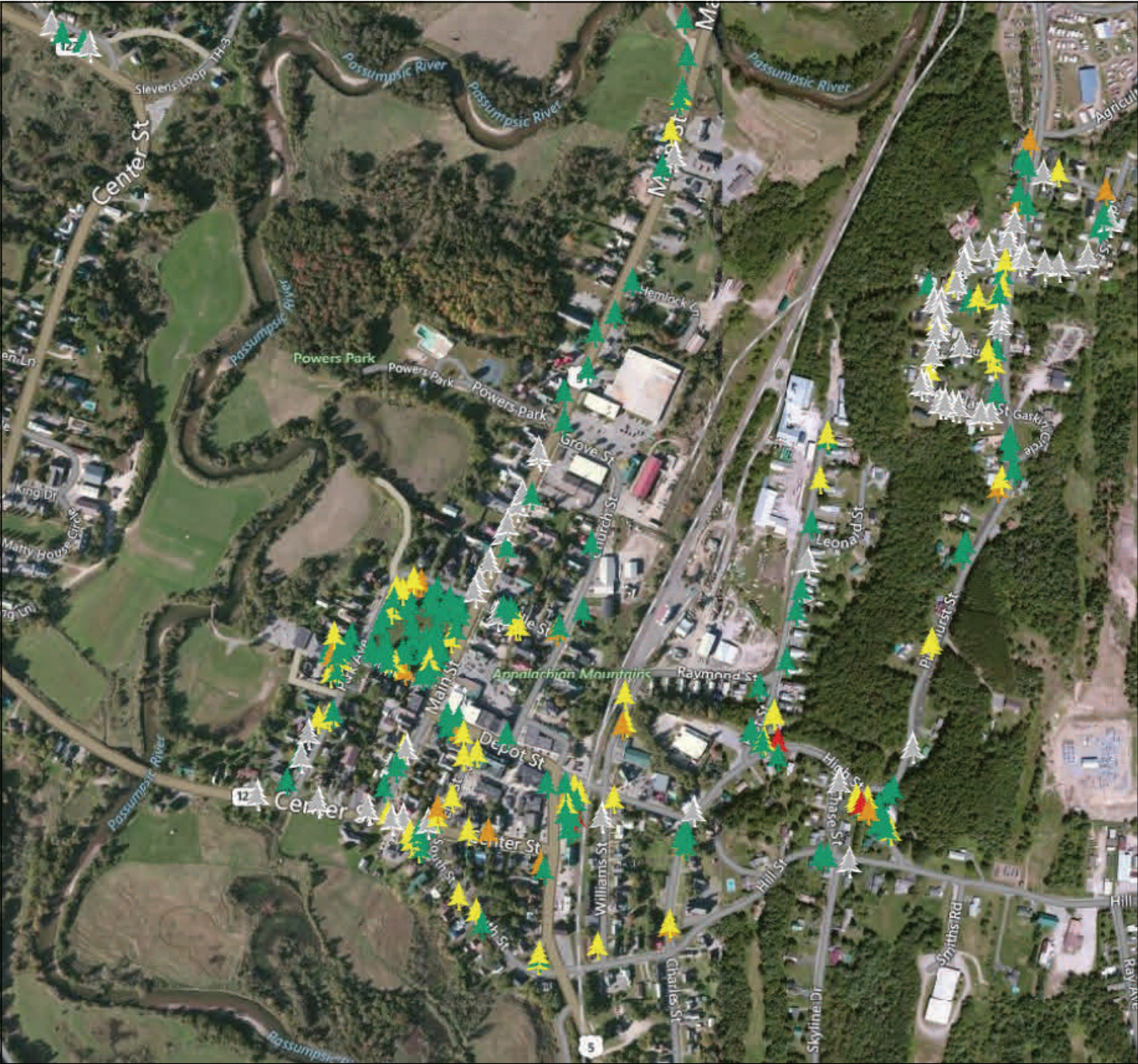


Lyndonville Public Tree Inventory Report



*Prepared for the Town of Lyndon
by the Vermont Urban & Community Forestry Program
December 2015*



Acknowledgements

This report was developed by the 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 Town of Lyndon, Vermont during the summer of 2015. We would like to thank the main contact for this project, Kaela Gray, Lyndon's Zoning Administrator and Planning Director. This report was made possible with funding from the USDA Forest Service. Special thanks to Neil Monteith with VT FPR for leading the on-the-ground data collection in Lyndonville. 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 inventory report.

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 community 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 to promote and support vibrant urban and community forests, such as Montpelier's, pictured above.

Contents

Acknowledgements.....	i
About the Vermont Urban & Community Forestry Program.....	i
Executive Summary.....	1
Summary of Findings.....	2
Summary of Recommendations.....	4
Introduction.....	5
Project Description.....	5
Town Profile.....	7
Methodology.....	7
Community Forest Diversity.....	10
Community Forest Structure.....	12
Community Forest Health.....	15
Tree Health and Maintenance Indicators.....	17
Economic Benefit and Ecosystem Services.....	19
Lyndonville Full Canopy Assessment.....	25
Discussion and Recommendations: Lyndonville’s Public Tree Program.....	28
Community Forest Diversity and Structure.....	29
Community Forest Health.....	31
Assessment Tools.....	33
Conclusion.....	35
Appendices.....	36
Appendix A: Full Street and Site List of Lyndonville’s Public Tree Inventory.....	36
Appendix B: Full Species and Genera List for Lyndonville’s Public Trees.....	37
Appendix C: Leaf Area and Canopy Cover by Species Comprising Lyndonville’s Community Forest.....	38
Appendix D: Instructions for Accessing Public Tree Data in ANR Atlas.....	39
Appendix E: Maps.....	40

Executive Summary

The goals of Lyndonville's public tree inventory were to accurately locate and assess health and maintenance needs of Town-owned trees within the public right-of-way (ROW), establish records of all public trees in order to better coordinate and plan for their on-going maintenance, 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, health, and benefits of Lyndonville's public tree population and will allow Town leadership 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 and was approved by the Town of Lyndon's Zoning Administrator and Planning Director, Kaela Gray. VT UFC and VT FPR staff completed an inventory of **244 trees** located within the public ROW of **32 streets** and on **8 Town-owned properties** and identified **41 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 an inventory and provides a basic assessment of the trees and urban canopy cover in the Village of Lyndonville.

Local government, town boards and committees, conservation agencies, and private landowners all play an important role in monitoring and maintaining community forests. Public trees provide a number of benefits to a community, including reducing stormwater runoff, reducing air pollution, providing shade, sequestering carbon dioxide (CO₂), enhancing property values, and improving the aesthetics of the community. The 244 public trees that were inventoried provide an estimated **\$16,985 in benefits annually** to the residents of Lyndonville. In addition to the public trees inventoried, an aerial tree canopy assessment was completed for the land area assessed in the inventory, which indicated an existing tree canopy cover of **37%** and an estimated long-term **stored CO₂ value of over \$615,800**.

Summary of Findings

Forest Diversity

- Of the 244 public trees, there are 36 different species in 20 different genera.
- The five most common tree genera by number of trees are *Acer* (maple) at 36%, *Malus* (crabapple) at 16%, *Picea* (spruce) at 9%, *Quercus* (oak) at 5%, and *Betula* (birch) at 5%.
- *Acer* and *Fraxinus* (4%) species together represent 40% percent of Lyndonville’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 *Acer saccharum* (sugar maple) at 21%, *Malus* species (crabapple) at 16%, *Acer rubrum* (red maple) at 7%, *Thuja occidentalis* (eastern white cedar) at 5%, and *Picea pungens* (blue spruce) at 4%.

Forest Structure

- Over half of the inventoried public trees (53%) have a diameter at breast height (DBH) measurement between 6 and 18”. 32% of inventoried public trees have a DBH between 0 and 6”, making 85% of Lyndonville’s community forest between 0 and 18”. 9% of the inventoried trees have DBH measurements in the 18-24” size class.
- The remaining 6% of inventoried trees were represented in the following size classes: 24-30” (4%), 30-36” (1%), 36-42” (1%), and 42”+ (0.4%).

Forest Cover

- There is an existing urban tree canopy (UTC) cover of 37% in Lyndonville. This analysis was done on both public and private land over the full extent of the Village, which encompasses the full area included in the public tree inventory.
- Trees could potentially cover an additional 51% of Lyndonville’s land surface. These “possible UTC” areas include low-lying vegetation or grassland, agricultural land, and impervious surfaces (e.g. parking lots, paved playgrounds, and the ROW).
- 41 potential public tree planting locations were identified within the Village.

- The remaining 12% of Lyndonville’s land area is buildings, streets, water, and other permanent features and is generally unsuited to UTC improvement.

Forest Health

- About three quarters (152, or 62%) of Lyndonville’s inventoried trees were assessed as being in “Good” condition. Of the remaining trees, 67 (27%) were considered to be in “Fair” condition, 22 (9%) were in “Poor” condition and 3 (1%) were “Dead”.
- 77 trees (32%) were flagged as in need of monitoring by a Certified Arborist or another qualified individual.

Tree Health and Maintenance Indicators

- As per request of the Town, the presence of the following health and maintenance indicators were assessed during Lyndonville’s public tree inventory: the presence or absence of stem-girdling roots, the need for pruning, staking, and/or mulching, and the need to remove stakes and/or mulch.
- None of Lyndonville’s inventoried public trees were assessed as having stem-girdling roots.
- Only 1 public tree was assessed as requiring staking, and none of Lyndonville’s inventoried public trees require the removal of stakes.
- 44% (108 public trees) of Lyndonville’s community forest were assessed to be in need of pruning.
- 14 public trees in Lyndonville’s community forest were assessed to be in need of mulch, and 36% (81) of Lyndonville’s assessed public trees require the removal of mulch. In the case of the latter, mounded mulch, often called “volcano mulching”, can reduce tree health in a number of ways (addressed in Discussion and Recommendations section).
- About half of Lyndonville’s public *Acer* (maple) trees (37) require monitoring, which represents the greatest monitoring needs of all of Lyndonville’s community forest genera.

