

Plainfield Public Tree Inventory Report



*Prepared for the Town of Plainfield and
the Plainfield Tree Warden
by the Vermont Urban & Community Forestry Program
January 2016*



Acknowledgements

This report was developed by Vermont Urban & Community Forestry Program (VT UCF) staff based on field work conducted by VT UCF staff and Plainfield resident Sarah Albert for the Town of Plainfield, Vermont in October 2015. We would like to thank Sarah Albert for her initiative and time towards collecting data on Plainfield's public trees. Special thanks to Andrea Urbano, VT UCF intern, and Diana Jaramillo, ECO Americorps member with VT UCF, for their work in analyzing data and developing this document.

About the Vermont Urban & Community Forestry Program

The field of forestry management is not confined to the natural areas and forests of Vermont, but extends to the populated urban and rural spaces where trees play important roles. The trees in public parks, along roadsides, on town greens, and in municipal forests compose our urban and community forests and merit careful stewardship. VT UCF is a collaborative effort between the Vermont Department of Forests, Parks, & Recreation, the University of Vermont (UVM) Extension, and the USDA Forest Service. The program provides technical and financial assistance as well as educational programs and resources for the management of trees and forests in and around Vermont communities. The mission of VT UCF is ***to lead citizens, businesses, and governments in understanding the value of urban and community forests and promote civic responsibility for and participation in the stewardship of these resources for this and future generations***. Since 1991, the program has been guided by a small staff and a twenty-member advisory council. The council meets quarterly to share information and advise the program; its members come from various professional associations, non-profits, educational institutions, municipal tree boards and committees, and state agencies.

The trees in our communities offer a wide variety of environmental, social, and economic benefits to the surrounding community, including but not limited to: stormwater mitigation, carbon dioxide (CO₂) sequestration, air quality improvement, shade, wildlife habitat, and

aesthetic value. VT UCF seeks to maximize these benefits by working with state and municipal officials, as well as dedicated volunteers and local organizations, to steward the urban forest's ecological integrity and diversity. VT UCF's programming and support reaches 100 Vermont communities annually. More information about VT UCF and its programming can be found at www.vtcommunityforestry.org.



VT UCF provides technical, financial, and educational services to VT communities like St. Albans, pictured above, to promote and support vibrant urban and community forests.

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Executive Summary

The goal of the Plainfield public tree inventory was to accurately locate and assess Town-owned trees within the public right-of-way (ROW) on streets in the concentrated town center and in select parks to maintain a record of tree conditions, plantings, and removals. A secondary goal of the project was to identify potential tree planting locations within the public ROW. The information collected in the inventory and presented in this report provides residents and decision makers with a better understanding of the composition, condition, and benefits of Plainfield's public trees and will allow the Plainfield Tree Warden to plan for tree maintenance and future tree planting using a map-based tree inventory tool.

This project was initiated in the summer of 2015 and was coordinated with Sarah Albert, Plainfield resident and long-time tree steward. Albert, along with VT UFC staff, completed an inventory of **126 trees** located within the public ROW of **8 streets** and in **3 town parks**, and also identified **13 potential public tree planting locations**. The data collected in the inventory were checked for quality, analyzed, and interpreted by VT UCF staff. This report was prepared in January 2016. It presents the results of the inventory and provides a basic assessment of the public tree population in downtown Plainfield.

Local government, town boards and committees, conservation agencies, and private landowners all play an important role in monitoring and maintaining urban forests. Public trees provide a number of benefits to a community, including mitigating stormwater runoff, reducing air pollution, providing shade, sequestering carbon dioxide (CO₂), enhancing property values, and improving the aesthetics of the community. The 126 public trees that were inventoried provide an estimated **\$9,336 in benefits annually (\$74/tree)** to the residents and businesses of Plainfield.

Summary of Findings

Community Forest Diversity

- Of the 126 public trees, there are 23 different species in 16 different genera.
- The five most common tree genera by number of trees are *Malus* (crabapple) at 23%, *Quercus* (oak) at 21%, *Acer* (maple) at 20%, *Thuja* (cedar) at 12%, and *Syringa* (lilac) at 6%.
- *Acer* and *Fraxinus* species together represent 23% percent of Plainfield’s public trees. Invasive tree pests currently threaten both of these genera: the Asian long horned beetle (ALB) and the emerald ash borer (EAB), respectively.
- The five most common species are *Malus* species (crabapple) at 23%, *Quercus rubra* (northern red oak) at 19%, *Thuja occidentalis* (eastern white-cedar) at 12%, *Acer saccharum* (sugar maple) at 6%, and *Syringa reticulata* (Japanese tree lilac) at 6%.

Community Forest Structure

- Nearly one half of the inventoried public trees (42%) in Plainfield have a diameter at breast height (DBH) measurement between 6” and 12”. A quarter (25%) of inventoried public trees has a DBH within the 3-6” size class. When combined, this means that 67% of inventoried public trees are between 3” and 12” in diameter.
- The remaining one third (33%) of inventoried trees are represented in the following size classes: 0-3” (9%), 12-18” (10%), 18-24” (6%), 24-30” (3%), 30-36” (2%), 36-42” (2%), and 42+” (1%).

Community Forest Health

- An overwhelming majority of Plainfield’s public trees (112, or 89%) were assessed as being in “Good” condition. Of the remaining trees, 11 (9%) were considered to be in “Fair” condition, 3 (2%) were in “Poor” condition, and no “Dead” trees were inventoried.
- 16 trees (13%) were assessed to be in need of monitoring by a Certified Arborist, the Plainfield Tree Warden, or another qualified individual.

- 5 public trees were assessed to show signs of decay and 1 public tree was assessed to have visible root damage.
- 18 public trees were assessed to be in need of pruning.

Summary of Recommendations

A healthy public tree population is contingent upon proper management, stewardship, and a municipality's commitment to understanding and maintaining its urban and community forest. A comprehensive public tree inventory is an important piece of a vibrant community tree program, along with other components described in the Discussion and Recommendations section of this report. Based on the results of the Plainfield public tree inventory, our priority recommendations are:

- As Plainfield's relatively young public trees mature, promote their health and integrity with a systematic structural pruning and maintenance cycle.
- Preserve the integrity and health of the nine mature shade trees over 24" in diameter through regular monitoring and, when needed, maintenance.
- Prioritize the timely assessment and, if needed, maintenance of the 16 trees that were identified as in need of monitoring by a Certified Arborist or the Plainfield Tree Warden.



The Plainfield public tree inventory team: VT UCF staff and Plainfield resident Sarah Albert (center).

Introduction

Project Description

In the summer of 2015, Sarah Albert, Plainfield resident and tree steward, and Nicko Rubin, Plainfield's Tree Warden, reached out to VT UCF with an interest to inventory the town's public trees. Through a grant from the USDA Forest Service, VT UCF and the VT Agency of Natural Resources (ANR) Geographic Information System (GIS) team has developed a map-based, Vermont-specific tree inventory tool; because of Plainfield's small size, VT UCF staff agreed to spend a day in Plainfield to conduct the inventory. The intent of the public tree inventory was to enable Plainfield residents and leadership to better understand, steward, and manage public trees more efficiently and cost effectively. The goals of the Plainfield public tree inventory were to accurately locate and assess Town-owned trees within the public ROW on streets in the concentrated town center and in select parks to maintain a record of tree conditions, plantings, and removals, and to identify potential tree planting locations within the ROW. A secondary goal of the project was to identify potential tree planting locations within the public ROW. The complete public tree inventory was conducted on October 14th, 2015 and will provide a foundation for future management decisions and improvements to the community forest. Additionally, benefits of tree canopy cover, such as the improvement of air and water quality and increased property value, will increase as Town leadership is empowered and informed to manage and support a vibrant public tree population.

Methodology

To plan for the public tree inventory, VT UCF staff coordinated with Plainfield resident Sarah Albert and the Tree Warden, Nicko Rubin to decide what streets and properties should be included in the inventory, and to determine the ROW boundaries for the streets. In total, the inventoried land area was about .13 square miles, a small fraction of the Town of Plainfield's 21 square mile total land area, but the concentrated center and most densely populated portion of town. The list of streets and sites with ROW boundaries is found in Appendix A and GIS maps of the inventoried trees are found in Appendix E.

VT UCF has developed a tree inventory tool in collaboration with VT ANR's GIS team. The map-based tool uses the free application *Collector for ArcGIS*, developed by Esri (<http://doc.arcgis.com/en/collector/>), for data collection and is linked to the publicly-accessible ANR Atlas online mapping website. All inventory data collected on public trees in Plainfield is available for viewing on ANR Atlas and instructions are included in Appendix D.

On October 14th, VT UCF staff and Sarah Albert walked along Plainfield's streets, recording specific data on the public trees and identifying appropriate potential planting locations or grass strips (recorded as "Vacant"). To ensure that only public trees were inventoried (as opposed to trees on private property) the inventory team had a list of the ROW boundaries for every street included in the inventory area. Upon reaching a new street, the team first determined the extent of the ROW from each curb; they measured the road width, subtracted that number from the full ROW boundary, and then divided the number in half to determine the ROW extent behind the curb on each side of the street. The following equation demonstrates this process:

Importance of Inventory and Community Forestry in Vermont

A public tree inventory establishes a record of the City-owned trees present in a municipality. An inventory can provide information about the species, size, health, maintenance needs, and location of each tree. This detailed information allows community leaders to estimate the numerous contributions and management requirements of the trees of which it is in charge. In the event of a disease outbreak or invasive insect infestation, data from an inventory may assist in monitoring and preventing spread, as well as supporting the response to the disease or infestation. An inventory can also help build public support for expanding community forests and to guide future urban planning.

Urban and community trees improve the quality of life for Vermont communities in a variety of ways. The most readily apparent benefit is the aesthetic value that trees provide a street, home, or public space. Along with this beauty is the functional benefit of providing shade along the streets in the summertime and blocking wind to reduce heating costs in the wintertime. The presence of trees has been shown to positively affect property values and boosts foot traffic in commercial areas. Parks and tree-lined sidewalks promote physical activity by creating shaded, comfortable outdoor spaces. Many types of urban wildlife depend on trees as sources of food and shelter. Unseen benefits of urban trees include improvements in air quality and temperature regulation through reduction of the heat island effect. Trees can mitigate noise pollution common in an urban environment and can clean and conserve water by controlling run-off. Additionally, urban and community forests create opportunities for education, community engagement, and in some instances can be related to crime reduction. Trees are an integral part of the green infrastructure of a place and contribute to keeping our communities healthier and our everyday lives more fulfilling.

$$\text{ROW distance from curb} = (\text{ROW width} - \text{road width})/2$$

If on a street with a sidewalk, the inventory team considered ROW to be the greater of either the ROW extent or the far edge of the sidewalk, so that all trees within the grass strip between sidewalk and street were included in the inventory.

