.
- Large and deep vertical cracks on the trunk or large branches.
- Large areas of exposed wood without bark on the trunk, indicating older wounds that have not closed.
- Branch wounds that remain open.
- Mushrooms or conks (shelf-like growths of fungi) on the trunk.
- Carpenter ants along with evidence of decayed wood in or around the tree.

Tools used by arborists to detect internal decay

Arborists have a number of tools available to check for internal decay.

- A rubber mallet relies on sounds made by differing wood densities as the tree is struck. This method is harmless to the tree but admittedly subjective.
- An increment borer is used to remove and examine a small core of the tree about ¼" thick. This method causes some wounding.
- An electric drill and 1/8" bit can reveal rot through changes in drilling speed and ease, as well as through examination of the extracted wood chips.
- The Shigo meter uses a pulsed electrical current to measure the resistance of the wood and thereby the presence of decay. Drilling is necessary for this method.



In addition to the above tools, arborists today often use the recently-developed resistograph. This is a boring instrument that uses a very fine needle to measure the resistance of the wood and records the variations on a printout similar to an electrocardiogram. The wounding created by a resistograph is far less than that caused by a drill.

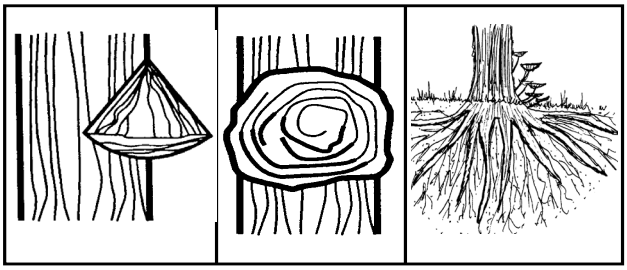
Visual observation is another important tool in the detection arsenal. Three common signs that signal serious problems are conks, cankers, and fungi.

Conks are visible fruiting structures of wood decay fungi and indicate serious problems. Conks may appear on the external surface of an infected stem or trunk.

Cankers. After wounds and other signs of decay, cankers are the second problem indicator. Cankers develop from microorganisms and appear as localized dead areas on outside bark. Cankers kill the cambium, the growing layer just inside the bark. The continuing dieback of the cambium layer prevents the wound from closing properly.

Cankers injure trees in several ways:

- The open wound may provide entry for other microorganisms.
- The trunk is weakened by the large dead area and may break at the canker face.
- Multiple cankers lessen overall trunk flexibility, especially in windy conditions.



Conk Canker Fungi

Root failure. The third problem that volunteers may encounter in trees is evidence of root failure. Three main causes of root failure are:

- *Severed roots*: caused by construction excavation
- *Shallow roots*: caused by a wet site (from a high water table or nearby water body) or improper tree planting
- *Decayed roots*

Indicators of decayed roots

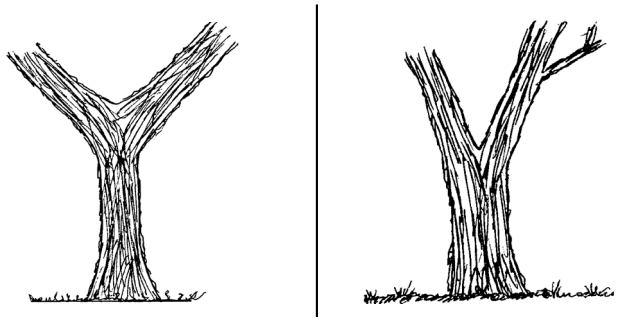
Indicator signs around the tree that may imply the presence of decayed roots include:

- Soil erosion
- Paving over roots
- Soil compaction
- Flooding
- Recent filling
- Gas leaks

Fungi that appear at the base of a tree trunk usually indicate the presence of root rot microorganisms. These microorganisms kill certain tree species and may cause even living trees to fall.

Weak forks in trunk or large branches. The fourth indicator sign of potential tree problems is a weak trunk or branch attachment, usually at less than a 40 percent angle. Pressure exerted from both sides of the fork during the growth process limits the formation of supporting wood on the inside of the narrow angle, making the fork structurally weak.

As the branch or trunk grows larger and heavier, its increased weight makes it more prone to breakage. A weak fork may not split completely at first. The problem may start with a small fissure that leaves the tree open to invasion by microorganisms and insects.

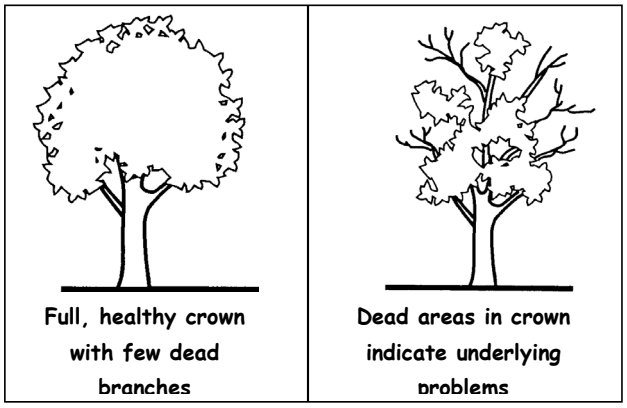


Healthy **Weak**

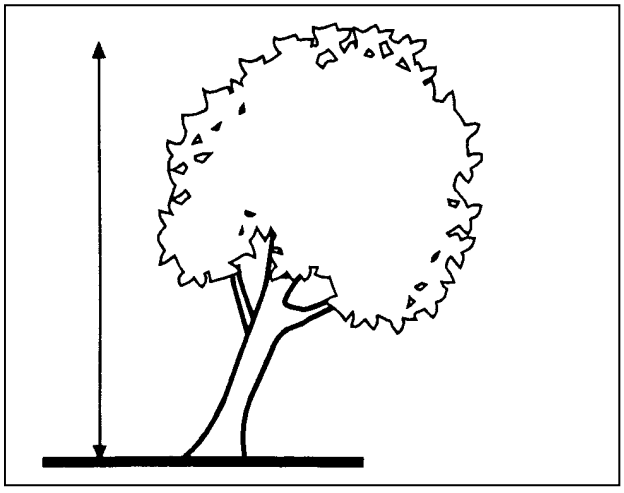
The resulting decay further weakens the fork and eventually causes it to split apart. Large branches or trunks with weak forks pose significant safety issues and should always be evaluated by a professional arborist.

Tree Characteristics

Canopy density. A healthy tree will have a full crown, with few dead branches. Dead or dying areas in the crown may indicate that the tree is stressed and could be in decline. It is important to examine the overall canopy to look for dead or declining sections as possible indicators of underlying problems.



Balance. A leaning or lopsided tree may be more problematic than one that grows vertically. If a tree has always been growing off-center, it is generally considered to be stable. Any sudden lean usually indicates weakening or breakage of support roots and should be cause for immediate attention.



Problem tree species

There are some species of trees whose inherent characteristics may pose potential problems.

Following are common species encountered as street trees, and whose characteristic(s) that may cause them to present problems. This information is offered to help volunteers assess tree condition by knowing to look for specific problems in these species.

Boxelder: weak wood
Silver maple: weak wood
Bradford pear: weak forks
Poplars: weak wood and forks
Willow: weak wood
Siberan elm: weak wood
Yellow wood: weak wood

Procedure for volunteers in identifying potential hazard trees

If you are concerned that trees that may potentially affect the safety of people or property, indicate that during data collection.

Identify those trees by indicating “yes” in the **Consult** field, with an explanation in the **Comments** field. This will indicate that the tree should be evaluated by a Tree Warden, UCF Program Staff or other trained professional arborist.

TREES TO CONSIDER FOR CONSULTATION MAY HAVE:

- Cavities, wounds, internal decay
- Cankers
- Signs of possible root damage
- Weak forks
- Sparse canopy or partial dieback
- Leaning or lopsidedness

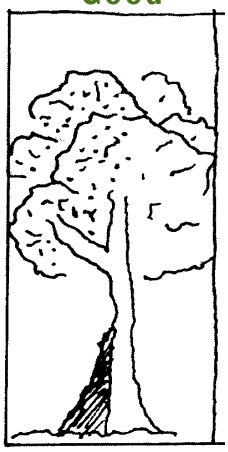
CONDITION

Overall condition is the first characteristic that inventory participants will be asked to record about each tree. Tree condition should be determined as accurately as possible, because that description will be used to plan the management steps for that individual specimen. Each tree should be assigned to one category.

If there are concerns about a tree's condition that require consultation by someone with additional expertise. In these cases, the ***Consult*** *field should be indicated "yes"; this will indicate that the tree requires further evaluation by the Tree Warden, UCF Program Staff, or other professional arborist.*

Every tree should be assigned a condition, regardless of whether or not it is also noted as requiring a consultation. The following general guidelines are provided so that condition assessment will be consistent among data collection teams.

Good



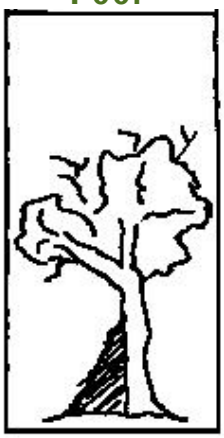
- Full canopy: ***75-100%*** live foliage.
- No dieback of branches ***over 2" diameter.***
- ***No significant*** structural defects (cankers, seams, decay, etc.).
- ***Minimal*** to no mechanical damage to trunk.
- No suckering (root or water).
- Form, foliage color, and leaf size is characteristic of the species.

Fair

- Thinning canopy: ***50-75%*** live foliage.
- New growth medium to low amount, or stunted.
- ***Significant*** mechanical damage to trunk, new or old.
- Insect/disease that is affecting tree.
- Foliage may be off-color, or exhibit early fall color; leaves may be smaller or sparser than normal.
- Form not representative of species.

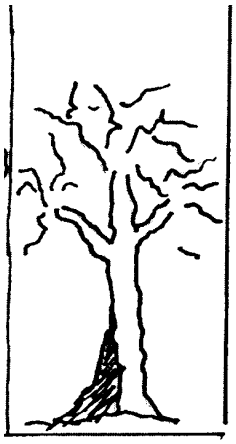
Tree Characteristics

Poor



- Tree is declining: ***25-50%*** live foliage.
- Visible dead branches ***over 2" diameter*** in canopy.
- ***Significant dieback*** of other branches.
- ***Severe*** mechanical damage to trunk, usually including decay resulting from damage.
- New foliage small, stunted, or minimal amount.
- Foliage may be off-color, or exhibit early fall color; leaves may be smaller and sparser than normal.

Dead



- No signs of life with new foliage
- Bark may be beginning to peel

VACANT PLANTING SITES

Determining what size tree to plant

The size of the above ground and underground space is critical to root development and will affect the overall growth of the tree. To determine the size of a new tree that could be planted, you need to look at both above ground and below ground conditions.

Above ground space

Is there available growing space above the ground to accommodate tree growth? Major problems and costs caused by trees planted too close to buildings, power lines, streetlights, and traffic signs can be avoided by selecting the right tree for the site.

Below ground space

Rooting space is the volume of soil available for root growth. Inadequate rooting space will limit water, nutrient uptake, and oxygen exchange necessary for successful plant growth. Common barriers to rooting space include sidewalks, roads, underground obstacles, soil compaction, and containers.

When determining usable soil volume, take into account that tree roots grow near the surface, primarily in the top 2 to 3 feet of soil. For this reason soil below 3 feet would not be considered in soil volume calculations.

If you identify a vacant planting space that could potentially house a tree, consider the space above and below ground. When collecting vacant planting site data, in the **Comments** field, indicate whether the site is:

- **Small:** Planting sites with limited soil volume (<500 cubic feet), such as narrow greenbelts and pits less than 6 feet wide and small, and/or <25' tree.
- **Medium:** Planting sites with an intermediate amount of soil volume (500 - 1000 cubic feet). Green belts greater than 6 feet wide, but still limited in the amount of below ground growing space, and/or 25 - 40' tree.
- **Large:** Planting that are large soil volume (>1000 cubic feet) such as parks and open space and/or >40' tree.

MAINTENANCE NEEDS

Pruning

Pruning is probably the most noticeable and most important of all tree maintenance practices. Careful pruning produces a strong structure that is better able to withstand conditions found in populated areas. Trees are usually pruned for one or more of three reasons:

- to preserve health
- to maintain good appearance
- to ensure public safety

A systematic pruning program is an important component of every community forest management plan.

