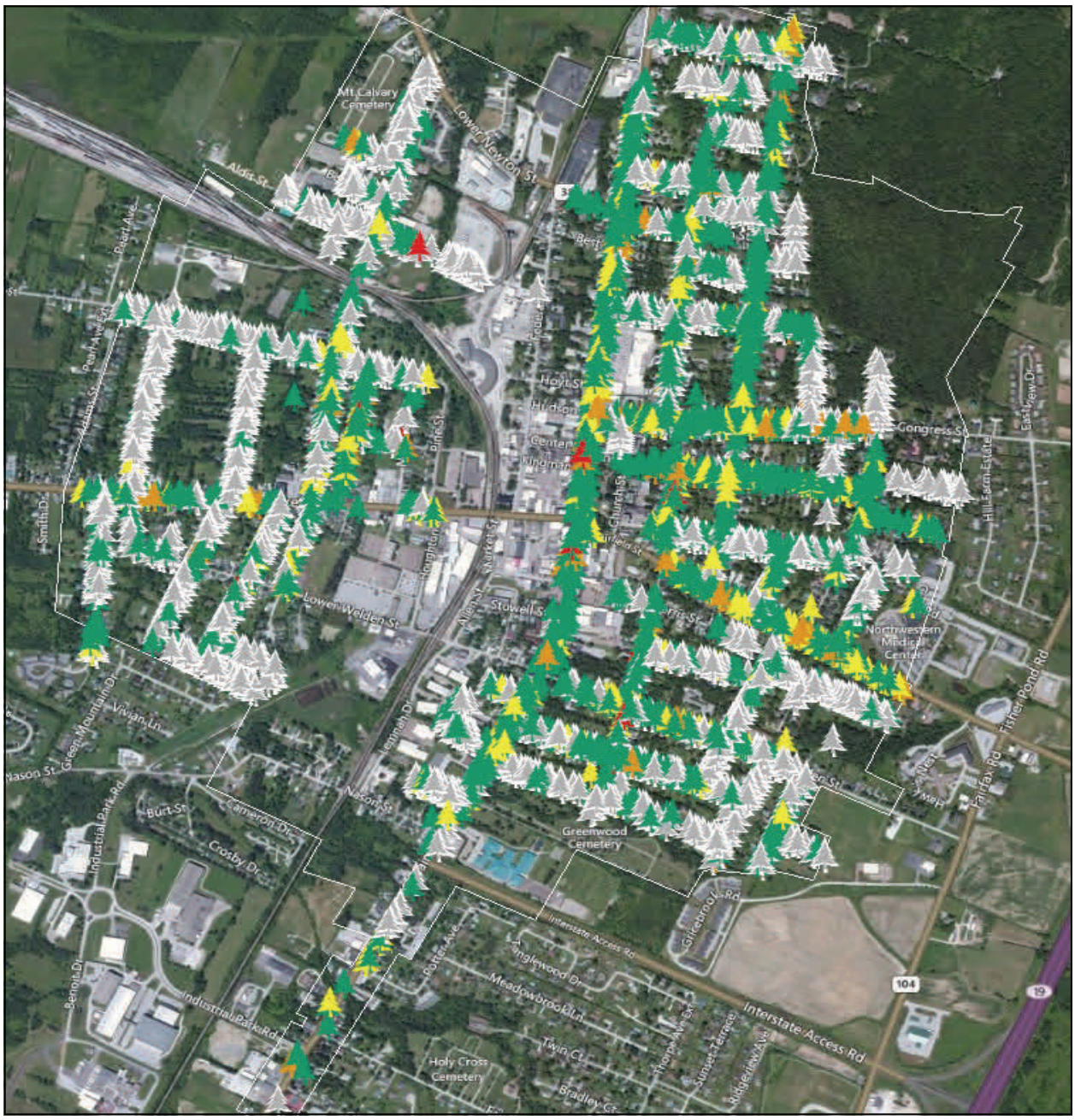
Saint Albans Public Tree Inventory Report



Prepared for the City of Saint Albans
by the Vermont Urban & Community Forestry Program
December 2015

FORESTS, PARKS & RECREATION VERMONT

UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

PLANT LIVE GROW
VERMONT URBAN & COMMUNITY FORESTRY PROGRAM

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

VT ANR GIS

Acknowledgements

This report was developed by Vermont Urban & Community Forestry Program (VT UCF) staff based on field work conducted by VT UCF staff and State Lands Foresters from the Vermont Department of Forests, Parks, & Recreation (VT FPR) for the city of Saint Albans, Vermont during the summer of 2015. We would like to thank the main St. Albans contacts for this project, Curtis Comfort, the City's Planning and Permitting Administrator and active Tree Warden, and Chip Sawyer, the City's Director of Planning & Development. Special thanks to Matt Leonard with VT FPR for leading the coordination of the on-the-ground data collection in Saint Albans. Additional 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. This report was made possible with funding from the USDA Forest Service.

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 (CO_2) 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.

Contents

Executive Summary

The goals of Saint Albans City's (herein after referred to as St. Albans) public tree inventory were to accurately locate City-owned trees within the public right-of-way (ROW), assess and document the overall condition of St. Albans' public trees, and identify potential public tree planting locations. The information collected in the inventory and presented in this report provides residents and decisions-makers with a better understanding of the composition, condition, and benefits of St. Albans' urban forest and will allow the St. Albans' Tree Warden to plan for tree maintenance and future tree planting using a map-based tree inventory tool.

This project was initiated in the spring of 2015, was coordinated with City staff from the Department of Planning & Development, and was approved by Chip Sawyer, Director of Planning & Development. VT UFC and VT FPR staff completed an inventory of **1,715 trees** located within the public ROW of **69 streets** and on **1 City-owned property** and identified **1,205 potential 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 December 2015. It presents the results of the inventory and provides a basic assessment of the trees and urban canopy cover in the City of St. Albans.

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 reducing stormwater runoff, reducing air pollution, providing shade, sequestering carbon dioxide (CO_2), enhancing property values, and improving the aesthetics of the community. The 1,715 public trees that were inventoried provide an estimated **$193,271 in benefits annually** to the residents and businesses of St. Albans. In addition to the public trees inventoried, an aerial tree canopy assessment was completed for the overall land area assessed in the inventory – encompassing both public and private late – that indicated an existing tree canopy cover of **28%** and an estimated long-term **stored CO_2 value of over $2,042,958.**

Summary of Findings

Forest Diversity

- Of the 1,715 public trees, there are 80 different species in 46 different genera.
- The five most common tree genera by number of trees are *Acer* (maple) at 49%, *Malus* (crabapple) at 9%, *Fraxinus* (ash) at 8%, *Quercus* (oak) at 5%, and *Gleditsia* (honeylocust) at 4%.
- *Acer* and *Fraxinus* species together represent 57% percent of St. Albans' 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 *Acer saccharum* (sugar maple) at 18%, *Acer rubrum* (red maple) at 14%, *Malus* species (crabapple) at 9%, *Acer platanoides* (Norway maple) at 9%, and *Fraxinus pennsylvanica* (green ash) at 7%.

Forest Structure

- Nearly a quarter the inventoried public trees (24%) have a diameter at breast height (DBH) measurement between 12 and 18". Similarly, nearly a quarter (23%) of inventoried public trees has a DBH within the 6-12" size class, 14% of inventoried public trees has a DBH measurement between 18 and 24". When combined with the percentage of St. Albans' public trees that have DBH measurements between 0 and 3" (9%) and 3 and 6" (12%), 83% of St. Albans' public trees are between 0 and 24".
- The remaining 17% of inventoried trees were represented in the following size classes: 24-30" (7%), 30-36" (4%), 36-42" (5%), and 42+" (1%).

Forest Cover

- There is an existing urban tree canopy (UTC) cover of 28% across the extent of St. Albans. This analysis was done on both public and private land over the full extent of the City's inventoried area.

- Trees could potentially cover an additional 55% of St. Albans' land surface. These "possible UTC" areas include low-lying vegetation or grassland, agricultural fields, and impervious surfaces (e.g. parking lots, paved playgrounds, and the ROW).
- The remaining 17% of St. Albans' land area is buildings, streets, water, and other permanent features and is generally unsuited to UTC improvement.
- 1,205 potential public tree planting locations were identified over the course of the inventory.

Forest Health

- Over three quarters (1,382, or 81%) of St. Albans' inventoried trees were assessed as being in "Good" condition. Of the remaining trees, 239 (14%) were considered to be in "Fair" condition, 78 (5%) were in "Poor" condition and 16 (1%) were "Dead".
- 426 trees (25%) were assessed to be in need of monitoring by a Certified Arborist, the City's Tree Warden, or another qualified individual.

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 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 St. Albans public tree inventory, our priority recommendations for the City of St. Albans are:

- Promote longevity and integrity of the public tree population by establishing a systematic and routine structural pruning program.
- Develop a plan to remove – and replace if appropriate – the 16 dead trees inventoried.
- Prioritize the timely assessment and, if needed, maintenance of the 426 trees that were identified as in need of monitoring by a Certified Arborist or the City's Tree Warden.

- Refer to the 1,205 potential public tree planting locations for future planting efforts, and use these plantings as an opportunity to increase the genera and species diversity within the City's urban forest.

The St. Albans public tree inventory was conducted by VT FPR State Lands Foresters and VT UCF staff and interns in the summer of 2015 and encompassed downtown streets (left) as well as residential roads (right) across the entire land area of the City.

Introduction

Project Description

In 2013 VT UCF received a multi-year grant from the USDA Forest Service to assist twenty priority communities in Vermont in moving their public tree programs forward. The project, *Care of the Urban Forest*, is an effort that aims to support these communities in three specific ways, by: (1) conducting a public tree inventory to assess urban forest structure, diversity, and health; (2) helping the community in the development of an urban forest management plan or strategic action plan, using information from the inventory; and (3) providing technical training for municipal employees and key volunteers to increase in-house capacity to manage, and promote the proper care, of public trees.

The City of St. Albans was interested in partnering with VT UCF on the *Care of the Urban Forest* project to conduct a full public tree inventory of the City that would be map-based and in an electronic format. The intent of the public tree inventory was to enable St. Albans City to better understand, steward, and manage its public trees more efficiently and cost effectively. The specific goals of St. Albans' public tree inventory were to accurately locate City-owned trees within the public ROW, assess and document the overall condition of St. Albans' public trees, and identify potential public tree planting locations. The complete public tree inventory was conducted over the course of approximately 200 field hours in August and September, 2015, and will provide a foundation for future management decisions and improvements to the urban forest. Additionally, benefits of tree canopy cover, such as the improvement of air and water quality and increased property value, will increase as the City is empowered and informed to manage and support a vibrant public tree population.

The City of St. Albans has historically designated a municipal employee as the City's Tree Warden. Currently, St. Albans' Planning and Permitting Administrator, Curtis Comfort, holds the position of Tree Warden. St. Albans currently has an explicit annual tree budget, which is primarily used for the removal of hazardous and problematic trees. Some funds from this budget are and can be used for tree plantings as well. In addition to the City's current urban

forestry stewardship efforts and investments, St. Albans has periodically engaged with VT UCF to advance its public tree program; an in-depth Urban Tree Canopy assessment (performed by the University of Vermont's Spatial Analysis Lab), downtown tree planting projects, and extensive green stormwater infrastructure installations along Main Street are examples. In addition to the City's activities, there is a rich history of citizen-led tree planting initiatives in St. Albans, particularly in the neighborhoods east of N. Main Street. The results from this public tree inventory – and the City's engagement in the *Care of the Urban Forest Project* – will continue to advance St. Alban's public tree stewardship efforts.

City Profile

The City of St. Albans is located in Franklin County, Vermont and is surrounded by the Town of St. Albans, which was incorporated separately from the City. Located approximately 30 miles north of Burlington, St. Albans is crossed by Interstate 89 and is about 15 miles south of Vermont's border with Quebec, Canada. The City of St. Albans covers a land area of approximately 2 square miles, within the Town's approximate 16 square miles land area, and has a population of 6,918 people, according to the 2010 U.S. Census. Chartered in 1763 by New Hampshire Governor Benning Wentworth, St.

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 urban forests and to guide future urban planning.

Urban 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 environmental 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 forests create opportunities for environmental 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.

Albans' history is rooted in agriculture. St. Albans City was, however, also known as "Railroad City", as it was home to a major depot, operations center, and repair shop of the Vermont and Canada Railroad[1]. The City's early economy was also supported by an iron foundry, a freight car manufacturer, and a large number of mechanic shops[2]. St. Albans was the home to the northernmost engagement of the Civil War, known as the St. Albans Raid, in 1864, and the City's separate incorporation occurred in 1902. Today, St. Albans is a tourist destination noted for its Victorian and craftsman style architecture dating back to the railroad era, when over 200 trains passed through daily[3]. In fact, St. Albans is a research target for genealogists, as European immigrants heading for the U.S. often landed in Halifax, Nova Scotia or Montreal, Quebec in Canada and used the train to cross the U.S. border, arriving in St. Albans. The National Archives lists for St. Albans covers the period between 1895 and 1965[4].