Each public tree identified was recorded into the *Collector for ArcGIS* application using an iPad, provided by VT UCF. The application is map-based and uses GPS and a base layer map to allow the user to input information about a tree, linking it to a particular geographic location. Data recorded for each public tree in Plainfield included street name, overall condition, species, diameter class (using a measurement for diameter at breast height, or DBH), a recommendation for monitoring (yes/no), whether the tree showed signs of decay (yes/no) or root damage (yes/no), if the tree needed to be pruned (yes/no), additional comments, and the nearest house or building address. In most cases, a picture was also taken of each tree. A full list and description of the parameters used in data collection can be found in Table 1.



VT UCF staff Mollie Klepack collects data on a public tree in Plainfield.

The data were compiled and subsequently checked for quality, analyzed, and summarized using Microsoft Excel and QGIS, a free and open source geographic information system (www.qgis.org/en/site/). Data were also analyzed through i-Tree, a free software suite

developed by the USDA Forest Service (www.itreetools.org); VT UCF staff ran the inventory data through the i-Tree Streets application, which uses sophisticated back-end models to determine the monetary value and ecological benefits of trees.

Table 1. Data collection parameters for the Plainfield public tree inventory

Data Parameters	Description
Site ID	Street name or property name.
Species	Common name. Include in comments box if not listed.
Tree Condition	<ul style="list-style-type: none"> ● <i>Good</i>: full canopy (75-100%), no dieback of branches over 2" in diameter, no significant defects, minimal mechanical damage ● <i>Fair</i>: thinning canopy (50-75%), medium to low new growth, significant mechanical damage, obvious defects/insects/disease, foliage off-color and/or sparse ● <i>Poor</i>: declining (25-50%), visible dead branches over 2" in diameter, significant dieback, severe mechanical damage or decay (over 40% of stem affected) ● <i>Dead</i>: no signs of life, bark peeling; scratch test on twigs for signs of life (green) ● <i>Vacant</i>: potential spot for a tree within the public ROW. Add "small", "medium", or "large" in the comments box <ul style="list-style-type: none"> - Small= max 30' at maturity, presence of overhead wires, minimum planting space 4' x 4' - Medium= 30-50' at maturity, green belts over 6' wide, no overhead wires - Large= 50'+ at maturity, parks and open space
Diameter (DBH)	Diameter taken at 4.5' above ground in classes of 0-3", 3-6", 6-12", 12-18", 18-24", 24-36", 36-42", 42"+. If on slope, uphill side measured. If abnormal growth, measured above or below growth. If multi-stemmed, each stem's DBH is squared, all squares summed, and the square root taken; indicate "multi-stemmed" in comments box.
Monitor	<p>Yes: any one visible defect is affecting >40% of the tree, the tree poses a hazard to people/infrastructure/cars, the trunk or branches are growing into utility wires, the tree is dead or in poor condition, or the tree is an ash tree showing evidence of woodpecker flecking, blanding, epicormic branching/water sprouts, and/or suspicious exit holes</p> <p>No: no major defects, tree in good or fair condition</p>
Decay	<p>Yes: visually noticeable decay present on inventoried tree</p> <p>No: no visually noticeable decay apparent on inventoried tree</p>
Roots	<p>Yes: The presence of root issues, including stem-girdling roots, compacted soil, exposed roots, or mechanical damage to roots.</p> <p>No: No visible root issues.</p>
Prune	<p>Yes: Flag trees for pruning if any of the following signs are present: broken branches, branches are overlapping /touching/growing on each other, the tree is overcrowded, branches are interfering with utility lines or other built infrastructures, the branches can interfere with pedestrians/vehicles/bikes, etc.</p> <p>No: No branch needs to be trimmed</p>
Comments	Notes, elaborate on any existing conditions; max 255 characters.
House Number	Corresponding house address, numerical field. If a corner lot house is on a different street, enter house number and write "House located on X Street; corner tree" in comments box.
Collection Date/Time	Date and time.
Photo	Photo of full tree. Additional photos of any significant defects.

Inventory Results

Community Forest Diversity

Of the 126 trees inventoried within the public ROW or on Town-owned land, there are a total of 23 different species in 16 different genera. The five most common tree genera, *Malus* (apple), *Quercus* (oak), *Acer* (maple), *Thuja* (cedar), and *Syringa* (lilac), comprise 82% of Plainfield's community forest (Figure 1). The five most common species are *Malus* species (crabapple) at 23%, *Quercus rubra* (northern red oak) at 19%, *Thuja occidentalis* (eastern white-cedar) at 12%, *Acer saccharum* (sugar maple) at 6%, and *Syringa reticulata* (Japanese tree lilac) at 6% (Figure 2). Complete species and genera lists can be found in Appendix B.

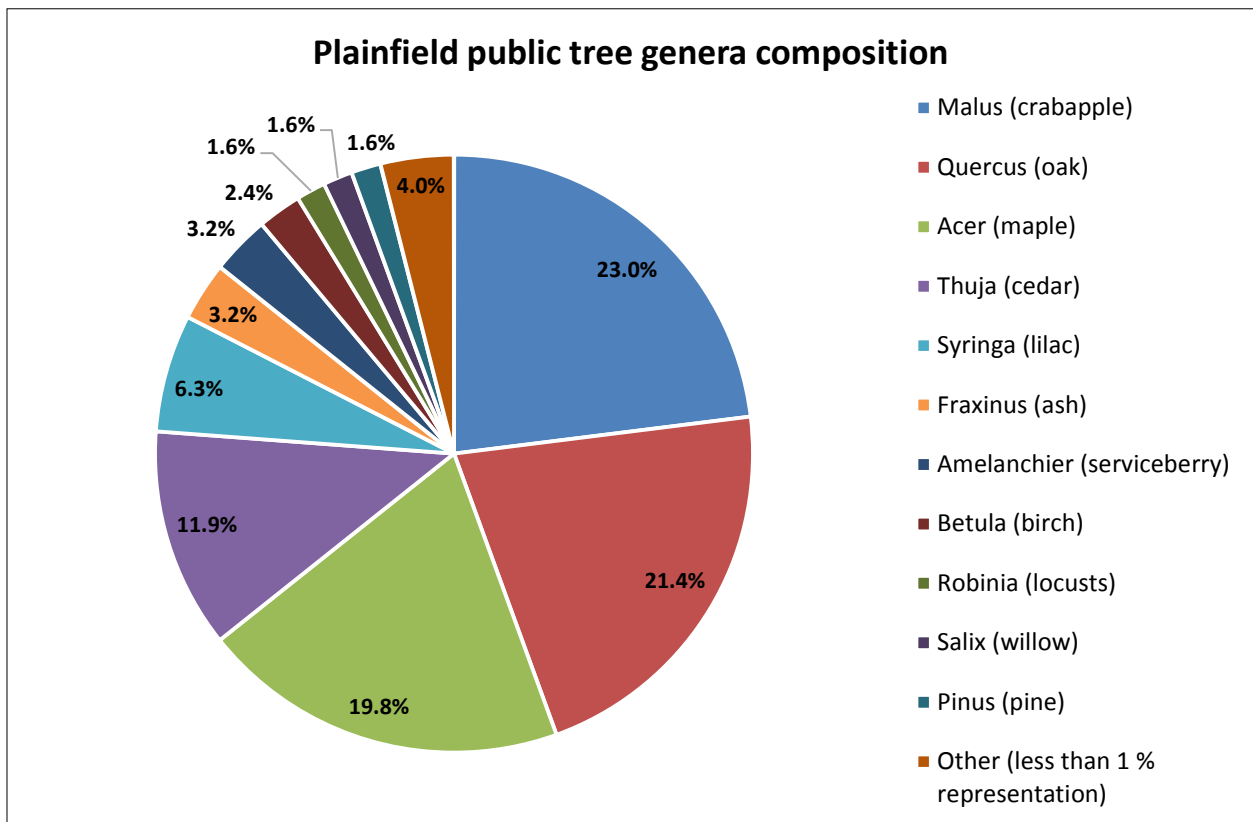


Figure 1. Tree genera by percent within the public ROW and parks in Plainfield.

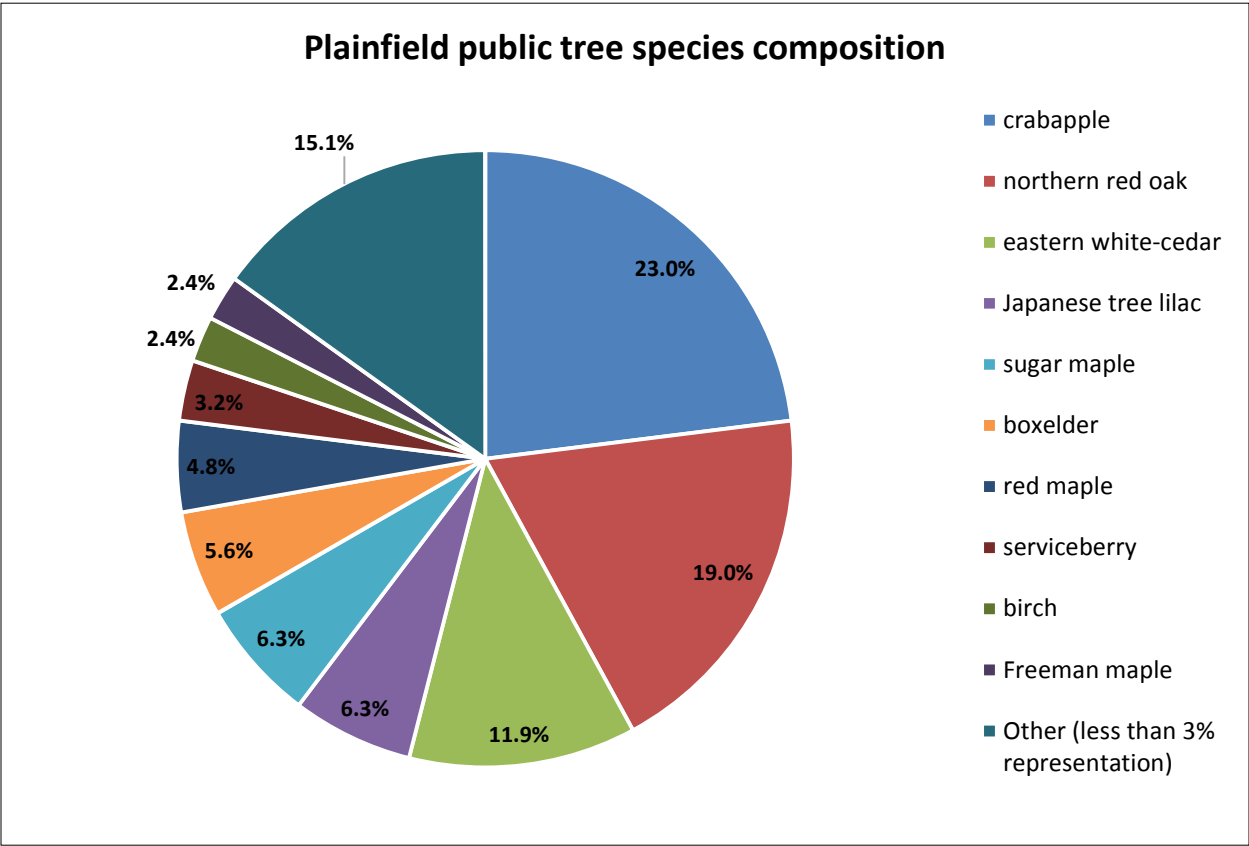


Figure 2. Species by percent within the public ROW and parks in Plainfield.