Pruning for health includes removal of broken, dead, or diseased branches, in order to prevent pathogenic organisms from penetrating into adjacent parts of the tree or spreading to other trees. Live branches are pruned out in order to allow for more sunlight and air circulation throughout the canopy. Crown pruning also reduces wind resistance and helps prevent breakage.

Pruning for appearance can maintain or restore the crown characteristics that are typical for the species. Crown shaping is also used to restrict growth of a normally large-growing shade or ornamental tree and keep it within certain boundaries, such as away from buildings.

Pruning for safety eliminates dead, split, and broken branches before they cause damage to people or property. Danger from falling limbs exists where there are targets, such as along community streets and in public parks.

Pruning for safety also includes two types of clearance trimming. Low-hanging live branches need to be removed to eight feet above ground to avoid interference with pedestrian traffic, and to eighteen feet above ground to avoid vehicular traffic. The second type of clearance trimming is the removal of branches that obscure traffic

signs and signals.

Safety pruning is required to keep branches away from energized electrical lines. Branches that touch lines may interrupt service and may cause serious injury if the lines are knocked down.

Pruning classes

There are several approaches to pruning that should be considered when evaluating a tree. They include:

- **Crown cleaning** is the removal of dead, diseased, obstructing, split, and/or broken branches that are 2" in diameter or greater. Crown cleaning also describes the need for thinning dense or heavy foliar masses, in order to reduce their susceptibility to failure.

- **Crown raisin**g is the removal of the lower limbs of a street tree in order to provide clearance for pedestrian and vehicular traffic. Limbs above sidewalks should be no lower than eight feet (8'). Limbs above the road should be no lower than eighteen feet (18').

- **Crown reduction** involves reducing the overall mass by cutting back the top and sides, or by just removing individual limbs of the tree. Crown reduction is commonly associated with pruning away from buildings, structures, or overhead utility wires.

Stem Girdling Roots

Stem girdling roots (SGR), or roots that circle around the trunk, can stop the flow of carbohydrates and water up and down the trunk and over time these roots structurally strangle the tree trunk, which can lead to tree failure ground level. A few signs to look for to diagnose SGRs include if the trunk has no root flare or if you can visibly see a root above the surface that is wrapped around the trunk.

Staking

Stakes may need to be removed or added. Not removing staking systems can cause long-term damage if they end up cutting into the trunk and they can also lead to weakening the tree's ability to support itself by not allowing the tree to develop proper tapering and anchoring roots that results from movement in the wind.

Not all trees need to be staked, but they are often installed in highly windy areas, or in high-use areas as a reminder that a new tree has been planted. If this is the case, it may be necessary to mark a tree for staking. If staking is necessary, they staking system should be removed after one year.

Cabeling and bracing

To help trees overcome weak branch unions, cables or rods can be installed by a professional Certified Arborist. These will add strength to the unions. It is important to note that cables and rods should be inspected on a yearly basis and should only be installed by an Arborist certified through the International Society of Arboriculture (ISA).

Mulching

Mulching trees has many benefits, including regulating temperatures, keeping lawn mowers and weed whackers away from the base of the tree, and conserving moisture. However, too much mulch can cause harm. Mulch should be applied in a 2 – 3 inch layer around the tree, should never touch the trunk, and can be applied annually.

The right way to mulch

The wrong way to mulch

Fertilizing

Trees should be fertilized based on an analysis-and-prescription approach. A sign that a tree may need fertilizing is yellowing of the leaves. It should be noted that fertilizing can cause more harm than good, especially if the tree is stressed. If you mark a tree for fertilization, a professional ISA Certified Arborist should confirm your recommendation.

Watering

Trees need water to survive – it is a basic requirement of the photosynthesis process. Watering is especially important during the early establishment period for a tree. If you inventory a tree that has been planted in the last couple of years that is struggling and not receiving regular watering, it should be indicated in order to ensure that the tree is put on a watering schedule.

TREE HEALTH EVALUATION

Two potential invasive forest pests are threatening Vermont's trees and for this reason, increasing species diversity is important. The emerald ash borer has already killed millions of ash trees. Ash trees are a popular urban tree for its tolerance to tough growing conditions and have planted extensively along streets in many Vermont communities.

The Asian long-horned beetle is another pest of great concern. This beetle has a larger tree appetite range and feasts on a variety of trees including maple, elm, horsechestnut, ash, birch, poplar, willow and many more. If any trees in the landscape are showing signs of infestation, take action by learning more and calling for assistance. For *more information on Vermont invasive tree pests, visit www.vtinvasives.org.*

When conducting a tree inventory, it is

important to look for signs on trees for potential pest problems so an infestation can be detected.

EAB/ALB surveying method

- Stand back from the tree and look from the top to the bottom to gauge the tree's overall health. Take note of crown condition, woodpecker activity on trunk and limbs, dead limbs, yellowing leaves, splitting bark, and defoliation. Move a quarter of the way around the tree and observe from that side. Continue this action until four sides have been observed.

- Using binoculars, start at the base of the tree and move slowly up the trunk looking for signs or symptoms of invasive insect attack (exit holes, frass, oviposition sites, oozing sap, bark splits, exposed galleries, woodpecker damage). Look at the limbs as well as the trunk; insects will attack the underside of small branches as well as the trunk so be sure to look at the entire tree.

- If you suspect Asian longhorned beetle or emerald ash borer, be sure to flag the tree and contact the USDA, Vermont Agency of Agriculture or Department of Forests, Parks, and Recreation. Even if you are not sure if what you are seeing is indicative of an invasive forest pest, contact someone from one of the above agencies anyway; it is better to be safe than sorry.

Emerald Ash Borer

Tree Identification

A tree is identified by both a scientific name and a common name. Scientific names are very precise. Each tree has only one scientific name. It consists of at least two parts: a genus name and a species name. Sometimes a tree is further identified by variety or cultivated variety (cultivar).

There are strict rules about how scientific names are written. For example,

Scientific name: *Acer rubrum*

- **Genus:** comes 1st, is capitalized
- **Species:** is not capitalized
- Scientific name is underlined or italicized
- The underlining is interrupted between the two parts

Common names are imprecise, and they often create confusion because their usage is not consistent. One common name may be used to describe two or more different trees or species of tree. Just as often, one tree species may be known by more than one common name.

An example of the confusion caused by common names occurs with two maple species. *Acer rubrum* is commonly (and almost equally) known by two common names, swamp maple and red maple. However, some people use "red maple" to refer to a red-leaved variety of Acer platanoides, Norway maple. Both are maples, but they have significant differences and Norway maple has invasive qualities as well.

The task of identifying a particular tree generally begins with the question "Conifer or hardwood?" There are readily noticeable differences between the two:

Conifers	**Hardwoods**
- mostly evergreen	- mostly deciduous
- needles or scales	- leaves
- no flowers	- flowers
- seeds are in cones	- seeds are in fruits

To identify conifers, it is helpful to look at:

- Overall form (silhouette, habit)
- Type of foliage
  - *Needle or scale shape*
  - *If needles, number in each bundle*
- Cones
  - *Shape, size, placement on twig*

To identify broad-leaved hardwood trees, it is helpful to look at:

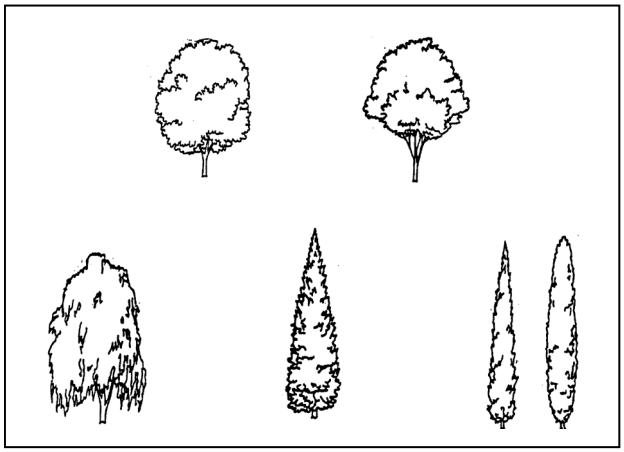
- Overall form (silhouette, habit)
- Leaf shapes
- Flowers
- Fruit
- Bark and twigs
- Buds (leaf and flower)

The overall form of trees is an important identification tool. Trees grow in distinct patterns that differ from species to species.

Some typical shapes are:

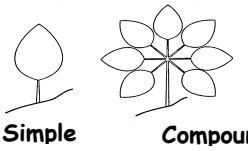
- Oval to rounded
- Vase
- Weeping
- Pyramidal or cone (many evergreens)
- Columnar

Tree Identification

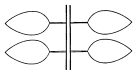


Leaves are a key feature for identifying deciduous hardwood trees. The first items to be determined about leaves are:

Leaf types



Leaf arrangement



Compound leaves have leaflets and include three types:

Pinnately compound

Palmately compound

Twice pinnately compound

Other distinctive features of leaves that aid in tree identification include:

- Shape
- Margin (edge)
  - Smooth, toothed, wavy
- Vein pattern
  - Feather-shape, palm-shape

Biologists sometimes use technical words to describe leaf shapes, such as lanceolate (lance-shaped, i.e. long and thin), ovate (egg-shaped), and obovate (wider at the leaf tip than at the leaf stalk).

Fruits are yet another feature that is useful to help identify a hardwood species. Types of fruits include

- Acorns (oak)
- Winged keys or samara
  - single (elm)
  - double (maple)
- Pomes (apple, pear)
- Drupes (cherry, plum)
- Pod (locust, honeylocust)
- Berry (holly, dogwood)
- Capsule (poplar, willow)
- Nut (beech, hickory, horsechestnut)

More detailed descriptions and illustrations of each of the above features are contained in tree identification manuals and field guides. Several titles are listed at the end of this section.

A process called “keying out” is a common method that is used to help identify a tree by using its leaves. Learning this method will help participants maximize use of the tree identification pages in this manual or

Tree Identification

any field guide.

In the “keying out” process, a species key is arranged in couplets. The two statements are written so that if one is true, the other must be false. Each statement in the couplet begins with the same number.

To navigate through the species key

- Read the pair of statements in the couplet
- Determine which statement applies to the plant in question

At the end of each statement there is either

- The genus of the plant identified, or
- Direction to another numbered couplet

When the genus of the plant has been identified, it is then possible to look up and read about that genus.

The tree genus and species can now be identified by referencing the written descriptions, drawings, and photographs.

The “Definitions for Tree Identification” that are found immediately following the Species Key example will also help navigate through the key.

Tree Identification

Species key for some of VT's common tree species

1. The leaves are opposite.	**2**	
1. The leaves are alternate.	**4**	
2. The leaves are simple.	**3**	
2. The leaves are compound.		**FRAXINUS (Ash)**
3. The leaves are pinnately veined.		**CATALPA (Catalpa)**
3. The leaves are palmately veined.		**ACER (Maple)**
4. The leaves are compound.	**5**	
4. The leaves are simple.	**6**	
5. The leaflets are lanceolate; there are more than 20 leaflets per leaf.		**GLEDITSIA (Honeylocust)**
5. The leaflets are ovate; there are less than 20 leaflets per leaf.		**ROBINIA (Locust)**
6. The leaves are lobed.	**7**	
6. The leaves are not lobed.	**8**	
7. The leaves are palmately veined.		**PLATANUS (Sycamore)**
7. The leaves are pinnately veined.		**QUERCUS (Oak)**
8. The leaves are pinnately veined.	**9**	
8. The leaves are palmately veined.	**12**	
9. The leaf stalk is more than ½ as long as the leaf blade, often as long as the blade or longer.	**15**	
9. The leaf stalk is less than ½ as long as the leaf blade.	**10**	
10. The leaves are double-toothed along the margin.	**14**	
10. The leaves are either single-toothed along the margin, or entire.	**11**	
11. The veins are straight and parallel, seldom branched.		**ZELKOVA**
11. The veins are somewhat curving and branched.		**MALUS (Crabapple)**
12. The leaf is broader than long.		**TILIA (Linden)**
12. The leaf is narrower than its length.	**13**	

13. The leaf is unequal in size at base, and uneven at base.	**CELTIS (Hackberry)**
13. The leaf is equal in size at base and even at base.	**MORUS (Mulberry)**
14. The leaf base in uneven.	**Ulmus (Elm)**
14. The leaf bas is even.	**Betula (Birch)**
15. The leaf is toothed edges with more than one tooth per vein and teeth are blunted. Blade is wide.	**Populus (Poplar)**
15. The leaf is toothed with rounded teeth. Sharp tipped spurs.	**Pyrus (Pear)**