Methodology

To plan for the public tree inventory, VT UCF staff coordinated with staff from the City of St. Albans' Department of Planning & Development, including the active Tree Warden, Curtis Comfort. Originally, the 69 public streets in St. Albans City were selected to be included in the inventory, as well as Barlow Park. The City already has an inventory of the trees on Taylor Park, which is the most prominent downtown park located on Main Street (but City staff may want to consider integrating those records into this public tree inventory in the future). In total, the inventoried land area was about 2 square miles, encompassing the full extent of St. Albans City. The ROW boundaries for all streets were provided by the St. Albans Department of Planning & Development. The list of streets and sites with ROW boundaries is found in Appendix A and GIS maps of the inventoried trees are in Appendix E.

VT UCF has developed a tree inventory tool in collaboration with the VT Agency of Natural Resources' (ANR) GIS team. The map-based tool uses the free application *Collector for ArcGIS*,

[1] Virtual Vermont: http://www.virtualvermont.com/towns/stalbans.html
[2] Austin J. Coolidge & John B. Mansfield, *A History and Description of New England;* Boston, Massachusetts 1859
[3] St. Albans Historical Society: http://stamuseum.org
[4] Genealogical lists: http://freepages.genealogy.rootsweb.ancestry.com/~holdenclan/albans.htm

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 St. Albans is available for viewing on ANR Atlas and instructions are included in Appendix D.

Throughout the months of August and September 2015, VT UCF staff and VT FPR State Lands Foresters walked along St. Albans' 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) each 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:

ROW distance from curb = (ROW width - 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 St. Albans included street name, overall condition, species, diameter class (using a measurement for diameter at breast height, or DBH), a recommendation for monitoring (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.

State Lands Forester and VT UCF District Urban Forester Matt Leonard collects data on a public tree in St. Albans.

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 used two applications in the i-Tree suite of tools to further assess St. Albans' urban forest. i-Tree Streets uses sophisticated models to determine the monetary value and ecological benefits of trees. i-Tree Canopy uses aerial imagery and random point locations to produce an estimate of land cover of a defined area - including tree canopy cover - that encompasses both public and private property.

Table 1. Data collection parameters for the St. Albans 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	● *Good:* full canopy (75-100%), no dieback of branches over 2" in diameter, no significant defects, minimal mechanical damage ● *Fair:* thinning canopy (50-75%), medium to low new growth, significant mechanical damage, obvious defects/insects/disease, foliage off-color and/or sparse ● *Poor:* declining (25-50%), visible dead branches over 2" in diameter, significant dieback, severe mechanical damage or decay (over 40% of stem affected) ● *Dead:* no signs of life, bark peeling; scratch test on twigs for signs of life (green) ● *Vacant:* potential spot for a tree within the public ROW. Add "small", "medium", or "large" in the comments box - 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	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, blonding, epicormic branching/water sprouts, and/or suspicious exit holes No: no major defects, tree in good or fair condition
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

Urban Forest Diversity

Of the 1,715 trees inventoried within the public ROW or on City-owned land, there are a total of 80 different species in 46 different genera. The five most common tree genera, *Acer* (maple), *Malus* (apple), *Fraxinus* (ash), *Quercus* (oak), and *Gleditsia* (honeylocust), comprise 75% of St. Albans' urban forest (Figure 1). The five most common species are *Acer saccharum* (sugar maple) at 18%, *Acer rubrum* (red maple) at 14%, *Malus* species (crabapple) at 9%, *Acer platanoides* (Norway maple) at 9%, and *Fraxinus pennsylvanica* (green ash) at 7% (Figure 2). Complete species and genera lists can be found in Appendix B.

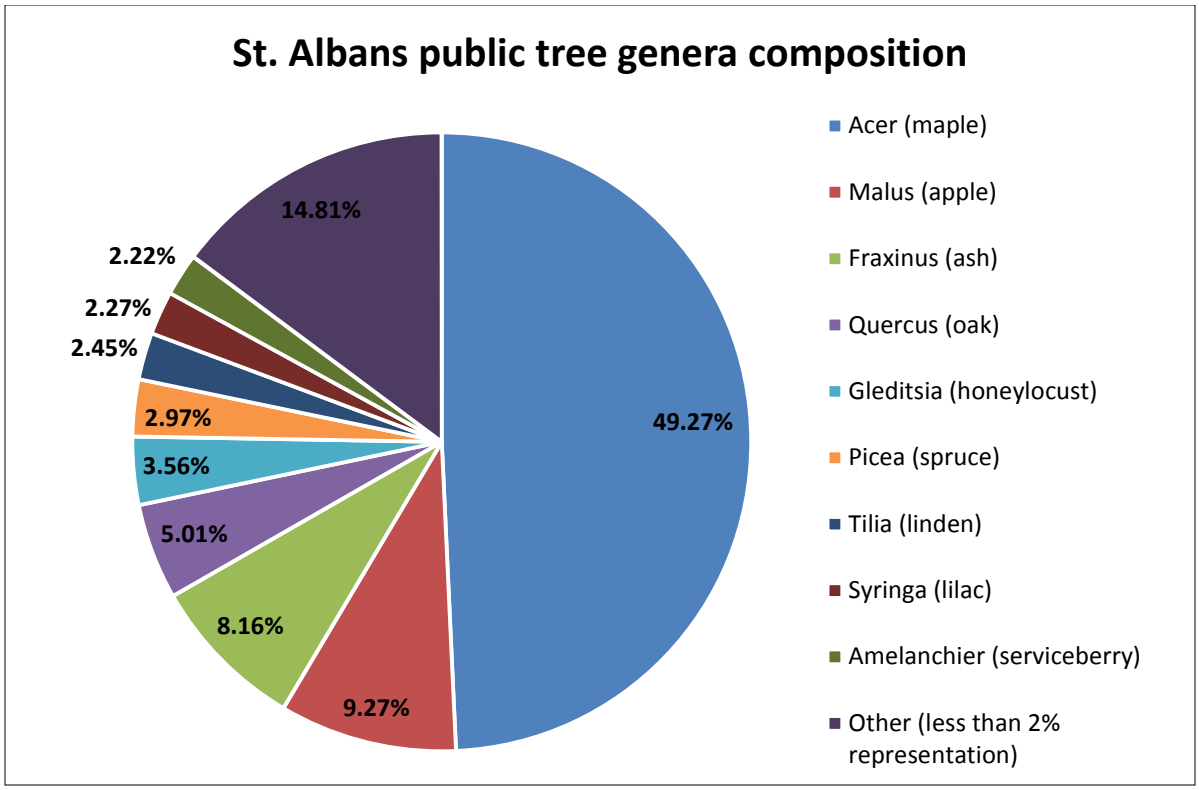


Figure 1. Tree genera by percent within the public ROW in St. Albans.

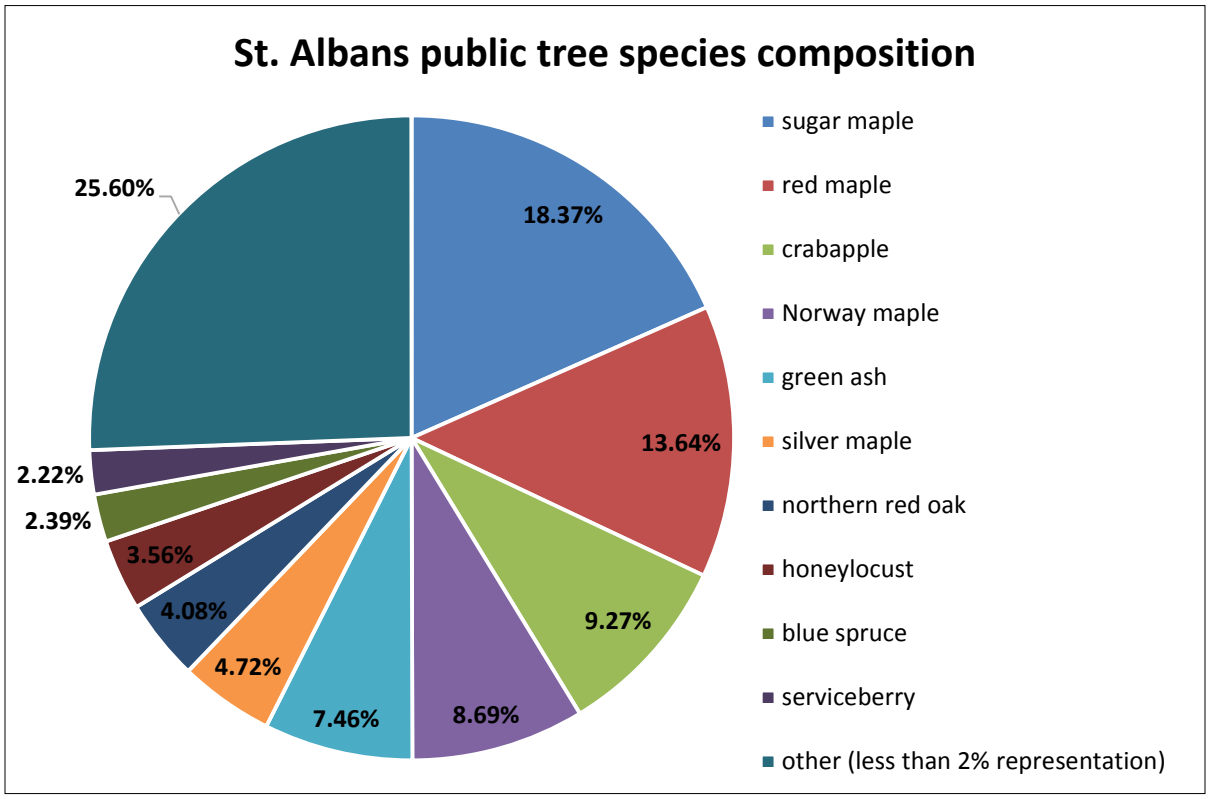


Figure 2. Species by percent within the public ROW in St. Albans.

Urban Forest Structure

In descending order by percent size class, the diameter distribution represented by St. Albans' public trees is: 24% (420) at 12-18", 23% (389) at 6-12", 14% (241) at 18-24", 12% (210) at 3-6", 9% (156) at 0-3", 7% (121) at 24-30", 5% (82) at 36-42", 4% (72) at 30-36", and 1% (24) at 42+" (Figure 3). Thus, approximately 83% of inventoried public trees are between 0 and 24 inches, with over half that (47%) represented between 6 and 18 inches. Size class distribution of the can somewhat be correlated to age structure of the urban forest.

The composition of genera and species within each of these size classes (Figures 4 and 5) indicates that *Acer* (maple) is most commonly represented in all size classes, which is likely because the genus comprises nearly a half of all St. Albans' inventoried public trees. The three largest size classes represented, 30-36", 36-42", and 42+" contain a total of 165 trees (approximately 10% of the urban forest) (Figure 4). The majority of inventoried trees within these large size classes are sugar and silver maples (Figure 5). These trees are growing within the public ROW or on public land and were likely not planted as street trees but left as remnants as the city has grown.

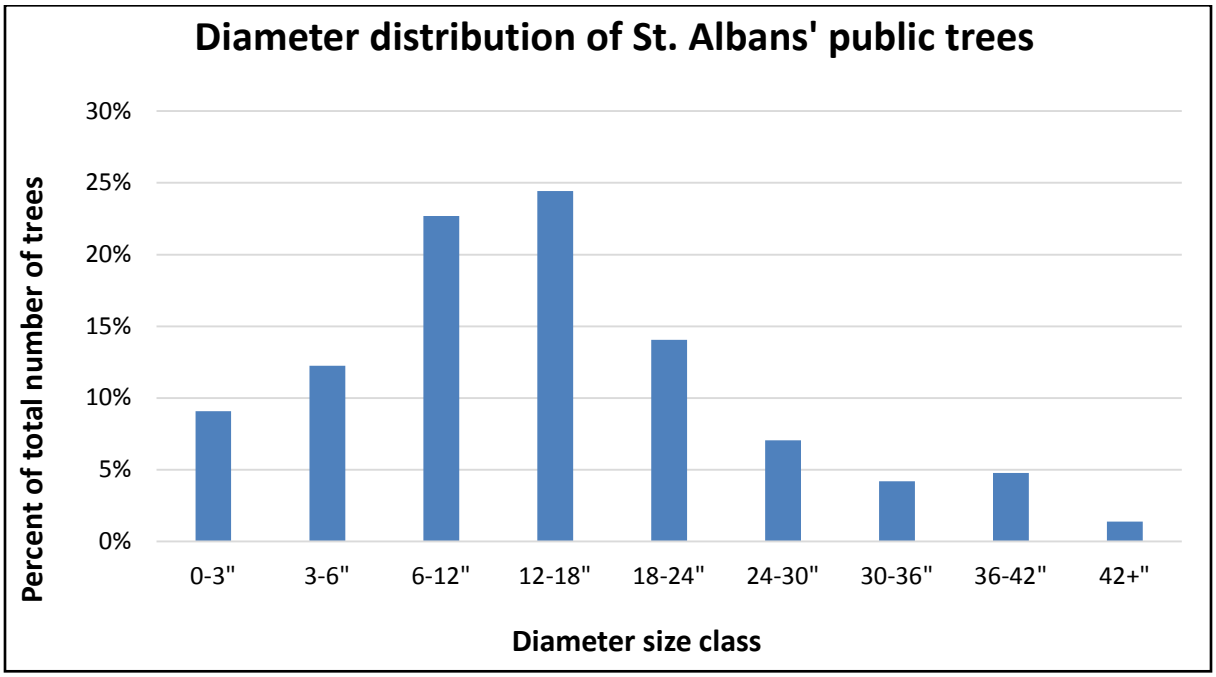


Figure 3. Percent of trees represented in each diameter class (inches).