Community Forest Structure

In descending order by percent size class, the diameter distribution represented by Plainfield’s public trees is: 42% (53) at 6-12”, 25% (32) at 3-6”, 10% (13) at 12-18””, 9% (11) at 0-3”, 6% (8) at 18-24”, 3% (4) at 24-30”, 2% (2) at 30-36”, 2% (2) at 36-42”, and 1% (1) at 42+” (Figure 3). Thus, approximately 86% of inventoried public trees are between 0 and 18 inches, with over two-thirds (67%) of all trees between 3 and 12 inches. Size class distribution can be roughly correlated to the age structure of the community forest.

The composition of genera and species within each of the DBH size classes (Figures 4 and 5) indicates that *Acer* (maple) and *Quercus* (oak) trees make up the majority of the larger diameter trees in Plainfield; these trees are growing within the public ROW or on Town-owned land and were likely not planted as street trees but left as remnants as the community has grown. The

largest public tree in Plainfield is over 42 inches in diameter and is a *Quercus rubra* (northern red oak) located on High Street. Plainfield's *Thuja* (cedar) trees are all 6-24", and all 29 *Malus* (crabapple) public trees are under 18" in diameter, which is characteristic of the small-growing species. There is a predominance of *Quercus* (oak) and *Malus* (crabapple) in the lower size classes, indicating species preference for new tree plantings in recent history.

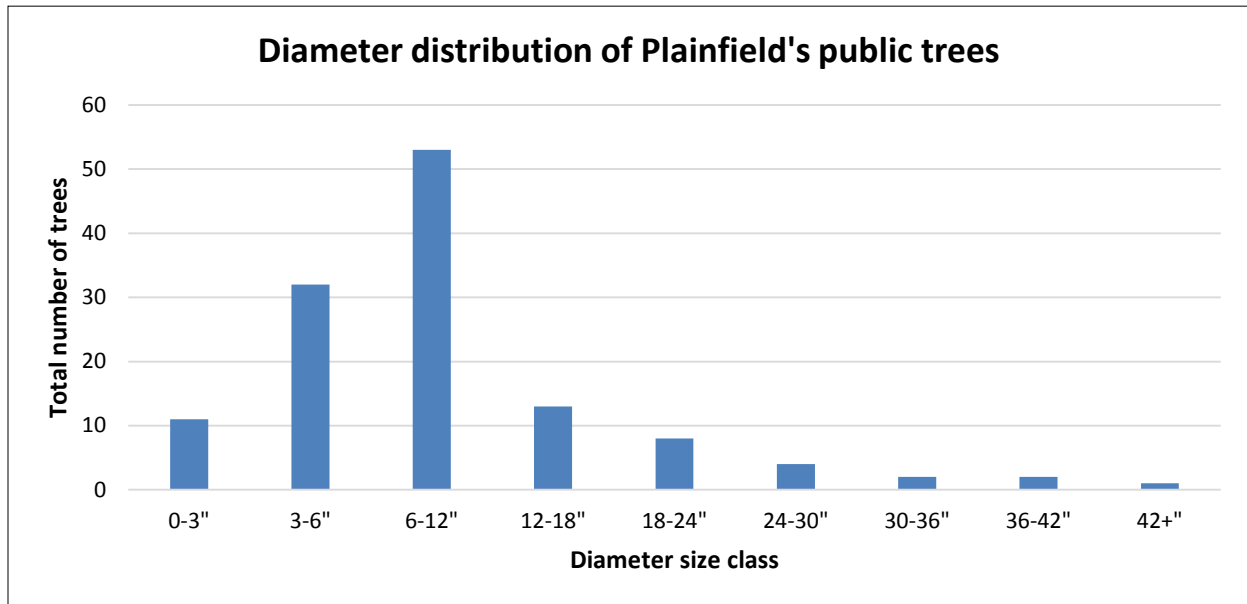


Figure 3. Percent of trees represented in each diameter class (inches) in Plainfield.

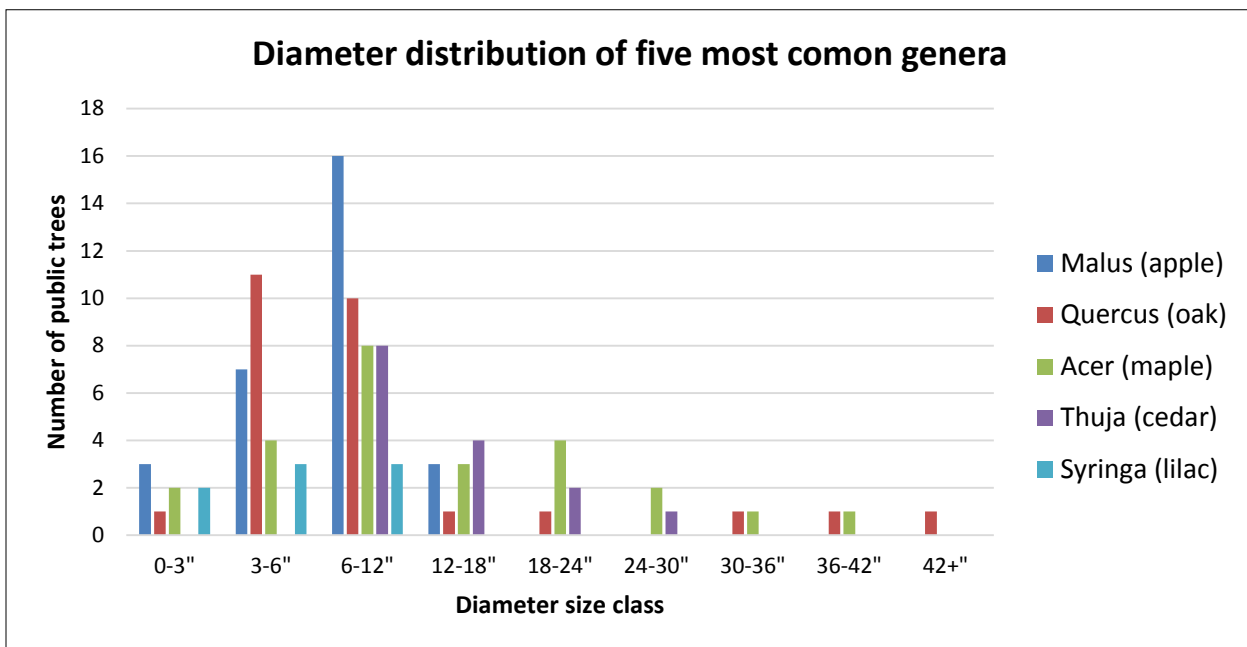


Figure 4. Diameter distribution for the five most common genera of Plainfield's public trees.

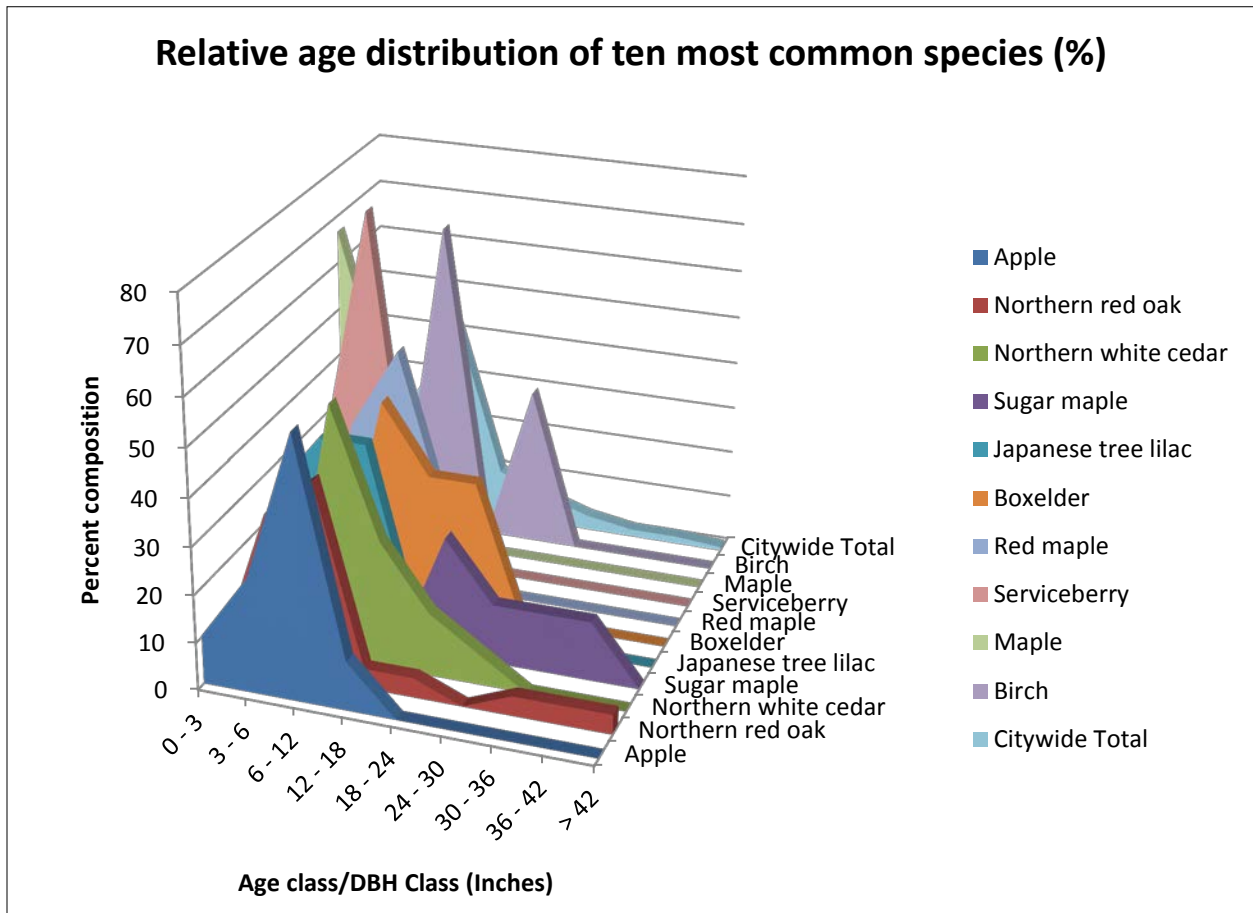


Figure 5. Diameter (and age) distribution of the ten most common species in Plainfield’s community forest. Data from this figure were derived from i-Tree Streets urban canopy structure output.