Tree Identification

Common Trees in Vermont

SUGAR MAPLE	*Acer saccharum*
NORWAY MAPLE	*Acer platanoides*
HONEYLOCUST	*Gleditsia triacanthos*
LITTLELEAF LINDEN	*Tilia cordata*
RED OAK	*Quercus rubra*
GREEN ASH	*Fraxinus pennsylvanica*
FLOWERING CRABAPPLE	*Malus spp.*
BOXELDER	*Acer negundo*
SILVER MAPLE	*Acer saccharinum*
RED MAPLE	*Acer rubrum*
AMERICAN ELM	*Ulmus americana*
WHITE ASH	*Fraxinus americana*
GINKGO	*Ginkgo biloba*
WHITE PINE	*Pinus strobus*
PIN OAK	*Quercus palustris*
PAPER BIRCH	*Betula papyrifera*
COTTONWOOD	*Populus deltoides*

Other Less Common Vermont Trees:

CATALPA	*Catalpa spp.*
HACKBERRY	*Celtis occidentalis*
AMUR MAPLE	*Acer ginnala*
ENGLISH HAWTHORN	*Crataegus laevigata*
JAPANESE TREE LILAC	*Syringa reticulata*
SERVICEBERRY	*Amelanchier canadensis*
HYBRID POPLAR	*Populus*

Oppsite Branching Trees

MAD CAP HORSE

Maple, Ash, Dogwood, Catalpa & Horsechestnut

MAPLE TIP SHEET

ROUNDED SINUS

NORWAY *Acer platanoides*

- BARK: Dark, looks corragates
- BUDS: greenish to maroon
- WINGED FRUIT: 180°

LEAF PETIOLE PRODUCES MILKY SAP WHEN BROKEN

RED: *Acer rubrum*

- BARK: 2-tone, older bark black and rough. Younger branches silver and smooth
- BUDS: red
- TWIGS: red, red petiole

LEAF: 3 LARGE POINTS, 2 SMALL; TWIG IS ODORLESS WHEN BROKEN

POINTED SINUS

SUGAR: *Acer saccharum*

- *BARK: long & thick that slightly curves back at edges*
- *BUDS: brown small conical/pointed*
- *Many branches and twigs*
- *WINGED FRUIT: 45°*

LEAF PETIOLE PRODUCES CLEAR SAP WHEN BROKEN

SILVER: *Acer saccharinum*

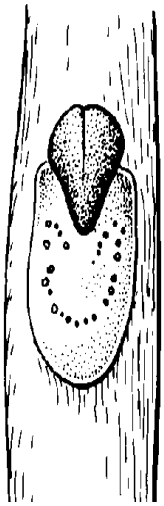
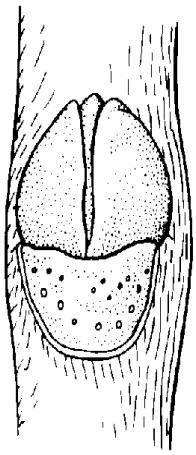
- BARK: older bark is shaggy
- BUDS: abundant terminal
- Re-curving branches
- LEAF: very deep sinuses

TWIG SMELLS RANK WHEN BROKEN

EVERGREEN TIP SHEET

PINE	SPRUCE	FIR	HEMLOCK
• Needles in bundles • White pine: 5 per bundle • Pitch Pine: 3 per bundle • Most others: 2 per bundle	• 4 sided needles (roll between fore finger and thumb) • Twigs rough • Pendulous branching • Cones hang down 'Sprickly Spruce'	• Needles not stalked • Twigs smooth • Upright branching • Upright cones 'Friendly Fir'	• Needles arranged in flat sprays • Twigs rough • Tiny round cones hang down from underside of branch

ASH TIP SHEET

WHITE ASH *Fraxinus americana*	GREEN ASH *Fraxinus pennsylvanica*
Trees are difficult to distinguish - you will need to look at the leaf scars to be sure.	
• Leaf scar: Top edge is rounded (smile shaped) **"Smile if you are proud to be an American"** 	• Leaf scar: Top edge is straight across. • Leaf: Tends to be more lanceloate (much longer than wide) 

OAK TIP SHEET

RED OAK *Quercus rubra*	WHITE OAK *Quercus alba*	PIN OAK *Quercus palustris*
• BUDS: hairy at extreme tips only, not angled • BARK: dark, furrowed - look for reddish 'ski trails' • ACORN: flat saucerlike. Nut is tall	• BUDS: blunt, reddish, slightly hairy at ends of bud scales • BARK: light gray, flaky. • ACRON: short stalked, bowl-like cap with raised 'bumpy' scales.	• BUDS: clustered, hairless • FORM: upper branches up-right. Middle branches horizontal. Lower branches downward • LEAF: distinct deeply incised lobes • ACORN: shallow, saucerlike, nut is short and squat

DEFINITIONS

Alternate: leaves occurring singly along a stem in an alternating position (cf. opposite)

Blade: the broad part of the leaf

Compound: each leaf is divided into two or more segments called leaflets (cf. simple)

Cultivar: cultivated variety. May be included as a third word in a scientific name.

Deciduous: refers to trees that lose their leaves on a seasonal basis

Double-toothed, double serrate: the large teeth on the leaf edge bear smaller teeth within

Entire: the margin of the leaf has no teeth or lobes

Genus: the first word in a two-word scientific name

Lanceolate: much longer than wide; lance-shaped

Lobed: a projecting division of a leaf

Margin: the edge of the leaf

Opposite: leaves situated at each node, across from each other on the stem (cf. alternate)

Ovate: egg-shaped in outline

Palmate: branching or radiating fan-like from a common point. Leaves can be palmately veined. Compound leaves can have palmately-arranged leaflets.

Petiole: the stem of the leaf (cf. stalk)

Pinnate: branching from a common axis; feather-like. Leaves can be pinnately veined. Compound leaves can have pinnately-arranged leaflets.

Samara: single (elm) or double (maple) winged keys that contain seeds

Simple: each leaf is composed of a single segment (cf. compound)

Serrate: the margin of the leaf has teeth; sawtoothed

Serrulate: the margin of the leaf has minute teeth

Species: the second word in a two-word scientific name

Stalk: the stem of the leaf (cf. petiole)

Variety: subdivision of a species. May be included as a third word in a scientific name.

Vermont Community Tree Inventory Planning Worksheet

The goal of Vermont's Community Tree Inventory Program is to engage citizens in the care and management of their trees and forests, and help them to identify, prioritize, and take action towards the management needs identified in their inventory. Inventories can be completed relatively quickly and simply or can be very detailed depending on the needs and capacity of your community. The Urban and Community Forestry (UCF) Program provides two basic inventory templates for Vermont communities to use:

The Vermont Roadside Tree Assessment: A "windshield survey" of back roads to identify hazardous trees and forest health issues. The roadside inventory is an inexpensive, quick and effective procedure whereby a cursory visual inspection and count can be made by trained volunteers or municipal staff from a vehicle. Trees with hazardous defects and pest and disease concerns can be flagged for a follow-up inspection by a qualified professional. Inspection may include all public trees in the town ROW or a representative sample.

Shade Tree Inventory: A more detailed, systematic inventory of public shade trees within a specified area or along high use roads or densely settled neighborhoods to identify species diversity, size class diversity, hazardous trees, structural or tree health concerns, and maintenance needs.

The Vermont Urban & Community Forestry Program can provide your community with:

- Planning support
- Training
- Data analysis and basic reporting
- Planning next action steps
- Tools (loaned measuring devices and inventory equipment, data storage, etc.)

HOW TO USE THIS WORKSHEET?

We have developed this worksheet to help you think through the process of planning your inventory. In general, the process involves:

1. Forming your inventory team.
2. Developing or updating urban forest management goals and specific objectives.

APPENDIX A - Vermont Community Tree Inventory Planning Worksheet

3. Determining where you want to focus your inventory, what data needs to be collected, and how it will be used.

4. Making a plan for conducting the inventory.

   a. Who will be involved?

   b. What are your training needs?

   c. What equipment do you need?

   d. What is your timeline for recruiting volunteers/hiring a consultant, conducting the inventory, analyzing and summarizing the data, and developing management recommendations

5. Getting outside and collecting your data.

FORM YOUR INVENTORY TEAM

Many towns have tree wardens or city foresters, individuals appointed by the Selectboard to protect and maintain public trees. Contact your town clerk to see who the tree warden is in your community or who is responsible for maintaining public trees. Your community may even have a tree board. Conservation Commission members are another great group to engage. Involve SOUL Tree Stewards, Master Gardeners, and outdoor recreational groups. Contact Elise Schadler at elise.schadler@uvm.edu for a list of SOUL Tree Stewards in your area and master.gardener@uvm.edu for a list of master gardeners.

	NAME	PHONE	EMAIL
1			
2			
3			
4			
5			
6			
7			
8			
9			

APPENDIX A - Vermont Community Tree Inventory Planning Worksheet

MANAGEMENT GOALS & OBJECTIVES

Develop or update urban and community forestry management goals and objectives.

Establish program goals that address identifiable community needs and management strategies that will produce measurable results. Program goals provide the basis for formulating, implementing, and evaluating your management actions. There is little point in establishing a goal if there is no practical way of determining whether progress is being made towards achieving that goal. For example, while it is most admirable to seek to "protect the health and welfare of the community" or to "improve the health of the urban forest," such goals are very general and tangible results are difficult to measure (USDA Forest Service 1992).

Some examples of measurable management goals and objectives include:

- Goal: Reduce the risk to personal safety and property by mitigating hazardous tree defects.

  Specific objectives include:

  - Regularly inspect trees for hazardous defects.

  - Develop or update the municipal tree ordinance to clarify roles and responsibilities.

  - Perform regular maintenance to promote tree health, vigor and structural strength.

This addresses a key public safety need. Tangible actions (e.g. establishing tree inspection guidelines) can be taken, and progress can be measured by documenting the dates when risk inspections are conducted and corrective actions are implemented.

- Goal: Reduce the risk of the introduction and spread of forest pests, plants and disease.

  Specific objectives include:

  - Educate community members about how forest pests and disease are introduced and spread.

  - Facilitate the early detection of invasive pests and plants.

  - Avoid pruning or removing host tree species or plants during times of the year when they are easily spread.

Tangible actions (e.g. annual surveying host species for invasive forest pests in high risk areas, such as campgrounds) can be taken.

APPENDIX A - Vermont Community Tree Inventory Planning Worksheet

- Goal: Reduce the impacts of invasive forests pests.

  Specific objectives include:

  - Enhance and maintain tree species diversity by filling existing and future planting spaces with diverse tree species.

  - Preserve historic and significant trees by identifying significant or historic trees to treat should these pests arrive, and

  - Promote tree health, vigor and structural strength by performing regular mainte nance, planting trees that are appropriate for the site and planting and maintaining trees at appropriate spacing.

  - Enhance and maintain age diversity.

- Goal: Ingetrage trees into all community planning decisions.

  Specific objectives include:

  - Residents and town staff are well trained in proper tree planting and care.

  - Management strategies are acknowledged, understood and cooperatively implemented by appropriate municipal departments or committees.

Goals and Objectives

APPENDIX A - Vermont Community Tree Inventory Planning Worksheet

FOCUS, DATA AND USE

Determine where you want to focus your inventory, what data to collect, and how it will be used.

Where? Based on your management goals and capacity, you may want to focus on trees in town centers and public open spaces and other high use areas where trees could be a hazard to public safety. You'll need to determine where the town right-of-way (ROW) boundaries are located in order to determine which trees are public trees. This may be difficult to obtain. Most towns use a standard width of 3 rods (1 rod=16.5 feet) for road ROW's. 3 rods is about 25' from the road center. Check with the town clerk or road commissioner regarding the town policy for determining ROW boundaries.

Using a map of your town, highlight where you want to focus.

Areas to Focus

_____

_____

_____

_____

_____

_____

What? What information do you need and how will it be used? Once you determine what trees you are interested in focusing on, then think about what information you need to collect to implement your management goals. For example, if one of your management goals is to "reduce the impacts of invasive forests pests" you would need to collect the following information to help you meet the specific objectives of enhancing and maintaining species and age diversity, preserving historic, and significant trees and promoting tree health, vigor and structural strength:

- Species, which will help you understand what species are dominant and in what proportion and where you need to diversify the species of trees with future plantings
- Diameter, which will help you to understand your age class diversity and develop a plan for planting replacement trees spread out over time.