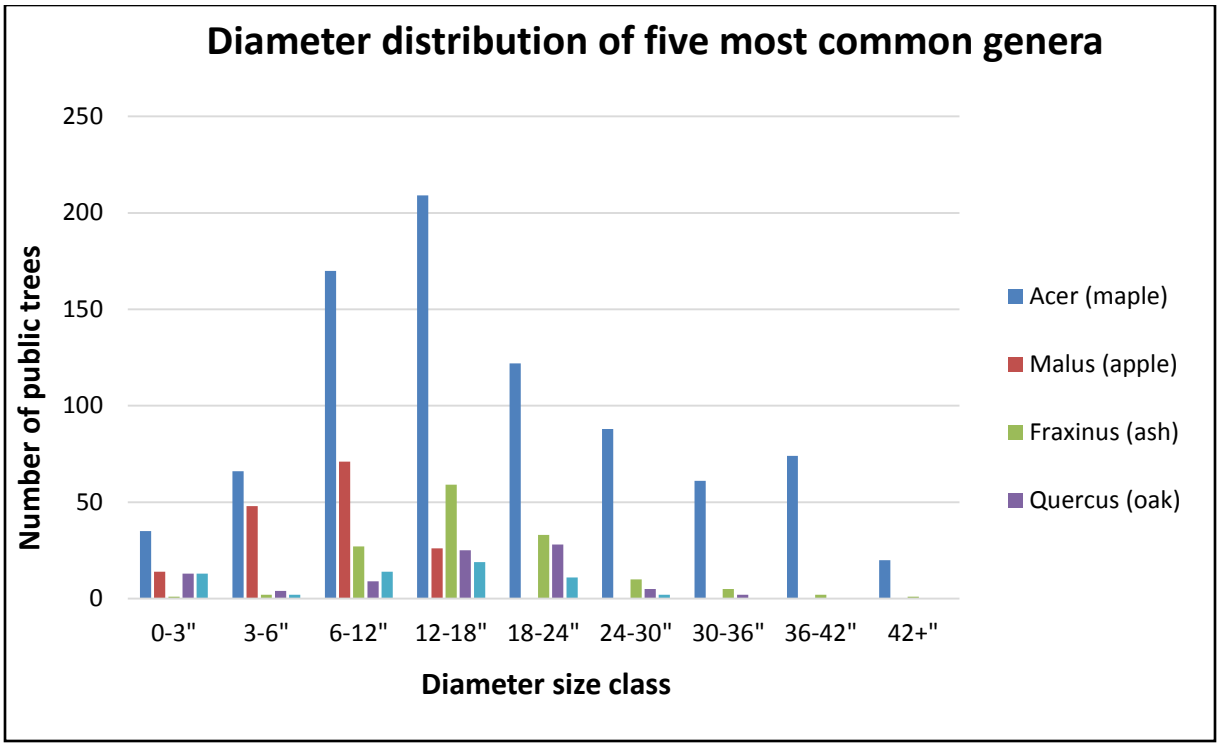


Figure 4. Diameter distribution for the five most common genera of St. Albans' public trees.

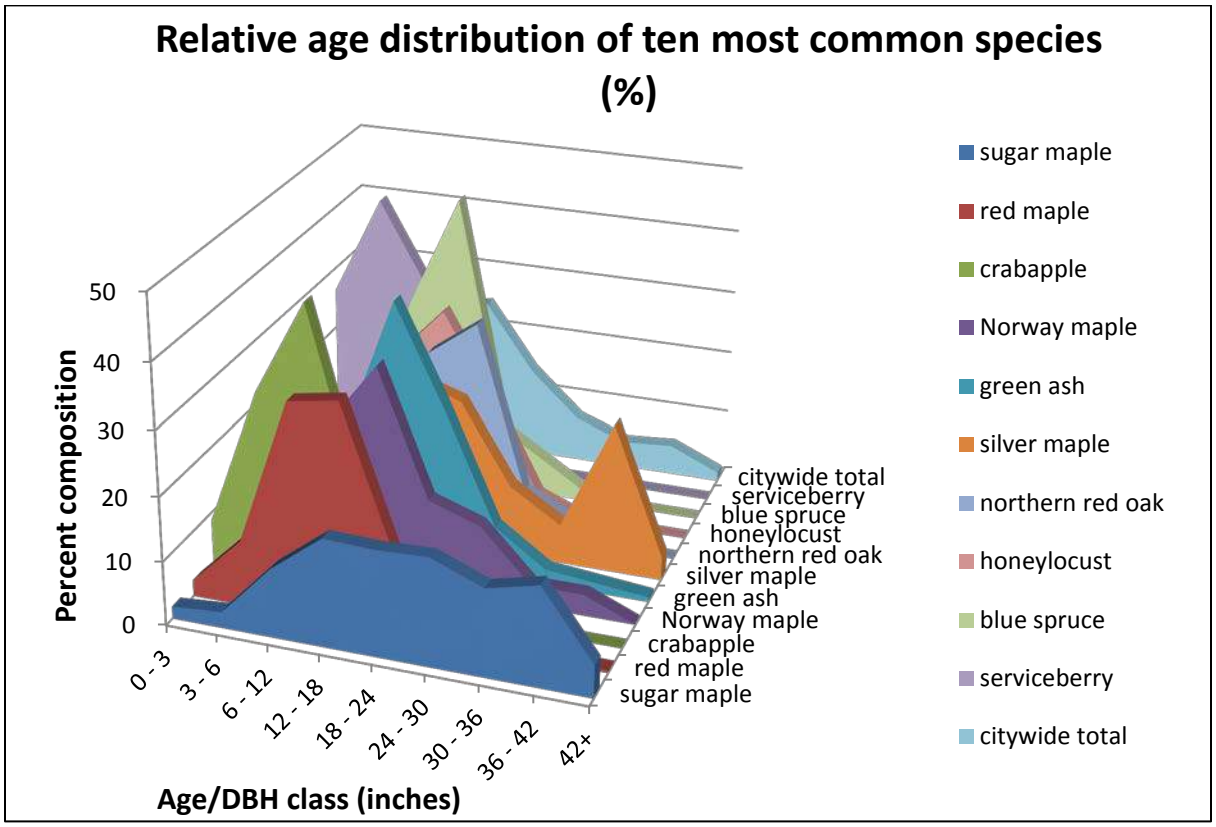


Figure 5. Diameter (and age) distribution of the ten most common species in St. Albans' urban forest. Data from this figure were derived from i-Tree Streets urban canopy structure output.

1,205 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, Aldis Street, Walnut Street, Cedar Street, and Pearl 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.

Urban Forest Health

80% (1,382) of St. Albans' inventoried public trees are assessed as being in "Good" condition. Of the remaining trees, 239 (14%) are considered to be in "Fair" condition, 78 (5%) are in "Poor" condition, and 16 (1%) are "Dead" (Figure 6). *Acer* (maple) and *Fraxinus* (ash) had the most trees in fair or poor conditions; however, *Acer* also comprises the highest percentage of inventoried trees. Identifiable dead trees were primarily *Acer* (maple) but also included three *Prunus* (ornamental cherry), two *Malus* (crabapple), and a *Quercus rubra* (northern red oak) (Figure 7). Appendix E includes maps detailing the location of inventoried trees by condition.

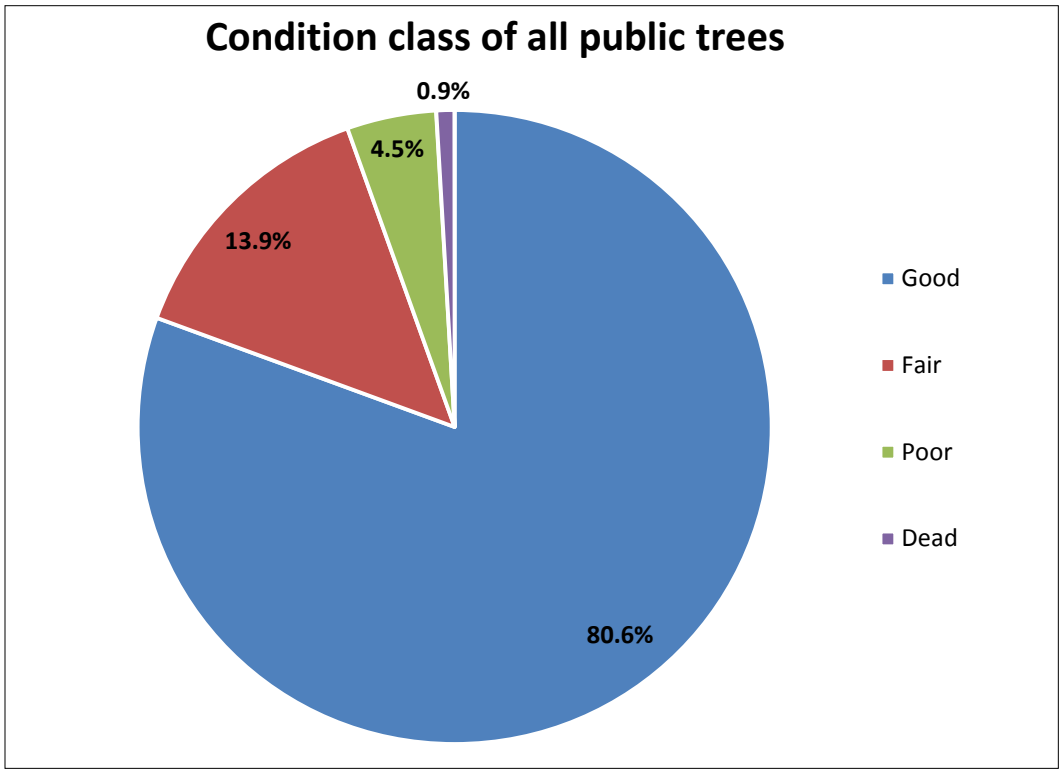


Figure 6. Percentage of St. Albans public trees in each condition class.

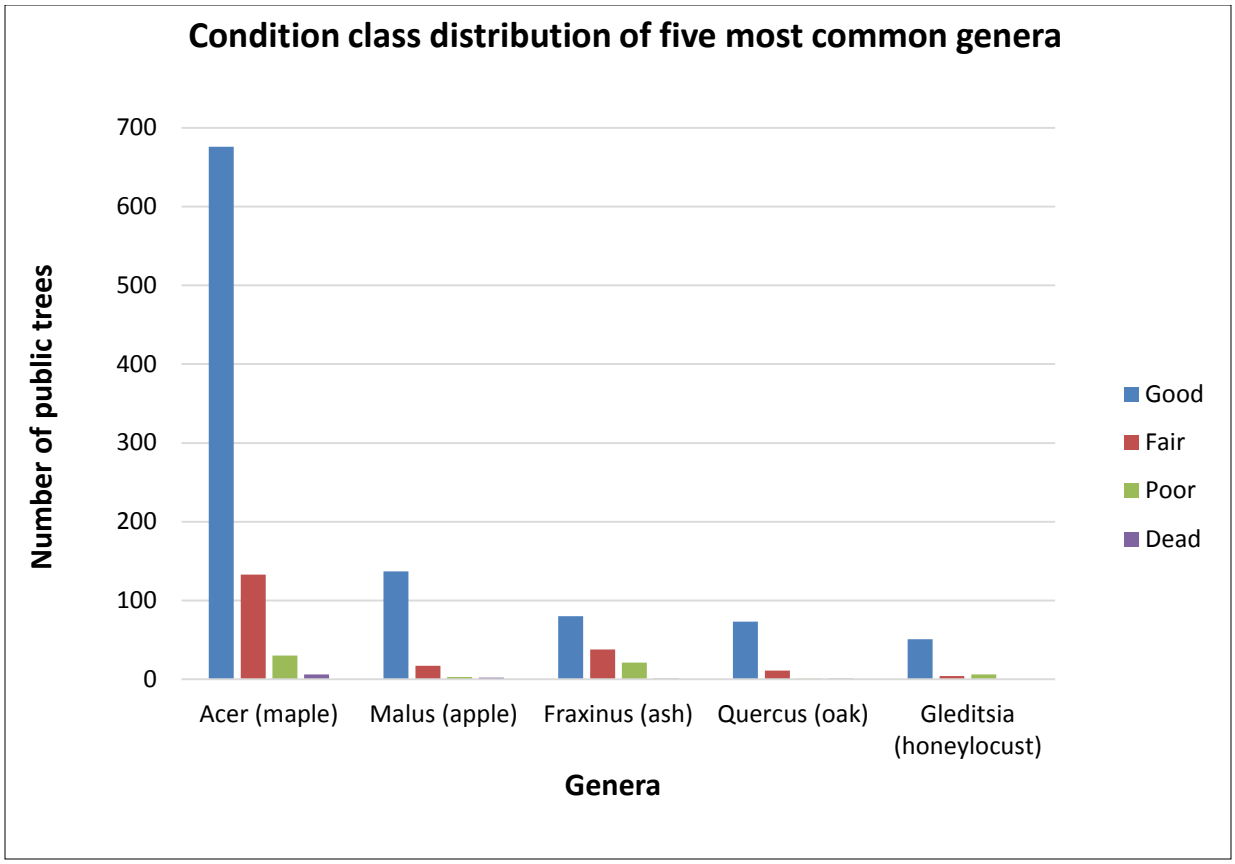


Figure 7. Number of St. Albans' public trees within the five most common genera displayed according to condition.