Summary of Recommendations

A healthy public tree population is contingent upon proper management, stewardship, and a municipality's commitment to understanding and maintaining its 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 Lyndonville public tree inventory, our priority recommendations for the Village of Lyndonville are:

- Enhance and promote longevity of the relatively young public tree population, and address the identified need for pruning of Lyndonville's public trees (44%) by establishing a systematic and routine structural pruning program.
- Prioritize the timely assessment and, if needed, maintenance or removal of the 77 trees that were identified as in need of monitoring by a Certified Arborist or relevant public official.
- Address the issue of volcano mulching in Lyndonville; 36% of the public trees in the village – mostly in the community's parks – have mulch applied too thick around the base of the tree and up against the trunk. This practice can cause serious tree health problems, is easily preventable, and is in reality more expensive for the Town, since the trees are currently mounded with much more mulch than they actually need.



Stand Lands Foresters from the St. Johnsbury District FPR office conducted the Lyndonville public tree inventory in September 2015.

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 municipal 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 community forest structure, diversity, and health; (2) helping the community in the development of an community 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 Town of Lyndon's Zoning Administrator and Planning Director and members of the Lyndon Planning Commission were interested in partnering with VT UCF on the *Care of the Urban Forest* project to conduct a full, map-based, electronic (opposed to paper-based) public tree inventory of the village of Lyndonville, the most populated area of the community. The intent of the public tree inventory was to enable Town of Lyndon leadership and Lyndonville residents to better understand, steward, and manage public trees more efficiently and cost effectively. The specific goals of Lyndonville's public tree inventory were to accurately locate and assess health and maintenance needs of Town-owned trees within the public right-of-way (ROW), establish records of all public trees in order to better coordinate and plan for their on-going maintenance, and identify potential public tree planting locations. The complete public tree inventory was conducted in September 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 when the Lyndonville is able to manage and support healthy public trees.

According to Kaela Grey, Lyndon's Zoning Administrator and Planning Director, the trees in Lyndonville's parks, lining its streets, and in other public spaces have been important to residents dating back to the 1890's. Historically, the Village Improvement Society (VIS), founded

in 1891, took charge of caring for trees and the downtown Village of Lyndonville. In its bylaws VIS listed: *planting and care of trees, improving parks, and beautifying the village*, as the purpose of the organization. Many of the village's main streets, including Main Street, Depot Street and Elm Street, were once lined with trees that enhanced the charm, and helped define the character of the town. Over time, trees were removed from these streets for a number of reasons, including the arrival of Dutch elm disease, utility line interference, new development, and a lack of proper maintenance.

Unfortunately, the Town of Lyndon has not been able to replace trees at the same rate they were removed. There are still a number of trees along the streets of town and in village parks, however long-time residents recall the removal of street trees along the major roadways as a loss for their community.

Since 1999, Lyndon has actively pursued increasing the prevalence and health of trees in the Village of Lyndonville. Through a number of grants and the involvement of area residents, projects have been undertaken to replant trees in the community. The Lyndon Historical Society's *Greening of the Gem Committee* was formed for this purpose.

The purchase and planting costs of trees have been funded through a variety of sources. State grant funds have been used in several instances (1999, 2000, 2002, 2006) along with local fundraising by the historical society, private donations for memorial trees, and where possible from the town's landscaping budget for parks, and public buildings.

At this time, Lyndon does not have an explicit tree budget. The cost of mulch and tree care in parks comes from a small landscaping budget. New and replacement trees are paid for as possible when there is an excess budget, or a donation. Care for hazardous trees is done by Village and Town staff, and in particularly hazardous situations, a local arborist is brought in to assist.

Town Profile

The Village of Lyndonville is located in the Town of Lyndon, in Caledonia County within Vermont's Northeast Kingdom. Lyndonville covers a land area of approximately 0.73 square miles, and has a population of 1,207 people, according to the 2010 U.S. Census. Lyndon was chartered in 1780 by Thomas Chittenden, and the Village of Lyndonville was incorporated into the Town of Lyndon through legislature in 1880. Lyndonville is located eight miles north of St. Johnsbury and 35 miles south of Newport, Vermont. U.S. Route 5 passes through the center of the village, and Interstate 91 bypasses it to the west. The Passumpsic River, flowing along the western edge of the Village, provided the power for the Town's historic grist and saw mill economy. By 1867, the Connecticut and Passumpsic Rivers Railroad bypassed Lyndon, encouraging business to move to Lyndonville. Bandstand Park, formerly known as Lyndonville Park, hosts many community events, including weekly band events and farmer's markets¹.

Methodology

To plan for the public tree inventory, VT UCF staff met and communicated with Lyndon's Zoning Administrator and Planning Director, Kaela Gray. Originally, 32 streets in Lyndonville were

¹ Town of Lyndon. Accessed 2015 at <http://www.lyndonvt.org/>

Importance of Inventory and Community Forestry in Vermont

A public tree inventory establishes a record of the community-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 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 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, community 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.

selected to be included in the inventory, as well as a number of priority Town-owned properties. In total, the inventoried land area was about 0.59 square miles, representing 81% of Lyndonville's total land area, and including the most densely populated sections of the Village. The ROW boundaries for all streets were provided through Lyndon's Planning Department. 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 developed an 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*, developed by Esri, (<http://doc.arcgis.com/en/collector/>) for data collection and is linked to the ANR Atlas online mapping tool. All inventory data collected on public trees in Lyndonville is available for viewing on ANR Atlas and instructions are included in Appendix D.

Over the course of several field days in September 2015, VT UCF staff VT FPR State Lands Foresters walked along predetermined streets and on Town-owned sites in Lyndonville, 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:

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

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 Lyndonville included street name, overall condition, species,

diameter class (using a measurement for diameter at breast height, or DBH), a recommendation for monitoring, the presence or absence of stem-girdling roots, the need (yes/no) for pruning, staking, and mulching, the need to remove (yes/no) staking and mulching, 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.

The data were compiled and subsequently checked for quality, analyzed, and summarized using Microsoft Excel and QGIS. 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 Lyndonville’s community 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 Lyndonville 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	Yes: any one defect is affecting >40% of the tree, posing a hazard to people/infrastructure/cars, growing into utility wires, dead or poor condition, ash tree

	showing evidence of woodpecker flecking, blanding, 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.
Stake	Yes: if the tree should be staked. Staking is required when the tree is unable to support itself with its existing root system. Staking supports the roots or root ball until the roots of the tree grow into the surrounding soil and can then support itself. Excessive top movement breaks off the root hairs during formation, limiting the root expansion of the plant. No: staking needed for inventoried tree
Prune	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. No: no branch needs to be pruned
Mulch	Yes: Mulch is recommended to either protect the tree from repeated mechanical damage from mowers or weed whackers, to cover exposed roots, or to help young trees become established. No: mulch does not need to be added to the tree
Stem-Girdling Roots	Yes: The presence of roots visibly growing in circular manner around the trees, opposed to radially out of the tree, and/or are growing over larger anchoring roots. No: the above was not present or noticeable on inventoried tree
Remove stake	Yes: Remove stakes from young trees (after one year in the ground) No: the stakes currently supporting public tree does not need to be removed
Remove mulch	Yes: Mounding mulch against the base of the tree (volcano mulching) holds moisture, promoting decay in the trunk. Mulch applied too thick can also encourage the growth of adventitious roots and can be a warm home to rodents in the winter time, posing an addition threat to the trunk. Mulch shouldn't be applied deeper than 4" and should be removed from the root collar. No: mulch currently located at base of tree does not be removed
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 244 trees inventoried within the public ROW or on Town-owned land, there are a total of 36 different species in 20 different genera. The five most common tree genera, *Acer* (maple), *Malus* (crabapple), *Picea* (spruce), *Quercus* (oak), and *Betula* (birch), comprise 70% of Lyndonville's community forest (Figure 1). The five most common species are *Acer saccharum* (sugar maple) at 21%, *Malus* species (crabapple) at 16%, *Acer rubrum* (red maple) at 7%, *Thuja*

occidentalis (eastern white cedar) at 5%, and *Picea pungens* (blue spruce) at 4% (Figure 2). Complete species and genera lists can be found in Appendix B.