APPENDIX A - Vermont Community Tree Inventory Planning Worksheet

- Tree health indicators such as crown dieback, structural damage, pest damage and condition, which will help you detect any pest or disease problems and develop a plant to manage them.
- Maintenance needs such as pruning, staking, fertilizing and stem girdling roots, will help you determine what resources (people and financial) are needed to address those needs.

Information needed

- ◯ Species
- ◯ Diameter at breast height (DBH)

Tree health indicators:

- ◯ Crown dieback
- ◯ Decay
- ◯ Bark splits
- ◯ Cankers
- ◯ Seams
- ◯ Woodpecker activity
- ◯ Exit holes
- ◯ Root damage

- ◯ Condition
- ◯ Remove the tree
- ◯ Consult needed.

Maintenance needs:

- ◯ Prune
- ◯ Stem girdling roots
- ◯ Stake
- ◯ Remove stake
- ◯ Cable/Brace
- ◯ Mulch
- ◯ Remove mulch
- ◯ Fertilize
- ◯ Water

- ◯ Vacant planting space size
- ◯ Nearest home/building address

APPENDIX A - Vermont Community Tree Inventory Planning Worksheet

MAKE A PLAN

1. **Who will be involved?** (*see "Form an inventory team" on page 35*)

2. **What is your timeline for recruiting volunteers, conducting the inventory, analyzing and summarizing the data, and developing management recommendations?** *(see table below)*

3. **What are your training needs?** Helpful skills for conducting community tree inventories include: tree identification, tree biology and assessment, and experience working with technology. If you need training in any of these areas, the UCF team can support you as well as go over the inventory protocol our inventory data collection methodology and system.

Training Needs

1. Inventory protocol
2. Using the VT UCF tree collection data application (free to download on any "smart" device)
3. Tree Identification
4.
5.
6.

Timeline

Activity	Timeline
Recruit volunteers to help collect data	May-June 2012

APPENDIX A - Vermont Community Tree Inventory Planning Worksheet

4. **What equipment do you need?**

Below is a list of the recommended equipment for inventory work. The UCF Program can provide a number of resources as part of an inventory field kit. It is important to designate one person to be responsible for the inventory field kit.

Person Responsible: _____

Phone: _____ Email: _____

Equipment	Quantity	Department/Contact
1. Tree diameter tapes	6	UCF Program
3. Tree ID guide	5	UCF Program
4. EAB/ALB SURVEY GUIDE	5	UCF Program
5. Flagging	5	UCF Program
6. Paper inventory sheets	5+	UCF Program
7. Pest sample tools (knife, collection vial, forceps)	5	UCF Program
8. Binoculars	5	UCF Program
9. Bright colored vests	8	UCF Program
10. First aid kit	5	UCF Program
11. Water/Snacks		
12. Comfortable footwear		
13. Hat, sunscreen, bug spray		
13. First aid kit		

APPENDIX A - Vermont Community Tree Inventory Planning Worksheet

5. What's your budget

Larger cities in Vermont have paid staff who are responsible for the care of public trees. You may want to hire a forestry consultant or youth to conduct the inventory for your community. Estimate costs below. As mentioned previously the UCF Program can help with data analysis and reporting if a community wants to use our inventory templates and either collect the data electronically or provide the data electronically.

Budget

Activity	Personnel Regular Time	Contracted Work	Adminstrative Costs (overhead)
Inventory			
Data analysis			
Reporting			

Urban and Community Forestry Contacts

Danielle Fitzko
VT Urban and Community Forestry Program
Dept. of Forests, Parks & Recreation
1National Life Drive, Davis 2
Montpelier, VT 05620-3801
(802) 598-9992danielle.fitzko@state.vt.us

Caitlin Cusack
VT Urban and Community Forestry Program
University of Vermont Extension
655 Spear Street
Burlington, VT 05405-0107
(802) 656-7746
caitlin.cusack@uvm.edu

Kate Forrer
VT Urban and Community Forestry Program
University of Vermont Extension
617 Comstock Road, Suite 5
Berlin, VT 05602
(802) 223-2389 ext. 210
katherine.forrer@uvm.edu

Elise Schadler
VT Urban and Community Forestry Program
University of Vermont Extension
655 Spear Street
Burlington, VT 05405-0107
(802) 881.1256
elise.schadler@uvm.edu

(This worksheet was developed using the Tree Emergency Planning Worksheet developed by: Lisa Burban (USDA Forest Service), Jim Hermann (Minneapolis Park and Recreation Board), and Katie Himanga (Heartwood Forestry). Updated May, 2006. Worksheet available on-line at: http://www.na.fs.fed.us/urban/inforesources - under "Urban Forest Management")

APPENDIX B - Sample FAQ Brochure

Community Tree Inventory: *Questions and Answers*

What are you doing?
We are community volunteers collecting data on our municipal trees.

This information will help our community manage its public tree population. The data collected will enable us to better understand how many and what types of trees to plant, which trees need more maintenance, and which ones survive best in our neighborhoods.

What information are you collecting?

- Type of tree
- Size of tree
- Tree health signs
- Overall tree condition
- Maintenance needs

  - pruning, mulching, staking, cabeling & bracing, fertilizing, watering

Are you going to cut them down?
NOT Necessarily. The purpose of the inventory is to collect the above information in order to assemble an overall picture of our community forest.

What's wrong with my tree?
The volunteers out here today have been trained to collect tree inventory information. They are not professional arborists. You can call a professional certified arborist to better understand what's wrong with your tree or visit www.treesaregood.com for more information on tree health and care.

How can I get involved?

CALL XXXXXXXXXX FOR MORE DETAILS: 000-000-0000

THIS INVENTORY IS BEING COMPLETED BY XXXX.

APPENDIX C - Sample MOA for loaning of Trimble Juno Units

CF-MOA-201*-**

State Of Vermont
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF FORESTS, PARKS AND RECREATION
VERMONT URBAN AND COMMUNITY FORESTRY PROGRAM
MEMORANDUM OF AGREEMENT

This Agreement is made between the State of Vermont, Department of Forests, Parks and Recreation, by the Urban and Community Forestry Program Coordinator, Danielle Fitzko, 103 South Main Street, Waterbury, Vermont 05601-0601, hereinafter called State, and [Municipality], hereinafter called Town, for the short-term lending of 2 'Juno' handheld data recorders with the following serial numbers:_____. This agreement is subject to the following terms and conditions:

Term: The term of this agreement shall be from [Start Date] to [End Date]. The data recorders may be picked up at the UVM Extension Berlin Office anytime after signing; they are to be returned to the UVM Extension Berlin or Burlington offices on or before [Date].

At least one representative of Town is required to attend a short orientation course on the proper operation of the data recorders, to be given by UCF Program Staff office on the time of pick up.

Condition and Repairs: Town agrees to accept loaned data recorders "as they are". [Town] agrees to return all data recorders loaned in at least as good condition as they were at the time of pickup. Town agrees to repair or pay for repairs to damaged data recorders. Town also agrees to reimburse State for any data recorders not returned or not repairable. The replacement cost per data recorder is $650.00.

Fee: There shall be no fee for the lending of the data recorders, except that Town agrees to acknowledge the Vermont Urban and Community Forestry Program on their list of supporting organizations and individuals.

Agreed this day of , 201*:

For [Municipality]: For State of Vermont:

Vermont Shade Tree Inventory Protocol

INVENTORY APPROACH

The shade tree inventory is conducted by foot. Each inventory team should have one field kit and be responsible for one street segment or area. When you approach each tree, walk around it and visually scan it from top to bottom before starting to collect data in order to identify the species and get a general sense of structural or health issues. It's important to assess all four sides because defects and health issues may only be obvious when viewed at certain angles. Use your binoculars to examine the crowns of larger trees. For more detailed instructions (with photo diagrams) reference the document, Shade Tree Inventort using a Juno Unit.

BEST PRACTICES FOR USING THE TRIMBLE JUNO UNIT

The Juno Series handhelds are durable devices, but are not fully rugged; take care when handling or using the handheld. When using the handheld:

Keep it clean—Keep the outer surface free of dirt and dust and ensure that protective covers and doors are appropriately fitted. To clean the handheld, wipe it with a clean dry cloth. Do not immerse the handheld in water.

Keep it dry— The handheld is not waterproof. Do not expose it to rain or moisture.

Protect the touch screen by using the stylus provided and avoid using excessive pressure and sharp or abrasive objects.

Do not store it in your car or any place where it is subject to extreme temperatures.

Don't drop the handheld or subject it to any strong impact.

Be patient— The handhelds respond best to a light, quick tap with the pen. You should not have to press hard or hold the pen on the screen; in fact, this will just damage the handheld. Please be patient, when the GPS running it can slow IT down.

Start with a fully charged battery & monitor throughout the day—Battery power can be monitored by tapping the battery icon on the top right corner of the main screen or by going to the start icon in the top left of the screen and tapping "Settings", the "System" tab and then the "Power" icon. When the GPS is running it does use up the battery a lot faster.

If the unit freezes—To reboot the unit hold the power key until the unit turns off. Wait a couple of seconds before tur**n**ing it back on again.

If the GPS doesn't seem to be working—If, after following the directions for collecting Lat/Long data, the GPS still doesn't seem to be working make sure that the GPS Controller is closed. GPS Controller is accessed by tapping on the Start icon in the upper left hand corner. After exiting out of GPS Controller close out of and then reopen DataPlus to reset the GPS function.

APPENDIX D - Vermont Shade Tree Inventory Protocol

Equipment

Field kit includes:

- Forestry cruiser vest
- Trimble Juno unit (make sure that the battery is charged)
- Instrument to measure trunk diameter (DBH) in inches
- Tree ID guides
- EAB/ALB/HWA signs and symptoms field guide
- Pest sample tools (knife, collection vial, forceps)
- Binoculars
- Flagging
- Extra paper inventory sheets, clipboard, paper and pencils

Extra equipment to remember:

- Map of each street or area to be inventoried
- Bright colored clothing or reflector vests
- Water/snacks
- Comfortable footwear
- Hat/sunscreen/bug spray
- First aid kit
- Cell phone

Data Collection—Setting up your project

1. Turn on the Juno unit by pressing the **Power** key on the left hand side.
2. Tap the **Start** icon in the top left of the screen.
3. Choose the **D+ Dataplus CE Progam**.
4. Tap the word **Menu** (bottom left) and select **Data -- Collect Data**.
5. **Create a new dataset**. (If you are conducting an inventory over multiple days you will open the same dataset each time by selecting the dataset and then tapping open selected.) Name your dataset with the first 4 letters or your town name and the year of the inventory. For example, the town of Colchester's inventory dataset for 2012 would be named Colc12.
6. Tap **Create**. To access the keyboard for entering text, tap the keyboard icon at the bottom of the page.
7. Enter the following data for your inventory project for each discrete area where you are collecting information. For example, you will enter a separate project for each greenspace (town green, ballfield, etc). You'll also want a separate project for each street. You may want to break each street up into separate segments, which should all be entered as separate projects.

FUNCTION KEYS FOR THE TRIMBLE UNIT
F2, Up Button or double tap: to select the drop down list or enter info. into a field.
F3: when you want to advance/add another tree
F4: exit up a level (from an individual tree record to the project record)
F5: advance down a level (from the project level to an individual tree record)
Type control key using the keyboard and then the Up Button: to go to a previously entered tree record or street/site.
Keyboard: in the middle of the bottom of the screen you will see a keyboard icon. Tap this to access the keyboard.

CODE	FIELD NAME	DESCRIPTION
pkSiteID	Unique site identifier	The program auto populates this field based on the data you enter in this form.
Town	Town name (required)	Select your town name from the drop down list.
Project	Project name (required)	Divide your town into neighborhoods, sections or areas. Indicate that here, i.e. northwestern quadrant.
Street	Street (required)	Select the street from the drop down list. If you are inventorying a greenspace, enter the name of the closest street where you will start. You will enter the name below.
FromAdd	From address (required)	Enter the number of the closest street address to where you started.
ToAdd	To address	Enter the number of the closest street address to where you plan on stopping.
Greenspace	Greenspace name	Enter the name of the greenspace.
Date	Date (required)	This should auto populate with today's date. If not, enter the inventory date.
Name	Surveyor name(s) (required)	Enter the initials for each surveyor.