In conducting the inventory, VT UCF and VT FPR staff assessed 426 trees (25%) as in need of monitoring. These trees should be reassessed by a Certified Arborist, the St. Albans 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 blonding, epicormic branching/water sprouts, and/or suspicious exit holes).

Although St. Albans' public trees are generally healthy (81% assessed as in "good' condition), proper maintenance and monitoring is required to promote the health, longevity, and benefits of St. Albans urban forest. Over half of the 426 public trees assessed to be in need of monitoring are maple species (Figure 8). Ash species comprise the second greatest monitoring needs in St. Albans' urban forest. Although no signs of EAB were noted as apparent on these inventoried public ash trees, they require monitoring in light of the current threat of EAB's arrival in Vermont. A map indicating the location of the 426 trees in need of monitoring can be found in Appendix E of this report.

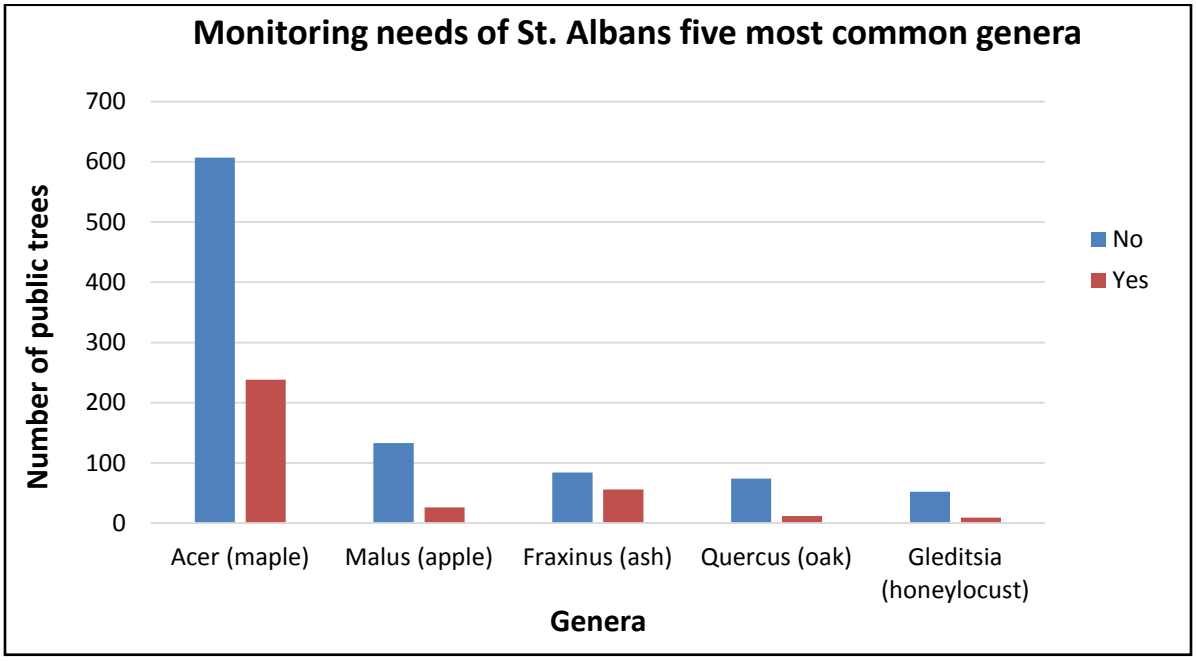


Figure 8. The number of St. Albans' inventoried public trees assessed to require monitoring (yes) within the City's five most common genera.

Economic Benefit and Ecosystem Services

The St. Albans public tree inventory data were analyzed using i-Tree Streets software to determine the monetary value of the ecosystem services provided by St. Albans' public trees. The 1,715 trees provide a total of $193,271 in annual benefits by filtering air pollutants, mitigating stormwater runoff, sequestering carbon dioxide (CO_2), conserving energy, and

increasing property values. On average, each public tree offers $113 annually in savings or services.

Figure 9 and Table 2 provide an overview of each ecosystem service provided by St. Albans' 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 program for the City of St. Albans will be provided to staff in the Department of Planning & Development.

It is important to recognize that the trees inventoried through this project are located on the approximately 2 square miles of land that makes up the City of St. Albans; expanding the inventory into St. Albans Town's 16 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 urban forest benefits.

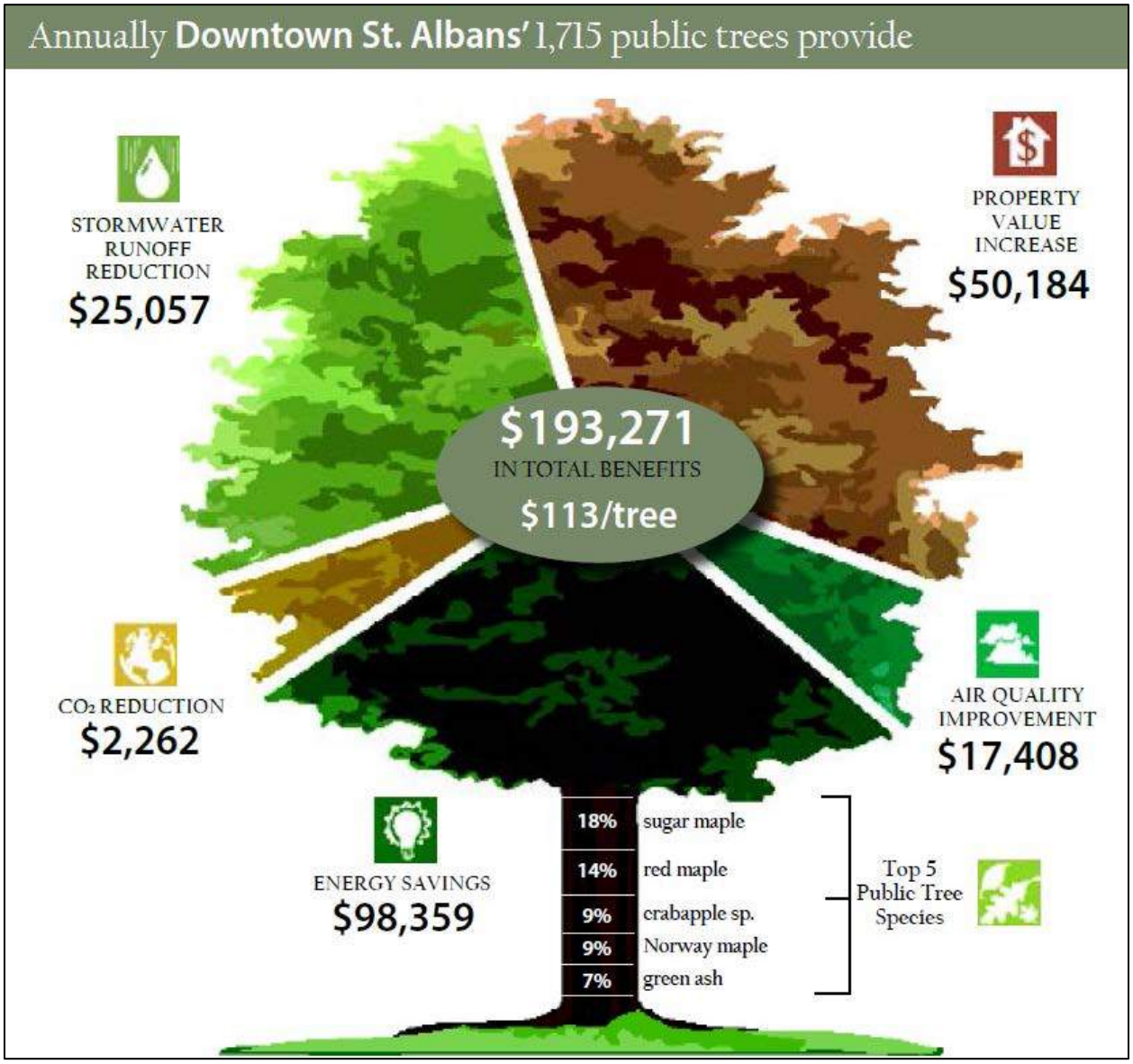


Figure 9. Summary of the benefits provided by St. Albans' public trees inventoried through this project, according to the i-Tree Streets assessment. Tree graphic concept courtesy of City of New York Department of Parks & Recreation.

Table 2. Annual environmental and monetary benefits provided by St. Albans' 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	$98,358.88	$ 57.35
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.	$2,262.49	$ 1.32
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.	$ 17,407.79	$ 10.15
Stormwater	Reductions in annual stormwater run-off due to rainfall interception by trees.	$25,057.42	$ 14.61
Aesthetic/other	Tangible and intangible benefits of trees reflected in increases in property values.	$ 50,184.38	$ 29.26
Stored carbon dioxide	Tallies all of the carbon dioxide stored in the urban forest over the life of the trees as a result of sequestration; *not an annual benefit but a cumulative benefit.	$ 32,204.41*	$ 18.87*

Saving the City an average of $98,359 annually in heating and cooling costs, St. Albans' urban forest's most significant analyzed economic benefit is energy conservation (Figure 9). The greatest energy cost savings from the City's public trees is in the form of natural gas (versus electricity). Of all St. Albans inventoried species, sugar maple and red maple provide the greatest net annual reduction in energy costs (Figure 10). This is likely because these species, the two most prevalent in St. Albans' urban forest (Figure 2), also have the greatest net leaf area (ft^2, Appendix C), and thus provide the most shade and temperature regulation. Per tree, silver maple and black locust are the most beneficial at $100 each. Furthermore, nine of the ten most beneficial energy conservation species are broadleaved (Figure 10), as their leaf area likely maximizes shade and energy regulation compared to needle-leaved species. It is important to note that these values are derived from species, diameter class (inches), and condition class inventory data.

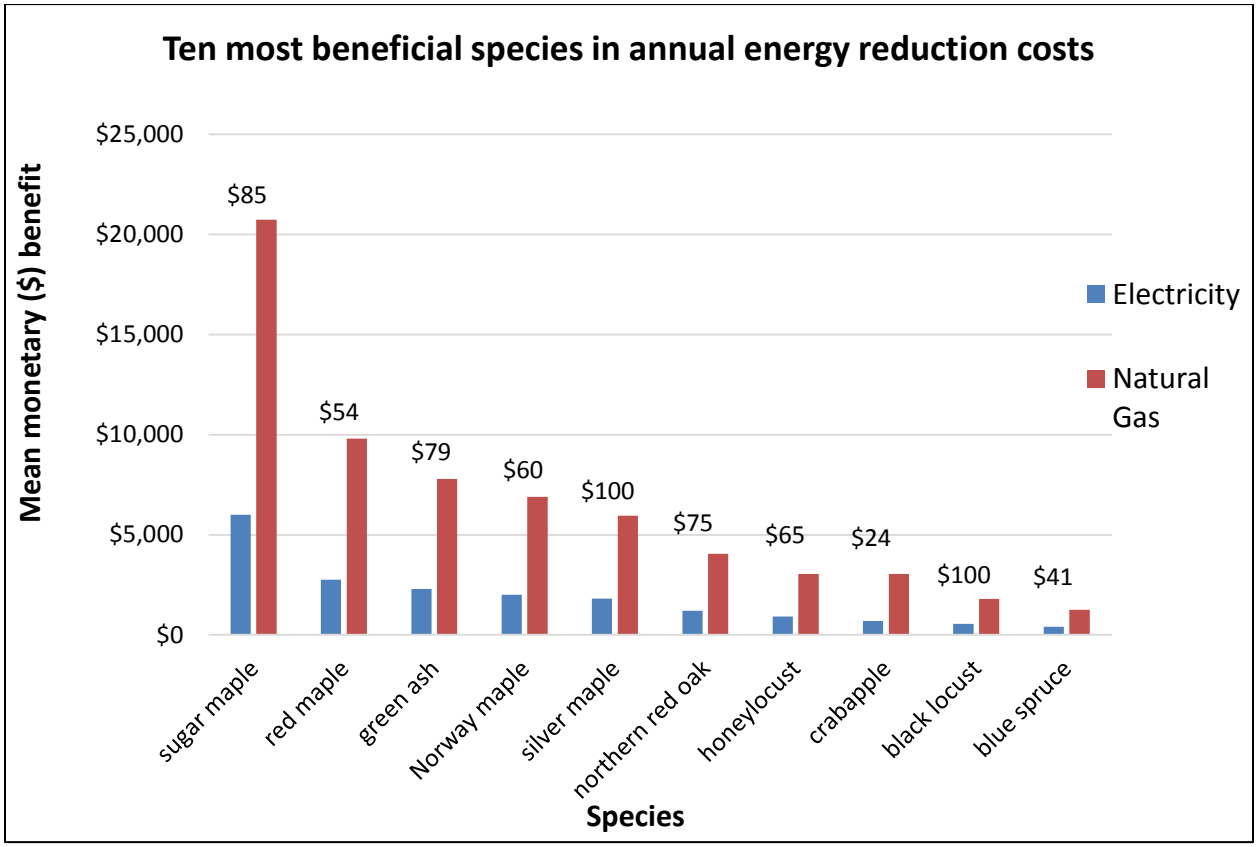


Figure 10. The average monetary value of the ten most beneficial species in annual energy reduction costs in St. Albans' urban forest. The monetary values located above each species' bar represent the average annual energy reduction benefit ($) per tree. Monetary values were derived from tree species, diameter (inches), and condition inventory data through i-Tree Streets' urban canopy benefits output.