13 potential tree planting locations or strips were identified within the public ROW (recorded as “Vacant”). Appendix A breaks down these locations by street. Of the inventoried streets and sites, High Street, Brook Road, and Mill Street offer the most vacant spots for tree planting. Additional consultation of these sites is necessary to plant a tree of appropriate size and species.

Community Forest Health

89% (112) of Plainfield’s inventoried public trees were assessed as being in “Good” condition. Of the remaining trees, 11 (9%) are in “Fair” condition, 3 (2%) are in “Poor” condition, and there were no “Dead” trees identified within the public ROW or on Town-owned land (Figure 6). The “Poor” trees are a crabapple and two sugar maples. Appendix E includes maps detailing the location of inventoried trees by condition.

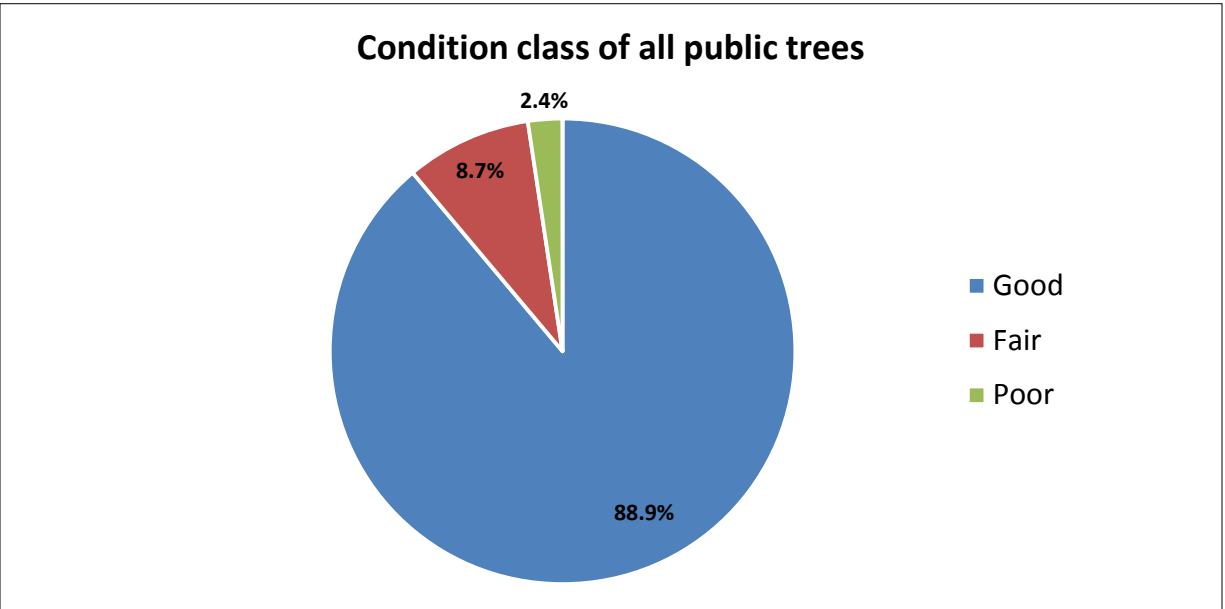


Figure 6. Percentage of Plainfield’s public trees in each condition class.

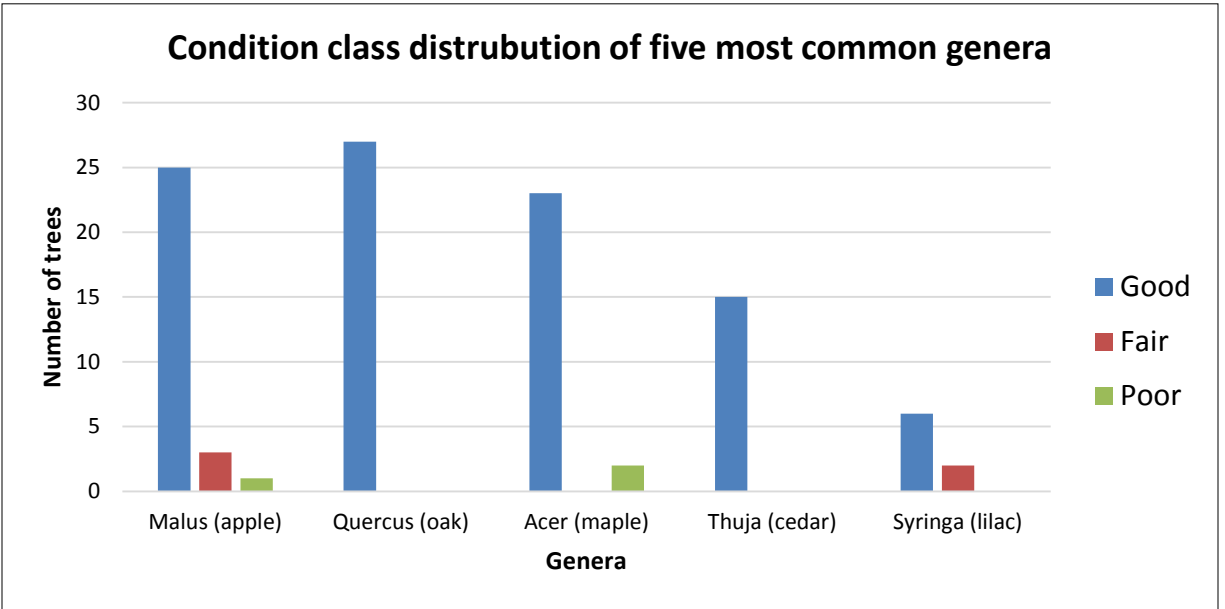


Figure 7. Plainfield’s public trees within the most common genera displayed according to condition.

Tree Health and Maintenance Indicators

The inventory team identified 16 trees (13%) as being in need of regular monitoring. These trees should be reassessed by a Certified Arborist, the Plainfield Tree Warden, or another

qualified individual in a timely matter. Trees that were flagged as in need of monitoring expressed one or more of the following conditions:

- The tree has a visible defect affecting >40% of the tree,
- The tree poses a hazard to people/infrastructure/cars,
- The tree is growing into utility wires,
- The tree is dead or in poor condition, or
- The tree is an ash (*Fraxinus*) and shows evidence of a sign or symptom of infestation by EAB (extensive woodpecker flecking, bark blanding, epicormic branching/water sprouts, and/or suspicious exit holes).

Although Plainfield’s public trees are generally healthy (89% assessed as in “Good” condition), proper maintenance and monitoring is required to promote their health, longevity, and benefits. Of the 16 trees identified as being in need of monitoring, 11 of them are of one of the five most common genera (Figure 8). Ash species only make up 3% of Plainfield’s community forest, but 3 out of 4 of the ash trees inventoried were flagged to be monitored. Although no signs of EAB were noted as apparent on these inventoried public ash trees, the Plainfield Tree Warden should be aware of the location and condition of all public ash trees in light of the current threat of EAB’s arrival in Vermont. A map indicating the location of the 16 trees in need of monitoring, as well as the 4 public ash trees, can be found in Appendix E of this report.

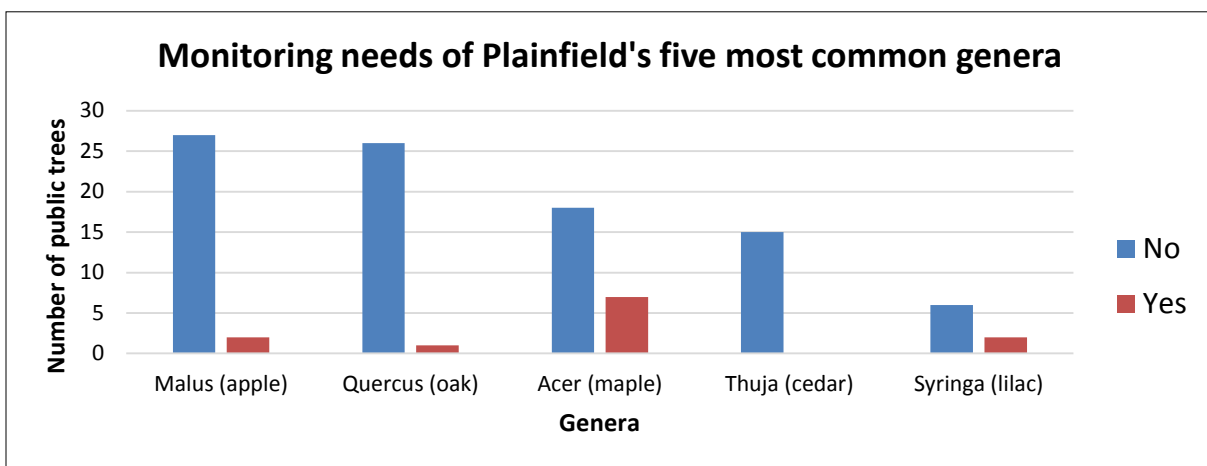


Figure 8. Plainfield public trees in need of monitoring (yes) within the five most common genera.

Of the assessed health and maintenance characteristics, the need for pruning is the most prominent need in Plainfield’s community forest, as it was observed in 14% (18) of inventoried public trees. Decay was observed in about 5% (5) of Plainfield’s public trees, and only one tree was identified to have root issues (Figure 9).