8. Tap F5 to start entering individual tree data.

Data collection—inventorying individual trees

We have designed this inventory program to allow you to collect information that will allow you to understand species and size class diversity and identify hazardous trees, structural or tree health concerns, and maintenance needs. We realize however that your community's capacity and management goals dictate the type of information you are able to collect so we have set up the program so that tree species is the only required field for each tree. A description of each data field is found in the table below.

FUNCTION KEYS FOR THE TRIMBLE UNIT
F2, Up Button or double tap: to select the drop down list or enter info. into a field.
F3: when you want to advance/add another tree
F4: exit up a level (from an individual tree record to the project record)
F5: advance down a level (from the project level to an individual tree record)
Type control key using the keyboard and then the Up Button: to go to a previously entered tree record or street/site.
Keyboard: in the middle of the bottom of the screen you will see a keyboard icon. Tap this to access the keyboard.

APPENDIX D - Vermont Shade Tree Inventory Protocol

Rules of Thumb for which trees to inventory

- Only inventory obvious, maintained trees.
- Shrubs or 'foundation plantings' should not be inventoried.
- If a large grouping of trees in located at a fence line/hedge row, they can be inventoried as one. Under the 'Tree Species' select hedge row.

CODE	FIELD NAME	DESCRIPTION
TreeNum	Tree number (required)	The program will auto populate this field. Make sure the number is recorded correctly on the map.
Sp	Tree species (required)	Many of the species also have the genus (i.e. maple) so if you are having trouble identifying to the species level you can enter the genus. If this is an empty planting site, then select vacant and then who manages the planting site (private, town, utility or other public entity). Note: To make navigation in a long list easier, when you have the species list tap the keyboard icon and then type in the first letters of the common name and it will advance the list to that letter.
DBH	Diameter at breast height (inches)	Select the diameter class in inches of the tree. If you need to measure the tree here are some tips: • Measure 4.5' on the uphill side of the tree. • It there is a bulge at DBH, measure just above the bulge, where the stem returns to normal. • If the tree has a fork below 4.5', measure just below the split. If the tree has multiple stems originating at ground level, measure the DBH of each stem, add the values together, and add a clarifying comment. (ex. The DBH for four multiple stems measuring 10 inches each is entered as "40" and "4 stems" is entered as a comment).

FUNCTION KEYS FOR THE TRIMBLE UNIT
F2, Up Button or double tap: to select the drop down list or enter info. into a field.
F3: when you want to advance/add another tree
F4: exit up a level (from an individual tree record to the project record)
F5: advance down a level (from the project level to an individual tree record)
Type control key using the keyboard and then the Up Button: to go to a previously entered tree record or street/site.
Keyboard: in the middle of the bottom of the screen you will see a keyboard icon. Tap this to access the keyboard.

APPENDIX D - Vermont Shade Tree Inventory Protocol

TREE HEALTH ASSESSMENT **The following checklist will allow you to identify and assess forest health issues and structural defects that could lead to a hazardous situation.**		
DdBrokn	Dead/Broken Branches	Select **'Y'** if there are any dead or broken branches >1" diameter in the crown.
CrwnDie	Crown Dieback	Select **'Y'** if the new fine twigs (<1" diameter) are missing leaves or branch(es) are dying, in a pattern generally from the tip towards the main stem.
Decay	Decay	Select 'Y' if there are signs of bacterial or fungal infection on main stem or branches.
BrkSplt	Bark splits	Select **'Y'** if there is a fissure or deep split in the bark and wood of the tree.
Cankers	Cankers	Select **'Y'** if there is an area of dead bark and cambium anywhere on the tree's surface. Cankers can be caused by fungi, insects, weather or mechanical damage such as mowers or vehicles.
Sprouts	Sprouts	Select **'Y'** if there are epicormic sprouts (also known as water sprouts) along the trunk.
WdPcker	Woodpecker activity	Select **'Y'** if there are woodpeckers actively feeding/nesting in the tree or if there is evidence (holes) of their activity in the stem and/or branches.
ExtHole	Exit holes	Select **'Y'** if you notice any evidence of insect exit holes on the stem or branches. You will most likely have to use binoculars to get a close enough look at holes in the top of the tree. Many insects infest the top of the tree first so it's important to start there.

FUNCTION KEYS FOR THE TRIMBLE UNIT
F2, Up Button or double tap: to select the drop down list or enter info. into a field.
F3: when you want to advance/add another tree
F4: exit up a level (from an individual tree record to the project record)
F5: advance down a level (from the project level to an individual tree record)
Type control key using the keyboard and then the Up Button: to go to a previously entered tree record or street/site.
Keyboard: in the middle of the bottom of the screen you will see a keyboard icon. Tap this to access the keyboard.

APPENDIX D - Vermont Shade Tree Inventory Protocol

Roots	Roots	Select **'Y'** if there are stem girdling roots, no trunk flare, mounding or other soil disturbance/compacted soil in the critical root zone.
Conditn	Condition	Overall health and structure of the tree: **Good:** 75-100% live foliage, no dieaback of branches over 2" diameter, no significant structural defects (cankers, seams, decay, etc.) or mechanical damage **Fair:** 50-75% live foliage, new growth medium to low amount, or stunted, significant mechanical damage to the trunk **Poor:** 25-50% live foliage, visible branches over 2" in diameter in canopy, significant dieback of other branches, severe mechanical damage to trunk **Dead:** no live foliage
Remove	Remove the tree	Select **'Y'** tree is dead or is a hazard and needs to be removed, use the drop down menu to select who is responsible for the removal. **Utility:** The tree is near a utility line. **Private:** The tree is on private property. **Public:** The tree is in the ROW or on municipal property. A hazard tree has structural defects in the roots, stem, or branches that may cause the tree or tree part to fail, where such failure may cause property damage or personal injury). *Before removing trees*, it is important to consult yo*ur tree warden, especially if the tree(s) could be considered shade/ornamental tree and is in a residential part of town.*
Consult	Consult needed	Select **'Y'** if you would like a hazardous tree assessment or follow-up pest survey be conducted. Indicate why the consult is needed.

FUNCTION KEYS FOR THE TRIMBLE UNIT
F2, Up Button or double tap: to select the drop down list or enter info. into a field.
F3: when you want to advance/add another tree
F4: exit up a level (from an individual tree record to the project record)
F5: advance down a level (from the project level to an individual tree record)
Type control key using the keyboard and then the Up Button: to go to a previously entered tree record or street/site.
Keyboard: in the middle of the bottom of the screen you will see a keyboard icon. Tap this to access the keyboard.

APPENDIX D - Vermont Shade Tree Inventory Protocol

MAINTENANCE NEEDS		
Prune	Prune	Select **'Y'** if dead branches, crossing branches, or sprouts need to be removed for form/structure/because they are a hazard, if lower limbs over a sidewalk/road need pruning for clearance, or if branches need to be prune away from a building, road, or other obstruction, such as utility wires. Use the drop down menu to select who is responsible for the removal. **Utility:** The tree is near a utility line. **Private:** The tree is on private property. **Public:** The tree is in the ROW or on municipal property.
SGRoots	Stem girdling roots	Select **'Y'** if any roots are encircling or running tangentially to a tree's stem.
Stake	Stake	Select **'Y'** if a newly planted trees needs to be staked.
RmStake	Remove Stake	Select **'Y'** if it has been over a year since the tree was planted or stabilized and the stake needs to be removed.
Cable	Cable	Select **'Y'** if needed to provide structural support for weak branch unions.
Mulch	Mulch	Select **'Y'** if mulch needs to be added around the base of the tree.
RmMulch	Remove mulch	Select **'Y'** if the mulch is too deep or too close to the tree stem.
Fertliliz	Fertilize	Select **'Y'** if trees shows signs of nutrient deficiency (yellowing leaves, slow growth)

FUNCTION KEYS FOR THE TRIMBLE UNIT
F2, Up Button or double tap: to select the drop down list or enter info. into a field.
F3: when you want to advance/add another tree
F4: exit up a level (from an individual tree record to the project record)
F5: advance down a level (from the project level to an individual tree record)
Type control key using the keyboard and then the Up Button: to go to a previously entered tree record or street/site.
Keyboard: in the middle of the bottom of the screen you will see a keyboard icon. Tap this to access the keyboard.

Water	Water	Select 'Y' if tree needs to be watered.
TreeSiz	Tree size	If it is a vacant planting space, then consider the space above and below ground. Enter whether the site is: **Small:** Planting sites with limited soil volume (<500 cubic yards), such as narrow greenbelts and pits less than 6 feet wide and small, and/or <25' tree. **Medium:** Planting sites with an intermediate amount of soil volume (500 - 1,000 cubic yards). Green belts greater than 6 feet wide, but still limited in the amount of below ground growing space, and/or 25 - 40' tree **Large**: Planting that are large soil volume (>1,000 cubic yards) such as parks and open space and/or >40' tree.
Comment	Comments	Enter additional comments or observations.
PicPrfx	Photo	Enter the file name(s) for any photos you took. **Note:** the name has to be exact in order to connect the photo with the tree data record. You may want to take a picture to share health symptom on the tree like an exit hole or a structural defect.
Lat	Latitude	GPS coordinate for the tree record. When you double click in the box, a <Sensor Data> box should pop up and eventually provide you with the GPS coordinates. Hit **Enter** and it will populate Latitude and Longitude.
Long	Longitude	(See above)

8. When you have finished entering the data for this tree, hit **F3** to enter data on your next tree.

9. When you're finished collecting data for the day exit out of Dataplus by tapping **F5** until you get back to the main screen. **X** out of the program and hold the **Power key** until the unit shuts down.

Vermont Shade Tree Inventory Protocol: Using a Juno Unit

BEST PRACTICES FOR USING THE TRIMBLE JUNO UNIT

The Juno Series handhelds are durable devices, but are not fully rugged; take care when handling or using the handheld. When using the handheld:

Keep it clean—Keep the outer surface free of dirt and dust and ensure that protective covers and doors are appropriately fitted. To clean the handheld, wipe it with a clean dry cloth. Do not immerse the handheld in water.

Keep it dry— The handheld is not waterproof. Do not expose it to rain or moisture.

Protect the touch screen by using the stylus provided and avoid using excessive pressure and sharp or abrasive objects.

Do not store it in your car or any place where it is subject to extreme temperatures.

Don't drop the handheld or subject it to any strong impact.

Be patient— The handhelds respond best to a light, quick tap with the pen. You should not have to press hard or hold the pen on the screen; in fact, this will just damage the handheld. Please be patient, when the GPS running it can slow IT down.

Start with a fully charged battery & monitor throughout the day—Battery power can be monitored by tapping the battery icon on the top right corner of the main screen or by going to the start icon in the top left of the screen and tapping "Settings", the "System" tab and then the "Power" icon. When the GPS is running it does use up the battery a lot faster.

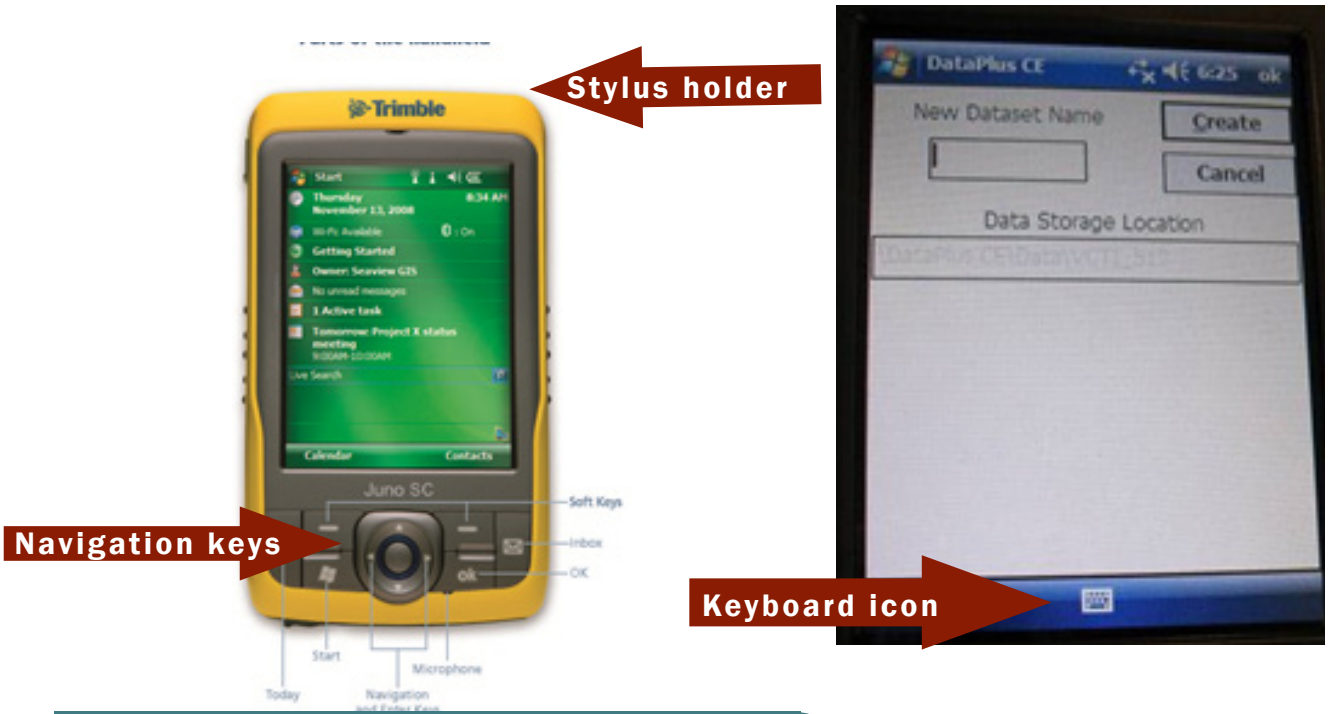
If the unit freezes—To reboot the unit hold the power key until the unit turns off. Wait a couple of seconds before tur**n**ing it back on again.