Of all the trees inventoried in St. Albans' urban forest, cottonwoods (*Populus deltoides*) and gingkos (*Gingko biloba*) provide the greatest annual reduction in stormwater at about $46 and $41 per tree, respectively (Figure 11). Stormwater reduction value is determined in consideration of the estimated gallons of rain water intercepted by the canopy, based on size, condition, and species character. Of the ten most beneficial species in reducing St. Albans' annual stormwater runoff, nine are deciduous trees and only one is coniferous (Figure 11).

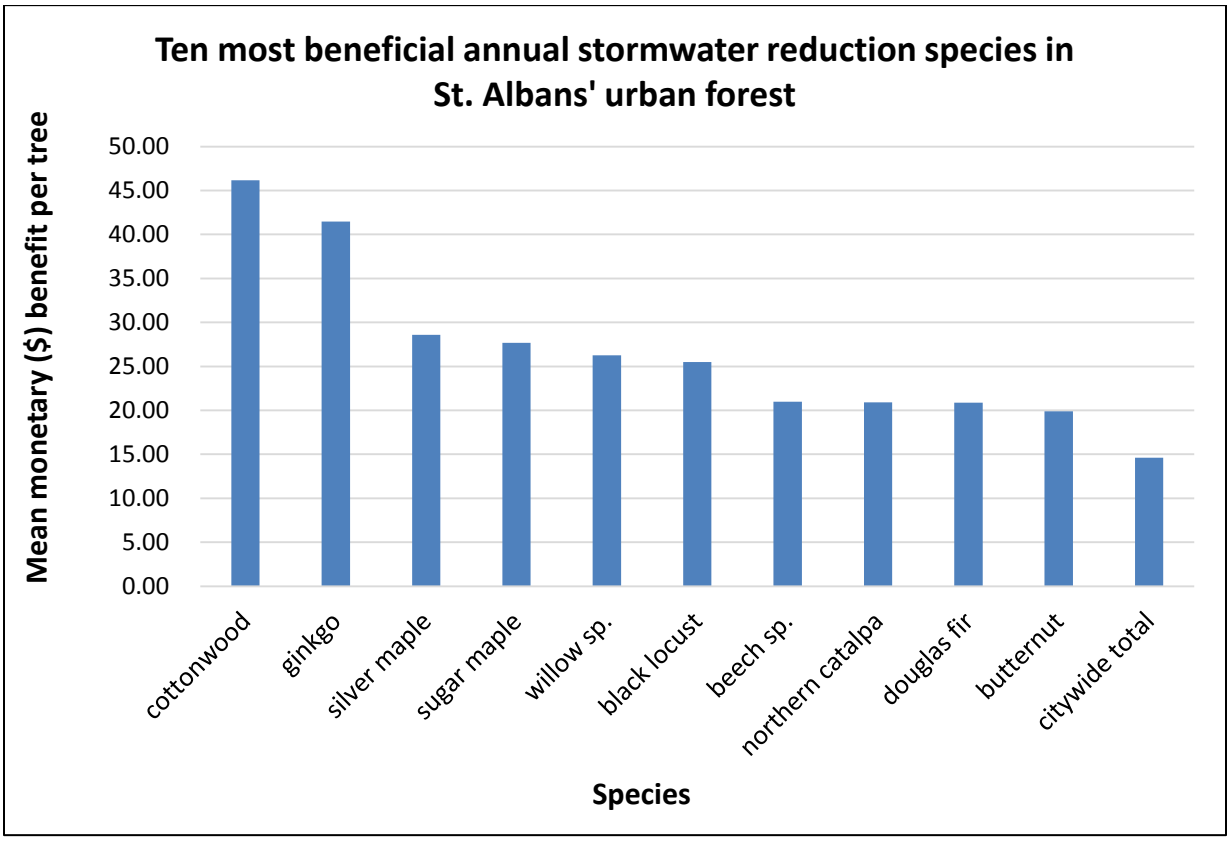


Figure 11. The average annual monetary value of the ten most beneficial stormwater reduction tree species in St. Albans' urban forest. Monetary values were derived from tree species, diameter (inches), and condition inventory data through i-Tree Streets' urban canopy benefits output.

St. Albans' Full Canopy Assessment

As a complement to the public tree inventory, VT UCF staff completed an i-Tree Canopy assessment for St. Albans City. VT UCF staff recognizes that an Urban Tree Canopy (UTC) assessment was completed a number of years ago by the University of Vermont's Spatial Analysis Lab (SAL) for St. Albans City; this assessment should be considered along with the

results of the SAL UTC assessment. For this report, VT UCF staff used i-Tree Canopy, a free, easy-to-use online application that allows users to assess total tree cover over an area based on randomly generated map points and user-defined land cover types. Like i-Tree Streets, this tool also assigns dollar values to the benefits associated with the overall tree canopy cover. The aim of this type of assessment is to help citizens and decision-makers better understand the existing and potential tree canopy in their community. Based on St. Albans' i-Tree Canopy assessment, approximately 28% of St. Albans' land area is currently occupied by tree canopy (Figures 12 and 13). Currently 13% of the total area is occupied by buildings, and is not suitable for tree canopy enhancement. In consideration of the other land cover types present, St. Albans could potentially increase its total tree canopy cover by an additional 33% on open lands of low-lying vegetation, and 4% on agricultural lands. Less than 1% of the land is water or wetlands, which while not suitable for tree planting provides many other benefits. The remaining 21% is impervious surface (parking lots, playgrounds, roads and the ROW), but with strategic planning initiative, some of this could be converted to canopy. In total, there is currently potential to increase St. Albans' overall tree canopy cover by 55%, though much of this land is privately-owned and/or used for other purposes such as agriculture (Figure 12).

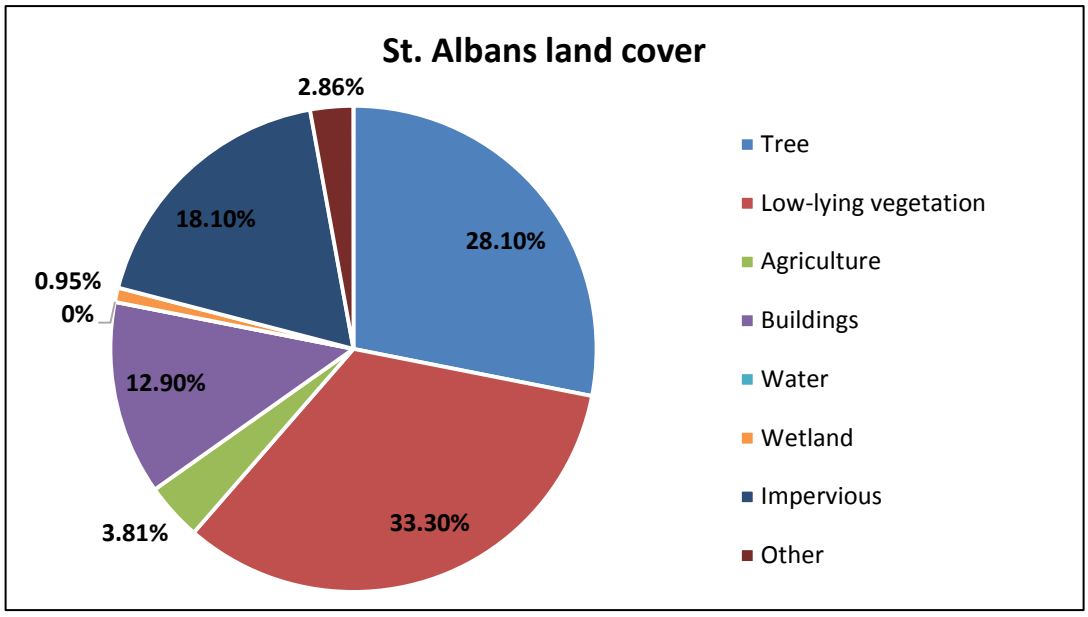
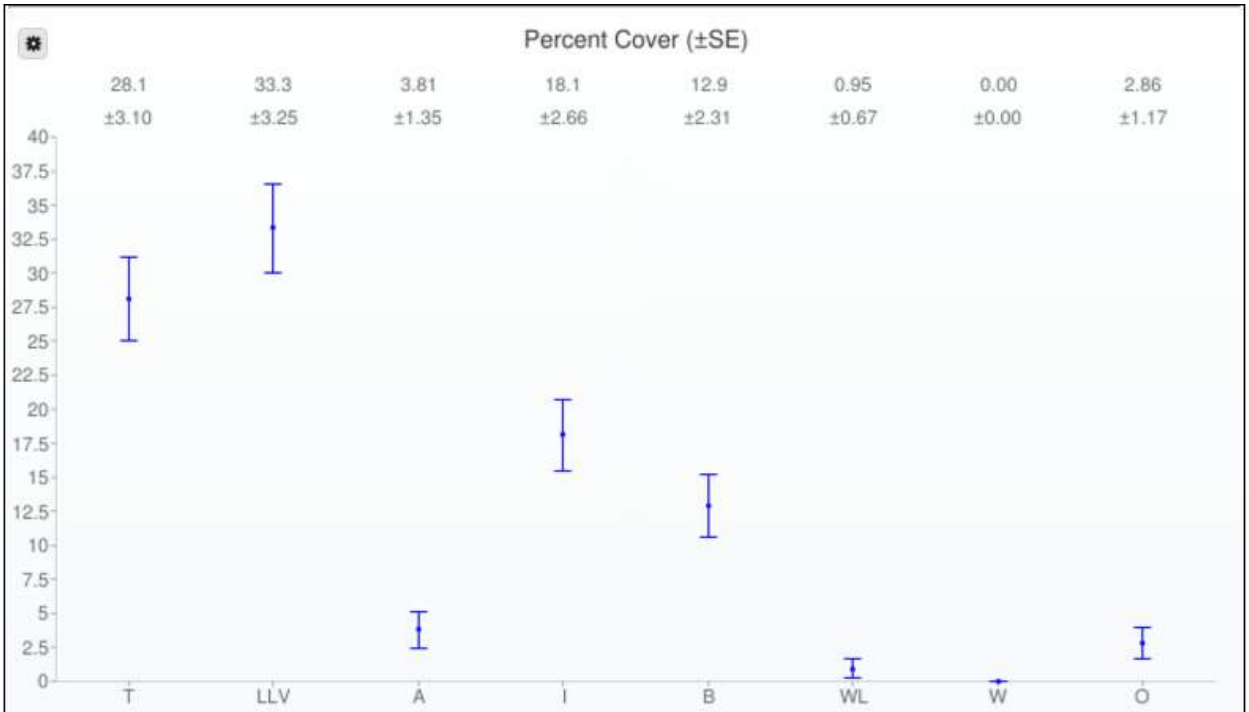


Figure 12. Land cover of St. Albans (includes public and private land).



Cover Class	Description	Abbr.	Points	% Cover
Tree	Tree, non-shrub	T	59	28.1 ±3.10
Low Lying Vegetation		LLV	70	33.3 ±3.25
Agriculture		A	8	3.81 ±1.35
Impervious		I	38	18.1 ±2.66
Building		B	27	12.9 ±2.31
Wetland		WL	2	0.95 ±0.67
Water		W	0	0.00 ±0.00
Other		O	6	2.86 ±1.17

Figure 13. i-Tree Canopy assessment for the inventory area of St. Albans, Vermont, including both public and private land. The above image shows the ground cover composition distribution.

Figure 14 (below) compliments the i-Tree Streets analysis of the monetary value of benefits provided by St. Albans' public trees by estimating the air quality benefits and corresponding monetary value of the full urban forest canopy. Of note is an estimated $2,042,958 in CO_2 storage and $81,018 in annual CO_2 sequestration value.