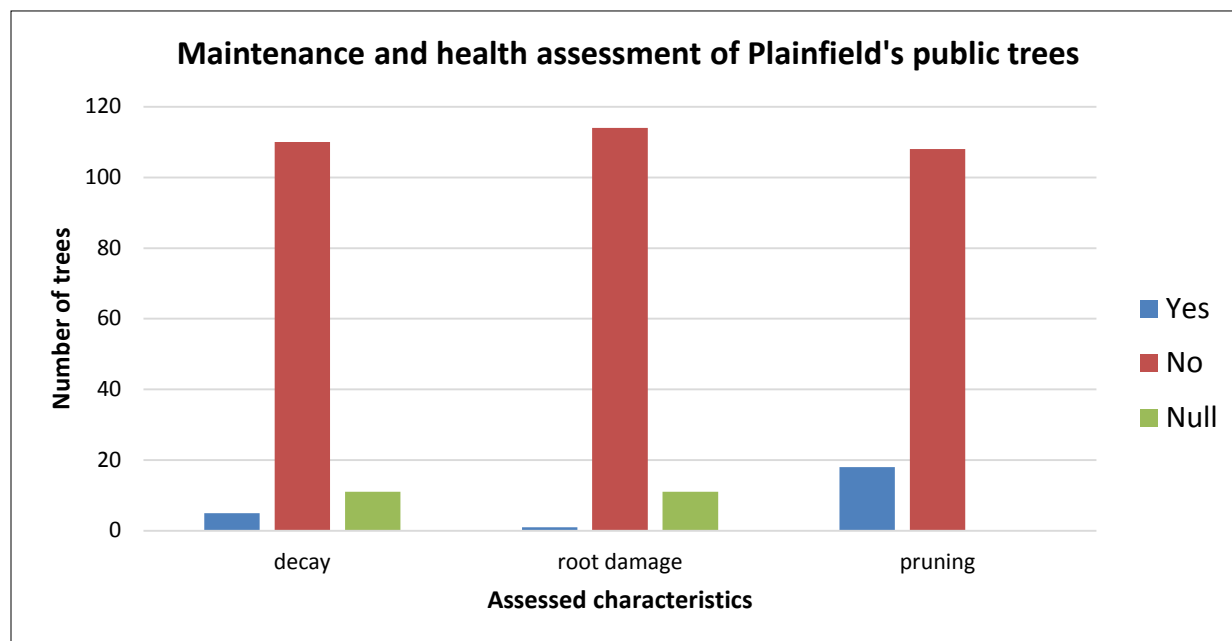


Figure 9. The number of Plainfield’s inventoried public trees assessed as having presence or absence of specific maintenance and health characteristics. Null values represent the number of unassessed trees, and thus indicate user error. Refer to Table 1 for descriptions of each assessed characteristic.

Economic Benefit and Ecosystem Services

The Plainfield tree inventory data were analyzed using i-Tree Streets software to determine the monetary value of the ecosystem services provided by Plainfield’s public trees. The 126 trees provide a total of \$9,336 in annual benefits by filtering air pollutants, mitigating stormwater runoff, sequestering carbon dioxide (CO₂), conserving energy, and increasing property values. On average, each public tree offers \$74 annually in savings or services.

Figure 10 and Table 2 provide an overview of each ecosystem service provided by Plainfield’s public trees. Energy conservation and property value increase are the most significant services provided by these trees in terms of their net monetary value (Figure 9). The full reports

produced through the i-Tree Streets application for Plainfield will be provided to the Plainfield Tree Warden.

It is important to recognize that the trees inventoried through this project are located less than 1 square mile of Plainfield’s total land; expanding the inventory into Plainfield’s 21 total miles of land area would increase these figures dramatically. It is also noteworthy that larger (mature) and long-lived trees provide substantially more benefits than small and young trees. Regular maintenance and care are needed to provide for public tree health, longevity, and maximized community forest benefits.

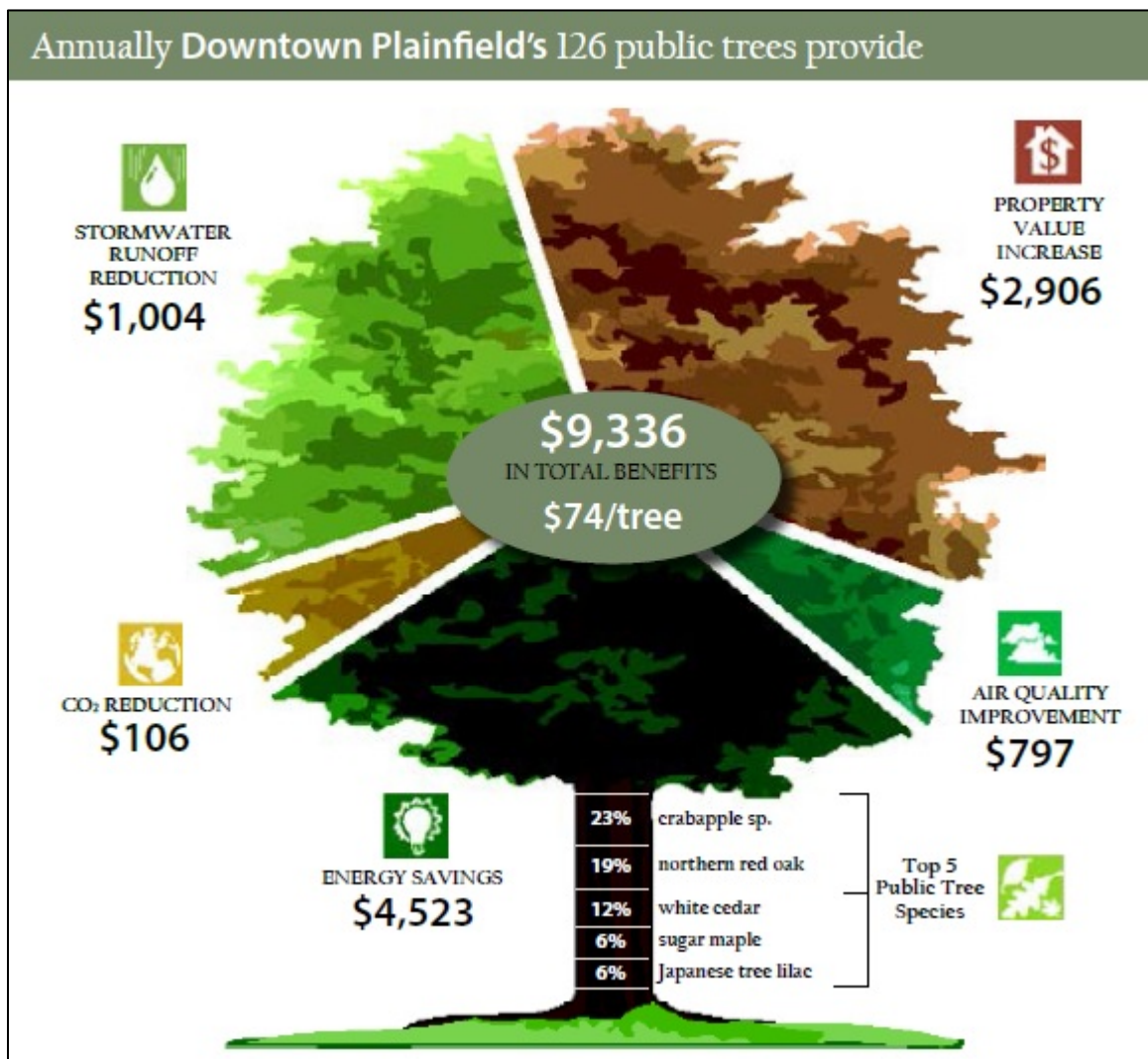


Figure 10. Summary of the benefits provided by Plainfield’s public trees inventoried through this project, according to an i-Tree Streets assessment. Tree graphic concept courtesy of City of New York Department of Parks & Recreation.

Table 2. Annual environmental and monetary benefits provided by Plainfield's public trees.

Benefit Type	Benefit Description	Total Value of Trees Inventoried	Average Value/Tree
Energy conservation	Reduced natural gas use in winter and reduced electricity use for air conditioning in summer	\$4,522.75	\$35.89
Carbon dioxide	Annual reductions in atmospheric CO2 due to sequestration by trees and reduced emissions from power plants due to reduced energy use. The model accounts for CO2 released as trees die and decompose and CO2 released during the care and maintenance of trees.	\$105.87	\$.84
Air quality	Quantifies the air pollutants (O3, NO2, SO2, PM10) deposited on tree surfaces and reduced emissions from power plants (NO2, PM10, VOCs, SO2) due to reduced electricity use. Also reported are the potential negative effects of trees on air quality due to BVOC emissions.	\$797.27	\$6.33
Stormwater	Reductions in annual stormwater runoff due to rainfall interception by trees.	\$1004.06	\$7.97
Aesthetic/other	Tangible and intangible benefits of trees reflected in increases in property values.	\$2,906.03	\$23.06
Stored carbon dioxide	Tallies all of the carbon dioxide stored in the community forest over the life of the trees as a result of sequestration; *not an annual benefit but a cumulative benefit.	\$1,194.91*	\$9.48*

Discussion and Recommendations

Plainfield's Public Tree Program

Plainfield citizen and Tree Warden's participation in this project demonstrates that there is local capacity and desire to enhance the community's public tree program. Plainfield has an active Tree Warden, residents who are passionate about trees and their value, and a history of tree stewardship and plantings to enhance streetscapes and recreational spaces in town. The 2015 public tree inventory and this report lay a foundation for better understanding the management needs and value of Plainfield's public trees, as well as the ways in which residents and Town leadership can be engaged for tree stewardship.

Recommendations

We recommend that the Plainfield Tree Warden and Town leadership note the following considerations to continue to develop the public tree program:

- Develop a management plan or action plan based on the results of the inventory to prioritize goals and establish a timeline for Plainfield's public tree program.
- Encourage the formation of a citizen Plainfield Tree Committee or Advisory Board to help coordinate and implement the Town's tree program
- Advocate for an explicit annual budget for Plainfield's trees; not only for hazardous tree removal and planting, but also for regular maintenance and monitoring of the public trees.
- Encourage citizens to participate in tree planting and other stewardship activities; particularly because of the high populations of trees in the *Acer* (maple) and *Fraxinus* (ash) genera, residents should be aware of the signs and symptoms of EAB and ALB and should be empowered to monitor for these invasive forest pests in their community forest.
- While there are only four public ash trees in downtown Plainfield, ash often grows along rural roadsides. Plan for the arrival of EAB by developing a community invasive forest pest preparedness plan, perhaps as a component of the overall plan for Plainfield's

public trees; this process will inform future planning efforts for other threats to the community forest.