If the GPS doesn't seem to be working—If, after following the directions for collecting Lat/Long data, the GPS still doesn't seem to be working make sure that the GPS Controller is closed. GPS Controller is accessed by tapping on the Start icon in the upper left hand corner. After exiting out of GPS Controller close out of and then reopen DataPlus to reset the GPS function.

APPENDIX E - Vermont Shade Tree Inventory Protocol with Juno Unit

Navigating the Trimble Unit

The Trimble unit is operated using the stylus, which functions similar to a mouse click except you tap the screen. The stylus holder is located in the top right corner of the unit. You can also use the navigation keys and enter key at the bottom of the unit to move between data fields once you are in the inventory program. A full keyboard is available for entering information. It can be accessed by tapping the keyboard icon at the bottom of the screen.



FUNCTION KEYS IN JUNO UNIT

Additional function keys have also been programmed to aid in navigation through the inventory program. These function keys will become visible once you open the inventory program, DataPlus:

Double tap, Up Button or F2: to select the drop down list or enter information into a field.

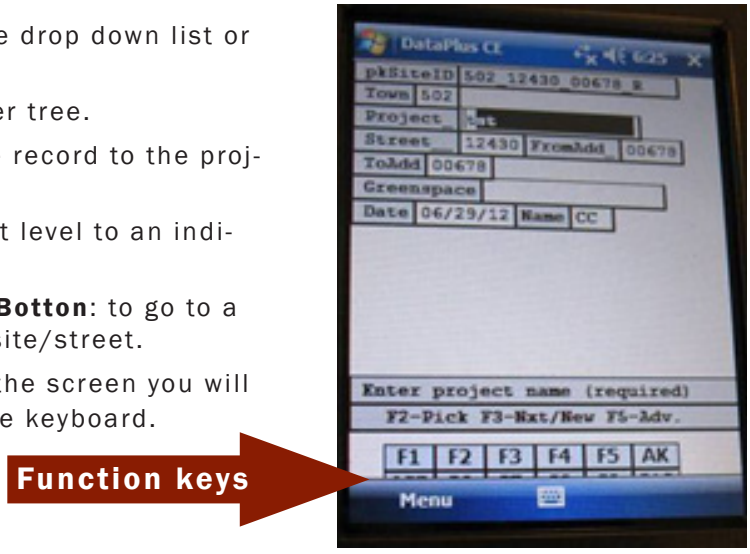
F3: when you want to advance/add another tree.

F4: exit up a level (from an individual tree record to the project record)

F5: advance down a level (from the project level to an individual tree record)

Control using the keyboard and then Up Botton: to go to a previously entered tree record or project site/street.

Keyboard: in the middle of the bottom of the screen you will see a keyboard icon. Tap this to access the keyboard.

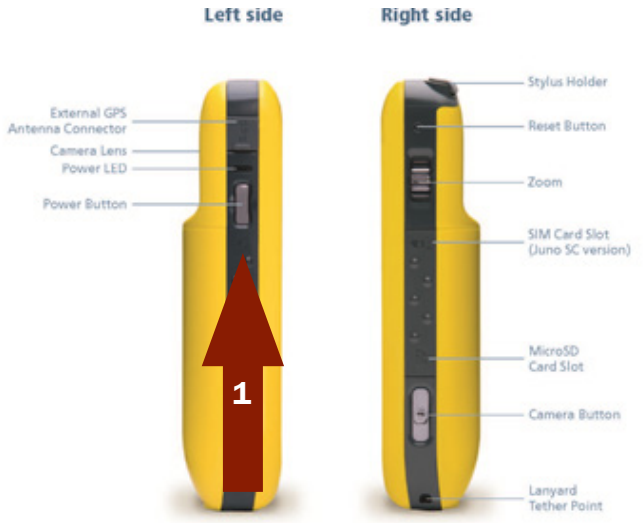


APPENDIX E - Vermont Shade Tree Inventory Protocol with Juno Unit

COLLECTING YOUR INVENTORY DATA

The following steps will guide you through the process for entering inventory data.

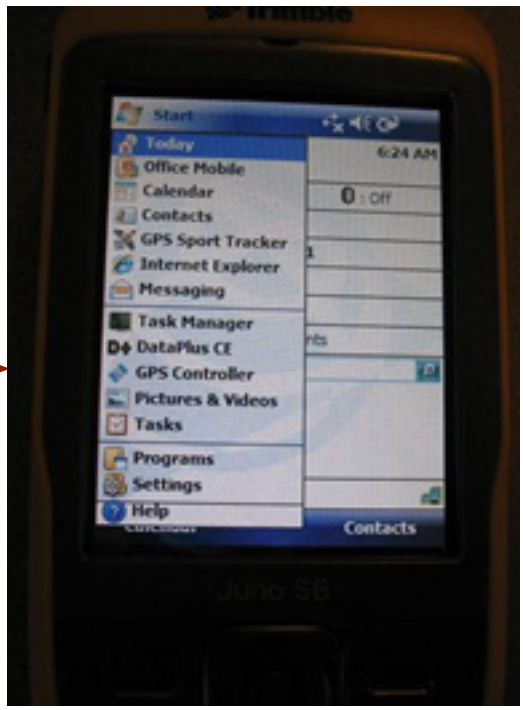
1. Turn on the Juno unit by pressing the Power key on the left hand side (see red arrow on parts diagram).



2. Tap the screen to show the main screen with the task list. Tap the start icon in the top left of the screen.

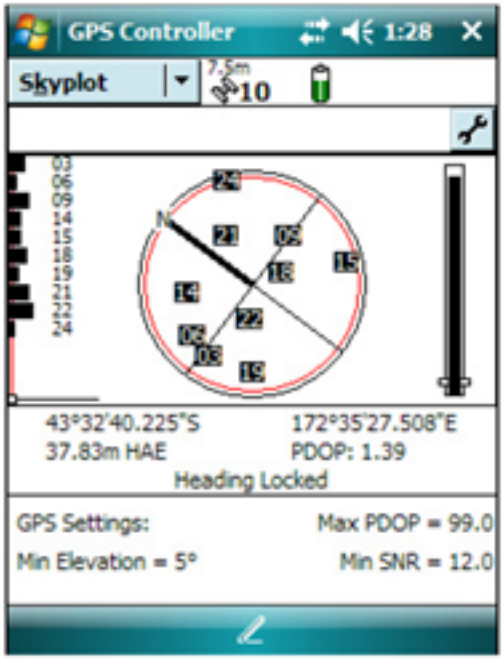
ENABLE THE GPS

3. Select GPS Controller from the drop down list. (In order for the GPS to work you need to open up GPS Controller and activate the GPS before opening the database program DataPlus.)



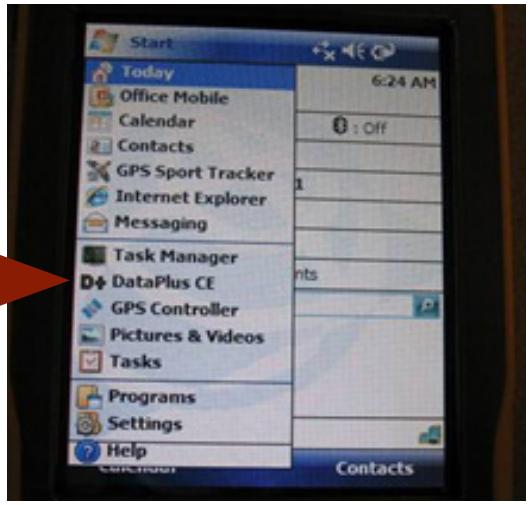
4. When GPS Controller opens you should see the Skyplot view. If you don't, then tap the drop down menu at the top (where the red arrow is pointing) and select Skyplot. If you give the Juno time (less than 1 min) then the Skyplot view will show you what satellites are available. If for some reason it says that GNSS (aka GPS) is disconnected then you'll have to connect it by selecting Setup from the same drop down menu, select Options (underneath Setup) and "Connect to GNSS".

5. After you have GNSS connected you are going to Exit out of GPS Controller via the drop down menu.

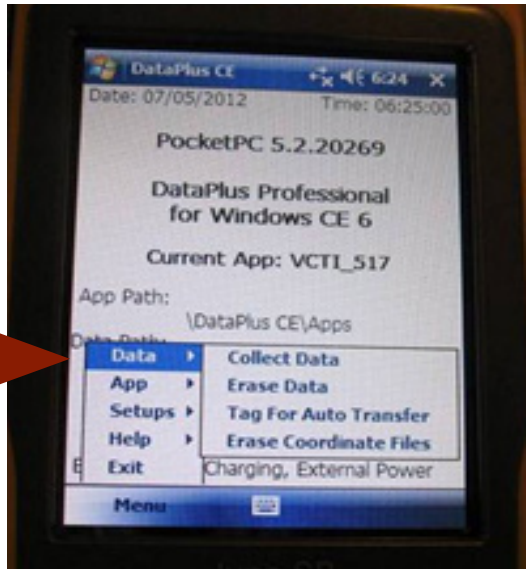


APPENDIX E - Vermont Shade Tree Inventory Protocol with Juno Unit

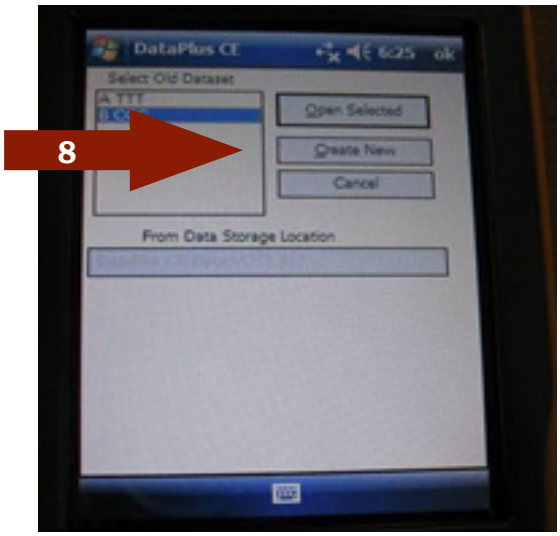
6. Choose the D+ Dataplus CE Progam



7. Tap the word Menu (bottom left) and select Data -- Collect Data.



8. Create a new dataset. (If you are conducting an inventory over multiple days you will open the same dataset each time by selecting the dataset and then tapping open selected.)



APPENDIX E - Vermont Shade Tree Inventory Protocol with Juno Unit

9. Name it with the first 4 letters or your town name and the year of the inventory. For example, the town of Colchester's inventory dataset for 2012 would be named Colc12. Tap Create. To access the keyboard for entering text, tap the keyboard icon at the bottom of the page.