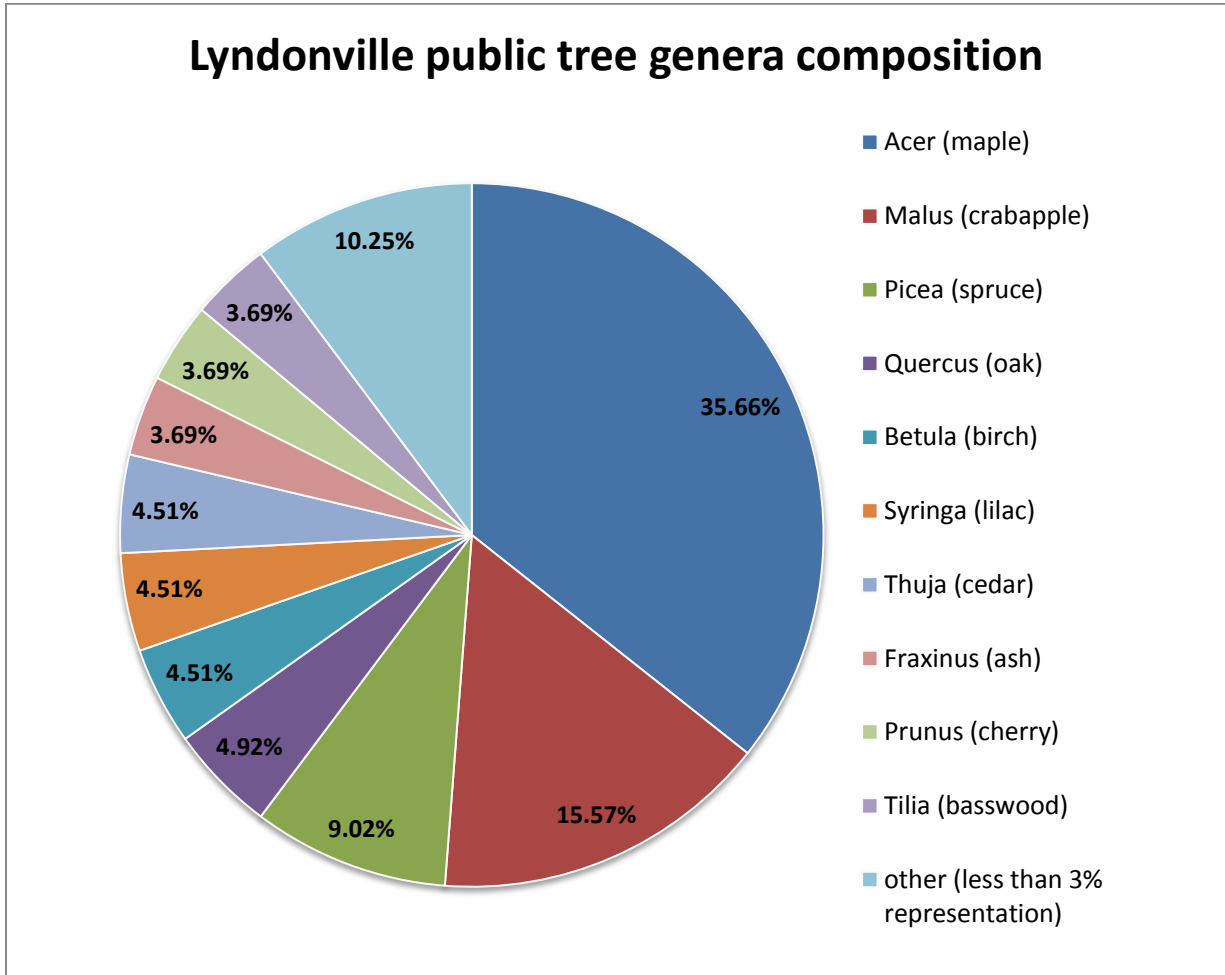


Figure 1. Most common tree genera by percent within the public ROW in Lyndonville.

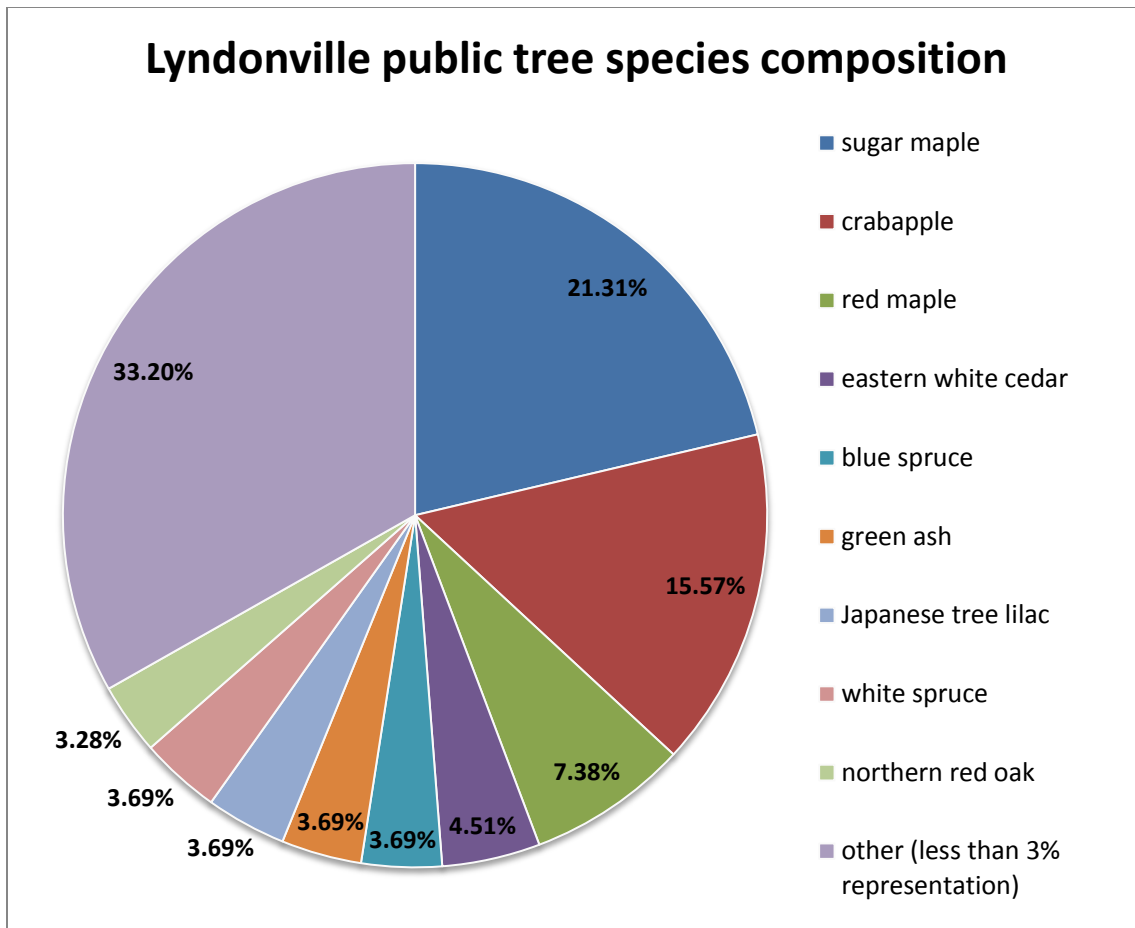


Figure 2. Most common species by percent within the public ROW in Lyndonville.

Community Forest Structure

In descending order by percent size class, the diameter distribution represented by Lyndonville’s public trees is: 35% (85) at 6-12”, 20% (48) at 3-6”, 18% (44) at 12-18”, 12% (29) at 0-3”, 9% (22) at 18-24”, 4% (9) at 24-30”, 1% (3) at 30-36”, 1% (2) at 36-42”, and 0.4% (1) at 42+” (Figure 3). Thus, approximately 85% of inventoried public trees are between 0 and 18 inches, indicating a relatively young community 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 over a third of all Lyndonville’s inventoried public trees. The three largest size classes represented, 30-36”, 36-42”, and 42+” contain a total of 6 trees (approximately 2% of the community forest). Half of inventoried trees within these large size

classes are sugar maples, one is a silver maple, one is a northern red oak, and the other is a birch species (Figure 5). These trees are growing within the public ROW or on Town-owned land and were probably not planted as street trees but left as remnants as the community has grown. Crabapples comprise the majority of public trees between the sizes of 6 and 12 inches (Figure 5), and since crabapples are relatively small species even at maturity, the number of large diameter public trees in the future will remain small if current planting trends remain the same.

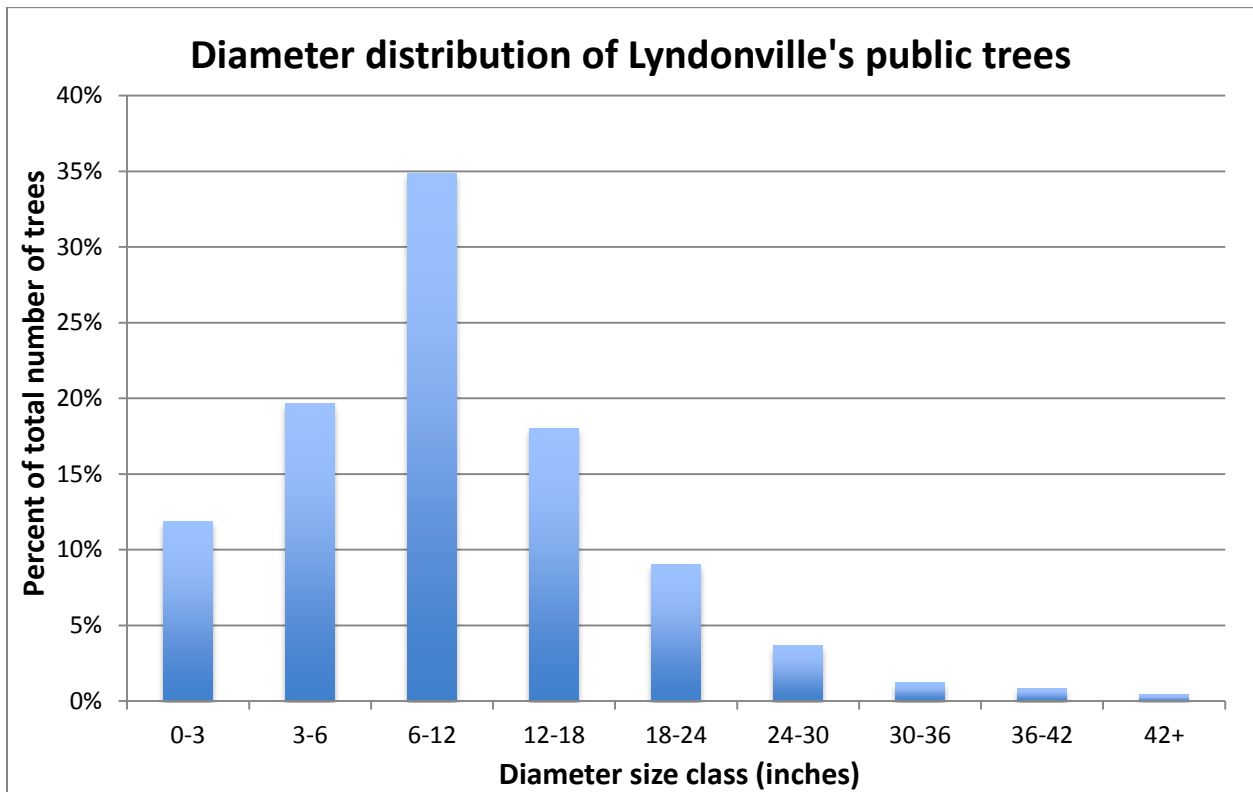


Figure 3. Percent of trees represented in each diameter class (inches) in Lyndonville.