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	$17.17	±1.90	404.99 lb	±44.71
NO2	Nitrogen Dioxide removed annually	$29.56	±3.26	1.10 T	±0.12
O3	Ozone removed annually	$1,539.24	±169.93	11.00 T	±1.21
PM2.5	Particulate Matter less than 2.5 microns removed annually	$3,181.89	±351.27	1,068.72 lb	±117.98
SO2	Sulfur Dioxide removed annually	$5.17	±0.57	1,391.63 lb	±153.63
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	$1,117.45	±123.36	3.68 T	±0.41
CO2seq	Carbon Dioxide sequestered annually in trees	$81,017.89	±8,944.04	2,239.17 T	±247.19
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	$2,042,958.19	±225,534.14	56,456.40 T	±6,232.55

Figure 14. i-Tree Canopy assessment estimates of air quality benefits provided by public and private trees in the area of the St. Albans public tree inventory.

Discussion and Recommendations

St. Albans' Public Tree Program

City of St. Albans staff participation in the *Care of the Urban Forest* demonstrates that there is local capacity and desire to enhance the community's public tree program. St. Albans 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 St. Albans' public trees, as well as the ways in which residents and City leadership can be engaged for tree stewardship.

Recommendations

We recommend that City of St. Albans staff 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 St. Albans' public tree program.
- Encourage the formation of a citizen St. Albans Tree Committee or Advisory Board to help coordinate and implement the City's tree program
- Advocate for an explicit annual budget for St. Albans' 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 urban forest.
- Plan for the arrival of EAB by developing a community invasive forest pest preparedness plan, perhaps as a component of the overall plan for St. Albans' public trees; this process will inform future planning efforts for other threats to the urban forest.
- Ensure that those who are caring for St. Albans' 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 St. Albans' 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.
- Encourage residents to plant trees on their private property to increase diversity, overall canopy cover, and the benefits provided by trees in St. Albans.
- Consider combining the current inventory of Taylor Park's trees with this inventory to have one comprehensive St. Albans City public tree inventory.

Urban Forest Diversity and Structure

An important best management practice in urban 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 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 St. Albans, 80 species and 46 genera are represented as public trees. Approximately a quarter (26%) of the public trees is of species that represent less than 3% of the total tree population, indicating diversity in the urban forest. However, one half (49%) of public trees inventoried is in the maple (*Acer*) genus, which is more than double the recommended representation within the public tree population. Sugar, red, and Norway maple comprise 18%, 14%, and 9% of *Acer* species diversity, respectively. Sugar maple is the most prevalent species in St. Albans . Norway maple is one of the most prevalent species in St. Albans, and is considered to be a non-native invasive species. Although an aesthetically pleasing and hearty tree, Norway maple can spread into nearby forests and out-compete native species such as sugar maple. In fact, Vermont's Plant Quarantine Rule prohibits the movement, distribution, and sale of Norway maple, as well as other invasive plant species. Ash trees

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

A successful urban 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 urban 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 urban forestry management.

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

Partnerships: A well-managed urban 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 urban forest. It should include strategies, budgets, and responsibilities for meeting that vision.

Staffing: The care of urban 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.

(*Fraxinus*) comprise 8% of St. Albans' public tree canopy. Both ash and maple trees are currently threatened by invasive tree pests; EAB and ALB, respectively. While neither of these pests have 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. In St. Albans high-density stands of ash were observed on Lake Street and South Main Street (see Appendix F for a map detailing the location of all public ash trees). Large densities of maple were observed within the public ROW of High Street, South and North Main Streets, and Messenger Street. The high densities of ash and maple species on South Main Street make it particularly important for future maintenance and monitoring efforts.

Nearly 70% of the inventoried public trees are 0-18" in diameter, indicating a generally young public tree population that has not yet reached maturity. The distribution of size classes within that 70% tell a story of continued engagement in tree planting in the ROW and in public spaces in the City, perhaps peaking within the past few decades, as nearly 50% of the public trees are 6-18" in diameter. 17% of St. Albans' public trees are over 24' in diameter; these large, mature shade trees are distributed across the city, often thriving in the wide grass strips between street and sidewalk, a remnant of thoughtful urban planning.

Recommendations:

We recommend that St. Albans 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 St. Albans' 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 maple (*Acer*) trees in St. Albans, we suggest selecting non-maple trees for future plantings.
- 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 1,205 identified potential tree planting locations ("vacant" spots) within the public ROW in Appendix A to strategically increase tree species and structural diversity in St. Albans.
- As St. Alban's relatively young public trees mature, promote their health and integrity with a systematic structural pruning and maintenance cycle.

Urban Forest Health

Overall, St. Albans City appears to have a healthy population of public trees. A dedicated tree care budget and established maintenance program (opposed to explicit line items for just planting and removal of trees) would further support the health of the urban forest. Approximately 19% (317) of St. Albans' public trees were either considered to be in "Fair" or "Poor" condition and 16 trees were designated as "Dead". There are high concentrations of "Fair", "Poor", and "Dead" trees were within the public ROW of North Main Street and Fairfield Street**.** 426 trees were assessed to be in need of monitoring by a Certified Arborist, the Tree Warden, or another qualified individual. Many of these trees overlap with those designated as in "Poor" condition or "Dead", and others were likely noted because of conflict with utility wires and/or other City infrastructure. See Appendix E for a map detailing the locations of trees in St. Albans by condition and a separate map indicating the location of the 426 trees that monitoring. 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 an urban setting. The full inventory data spreadsheet, with specific comments associated with the 426 trees requiring monitoring will be given to the St. Albans Tree Warden and staff in the Department of Planning & Development; some recurring themes from these comments are presented in the recommendations below.

Recommendations:

In order to ensure the long-term health and vibrancy of St. Albans' public trees, we recommend the following activities:

- Prioritize the monitoring of the 426 trees (which include the 16 dead trees) that have been flagged for monitoring by a Certified Arborist or the St. Albans Tree Warden.
- Develop a plan to remove – and replace, if appropriate – the 16 dead public trees in a timely fashion.
- There are pruning needs noted in the Comments field for many of the 426 public trees that should be monitored; examples include presence of deadwood in the crown and hazard limbs, need for structural and utility pruning, and need for raising the crown for pedestrian or vehicular clearance. Consider establishing a multi-year routine pruning regime in St. Albans to address pruning needs.
- Over 100 public trees were explicitly noted to be near or already in conflict with powerlines; develop a relationship with the St. Albans utility company arborists to ensure that all utility pruning is done properly and safely.
- Encourage a culture of continual monitoring and updating the tree inventory spreadsheet as necessary as regular tree management occurs in St. Albans; consider assigning the responsibility of inventory database maintenance to one individual, or investing in a commercial inventory and management system.

Assessment Tools

Using free and accessible i-Tree software developed by the USDA Forest Service, VT UCF staff was able to assess the benefits, value, and extent of St. Albans' urban tree canopy. i-Tree Streets allowed us to determine the economic value of the ecosystem services provided by the 1,715 inventoried trees in St. Albans. The City's forest generates about $193,271 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 $113 in service or savings every year. The trees of St. Albans 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. 1991[5]). 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 1984[6]).
- **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 million tons of carbon, (Nowak and Crane 2002[7]). 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.

Using a random sample method and based on assessing land cover types, i-Tree Canopy allowed us to measure the overall tree canopy cover within the boundaries of the inventory area, capturing both private and public tree canopy.

[5] 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.

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

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

Recommendations

We recommend that St. Albans explore the results of the two i-Tree assessments detailed in this report and:

- Use the information generated through i-Tree Streets and i-Tree Canopy to promote the understanding of tree benefits and the investment in urban forest management and local stewardship.
- Use the i-Tree Canopy UTC and land cover assessment, combined with the previous SAL UTC assessment, to inform and promote efforts towards an overall urban canopy cover of 35-40%.
- 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 is one component of a long-term effort by City of St. Albans staff to understand, manage, and steward the city'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 St. Albans' leadership and the staff in the Department of Planning & Development, including the St. Albans Tree Warden, based on long-term vision and capacity. Looking ahead, the City of St. Albans should focus efforts on maintaining the quality of the urban trees, increasing its genera diversity, and increasing urban canopy cover. With improved monitoring, regular maintenance, and an engaged and informed citizenry, the potential for a healthy, sustainable urban forest is attainable.

Appendices

Appendix A: Full Street and Site List of St. Albans' Public Tree Inventory

Street/Site name	ROW Extent (feet)	Number of Trees	Number of Vacant Spots or Strips
ALDIS ST	25	19	68
BANK ST	30	74	1
BARLOW ST	25	18	34
BELLOWS ST	17	3	23
BEVERLY CT	20	24	54
BISHOP ST	25	38	38
BORLEY ST	25	5	13
BOWLES LN	20	1	12
BRAINERD ST	25	40	33
BROWN AV	28	18	10
BURNELL TERR	25	4	23
CALO CT	25	5	8
CALVARY ST	33	7	14
CEDAR ST	25	3	61
CONGRESS ST	33	99	17
CREST RD	25	2	0
DIAMOND ST	25	60	39
DONNELLY CT	16	3	11
DRISCOLL DR	40	11	0
EDWARD ST	30	44	39
EWELL CT	25	12	14
FAIRFIELD ST	33	90	0
FARRAR ST	25	32	9
FERRIS ST	16	6	8
FINN AV	25	0	27
FOREST HILL DR	15	1	6
GOVERNOR SMITH DR	30	0	17
GREENSPACE-BARLOW PARK	N/A	7	4
GUYETTE CIR	20	3	33
HIGH ST	33	142	8
HODGES CT	20	0	13
HUNTINGTON ST	25	26	37
ISHAM AV	25	0	5
LAKE ST	33	45	3

LAKEVIEW TERR	50	28	17
LASALLE ST	21	4	3
LINCOLN AV	25	75	10
LOCKE TERR	25	5	16
LOWER GILMAN ST	25	9	21
LOWER NEWTON ST	25	5	0
MAIDEN LN	21	3	8
MAPLE ST	21	4	2
MESSENGER ST	25	94	19
MURRAY DR	25	1	16
N ELM ST	33	82	35
N MAIN ST	50	163	7
NEW ST	10	3	4
OAK ST	21	27	3
PEARL ST	25	25	61
PROSPECT ST	33	11	27
QUARRY CT	15	1	9
QUINTIN CT	20	0	6
RUBLEE ST	20	11	14
RUGG ST	25	11	17
RUSSELL ST	20	21	32
S ELM ST	25	18	11
S MAIN ST	50	102	11
SAVAGE ST	15	0	4
SMITH ST	33	26	2
SPRUCE ST	21	13	1
STANLEY CT	25	10	14
STEVENS AV	23	1	8
THORPE AV	41	22	17
UPPER GILMAN ST	25	6	20
UPPER NEWTON ST	25	22	3
UPPER WELDEN ST	30	53	21
WALNUT ST	25	14	66
WARD TERR	16	3	12
WARNER DR	25	0	6

Appendix B: Full Species and Genera List for St. Albans' Public Trees

Common Name	Scientific Name	Number of Trees	Percent of Total Population
sugar maple	*Acer saccharum*	315	18.4%
red maple	*Acer rubrum*	234	13.6%
crabapple	*Acer sp.*	159	9.3%
Norway maple	*Acer platanoides*	149	8.7%
green ash	*Fraxinus pennsylvanica*	128	7.5%
silver maple	*Acer saccharinum*	81	4.7%
northern red oak	*Quercus rubra*	70	4.1%
honeylocust	*Gleditsia triacanthos*	61	3.6%
blue spruce	*Picea pungens*	41	2.4%
serviceberry	*Amelanchier canadensis*	38	2.2%
white cedar	*Thuja occidentalis*	32	1.9%
amur maple	*Acer ginnala*	25	1.5%
black locust	*Robinia pseudoacacia*	24	1.4%
cherry plum	*Prunus cerasifera*	23	1.3%
Japanese tree lilac	*Syringa reticulata*	22	1.3%
littleleaf linden	*Tilia cordata*	21	1.2%
mountain ash	*Sorbus aucuparia*	20	1.2%
boxelder	*Acer negundo*	18	1.0%
broadleaf deciduous small	*Broadleaf*	16	0.9%
lilac	*Syringa vulgaris*	15	0.9%
American elm	*Ulmus americana*	14	0.8%
maple	*Acer sp.*	13	0.8%
white ash	*Fraxinus americana*	12	0.7%
black walnut	*Juglans nigra*	10	0.6%
pin oak	*Quercus palustris*	10	0.6%
horsechestnut	*Aesculus hippocastanum*	10	0.6%
American basswood	*Tilia americana*	9	0.5%
silver Linden	*Tilia tomentosa*	9	0.5%
Norway spruce	*Picea abies*	9	0.5%
cottonwood	*Populus deltoides*	7	0.4%
paper birch	*Betula papyrifera*	6	0.3%
tulip tree	*Liriodendron tulipifera*	6	0.3%
amur corktree	*Phellodendron amurense*	5	0.3%
eastern redbud	*Cercis canadensis*	5	0.3%
trident maple	*Acer buergerianum*	5	0.3%