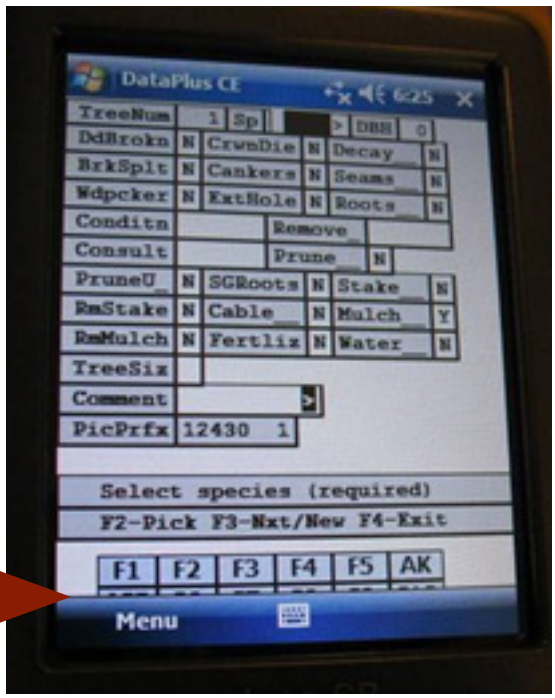
10. Enter the following data for your inventory project for each discrete area where you are collecting information. For example, you will enter a separate project for each greenspace (town green, ballfield, etc). You'll also want a separate project for each street. You may want to break each street up into separate segments, which should all be entered as separate projects.

CODE	FIELD NAME	DESCRIPTION
pkSiteID	Unique site identifier	The program auto populates this field based on the data you enter in this form.
Town	Town name (required)	Select your town name from the drop down list.
Project	Project name (required)	Divide your town into neighborhoods, sections or areas. Indicate that here, i.e. northwestern quadrant.
Street	Street (required)	Select the street from the drop down list. If you are inventorying a greenspace, enter the name of the closest street where you will start. You will enter the name below.
FromAdd	From address (required)	Enter the number of the closest street address to where you started.
ToAdd	To address	Enter the number of the closest street address to where you plan on stopping.
Greenspace	Greenspace name	Enter the name of the greenspace.
Date	Date (required)	This should auto populate with today's date. If not, enter the inventory date.
Name	Surveyor name(s) (required)	Enter the initials for each surveyor.

APPENDIX E - Vermont Shade Tree Inventory Protocol with Juno Unit

11. Tap the F5 function key to start entering individual tree data.

12. Now you are ready to collect data on individual trees. Your tree data entry form should look like the photo on the right. We have designed this inventory program to allow you to collect information that will allow you to understand species and size class diversity and identify hazardous trees, structural or tree health concerns, and maintenance needs. We realize however that your community's capacity and management goals dictate the type of information you are able to collect so we have set up the program so that tree species is the only required field for each tree. A description of each data field is found in the table below.



Function keys

Rules of Thumb for which trees to inventory

- Only inventory obvious, maintained trees.
- Shrubs or 'foundation plantings' should not be inventoried.
- If a large grouping of trees in located at a fence line/hedge row, they can be inventoried as one. Under the 'Tree Species' select hedge row.

FUNCTION KEYS FOR THE TRIMBLE UNIT
F2, Up Button or double tap: to select the drop down list or enter info. into a field.
F3: when you want to advance/add another tree
F4: exit up a level (from an individual tree record to the project record)
F5: advance down a level (from the project level to an individual tree record)
Type control key using the keyboard and then the Up Button: to go to a previously entered tree record or street/site.
Keyboard: in the middle of the bottom of the screen you will see a keyboard icon. Tap this to access the keyboard.

APPENDIX E - Vermont Shade Tree Inventory Protocol with Juno Unit

CODE	FIELD NAME	DESCRIPTION
TreeNum	Tree number (required)	The program will auto populate this field. Make sure the number is recorded correctly on the map.
Sp	Tree species (required)	Many of the species also have the genus (i.e. maple) so if you are having trouble identifying to the species level you can enter the genus. If this is an empty planting site, then select vacant and then who manages the planting site (private, town, utility or other public entity). Note: To make navigation in a long list easier, when you have the species list tap the keyboard icon and then type in the first letters of the common name and it will advance the list to that letter.
DBH	Diameter at breast height (inches)	Select the diameter class in inches of the tree. If you need to measure the tree here are some tips: • Measure 4.5' on the uphill side of the tree. • It there is a bulge at DBH, measure just above the bulge, where the stem returns to normal. • If the tree has a fork below 4.5', measure just below the split. If the tree has multiple stems originating at ground level, measure the DBH of each stem, add the values together, and add a clarifying comment. (ex. The DBH for four multiple stems measuring 10 inches each is entered as "40" and "4 stems" is entered as a comment).
TREE HEALTH ASSESSMENT **The following checklist will allow you to identify and assess forest health issues and structural defects that could lead to a hazardous situation.**		
DdBrokn	Dead/Broken Branches	Select '**Y**' if there are any dead or broken branches >1" diameter in the crown.
CrwnDie	Crown Dieback	Select '**Y**' if the new fine twigs (<1" diameter) are missing leaves or branch(es) are dying, in a pattern generally from the tip towards the main stem.

FUNCTION KEYS FOR THE TRIMBLE UNIT
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APPENDIX E - Vermont Shade Tree Inventory Protocol with Juno Unit

Decay	Decay	Select 'Y' if there are signs of bacterial or fungal infection on main stem or branches.
BrkSplt	Bark splits	Select **'Y'** if there is a fissure or deep split in the bark and wood of the tree.
Cankers	Cankers	Select **'Y'** if there is an area of dead bark and cambium anywhere on the tree's surface. Cankers can be caused by fungi, insects, weather or mechanical damage such as mowers or vehicles.
Sprouts (labeled as seams)	Sprouts	Select **'Y'** if there are epicormic sprouts (also known as water sprouts) along the trunk.
WdPcker	Woodpecker activity	Select **'Y'** if there are woodpeckers actively feeding/nesting in the tree or if there is evidence (holes) of their activity in the stem and/or branches.
ExtHole	Exit holes	Select **'Y'** if you notice any evidence of insect exit holes on the stem or branches. You will most likely have to use binoculars to get a close enough look at holes in the top of the tree. Many insects infest the top of the tree first so it's important to start there.
Roots	Roots	Select **'Y'** if there are stem girdling roots, no trunk flare, mounding or other soil disturbance/compacted soil in the critical root zone.
Conditn	Condition	Overall health and structure of the tree: **Good:** 85% live foliage, less than 15% deadwood, no significant structural defects (cankers, seams, decay, etc.) **Fair:** 60% live foliage, less than 40% deadwood **Poor:** 35% live foliage, over 40% deadwood **Dead:** no live foliage

FUNCTION KEYS FOR THE TRIMBLE UNIT
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F5: advance down a level (from the project level to an individual tree record)
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Keyboard: in the middle of the bottom of the screen you will see a keyboard icon. Tap this to access the keyboard.

Remove	Remove the tree	Select **'Y'** tree is dead or is a hazard and needs to be removed, use the drop down menu to select who is responsible for the removal. **Utility:** The tree is near a utility line. **Private:** The tree is on private property. **Public:** The tree is in the ROW or on municipal property. A hazard tree has structural defects in the roots, stem, or branches that may cause the tree or tree part to fail, where such failure may cause property damage or personal injury). *Before removing trees*, it is important to consult yo*ur tree warden, especially if the tree(s) could be considered shade/ornamental tree and is in a residential part of town.*
Consult	Consult needed	Select **'Y'** if you would like a hazardous tree assessment or follow-up pest survey be conducted. Indicate why the consult is needed.
MAINTENANCE NEEDS		
Prune	Prune	Select **'Y'** if dead branches, crossing branches, or sprouts need to be removed for form/structure/because they are a hazard, if lower limbs over a sidewalk/road need pruning for clearance, or if branches need to be prune away from a building, road, or other obstruction, such as utility wires. Use the drop down menu to select who is responsible for the removal. **Utility:** The tree is near a utility line. **Private:** The tree is on private property. **Public:** The tree is in the ROW or on municipal property.

FUNCTION KEYS FOR THE TRIMBLE UNIT
F2, Up Button or double tap: to select the drop down list or enter info. into a field.
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APPENDIX E - Vermont Shade Tree Inventory Protocol with Juno Unit

RmStake	Remove Stake	Select **'Y'** if it has been over a year since the tree was planted or stabilized and the stake needs to be removed.
Cable	Cable	Select **'Y'** if needed to provide structural support for weak branch unions.
Mulch	Mulch	Select **'Y'** if mulch needs to be added around the base of the tree.
RmMulch	Remove mulch	Select **'Y'** if the mulch is too deep or too close to the tree stem.
Fertliliz	Fertilize	Select **'Y'** if trees shows signs of nutrient deficiency (yellowing leaves, slow growth)
Water	Water	Select 'Y' if tree needs to be watered.
TreeSiz	Tree size	If it is a vacant planting space, then consider the space above and below ground. Enter whether the site is: **Small:** Planting sites with limited soil volume (<500 cubic yards), such as narrow greenbelts and pits less than 6 feet wide and small, and/or <25' tree. **Medium:** Planting sites with an intermediate amount of soil volume (500 - 1,000 cubic yards). Green belts greater than 6 feet wide, but still limited in the amount of below ground growing space, and/or 25 - 40' tree **Large**: Planting that are large soil volume (>1,000 cubic yards) such as parks and open space and/or >40' tree.
Comment	Comments	Enter additional comments or observations.
PicPrfx	Photo	Enter the file name(s) for any photos you took. **Note:** the name has to be exact in order to connect the photo with the tree data record. You may want to take a picture to share health symptom

FUNCTION KEYS FOR THE TRIMBLE UNIT
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F5: advance down a level (from the project level to an individual tree record)
Type control key using the keyboard and then the Up Button: to go to a previously entered tree record or street/site.
Keyboard: in the middle of the bottom of the screen you will see a keyboard icon. Tap this to access the keyboard.

13. When you have finished entering the data for this tree, hit **F3** to enter data on your next tree. If at any time you need to go back to a previous tree you can do this by tapping the top of the function box that is below **F2**.

14. When you're finished collecting data for the day exit out of DataPlus by tapping **F5** until you get back to the main screen. **X** out of the program and hold the **Power key** until the unit shuts down.

FUNCTION KEYS FOR THE TRIMBLE UNIT
F2, Up Button or double tap: to select the drop down list or enter info. into a field.
F3: when you want to advance/add another tree
F4: exit up a level (from an individual tree record to the project record)
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APPENDIX E - Vermont Shade Tree Inventory Protocol with Juno Unit

ENSURING BEST GPS READINGS

The Trimble unit will receive 2 to 5 meter positioning accuracy in real time. The GPS accuracy specification of Juno series handhelds applies in open environments with few obstacles to block or reflect signals. You should be aware that in environments where GPS signals may reflect off objects such as buildings, vehicles, or trees, the positional accuracy will significantly degrade.

The GPS antenna is located at the top of the device. For optimal reception, hold the handheld at or close to vertical. When collecting point data, remain stationary at the point for at least 10 seconds before double tapping in the Latitude or Longitude fields.

TAKING PHOTOS

1. Press the camera button on the right hand side of the unit.

2. Center on your photo and press the camera button again to take a photo.

3. In order for the program to know which photo to connect to each tree, you need to name the photo the same name as is in the PicPrfx field in the data entry for that tree. You will notice in the PicPrfx field, the program auto populates it with an ID number.