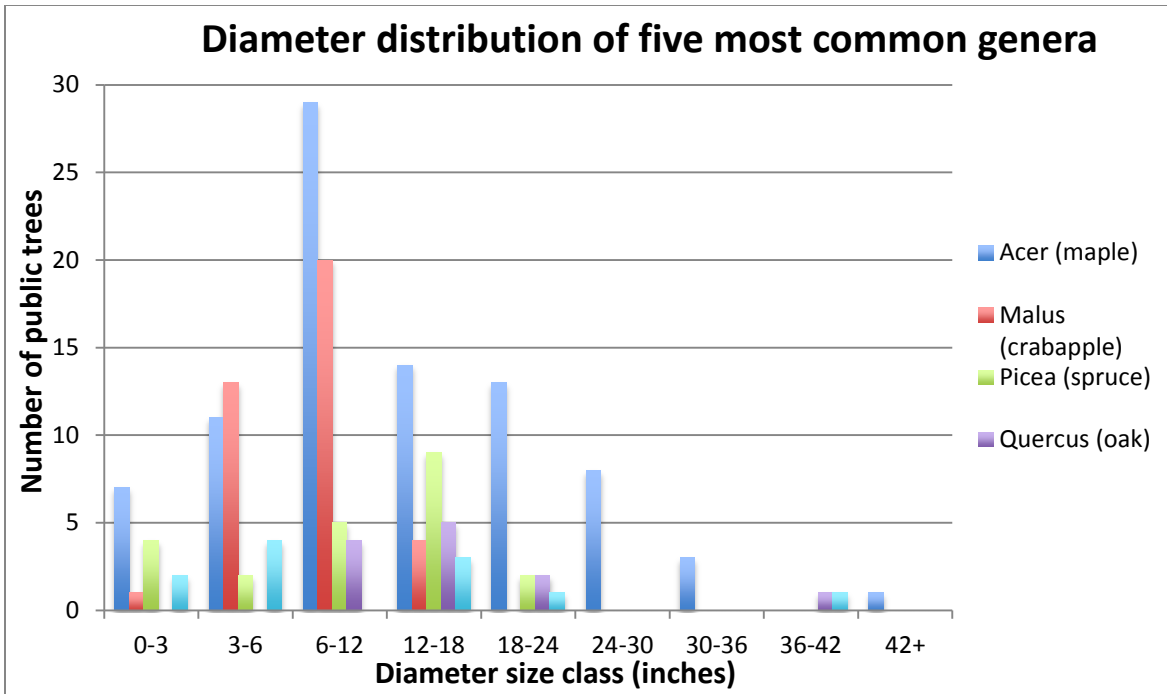


Figure 4. Diameter distribution for the five most common genera of Lyndonville’s public trees.

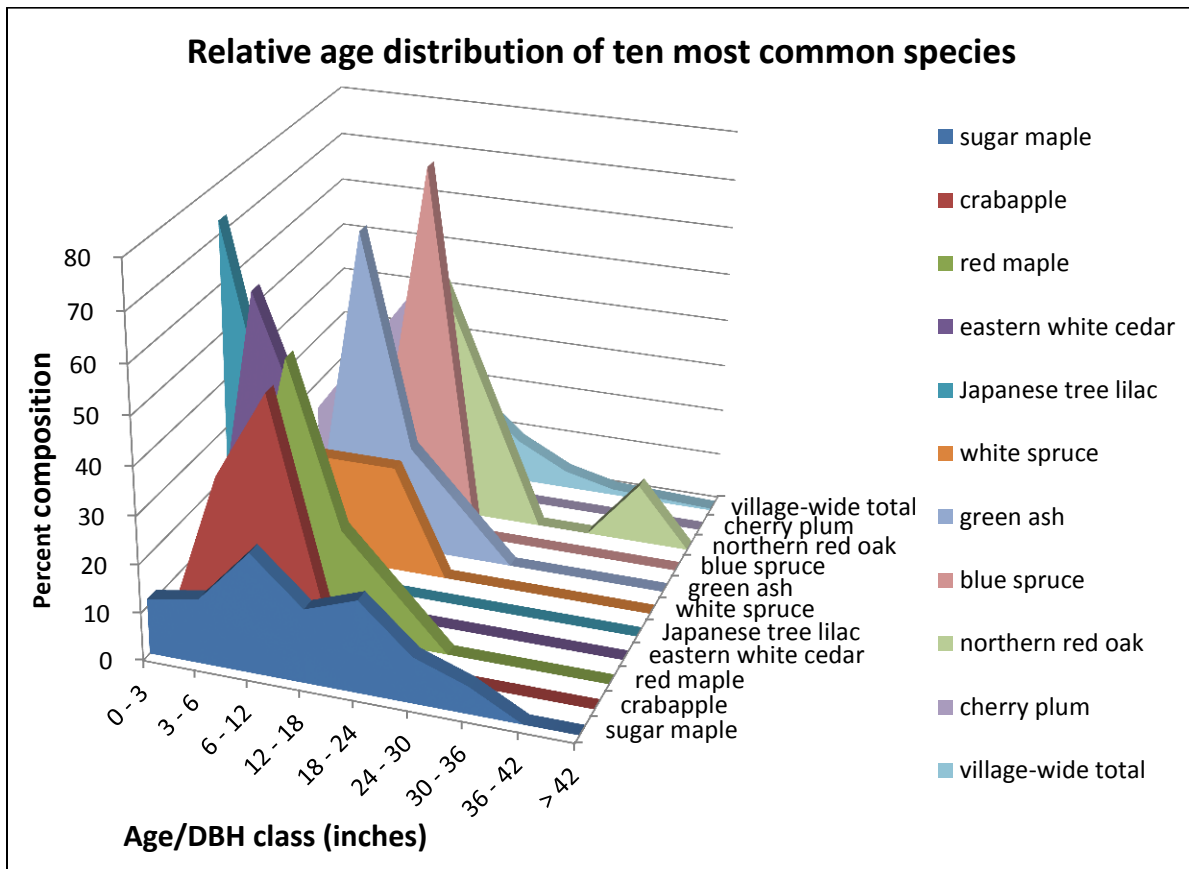


Figure 5. Diameter (and age) distribution of the ten most common species in Lyndonville’s community forest. Data from this figure were derived from i-Tree Streets urban canopy structure output.

41 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, Westview Street, Charland Street, and Pinehurst Street offer the most potential spots for tree planting. Additional consultation of these sites is necessary to plant a tree of appropriate size and species.

Community Forest Health

The majority (62% or 152) of Lyndonville’s inventoried public trees are assessed as being in “Good” condition. Of the remaining trees, 67 (27%) are considered to be in “Fair” condition, 22 (9%) are in “Poor” condition, and 3 (1%) are “Dead” (Figure 6). *Acer* (maple) had the most trees in fair or poor conditions; however, this genus also comprises the highest percentage of total inventoried trees (Figure 7). The three inventoried dead trees were a broadleaf deciduous medium species, a sugar maple, and an American elm. Appendix E includes maps detailing the location of inventoried trees by condition.

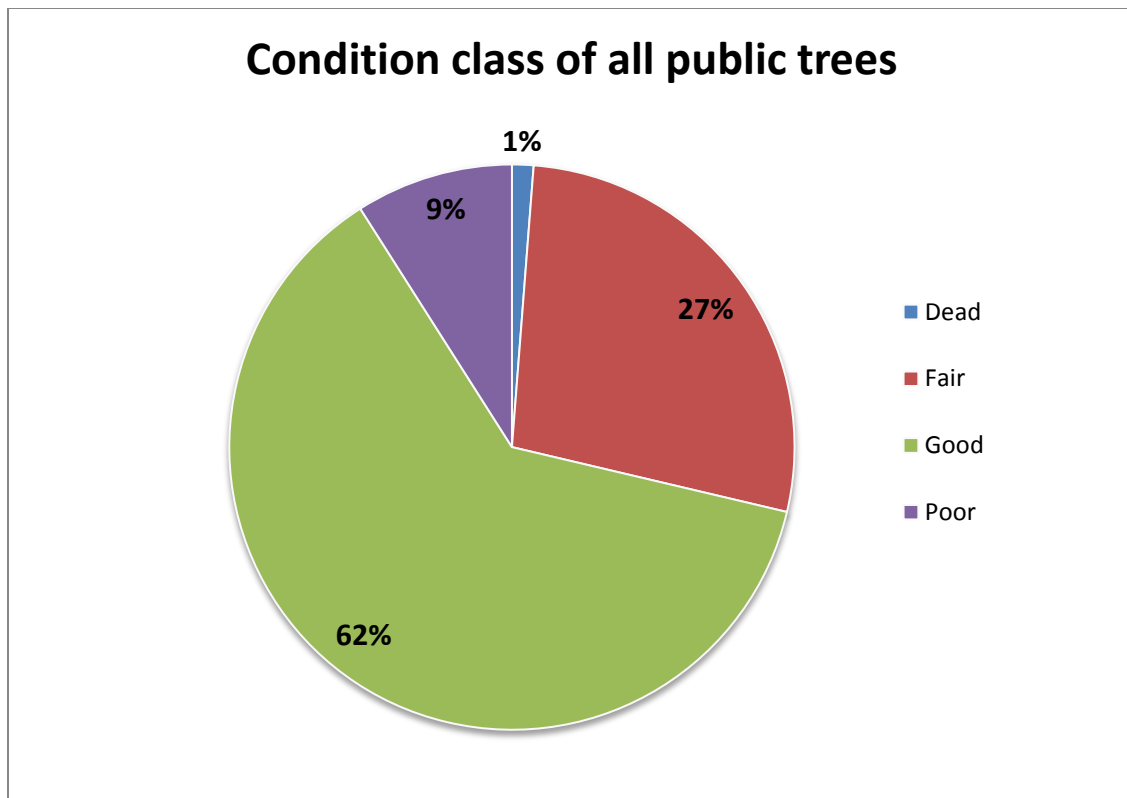


Figure 6. Percentage of public trees in each condition class in Lyndonville.