- Ensure that those who are caring for Plainfield’s public trees are trained in best tree care practices. Public trees should be structurally pruned to promote long-term integrity, newly-planted trees should be irrigated to promote proper establishment, mulch should be applied properly, and mechanical and compaction damage should be minimized during any construction or regular maintenance activities.
- Establish a routine and systematic pruning cycle (multi-year) for all public trees to reduce the occurrence of branch failures due to poor structure, minimize conflicts with people and infrastructure, improve lines of sight, reduce storm damage, and protect public safety.
- Communicate the benefits of Plainfield’s public trees at local events and to local leadership, and encourage citizen participation in VT UCF educational programming, such as the Stewardship of the Urban Landscape course, winter webinar series, annual VT Tree Stewards Conference, and Forest Pest First Detector trainings.

Community Forest Diversity and Structure

An important best management practice in urban and community forestry is to maintain a diverse range of species. It is recommended that communities work towards a goal of no more than 20% representation of a single genus (for example, *Acer*) in a tree population and no more than 10% of one species (for example, *Acer saccharum*). Resistance to disease and insect infestation is one of the many reasons that diversity of public trees is of paramount concern. A more diverse urban and community forest is more resistant to environmental stressors, and can therefore remain healthy and resilient in the face of change. Furthermore, by maintaining greater diversity a community can prevent a rapid loss of canopy due to insect and disease issues.

In downtown Plainfield’s relatively small public tree population (126 trees), 23 species and 16 genera are represented. One fifth of the public trees are of species that represent less than 3% of the total tree population, indicating a level of diversity. However, three genera (*Malus*,

Quercus, and Acer) are over the recommended genera representation within the public tree population, and three species (crabapple, northern red oak, and eastern white-cedar) are over the recommended species representation within the public tree population. Unlike many Vermont communities, Plainfield does not have an abundance of Norway maple, which is considered to be a non-native invasive species. However, other maple (*Acer*) species (sugar maple, boxelder, red maple, and Freeman maple) make up about 20% of the total public tree population. Ash trees (*Fraxinus*) only comprise 3% of Plainfield's public tree canopy. Both ash and maple trees are currently threatened by invasive tree pests; EAB and ALB, respectively. While neither of these pests has been discovered to-date in Vermont, the largest ALB infestation in North America is just over 50 miles to our south in Worcester, MA and with the discovery of EAB in New Hampshire in 2013, Vermont is now surrounded on all sides by states or provinces with isolated infestations of EAB.

Over two-thirds of the inventoried public trees are 3-12" in diameter, indicating a generally young public tree population that has not yet reached maturity. The distribution of size classes within that 67% tell a story of continued engagement in tree planting in the ROW and in public spaces in

Components of a Managed, Vibrant, and Resilient Public Tree Program

A successful community forestry program requires a combination of organized leadership, comprehensive information about the tree population, dedicated personnel, and effective public relations. We recommend the following components for successful community forest management.

Public Policies: A tree ordinance or policy provides authority for conducting forestry programs, defining municipal responsibility for public and private trees, passing regulations and setting minimum standards for community forestry management.

Leadership: Define who is responsible for the oversight of the community forest, including formulating policies, advising, administration, management, representation and/or advocacy.

Partnerships: A well-managed community forest takes the work of many. Seek strategic partnership to meet a shared vision. At a minimum the tree warden, a local advisory committee like a tree board or conservation commission and municipal staff (parks, roads, planning) should collaborate.

Responsibility: A clear understanding of which trees and areas will be managed is an important first step. Street trees, parks and village greens, cemeteries and schools are typical areas of municipal responsibility.

Assessment: A complete public tree inventory, including tree locations, species, condition, and management needs provides the necessary information to manage the resource. An inventory is the foundation to developing a strategic management plan.

Management Plan: A management plan provides a vision for the long-term management of the community forest. It should include strategies, budgets, and responsibilities for meeting that vision.

Staffing: The care of community forest requires a certain skill set that can be found in-house with professional staff or through consultants. Whether creating a staff position for a Certified Arborist or urban forester, or contracting with them on an as-needed basis, professional assistance will have some of the greatest and most immediate impacts on an urban forestry program.

Tree Canopy Goals: Consider a community's entire tree canopy to reduce loss and maximize gains over time by protecting undeveloped forest and impacts of land development, enhance the health condition and function of forests, and reforest through active replanting or allowing regeneration.

Plainfield, perhaps peaking within the past decade, as nearly half (42%) of the public trees are 6-12" in diameter. Only 8% of Plainfield's public trees are over 24' in diameter; these large, mature shade trees are perhaps remnants of natural forest stands that have survived the pressures of development as the community has grown. It is important to note that larger, mature trees provide greater environmental, economic, aesthetic, and social benefits, and preservation of these trees should be prioritized.

Recommendations:

We recommend that Plainfield continues to develop its species and structural diversity by:

- Planting new species and increasing the number of lesser represented species in order to promote long-term health and resilience of individual trees and Plainfield's overall tree population. Refer to VT UCF's Tree Selection Guide at vtcommunityforestry.org/resources/tree-care/tree-selection.
- Due to the high number of existing crabapple (*Malus*) trees in Plainfield, we suggest selecting non-crabapple trees for future plantings.
- As Plainfield's relatively young public trees mature, promote their health and integrity with a systematic structural pruning and maintenance cycle.
- Existing ash (*Fraxinus*) trees should be regularly monitored for signs and symptoms of EAB and new ash trees should not be planted.
- Refer to the significant list of 13 identified potential tree planting locations ("vacant" spots) within the public ROW in Appendix A to strategically increase tree species and structural diversity in Plainfield.

Community Forest Health

Overall, Plainfield's public tree population is healthy, as 89% of inventoried trees were assessed to be in "Good" condition. A dedicated tree care budget and established maintenance program would further support the health of the community forest. Approximately 11% (14) of Plainfield's public trees were either considered to be in "Fair" or "Poor" condition and the locations of these trees can be found on the map in Appendix E. A total of 16 trees were assessed to be in need of monitoring by a Certified Arborist, the Plainfield Tree Warden, or

another qualified individual. Many of these trees overlap with those designated as in “Fair” or “Poor” condition, and others were likely noted because of conflict with utility wires and/or other infrastructure. Low soil volume and fertility, soil compaction, exposure to road salt spray, root damage, mechanical damage to the trunk or branches, and improper pruning and planting are some of the contributing factors that may lead to decreased tree health in urban and residential settings. The full inventory data spreadsheet, with specific comments associated with the 16 trees requiring monitoring will be given to the Plainfield Tree Warden; some recurring themes from these comments are presented in the recommendations below.

Recommendations:

In order to ensure the long-term health and vibrancy of Plainfield’s public trees, we recommend the following activities:

- Prioritize the monitoring of the 16 trees that have been flagged for monitoring by a Certified Arborist or the Plainfield Tree Warden.
- There are pruning needs noted in the Comments field for many of the 16 public trees that should be monitored; examples include utility conflict, need for structural pruning, and correction of previous improper pruning cuts. Consider establishing a multi-year routine pruning regime in Plainfield to address pruning needs.
- A few trees were noted to be “volcano mulched”; mounding mulch thickly and against the trunk promotes rot, making the trunk susceptible to insects and disease, it can produce stem-girdling roots, it can become winter habitat for rodents that may chew the bark of the tree, and it can cause a number of other tree health problems. Remove the mulch from the direct base of these trees. Mulch provides many benefits to trees, particularly as they establish after planting, but proper mulch application is necessary for its benefits to manifest. Proper mulch depth around the base of the tree is 2-4” and should be applied in a donut shape around the tree, with no mulch touching the trunk.
- Encourage a culture of continual monitoring and updating the tree inventory spreadsheet as necessary as regular tree management occurs in Plainfield.

Assessment Tools

Using free and accessible i-Tree software developed by the USDA Forest Service, VT UCF staff was able to assess the benefits and economic value of Plainfield's public tree canopy. i-Tree Streets allowed us to determine the economic value of the ecosystem services provided by the 126 inventoried trees in Plainfield. The town's downtown community forest generates about \$9,336 annually through the benefits of air quality improvement, carbon storage, electricity and natural gas, aesthetics, and storm water control; on average, each tree offers approximately \$74 in service or savings every year. The trees of Plainfield provide services to the city in the following ways:

- **Aesthetics:** Trees can make an urban or suburban environment a more pleasant and satisfying place to live, work, and spend leisure time (Dwyer et al. 1991¹). In economic terms, presence of – particularly mature - shade trees can significantly increase property value. There are numerous health benefits associated with the mere presence of trees. For example, hospital patients with window views of trees have been shown to recover faster than patients without such views (Ulrich 1984²).
- **Air quality:** Trees improve air quality by removing air pollutants through their leaves, altering emissions from building energy use, and by lowering air temperature.
- **Energy use:** Trees influence thermal comfort and energy use by providing shade, transpiring moisture, and reducing wind speeds, mitigating the need for heating of buildings in the winter and cooling in the summer.
- **Stored carbon and sequestered carbon dioxide:** Trees store carbon in their tissues as they accumulate biomass over time; an estimated 770 million tons of carbon, valued at \$14.3 billion, is stored in the public forests in the contiguous United States store 770

¹ Dwyer, J.F., H. W. Schroeder, and P. H. Gobster. (1991). The significance of urban trees and forests: toward a deeper understanding of values. *Journal of Arboriculture*, 17: 276-284.

² Ulrich, R.S. (1984). View through a window may influence recovery from surgery. *Science*, 224:420-421.

million tons of carbon, (Nowak and Crane 2002³). Trees also mitigate greenhouse gas emissions by sequestering carbon dioxide through the process of photosynthesis.

- **Storm water run-off:** Trees and soil improve water quality and reduce costs associated with stormwater treatment by retaining or slowing flow of precipitation.

Recommendations

We recommend that the Plainfield Tree Warden and engaged citizens explore the results of the i-Tree assessment detailed in this report and:

- Use the information generated through i-Tree Streets to promote the understanding of tree benefits and the investment in community forest management and local stewardship.
- Explore the other free assessment tools in the i-Tree tools suite (www.itreetools.org).