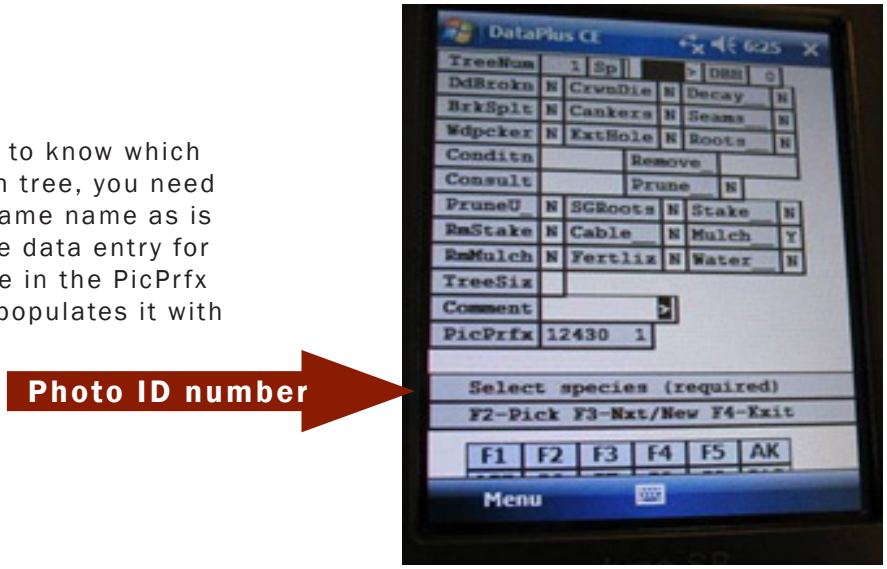
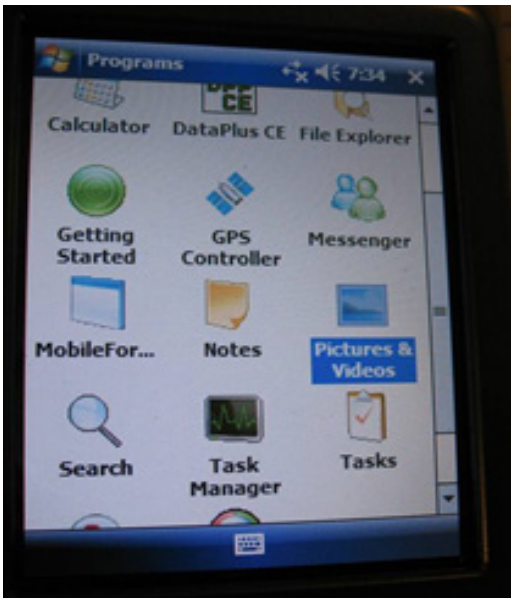


Photo ID number

APPENDIX E - Vermont Shade Tree Inventory Protocol with Juno Unit

4. Rename your photo



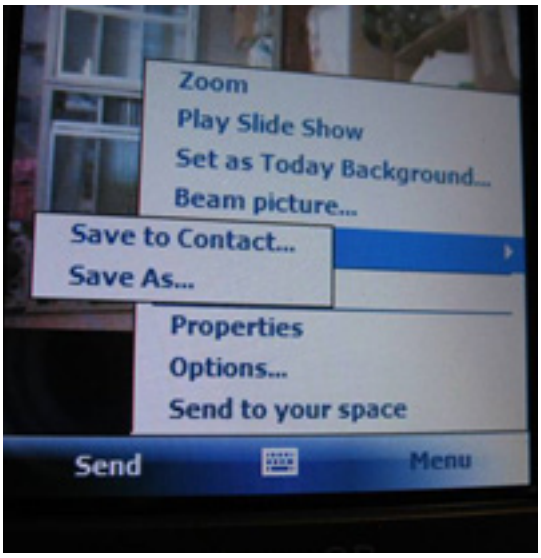
A. Close your photo and go to the windows icon in the top left hand corner.

B. Tap on Program.

C. Tap on Pictures and Videos.

D. Tap on the photo.

E. Tap the Menu icon in the bottom right



F. Tap Save

G. Tap Save As...

H. Using the keyboard, enter the photo ID number exactly as it appears in the PicPrfx field.

APPENDIX E - Vermont Shade Tree Inventory Protocol with Juno Unit

BACKING UP YOUR DATA

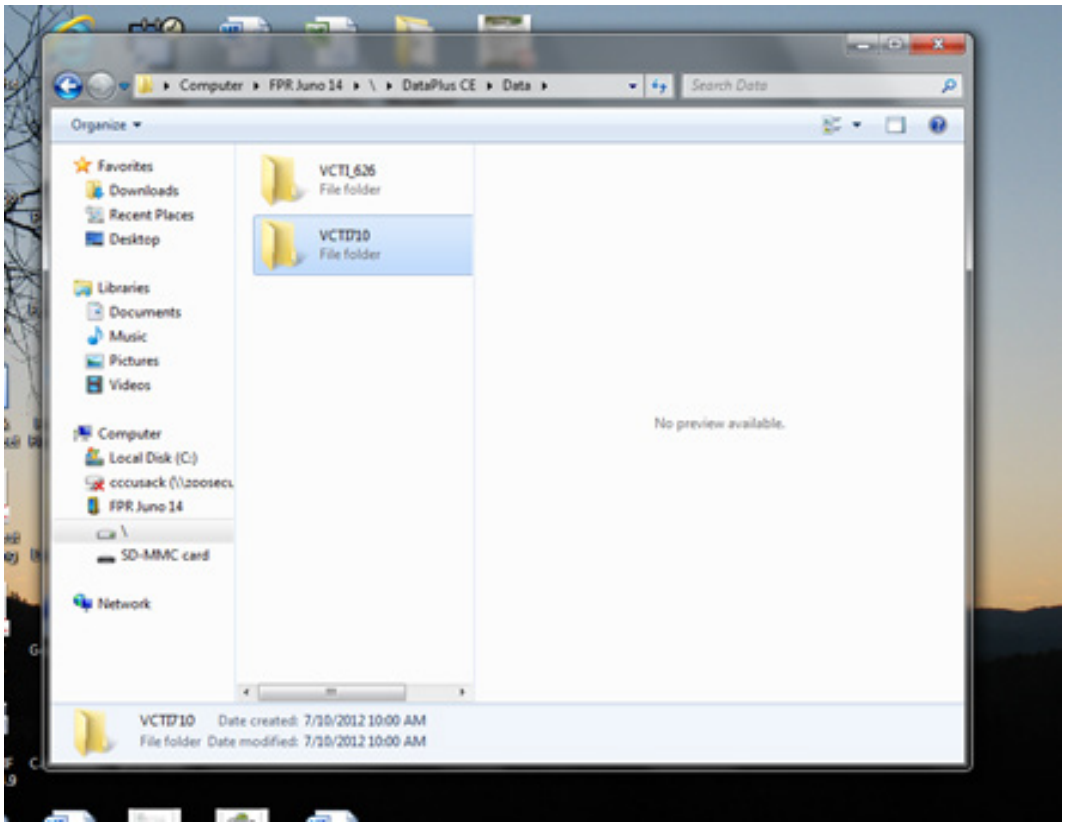
There is nothing worse than spending hours collecting data only to have it lost due to some technological malfunction. We recommend that you backup your data after each inventory day. To do so you'll need a PC with either Windows XP or Windows 7. If you have Windows 7 it should already have Windows Mobile, a program that allows your computer to talk to the Juno unit. The first time you plug a Windows Mobile device such as a camera or the Juno unit into a computer that's connected to the Internet and running Windows 7, Windows Mobile Device Center should be automatically downloaded and installed on the computer. If you have Windows XP you will need to download Active Sync by going to: http://www.microsoft.com/en-us/download/details.aspx?id=15.

1. Plug the Juno into your computer.

2. Using Windows Explorer navigate to the VCTI folder by clicking on the FPR Juno folder under My Computer, and then DataPlusCE, and then Data, and then VCTI710 as shown in the diagram.

3. Right click on the folder and click copy.

4. Paste the folder to your hard drive.



SPECIES ID CODES

ABBA	Abies balsamea	Balsam fir
ABCO	Abies concolor	White fir
AC	Acer species	Maple
ACFR	Acer x freemanii	Freeman maple
ACGI	Acer ginnala	Amur maple
ACNE	Acer negundo	Boxelder
ACPL	Acer platanoides	Norway maple
ACRU	Acer rubrum	Red maple
ACSA1	Acer saccharinum	Silver maple
ACSA2	Acer saccharum	Sugar maple
ACTA	Acer tataricum	Tatar maple
AEGL	Aesculus glabra	Ohio buckeye
AEHI	Aesculus hippocastanum	Horsechestnut
AM	Amelanchier species	Serviceberry
BDL OTHER	Broadleaf Deciduous Large	Broadleaf Deciduous Large
BDM OTHER	Broadleaf Deciduous Medium	Broadleaf Deciduous Medium
BDS OTHER	Broadleaf Deciduous Small	Broadleaf Deciduous Small
BE	Betula species	Birch
BEL OTHER	Broadleaf Evergreen Large	Broadleaf Evergreen Large
BEM OTHER	Broadleaf Evergreen Medium	Broadleaf Evergreen Medium
BENI	Betula nigra	River birch
BEPA	Betula papyrifera	Paper birch
BEPE	Betula pendula	European white birch
BES OTHER	Broadleaf Evergreen Small	Broadleaf Evergreen Small
CA1	Carya species	Hickory
CA3	Catalpa species	Catalpa
CABE	Carpinus betulus	European hornbeam
CAOV	Carya ovata	Shagbark hickory
CASP	Catalpa speciosa	Northern catalpa
CECA	Cercis canadensis	Eastern redbud

APPENDIX D - Species ID Codes

CEL OTHER	Conifer Evergreen Large	Conifer Evergreen Large
CEM OTHER	Conifer Evergreen Medium	Conifer Evergreen Medium
CEOC	Celtis occidentalis	Northern hackberry
CES OTHER	Conifer Evergreen Small	Conifer Evergreen Small
CO1	Cornus species	Dogwood
COCO2	Corylus colurna	Turkish hazelnut
CR	Crataegus species	Hawthorn
ELAN	Elaeagnus angustifolia	Russian olive
FA	Fagus species	Beech
FASY	Fagus sylvatica	European beech
FR	Fraxinus species	Ash
FRAM	Fraxinus americana	White ash
FRPE	Fraxinus pennsylvanica	Green ash
GIBI	Ginkgo biloba	Ginkgo
GLTR	Gleditsia triacanthos	Honeylocust
GYDI	Gymnocladus dioicus	Kentucky coffeetree
ILOP	Ilex opaca	American holly
JU	Juniperus species	Juniper
JUCI	Juglans cinerea	Butternut
JUCO1	Juniperus communis	Common juniper
JUNI	Juglans nigra	Black walnut
JUVI	Juniperus virginiana	Eastern red cedar
LIST	Liquidambar styraciflua	Sweetgum
LITU	Liriodendron tulipifera	Tulip tree
LOSP	Lonicera species	Honeysuckle
MA2	Malus species	Crabapple
MAGR	Magnolia grandiflora	Southern magnolia
MEGL	Metasequoia glyptostroboides	Dawn redwood
MORU	Morus rubra	Red mulberry
PI1	Picea species	Spruce
PI2	Pinus species	Pine

APPENDIX D - Species ID Codes

PIAB	Picea abies	Norway spruce
PIGL1	Picea glauca	White spruce
PIMA	Picea mariana	Black spruce
PINI	Pinus nigra	Austrian pine
PIPU	Picea pungens	Blue spruce
PIRU	Picea rubens	Red spruce
PIST	Pinus strobus	Eastern white pine
PISY	Pinus sylvestris	Scotch pine
PO	Populus species	Cottonwood
POBA	Populus balsamifera	Balsam poplar
PONI	Populus nigra	Black poplar
POTR1	Populus tremuloides	Quaking aspen
PR	Prunus species	Plum
PRVI	Prunus virginiana	Common chokecherry
PY	Pyrus species	Pear
QU	Quercus species	Oak
QUBI	Quercus bicolor	Swamp white oak
QUCO	Quercus coccinea	Scarlet oak
QUMA1	Quercus macrocarpa	Bur oak
QUMU	Quercus muehlenbergii	Chinkapin oak
QUNI	Quercus nigra	Water oak
QUPA	Quercus palustris	Pin oak
QURO	Quercus robur	English oak
QURU	Quercus rubra	Northern red oak
QUSH	Quercus shumardii	Shumard oak
RHSP	Rhus species	Sumac
RHTY	Rhus typhina	Staghorn sumac
ROPS	Robinia pseudoacacia	Black locust
SA	Salix species	Willow
SAAL4	Salix alba	White willow
SADI	Salix discolor	Pussy willow

APPENDIX D - Species ID Codes

SAFR	Salix fragilis	Crack willow
SO	Sorbus species	Mountain ash
SOAM	Sorbus americana	American mountain ash
SOAU	Sorbus aucuparia	European mountain ash
SYRE	Syringa reticulata	Japanese tree lilac
SYSP	Syringa species	Lilac
TH9	Thuja species	Red cedar
TI	Tilia species	Basswood
TIAM	Tilia americana	American basswood
TICO	Tilia cordata	Littleleaf linden
ULAM	Ulmus americana	American elm
ULPA	Ulmus parvifolia	Chinese elm
ULPU	Ulmus pumila	Siberian elm
ULS	Ulmus species	Elm
VACANT	Vacant planting site	Vacant planting site