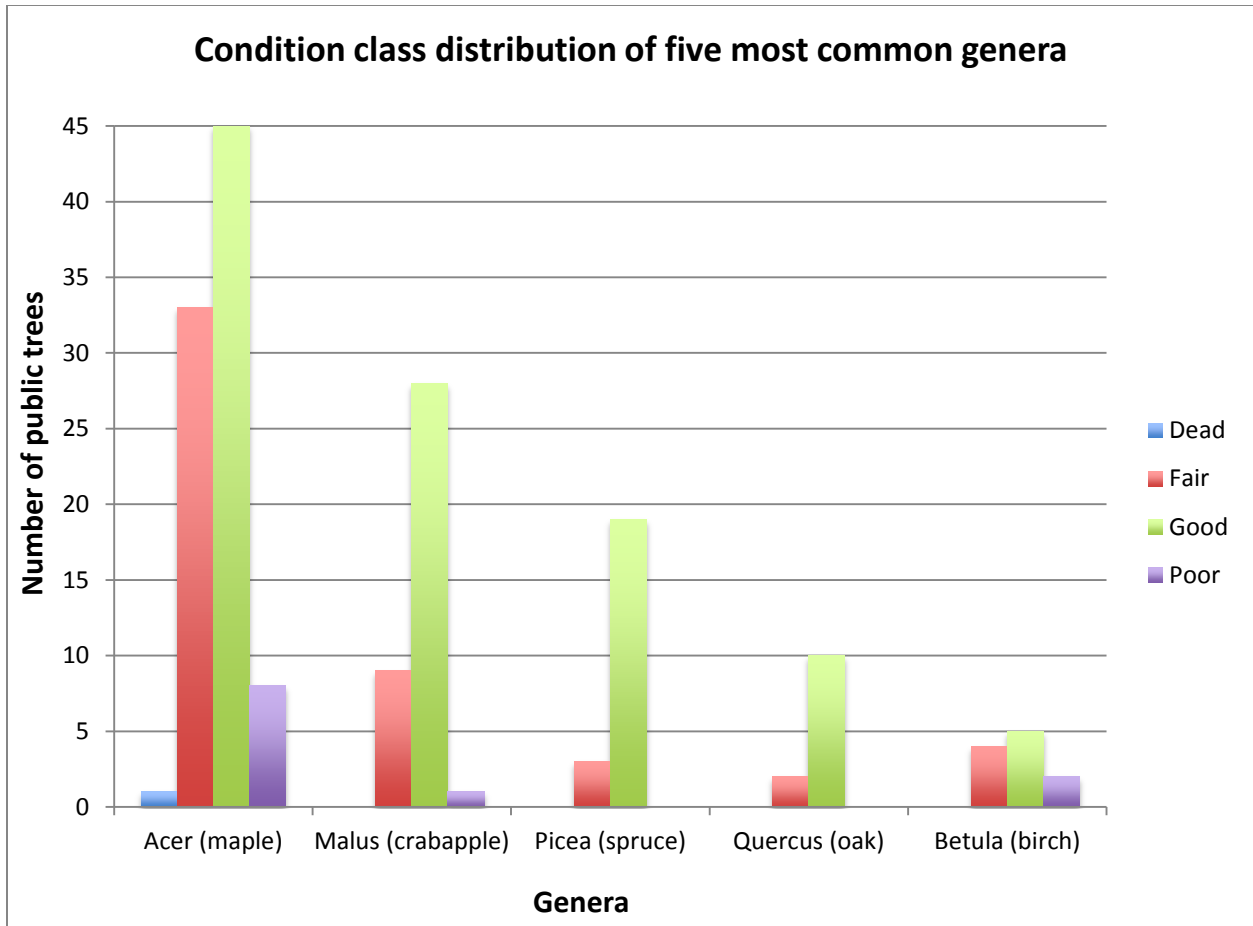


Figure 7. Number of public trees within the five most common genera displayed according to condition.

In conducting the inventory, VT UCF and VT FPR staff flagged 77 trees (32%) as in need of monitoring. These trees should be reassessed by a Certified Arborist, the Lyndon Tree Warden, or another qualified individual in a timely matter. Figure 8 presents monitoring needs of the five most common genera in Lyndonville. 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 the emerald ash borer (extensive woodpecker flecking, bark blinding, epicormic branching/water sprouts, and/or suspicious exit holes).

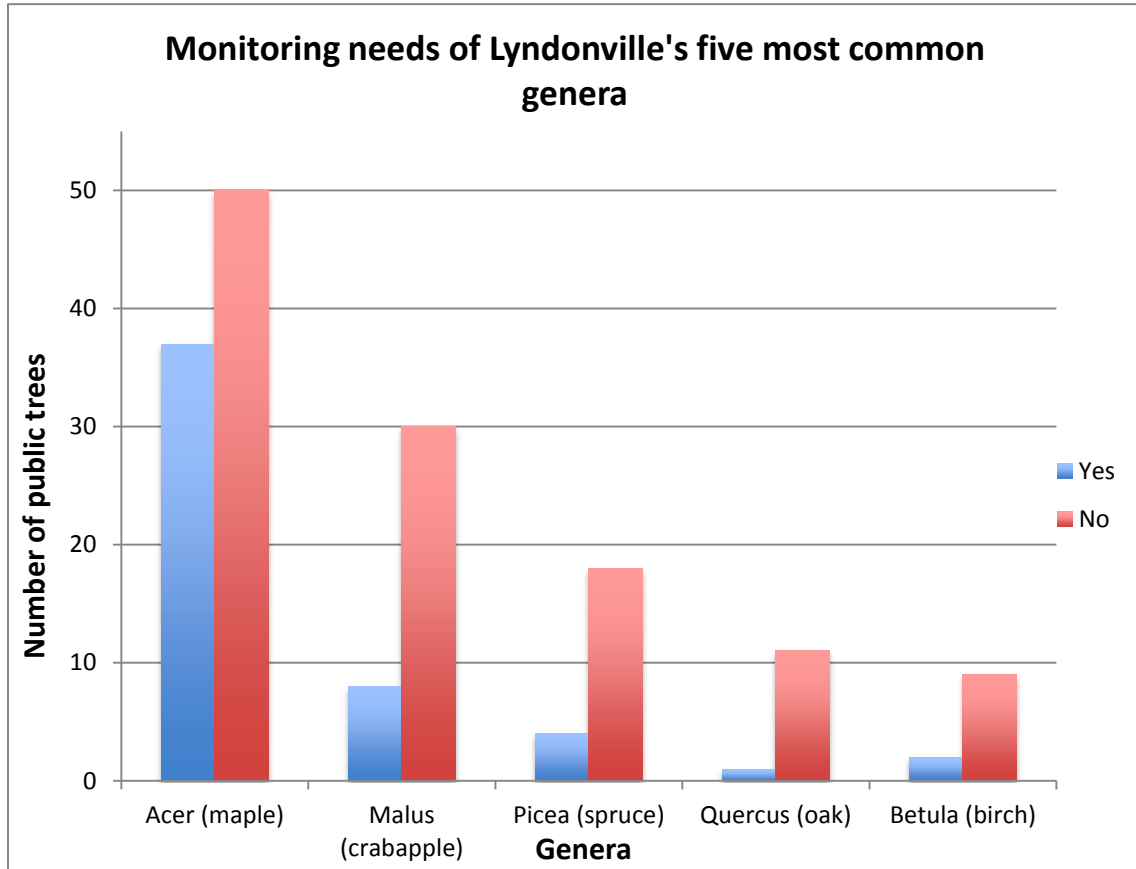


Figure 8. The number of Lyndonville’s inventoried public trees assessed to require monitoring (yes) within the Town’s five most common genera.

Tree Health and Maintenance Indicators

Although Lyndonville’s public trees are generally healthy (62% assessed as in “good’ condition), proper maintenance and monitoring is required to promote the health, longevity, and benefits of Lyndonville’s community forest. To better understand the specific maintenance and monitoring needs of Lyndonville’s public trees, the Town of Lyndon requested that the VT FPR inventory teams assess the presence (or absence) of stem-girdling roots, the need for pruning, staking, and mulching, and the need of stake and mulch removal for each inventoried tree (Figure 9). The Town of Lyndon should be aware of the public trees assessed with the observed

health (e.g., stem-girdling roots) or required maintenance (e.g., pruning, staking, mulching) characteristics.

No trees in Lyndonville's community forest were assessed as having stem-girdling roots. Of the assessed maintenance characteristics, Lyndonville's community forest is, however, in need of a more targeted and routine pruning regime. Nearly half (44% or 108) of Lyndonville's inventoried trees were assessed as in need of pruning (Figure 9). The majority of public trees requiring pruning are maple trees. Removing mulch is of second priority for those maintaining Lyndonville's community forest, as over a third (36% or 81) of the assessed public trees assessed require mulch removal (Figure 9). It is important to note that this percentage is derived from the total number of trees (222) assessed for mulch removal; 22 public trees were not assessed for mulch removal due to user error. Most of these public trees are maple species and are located within Lyndonville's inventoried greenspaces, such as South Street Park, Bandstand Park, and Veterans Park. Only 14 of Lyndonville's public trees (6%) require adding mulch. None of Lyndonville's public trees require the removal of stakes, and only one public tree requires stakes be added (Figure 9); this tree is a sugar maple located in Veterans Park. Please note that 21 trees were not assessed for either stake removal or additions during Lyndonville's community forest inventory due to user error.