eastern white pine	*Pinus strobus*	5	0.3%
katsura tree	*Cercidiphyllum sp.*	5	0.3%
swamp white oak	*Quercus bicolor*	4	0.2%
hornbeam	*Carpinus*	4	0.2%
dogwood	*Cornaceae*	4	0.2%
hawthorn	*Crataegus sp.*	4	0.2%
elm	*Ulmus sp.*	4	0.2%
northern hackberry	*Celtis occidentalis*	4	0.2%
willow	*Salix sp.*	4	0.2%
birch	*Betula sp.*	3	0.2%
katsura	*Cercidiphyllum sp.*	3	0.2%
butternut	*Juglans cinerea*	3	0.2%
black tupelo	*Nyssa sylvatica*	3	0.2%
tartar maple	*Acer tataricum*	3	0.2%
catalpa	*Catalpa speciosa*	3	0.2%
river birch	*Betula nigra*	3	0.2%
hedge maple	*Acer campestre*	2	0.1%
alder	*Betulaceae sp.*	2	0.1%
red cedar	*Juniperus virginiana*	2	0.1%
basswood	*Tilia americana*	2	0.1%
lilac	*Syringa sp.*	2	0.1%
Russian olive	*Elaeagnus angustifolia*	2	0.1%
eastern hophornbeam	*Carpinus sp.*	2	0.1%
beech	*Fagus sp.*	2	0.1%
oak	*Quercus sp.*	1	0.1%
ginkgo	*Gingko sp.*	1	0.1%
white oak	*Quercus Alba*	1	0.1%
quaking aspen	*Populus tremuloides*	1	0.1%
juniper	*Juniperus sp.*	1	0.1%
grey birch	*Betula populifolia*	1	0.1%
honeysuckle	*Lonicera sp.*	1	0.1%
balsam fir	*Abies balsamea*	1	0.1%
European hornbeam	*Ostrya sp.*	1	0.1%
black spruce	*Carpinus betulus*	1	0.1%
broadleaf deciduous large	*Broadleaf*	1	0.1%
tree of heaven	*Ailanthus altissima*	1	0.1%
Chinese elm	*Ulmus parvifolia*	1	0.1%
Ohio buckeye	*Aesculus glabra*	1	0.1%
broadleaf deciduous medium	*Broadleaf*	1	0.1%

douglas fir	*Pseudotsuga menziesii*	1	0.1%
silver linden	*Tilia tomentosa*	1	0.1%
pear	*Pyrus sp.*	1	0.1%
Japanese larch	*Larix kaempferi*	1	0.1%
striped maple	*Acer pennsylvanicum*	1	0.1%

Appendix C: Leaf Area and Canopy Cover by Species Comprising St. Albans' Urban Forest

Species	Number of Trees	% of Total Trees	Leaf Area (ft2)	% of Total Leaf Area	Canopy Cover (ft2)	% of Total Canopy Cover
sugar maple	314	18.31	2,083,499.83	40.27	427,776.00	28.45
red maple	234	13.64	596,825.72	11.54	176,485.77	11.74
crabapple	159	9.27	93,179.54	1.80	43,579.34	2.90
Norway maple	149	8.69	327,361.90	6.33	134,172.47	8.92
green ash	128	7.46	428,495.54	8.28	155,153.70	10.32
silver maple	81	4.72	480,638.51	9.29	131,859.47	8.77
northern red oak	70	4.08	209,594.11	4.05	83,566.69	5.56
honeylocust	61	3.56	157,665.65	3.05	63,585.58	4.23
blue spruce	41	2.39	60,542.43	1.17	24,698.07	1.64
serviceberry	38	2.22	9,867.30	0.19	6,496.03	0.43
broadleaf deciduous small	35	2.04	9,085.22	0.18	5,634.65	0.37
northern white cedar	32	1.87	17,824.32	0.34	14,163.90	0.94
amur maple	25	1.46	10,758.86	0.21	6,241.75	0.42
Japanese tree lilac	24	1.40	3,637.85	0.07	2,414.26	0.16
black locust	24	1.40	127,727.03	2.47	39,067.56	2.60
cherry plum	23	1.34	5,098.80	0.10	3,483.97	0.23
littleleaf linden	21	1.22	33,668.67	0.65	13,010.28	0.87
American mountain ash	20	1.17	9,012.81	0.17	5,347.39	0.36
boxelder	18	1.05	18,372.08	0.36	8,676.36	0.58
maple sp.	17	0.99	4,789.85	0.09	2,464.96	0.16
American elm	14	0.82	29,973.62	0.58	8,671.67	0.58
white ash	12	0.70	41,822.95	0.81	14,991.39	1.00
pin oak	10	0.58	33,883.50	0.65	11,708.82	0.78
silver linden	10	0.58	3,502.25	0.07	1,040.04	0.07
black walnut	10	0.58	40,637.63	0.79	12,286.09	0.82
horsechestnut	10	0.58	11,478.30	0.22	4,765.30	0.32
Norway spruce	9	0.52	17,001.51	0.33	7,107.11	0.47
American basswood	9	0.52	18,087.87	0.35	5,386.02	0.36
cottonwood	7	0.41	74,283.03	1.44	18,388.13	1.22
katsura tree	6	0.35	12,464.61	0.24	3,522.29	0.23
tulip tree	6	0.35	21,525.58	0.42	7,240.90	0.48
paper birch	6	0.35	18,745.43	0.36	6,122.69	0.41

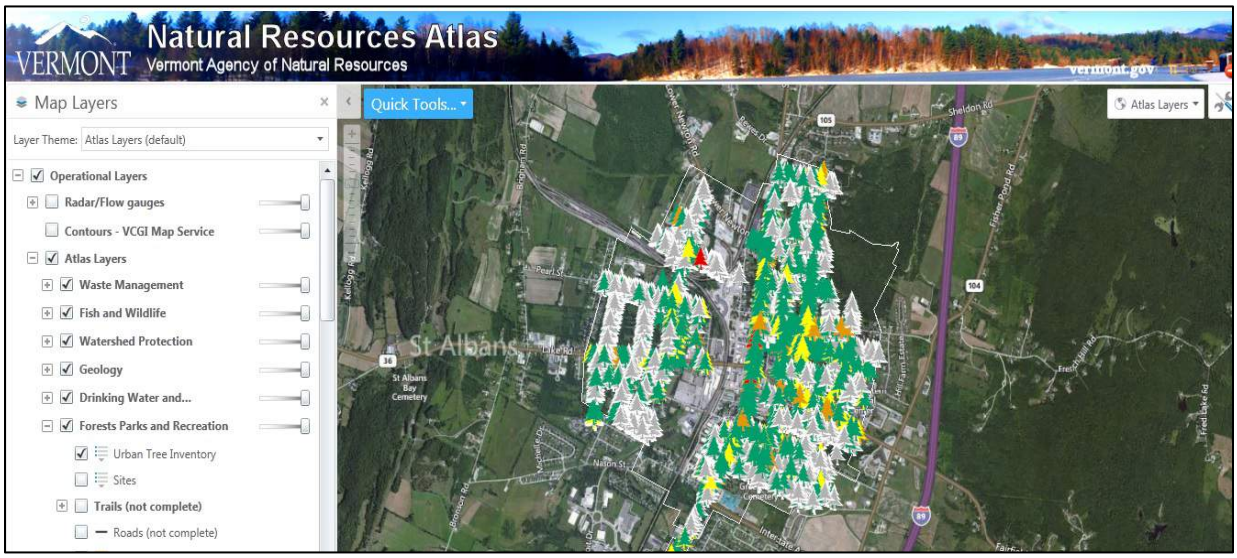
trident maple	5	0.29	2,549.85	0.05	1,491.74	0.10
eastern white pine	5	0.29	11,463.19	0.22	4,858.95	0.32
eastern redbud	5	0.29	579.48	0.01	396.96	0.03
amur corktree	5	0.29	10,495.63	0.20	2,955.89	0.20
elm sp.	4	0.23	8,823.94	0.17	2,712.06	0.18
northern hackberry	4	0.23	11,365.64	0.22	3,897.73	0.26
American hornbeam	4	0.23	1,683.08	0.03	301.03	0.02
willow sp.	4	0.23	20,480.72	0.40	6,474.87	0.43
swamp white oak	4	0.23	1,480.35	0.03	499.44	0.03
hawthorn	4	0.23	1,601.98	0.03	1,053.50	0.07
dogwood sp.	4	0.23	786.64	0.02	517.46	0.03
birch sp.	3	0.17	5,228.13	0.10	1,405.03	0.09
river birch	3	0.17	5,999.41	0.12	2,220.71	0.15
butternut	3	0.17	12,173.49	0.24	3,909.10	0.26
northern catalpa	3	0.17	12,211.91	0.24	3,870.96	0.26
eastern hophornbeam	2	0.12	3,259.16	0.06	838.63	0.06
Russian olive	2	0.12	934.31	0.02	603.99	0.04
basswood	2	0.12	150.44	0.00	17.63	0.00
hedge maple	2	0.12	929.57	0.02	541.86	0.04
eastern red cedar	2	0.12	1,558.22	0.03	1,060.15	0.07
broadleaf deciduous medium	2	0.12	2,424.68	0.05	556.06	0.04
beech sp.	2	0.12	8,483.60	0.16	2,787.62	0.19
black tupelo	2	0.12	841.54	0.02	150.52	0.01
black spruce	1	0.06	419.14	0.01	98.23	0.01
treen of heaven	1	0.06	150.71	0.00	19.14	0.00
coniferous evergreen medium	1	0.06	319.99	0.01	221.67	0.01
broadleaf deciduous large	1	0.06	2,700.19	0.05	1,465.55	0.10
Chinese elm	1	0.06	234.49	0.00	38.38	0.00
striped maple	1	0.06	55.94	0.00	13.64	0.00
balsam fir	1	0.06	917.81	0.02	332.44	0.02
quaking aspen	1	0.06	3,117.36	0.06	1,110.60	0.07
douglas fir	1	0.06	2,636.35	0.05	1,131.63	0.08
white oak	1	0.06	170.20	0.00	71.28	0.00
common pear	1	0.06	333.77	0.01	117.17	0.01
oak sp.	1	0.06	2,592.70	0.05	877.61	0.06
gray birch	1	0.06	1,629.58	0.03	419.32	0.03
ginkgo	1	0.06	9,589.44	0.19	2,370.98	0.16

European hornbeam	1	0.06	795.10	0.02	136.74	0.01
broadleaf deciduous large	1	0.06	11,581.55	0.22	2,783.10	0.19
Total	1,715	100.00	5,173,801.60	100.00	1,503,438.04	100.00

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

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

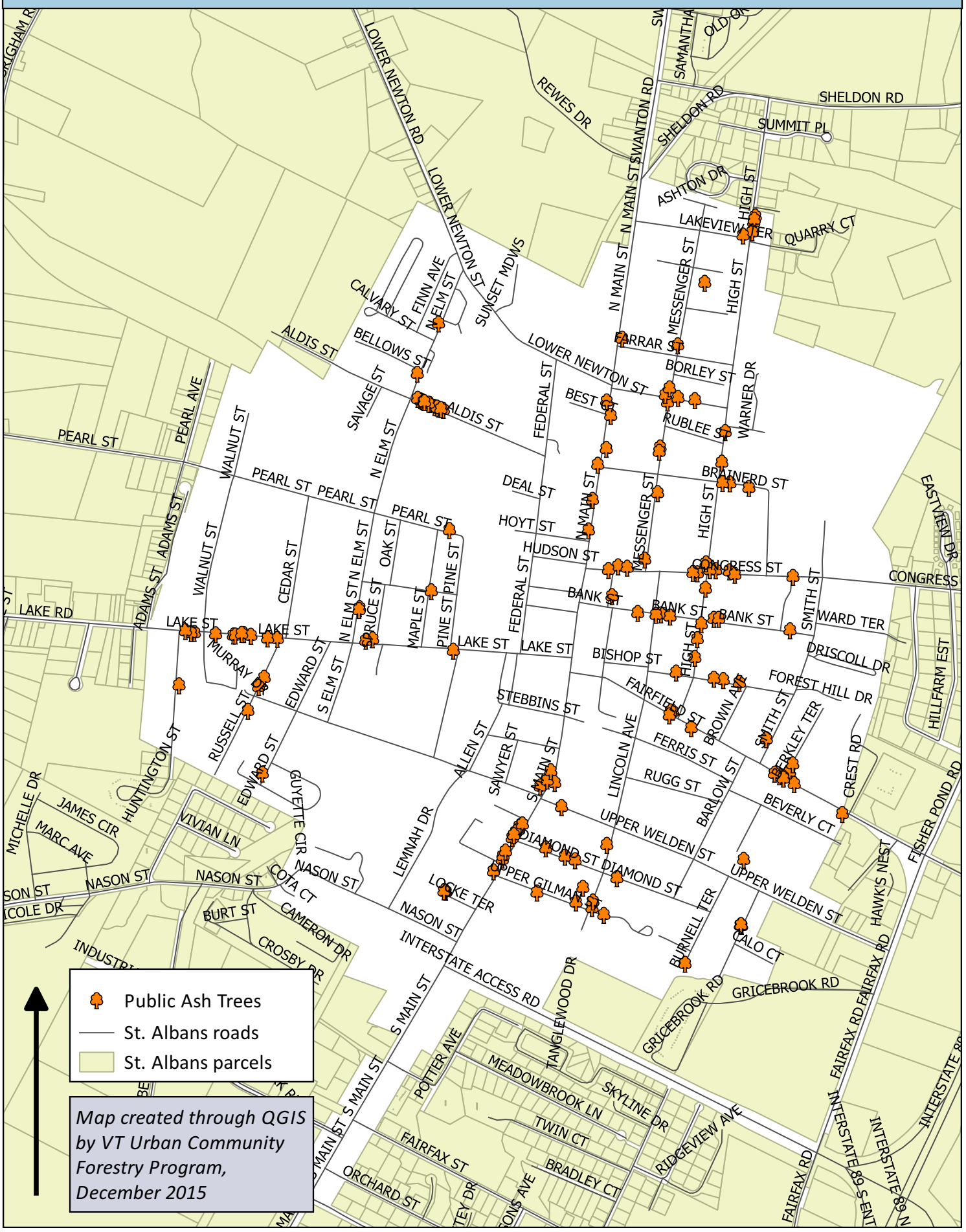
1. Set your web browser (Internet Explorer works best, Chrome does not work) to http://anrmaps.vermont.gov/websites/anra/ (or search "VT ANR Atlas").
2. Zoom in to St. Albans City using the +/- scale navigation tool in the upper left portion of the map (the tree data layer won't show up unless you are 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.
    - 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.
    - 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.