Conclusion

Trees in our downtowns and densely populated landscapes contribute to environmental integrity, social cohesiveness, economic activity, cultural heritage, and overall well-being. This report should help the leaders and citizens of Plainfield to understand, manage, and steward the town's public tree population. The recommendations outlined in this report are based on VT UCF staff's observations and data analysis combined with their experience and evaluation; they should be considered by Plainfield's Tree Warden and municipal leadership based on long-term vision and capacity. Looking ahead, Plainfield should focus efforts on maintaining the quality of the community trees, increasing its species and age diversity. With improved monitoring, regular maintenance, and an engaged and informed citizenry, the potential for a healthy, sustainable community forest is attainable.

³ Nowak, D.J.; D. E. Crane. (2002). Carbon storage and sequestration by urban trees in the USA. *Environmental Pollution* 116(3): 381-389.

Appendices

Appendix A: Full Street and Site List for Plainfield's Public Tree Inventory

Street/site name	ROW Extent (Feet)	Number of trees	Number of vacant spots or strips
Brook Road	25"	1	2
Creamery Street	25"	11	0
Greenspace (Washburn Park, Village Park, and the Rec Field)	N/A	38	0
High Street	66"	42	6
Hudson Avenue	25"	13	0
Main Street	25"	12	1
Mill Street	25"	3	4
Route 2	66"	2	0
School Street	66"	4	0

Appendix B: Full Species and Genera List for Plainfield's Public Trees

Common Name	Scientific Name	Number of Trees	Percent of total population
crabapple	<i>Malus</i>	29	23.0%
northern red oak	<i>Quercus rubra</i>	24	19.0%
eastern white-cedar	<i>Thuja occidentalis</i>	15	11.9%
Japanese tree lilac	<i>Syringa reticulata</i>	8	6.3%
sugar maple	<i>Acer saccharum</i>	8	6.3%
boxelder	<i>Acer negundo</i>	7	5.6%
red maple	<i>Acer rubrum</i>	6	4.8%
serviceberry	<i>Amelanchier</i>	4	3.2%
birch	<i>Betula</i>	3	2.4%
Freeman maple	<i>Acer</i>	3	2.4%
black locust	<i>Robinia pseudoacacia</i>	2	1.6%
eastern white pine	<i>Pinus strobus</i>	2	1.6%
green ash	<i>Fraxinus pennsylvanica</i>	2	1.6%
white ash	<i>Fraxinus americana</i>	2	1.6%
white oak	<i>Quercus alba</i>	2	1.6%
willow	<i>Salix</i>	2	1.6%
American chestnut	<i>Castanea dentata</i>	1	0.8%
American elm	<i>Ulmus americana</i>	1	0.8%
black cherry	<i>Prunus virginiana</i>	1	0.8%
bur oak	<i>Quercus macrocarpa</i>	1	0.8%
eastern cottonwood	<i>Populus deltoides</i>	1	0.8%
honeylocust	<i>Gleditsia triacanthos</i>	1	0.8%
Norway maple	<i>Acer platanoides</i>	1	0.8%

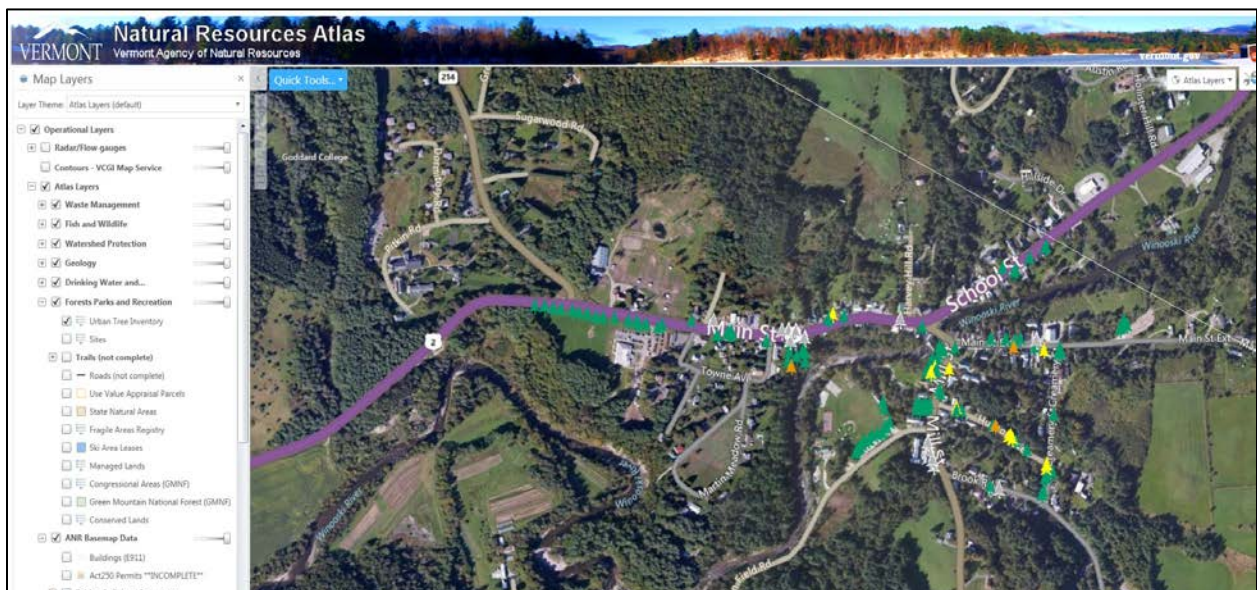
Appendix C: Leaf Area and Canopy Cover by Species of Plainfield’s Community Forest

Species	Number of Trees	% of Total Trees	Leaf Area (ft2)	% of Total Leaf Area	Canopy Cover (ft2)	% of Total Canopy Cover
crabapple	29	23.02	15,929.94	8.63	7,742.95	11.72
northern red oak	24	19.05	57,643.71	31.22	20,147.62	30.5
eastern white-cedar	15	11.9	10,007.00	5.42	7,379.25	11.17
sugar maple	8	6.35	40,929.73	22.17	8,905.18	13.48
Japanese tree lilac	8	6.35	2,121.97	1.15	1,416.48	2.14
boxelder	7	5.56	11,195.84	6.06	5,369.01	8.13
red maple	6	4.76	9,282.39	5.03	2,380.41	3.6
serviceberry	4	3.17	661.01	0.36	476.51	0.72
maple	3	2.38	350.73	0.19	161.12	0.24
birch	3	2.38	7,306.47	3.96	2,129.88	3.22
white oak	2	1.59	1,139.96	0.62	356.88	0.54
white ash	2	1.59	2,124.62	1.15	697.43	1.06
eastern white pine	2	1.59	450.96	0.24	106.35	0.16
black locust	2	1.59	3,676.85	1.99	1,294.85	1.96
green ash	2	1.59	2,918.00	1.58	1,043.68	1.58
willow	2	1.59	3,259.16	1.77	838.63	1.27
American chestnut	1	0.79	559.49	0.3	184.25	0.28
black cherry	1	0.79	925.57	0.5	474.12	0.72
American elm	1	0.79	7,288.97	3.95	2,398.75	3.63
Norway maple	1	0.79	4,628.57	2.51	1,672.07	2.53
honeylocust	1	0.79	1,506.33	0.82	685.75	1.04
bur oak	1	0.79	569.98	0.31	178.44	0.27
cottonwood	1	0.79	150.71	0.08	19.14	0.03
Total	126	100	184,627.96	100	66,058.75	100

Appendix D: Instructions for Accessing Public Tree Data in ANR Atlas

Anyone with Internet access can view all of Plainfield's inventoried public trees by using the Vermont Agency of Natural Resources' (ANR) Atlas mapping tool. Follow these simple steps:

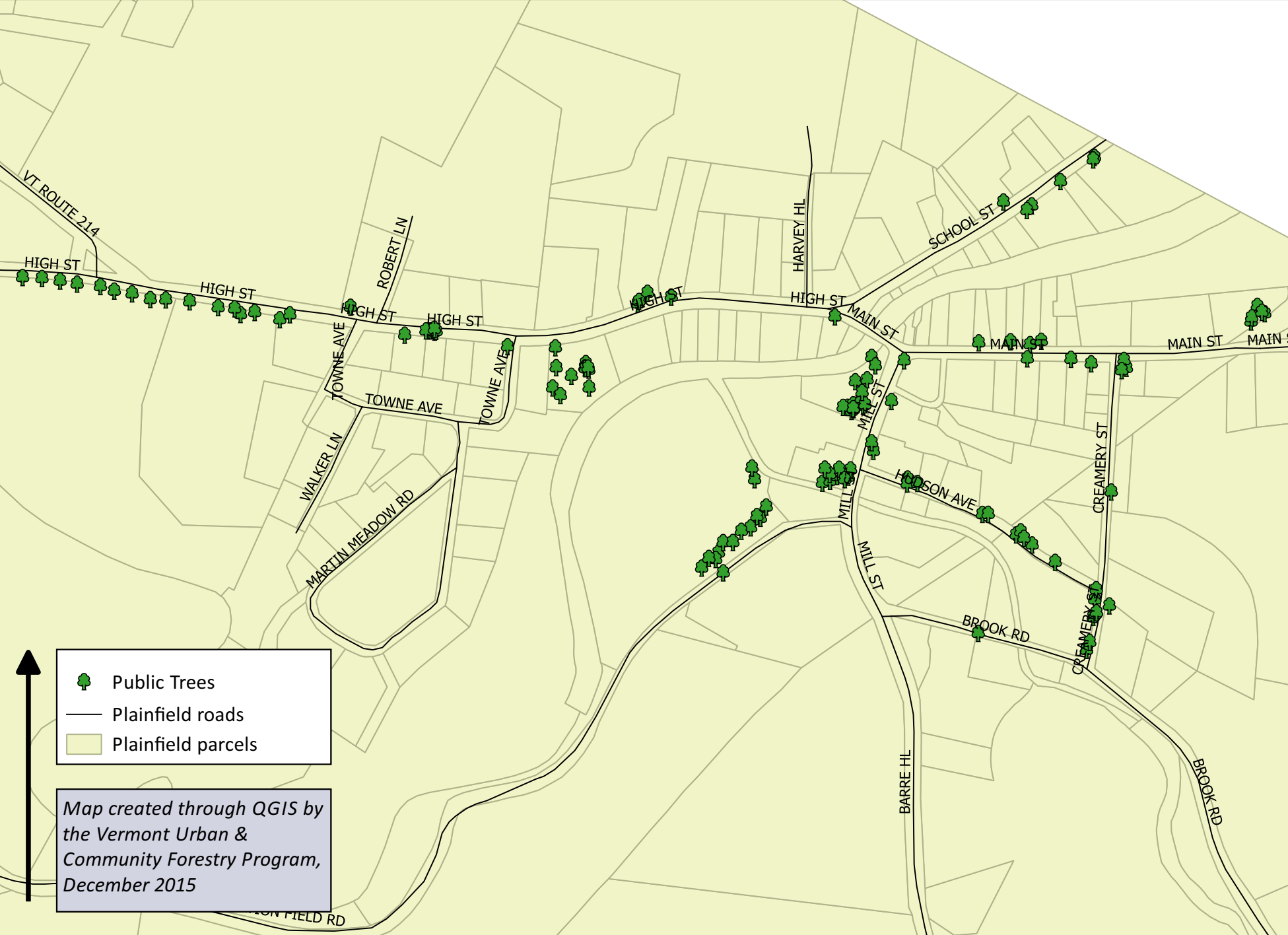
1. Set your web browser (Internet Explorer works best, Chrome does not work) to <http://anrmaps.vermont.gov/websites/anra/> (or search "VT ANR Atlas").
2. Zoom in to Plainfield using the +/- scale navigation tool in the upper left portion of the map (the tree data layer won't show up unless you are zoomed in to the city-level so that you can see the street names on the map).
3. In the information pane on the left of the screen switch to the "map layers" tab at the bottom.
4. Expand the "Forests, Parks, & Recreation" heading,
5. Click on the box to the left of "Urban Tree Inventory" to load public tree data (it might take a moment for the layer to load).
6. Once you see all the trees on the map, you can zoom in and right-click on any individual tree and click on "What's here"; when you do this, the left information pane will change to give you the basic details for that specific tree.
 - o To access all of the information collected on that specific tree, click on the grey text title of the tree in the left pane and a new window will open with the inventory data.
 - o In this new window there are three tabs: "Details" and "Attributes" display the same information in different formats and if a photo was taken of the tree, it will show up in the "Attachments" tab.