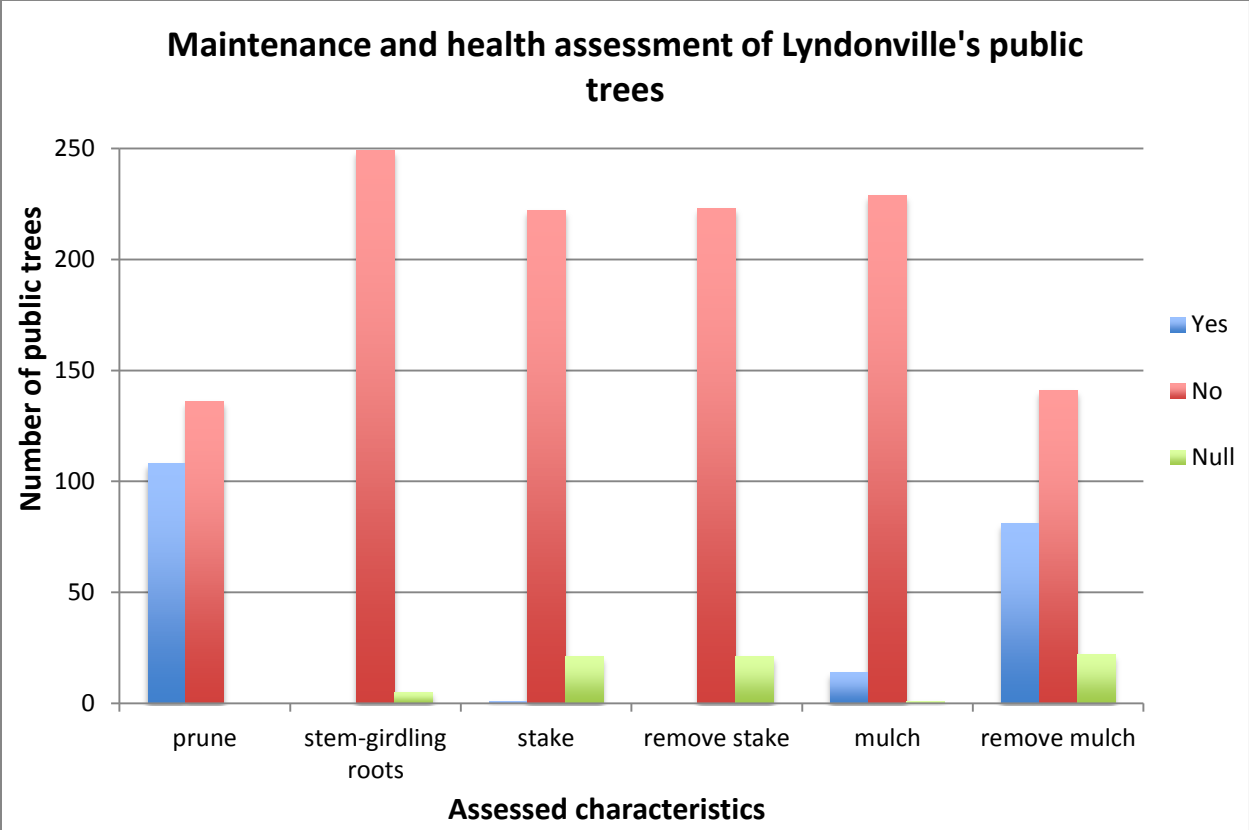


Figure 9. The number of Lyndonville’s inventoried public trees assessed as having presence or absence of town-specific maintenance and health characteristics. Null values represent the number of unassessed trees, and thus indicate user error. Refer to Table 1 for descriptions of each assessed characteristic.

Economic Benefit and Ecosystem Services

The Lyndonville public tree inventory data were analyzed using i-Tree Streets software to determine the monetary value of the ecosystem services provided by Lyndonville’s public trees. The 244 trees provide a total of \$16,985 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 \$70 annually in savings or services.

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

through the i-Tree Streets program for Lyndonville will be given to the main Town of Lyndon contact for this project.

It is important to recognize that the trees inventoried through this project are located on approximately 0.69 square miles of Lyndonville's approximate 0.73 square miles of total land area. Further, the inventory area (0.69 square miles) represents approximately 2% of the Town of Lyndon's total land area of 39.5 square miles. Expanding the inventory to all of Lyndonville's roads would increase these figures, although this increase would likely be insignificant. Expanding the inventory to all of Lyndon's roads would, however, increase these results dramatically. It is also noteworthy that larger 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.

Annually Lyndonville's 244 public trees provide

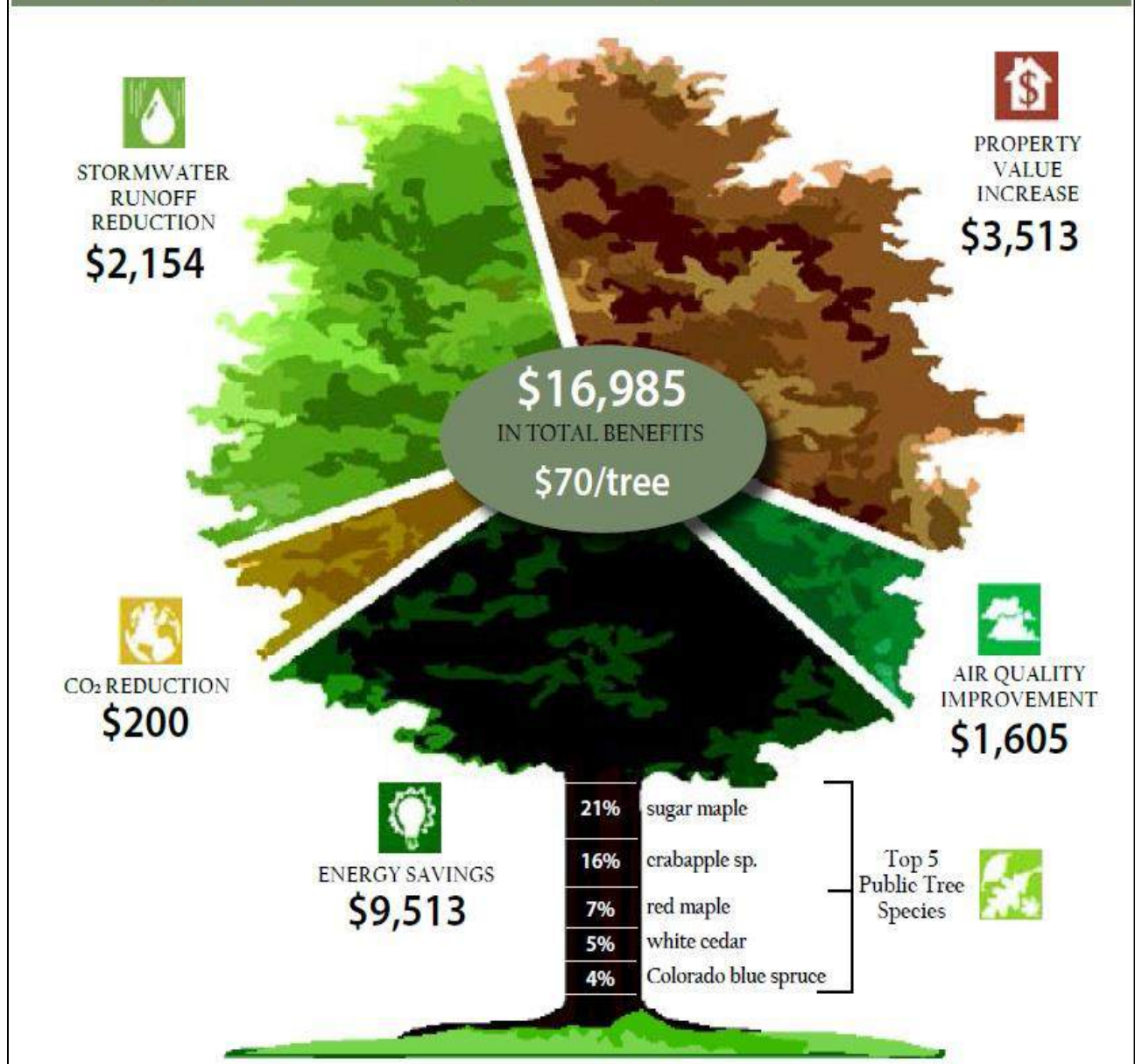


Figure 10. Summary of the benefits provided by Lyndonville's public trees inventoried through this project, according to the i-Tree Streets assessment. Tree graphic concept courtesy of City of New York Department of Parks & Recreation.

Table 2. Annual environmental and monetary benefits provided by Lyndonville’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	\$9,513.30	\$ 38.99
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.	\$199.72	\$ 0.82
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.	\$ 1,604.96	\$ 6.58
Stormwater	Reductions in annual stormwater runoff due to rainfall interception by trees.	\$2,154.02	\$ 8.83
Aesthetic/other	Tangible and intangible benefits of trees reflected in increases in property values.	\$ 3,512.61	\$ 14.40
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.	\$ 2,051.40*	\$ 8.41*

Saving the Town an average of \$16,985 annually in energy costs, Lyndonville's community forest's most significant analyzed economic benefit is energy conservation (Figure 10). The greatest energy cost savings from the Village's public trees is in the form of natural gas (versus electricity). This may be because the Village's primary energy use is natural gas. Of all Lyndonville's inventoried species, sugar maple and crabapple provide the greatest net annual reduction in energy costs (Figure 11). Sugar maples are the most prevalent species in larger diameter (i.e., age) classes (Figure 5), and are thus providing the greatest annual net reduction in energy costs for the Village of Lyndonville. Of all tree species included in Lyndonville's public tree population, northern red oak and silver maple provide the greatest annual reduction in energy costs per tree (Figure 12). This is likely because these species have significant overall leaf area (ft², Appendix C) per mature tree and thus provide significant shade and temperature regulation. Nine of the ten most beneficial energy conservation species are broadleaved (Figure 11), 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.