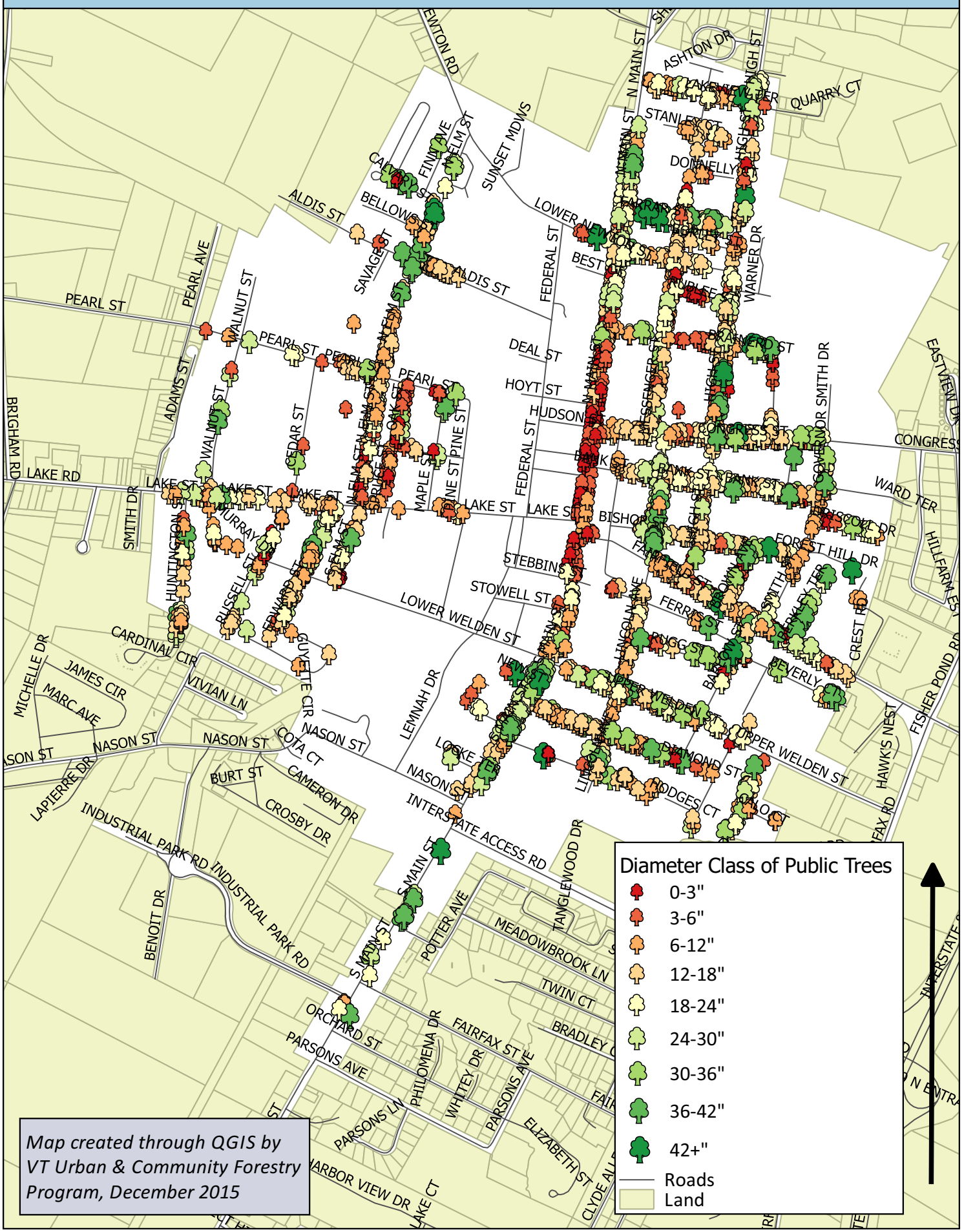
Appendix E: Maps

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

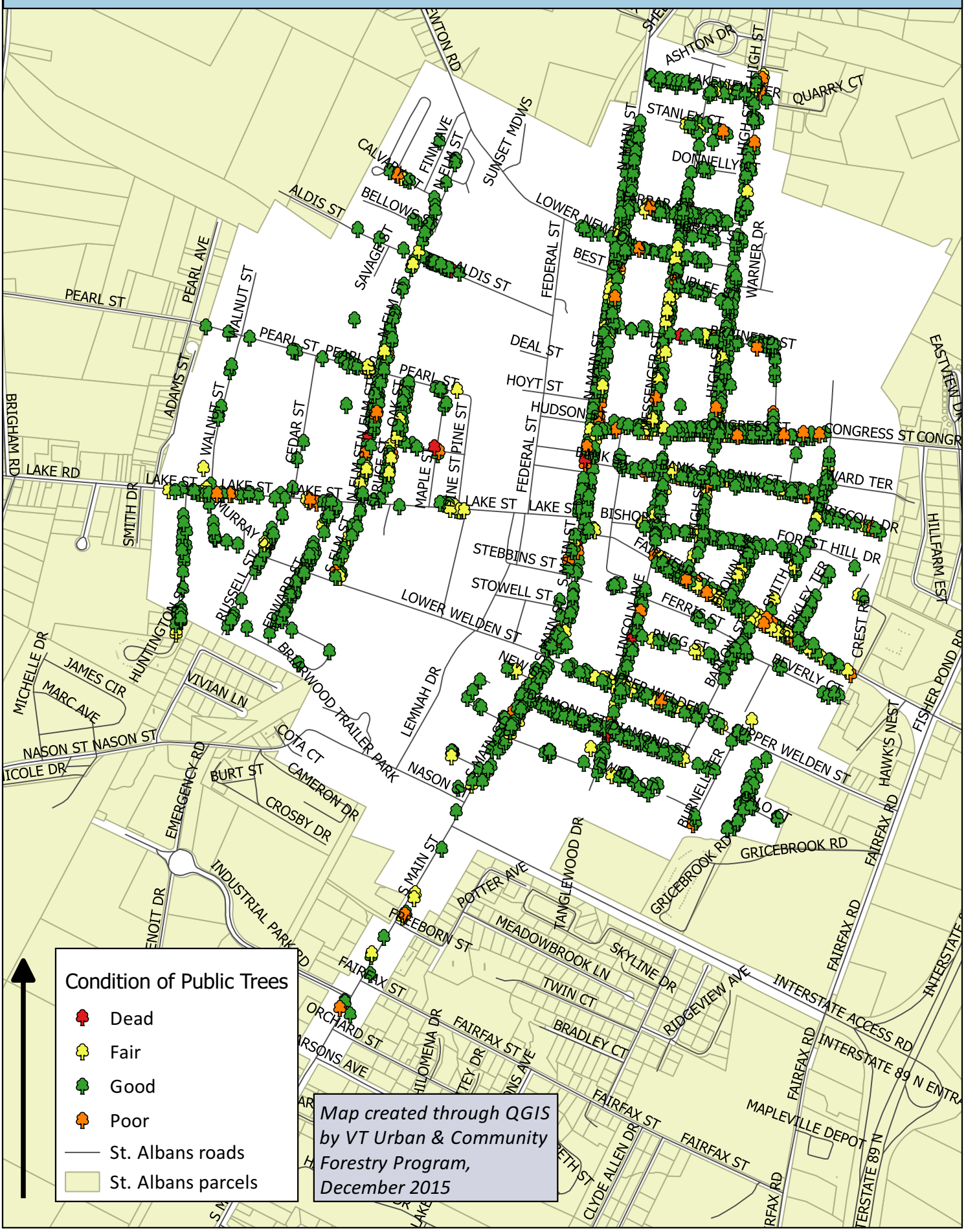
St. Albans Public Ash Trees



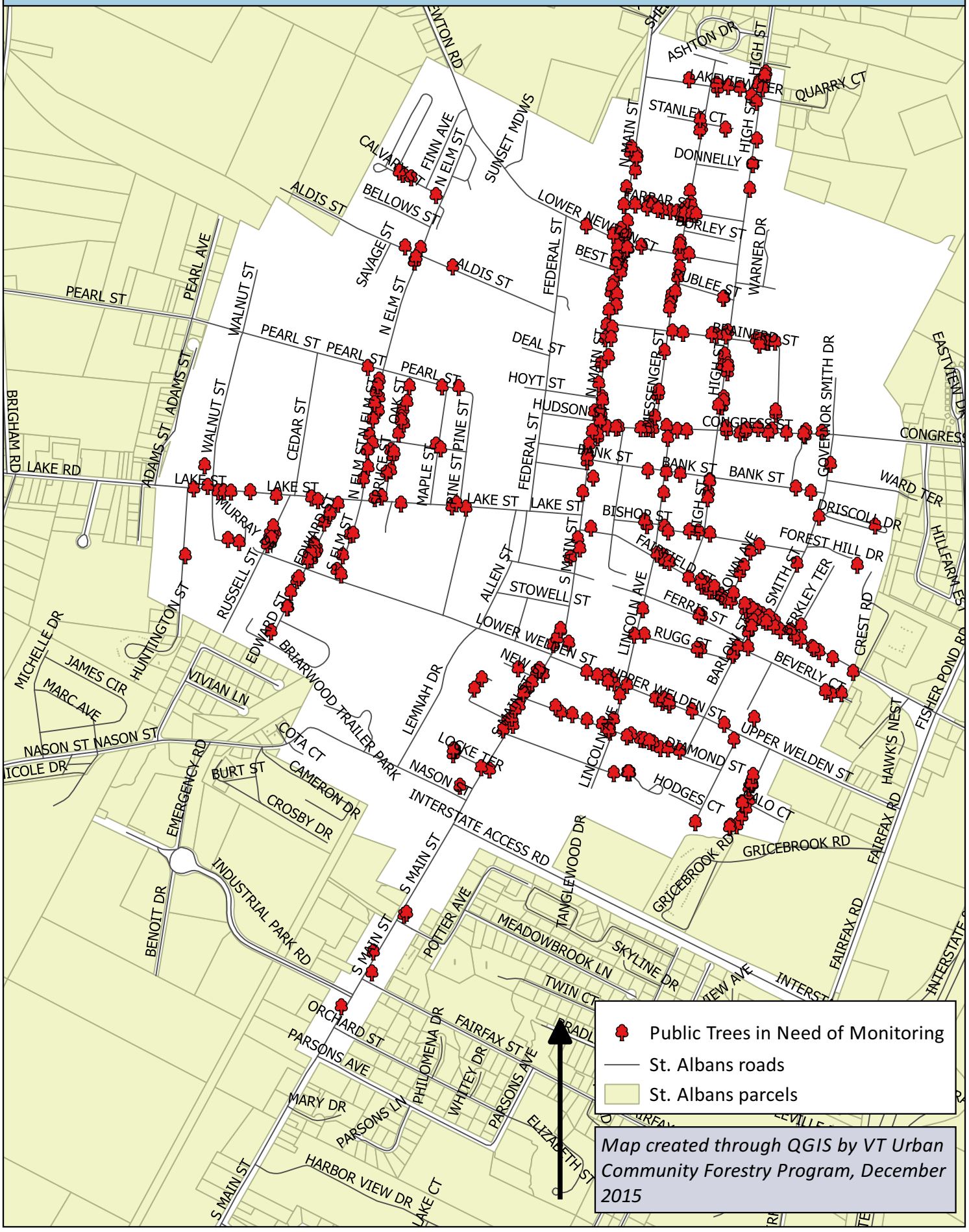
St.Albans Public Trees by Diameter Class



St. Albans Public Trees by Condition Class



St. Albans Public Trees in Need of Monitoring



All Public Trees in St. Albans

Potential Public Trees Planting Locations in St. Albans