Appendix E: Maps

1. All Public Trees Inventoried in Plainfield
2. All Public Trees Inventoried in Plainfield by Diameter Class
3. All Public Trees Inventoried in Plainfield by Condition Class
4. Public Trees in Need of Monitoring in Plainfield
5. Plainfield's Public Ash Trees
6. Potential Public Tree Planting Locations in Plainfield

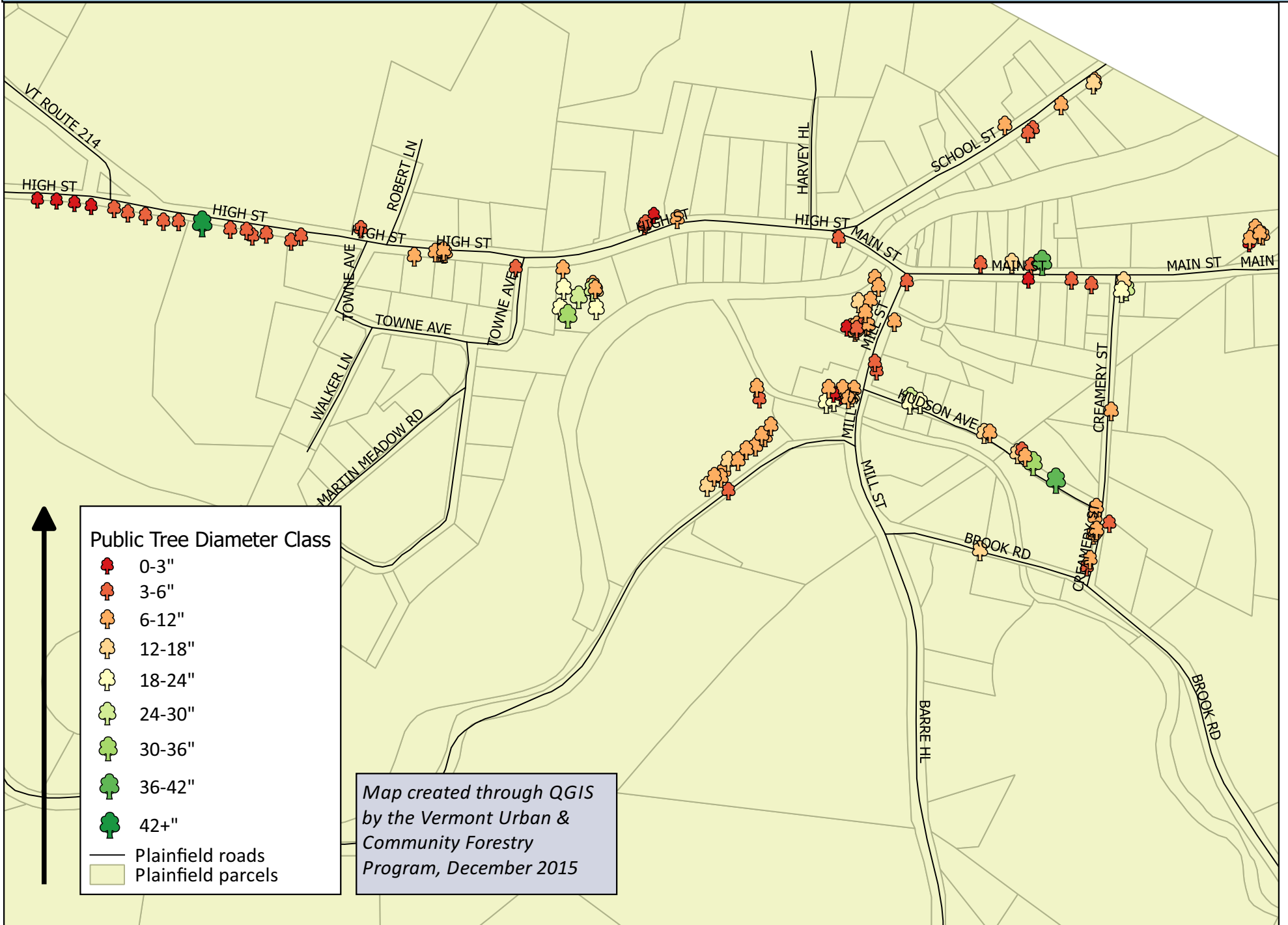
Plainfield's Public Trees



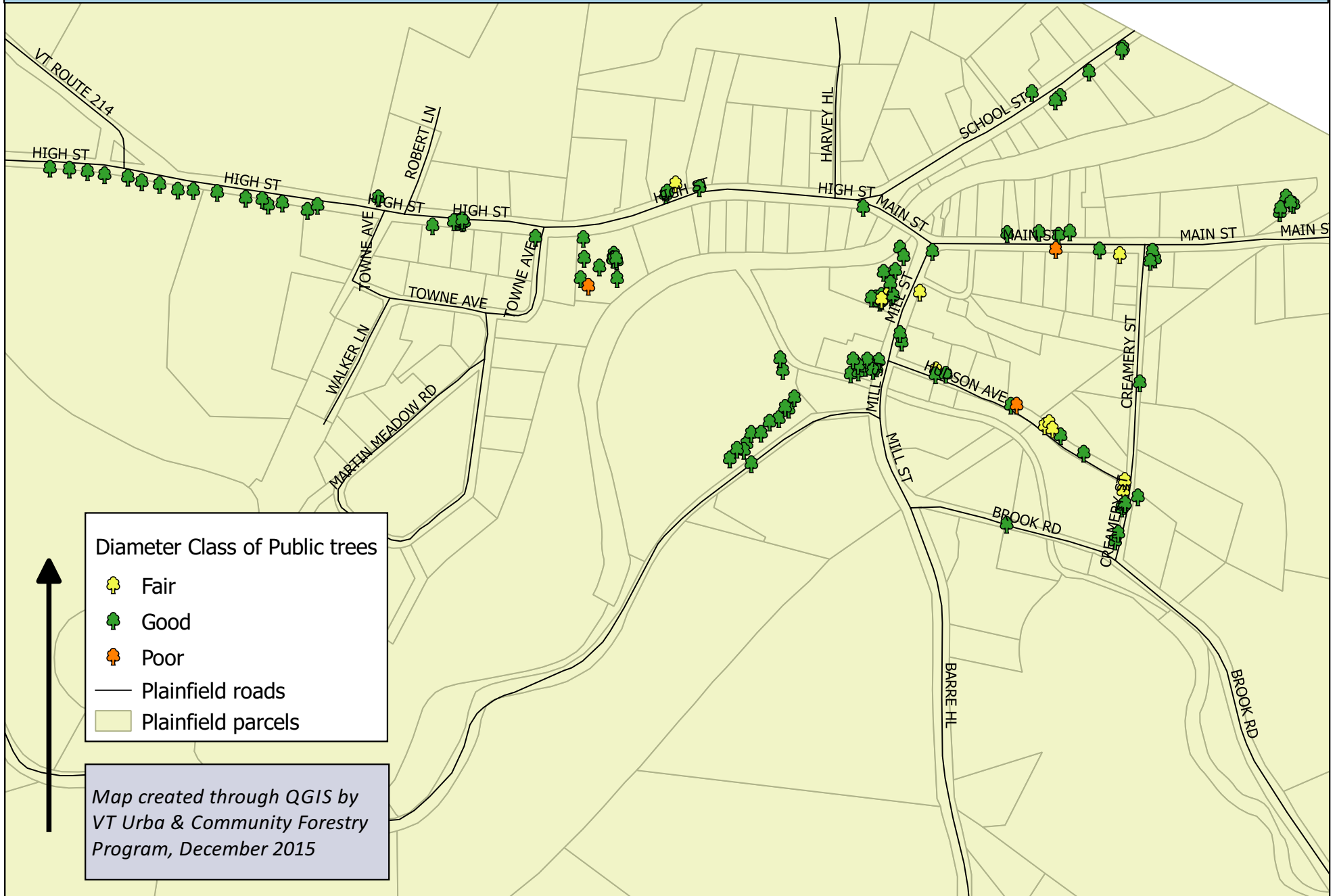
-  Public Trees
-  Plainfield roads
-  Plainfield parcels

Map created through QGIS by
the Vermont Urban &
Community Forestry Program,
December 2015

Plainfield Public Trees by Diameter Class



Plainfield Public Trees by Condition Class






Plainfield Public Trees in Need of Monitoring



Plainfield Public Ash Trees



-  Plainfield ash
-  Plainfield roads
-  Plainfield parcels

Map created through
QGIS by VT Urban &
Community Forestry
Program, December
2015

Potential Public Trees Planting Locations in Town