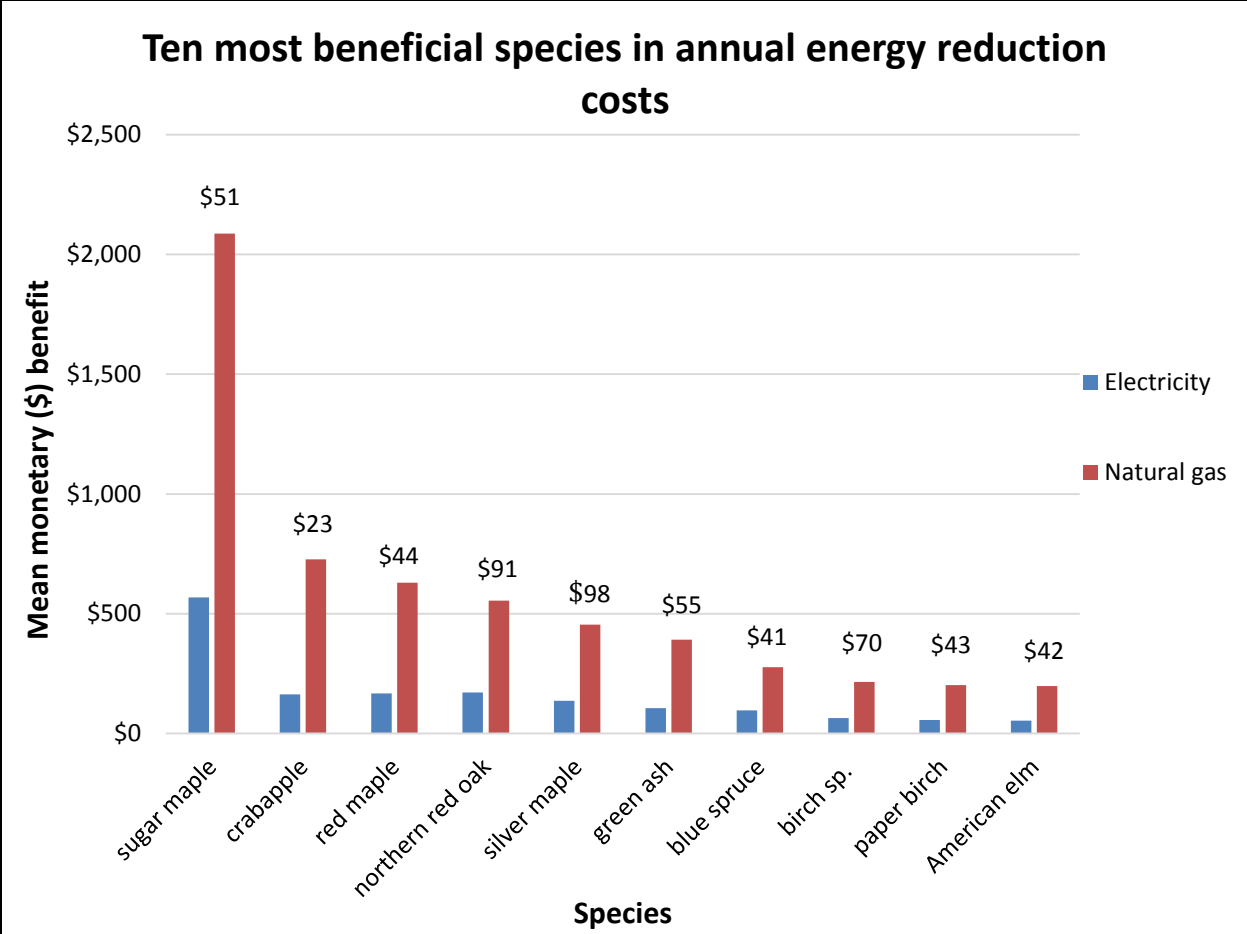


Figure 11. The average monetary value of the ten most beneficial species in annual energy reduction costs in Lyndonville’s community forest. The monetary values located above each species’ bar represents the average annual energy reduction benefit (\$) per tree. Monetary values were derived from tree species, diameter (inches), and condition inventory data through i-Tree Streets’ urban canopy benefits output.

Of all the species inventoried in Lyndonville’s community forest, silver maples provide the greatest net annual reduction in stormwater costs of about \$30 per tree (Figure 12). Only six silver maples were included in Lyndonville’s public tree inventory, so this relatively high monetary stormwater reduction benefit is attributable to their large size (all but one are 18-42+” in diameter) and healthy condition. Northern red oak and eastern white pine, the second and third most beneficial species in annual stormwater reduction costs, save about \$22 and \$21 per tree each year, respectively. Of the ten most beneficial species in reducing Lyndonville’s annual stormwater runoff, eight are deciduous trees and only two are coniferous (Figure 12).

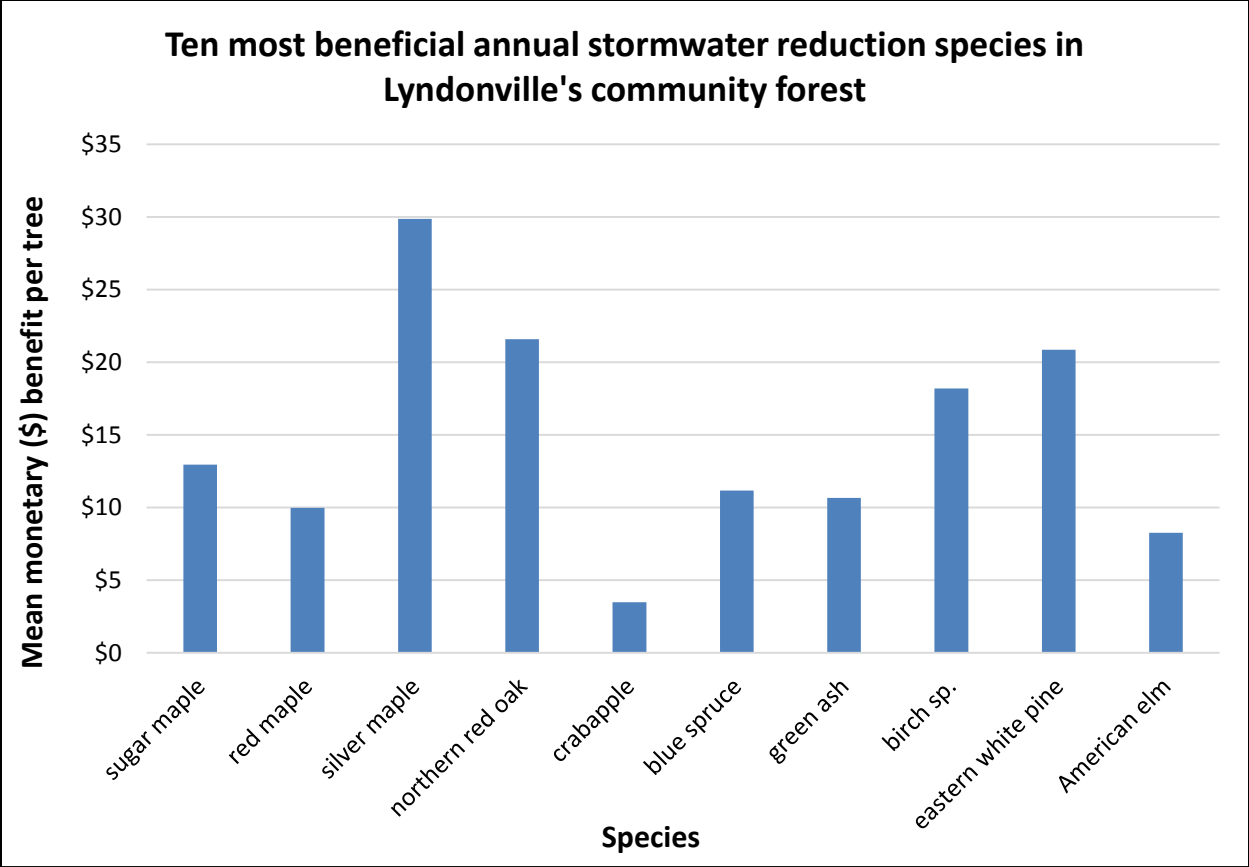


Figure 12. The average annual monetary value of the ten most beneficial stormwater reduction tree species in Lyndonville’s community forest. Monetary values were derived from tree species, diameter (inches), and condition inventory data through i-Tree Streets’ urban canopy benefits output.

Lyndonville Full Canopy Assessment

As a complement to the public tree inventory, VT UCF staff completed an i-Tree Canopy assessment for Lyndonville. i-Tree Canopy is 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 Lyndonville’s i-Tree Canopy assessment, approximately 37% of the village’s land area is currently occupied by tree canopy (Figures 13 and 14). Currently 9% of the total area is occupied by buildings, and is not suitable for tree planting (although this is likely a higher percentage in the downtown area). In consideration of the other land cover types

present, Lyndonville could potentially increase its total tree canopy cover by an additional 29% on open lands of low-lying vegetation, and about 2% on agricultural lands. About 3% of the land is water or wetlands, which while not suitable for tree planting provides many other benefits. The remaining 20% 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 Lyndonville’s overall tree canopy cover by 51%, though a portion of this land is privately-owned and/or used for other purposes such as agriculture (Figure 13).

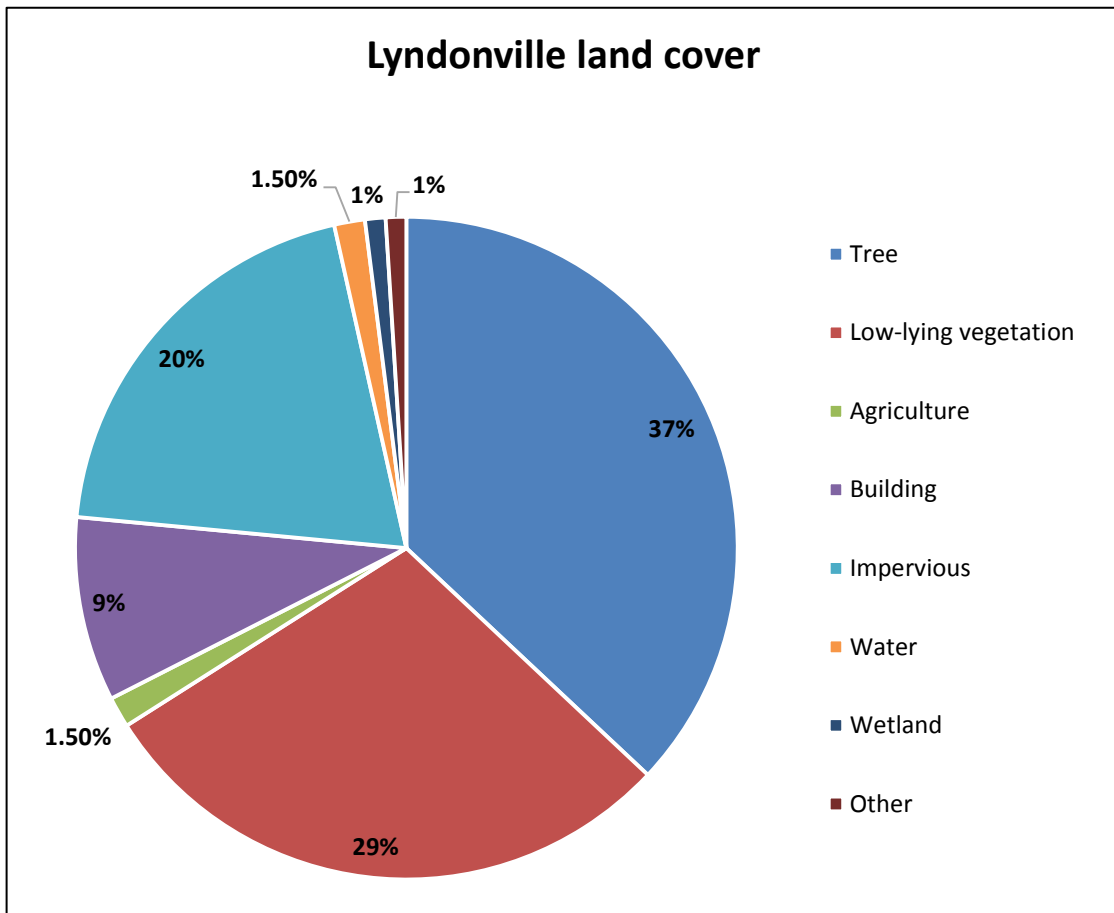


Figure 13. Land cover of Lyndonville (includes public and private land).

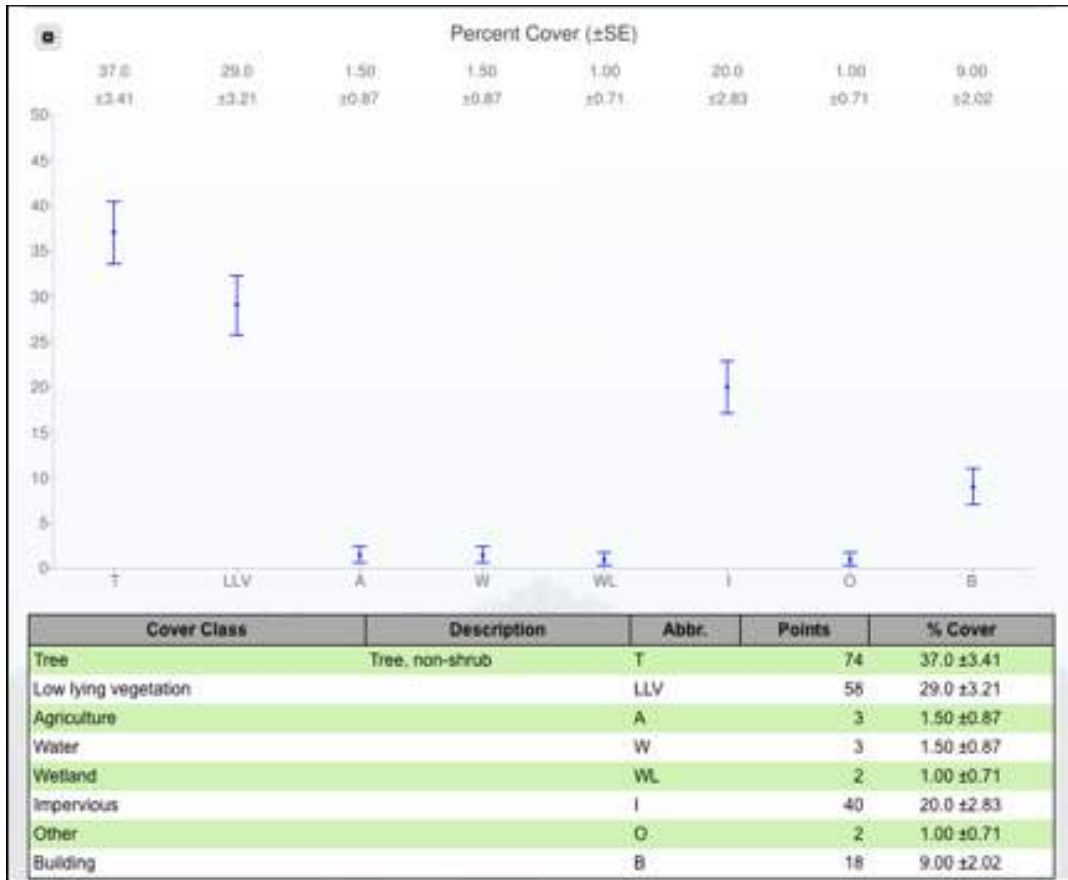


Figure 14. i-Tree Canopy assessment for the inventory area of Lyndonville, Vermont, including both public and private land. The above image shows the ground cover composition distribution.

Figure 15 (below) compliments the i-Tree Streets analysis of the monetary value of benefits provided by Lyndonville’s public trees by estimating the air quality benefits and corresponding monetary value of the full community forest canopy. Of note is an estimated \$615,829 in CO₂ storage and \$24,422 in annual CO₂ sequestration value.

Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$5.18	±0.48	122.08 lb	±11.26
NO2	Nitrogen Dioxide removed annually	\$8.91	±0.82	665.68 lb	±61.42
O3	Ozone removed annually	\$463.99	±42.81	3.31 T	±0.31
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$959.15	±88.50	322.16 lb	±29.72
SO2	Sulfur Dioxide removed annually	\$1.56	±0.14	419.49 lb	±38.71
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$336.84	±31.08	1.11 T	±0.10
CO2seq	Carbon Dioxide sequestered annually in trees	\$24,422.06	±2,253.39	674.98 T	±62.28
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$615,829.98	±56,821.83	17,018.23 T	±1,570.25

Figure 15. i-Tree Canopy assessment estimates of air quality benefits provided by public and private trees in the area of the Lyndonville public tree inventory.

Discussion and Recommendations

Lyndonville's Public Tree Program

Lyndonville's participation in the *Care of the Urban Forest* demonstrates that there is local capacity and desire to enhance the community's public tree program. It is evident that there are residents and Town leadership who are passionate about trees, acknowledge the loss and noticeable absence of a shaded canopy in the village, and are eager to revitalize the community forest. The 2015 public tree inventory and this report lay a foundation for better understanding the management needs and value of Lyndonville's public trees, as well as the ways in which residents and Town leadership can be engaged for tree stewardship.

Recommendations

We recommend that Town of Lyndon leadership consider the following points to continue to develop its public tree program, particularly in the Village of Lyndonville:

- Develop a public tree management plan or action plan based on this inventory report to prioritize goals and establish a timeline for Lyndonville's public tree program.
- Form a Lyndonville Tree Committee or Board to coordinate and implement the Town's tree program
- Advocate for an explicit and regular annual budget for maintenance, planting, and removal of Lyndonville's 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 (less so) *Fraxinus* (ash) genera, residents should be aware of the signs and symptoms of the Asian long horned beetle (ALB) and emerald ash borer (EAB), and empowered to monitor for these invasive forest pests.
- Plan for the arrival of EAB by developing a community invasive forest pest preparedness plan; this process will inform future planning efforts for other threats to the community forest.

- Ensure that those who are caring for Lyndonville’s public trees are trained in best tree care practices, particularly focused on proper pruning and mulching. All 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 about the benefits of Lyndonville’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, our winter webinar series, the annual VT Tree Stewards Conference, and the Forest Pest First Detector trainings.
- Encourage residents and local businesses to plant trees on their private property to increase diversity, overall canopy cover, and the benefits provided by trees in Lyndonville.

Community Forest Diversity and Structure

An important best management practice in 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 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 Lyndonville, 36 species and 20 genera are represented as public trees, indicating diversity in the community forest. A third of the public trees are of species that represent less than 3% of

the total tree population. Over a third (36%) of public trees inventoried is in the maple (*Acer*) genus, which is over the recommended representation within the public tree population. Sugar maple and red maple comprise 21% and 8% of *Acer* species diversity, respectively. Sugar maple is the most prevalent species in Lyndonville, and its composition is more than double the recommended representation within the public tree population. Ash trees (*Fraxinus*) comprise 4% of Lyndonville'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. High-density stands of maples were observed in Lyndonville's greenspaces, such as Veterans Park, Bandstand Park, and South Street Park during the inventory. Most of the ash trees inventoried in Lyndonville are located on Main Street.

85% of the inventoried public trees are 0-18" in diameter, indicating an overwhelmingly young tree population. The context of Lyndonville's public tree history of tree removal due to Dutch elm disease,

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 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 a community 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.

utility line interference, new development, and a lack of proper maintenance, informs the absence of large, mature shade trees; those that do exist in town are concentrated near the heart – and oldest part – of the village. Sugar maples represent a significant portion of the public trees over 18” in diameter, indicating that these were likely planted in public spaces without interference of utility lines and development and were likely planted long before the current era of citizen and Town leadership interest in Lyndonville’s community forest.

Recommendations:

We recommend that Lyndonville 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 Lyndonville’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 maple (*Acer*) trees in Lyndonville, 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 list of 41 identified potential tree planting locations (“vacant” spots) within the public ROW in Appendix A to strategically increase tree species and structural diversity in Lyndonville.
- Invest efforts in planting new trees, and as these mature, promote their health with a systematic structural pruning and maintenance cycle.
- Preserve existing mature shade trees in Lyndonville with special attention and targeted maintenance for the few large diameter trees.

Community Forest Health

Overall, Lyndonville appears to have a healthy population of public trees; a dedicated tree care budget and established maintenance program would further increase the health of the community forest. Approximately 36% (89) of Lyndonville’s public trees were either considered to be in “Fair” or “Poor” condition and 3 trees were designated as “Dead”. There are high

concentrations of “Fair”, “Poor”, and “Dead” trees in Lyndonville’s inventoried greenspaces, such as the South Street Park, Bandstand Park, and Veterans Park. 77 trees were flagged to be revisited by a Certified Arborist, the Lyndon 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 or other infrastructure. Some trees, however, might require monitoring as a result of the need for pruning, staking, and/or mulching, and/or require removing stakes or mulch (Figure 8). See Appendix E for a map detailing the locations of trees in Lyndonville by condition and a map indicating the location of the 77 trees requiring monitoring. Low soil volume and fertility, soil compaction, exposure to road salt spray, root damage, mechanical damage to the stem, 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 77 trees requiring monitoring will be given to Lyndon’s Zoning Administrator and Planning Director; some recurring themes from these comments are presented in the recommendations below.

Recommendations:

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

- Prioritize the monitoring of the 77 trees (which include the 3 dead trees) that have been flagged for monitoring by a Certified Arborist, the Lyndon Tree Warden, or another qualified individual.
- Develop a plan to remove – and replace, if appropriate – the 3 dead public trees in a timely fashion.
- Encourage a culture of continual monitoring and updating the tree inventory spreadsheet as necessary as regular tree maintenance occurs in Lyndonville. Consider assigning one Town of Lyndon staff member the responsibility of maintaining the inventory data and maintenance records.
- Remove the mulch from the 81 trees assessed as require mulch removal as soon as possible. The mulch around the base of the trees planted in all of Lyndonville’s parks is

mounded too high – volcano mulched – and should be addressed. Mulch provides many benefits to trees, particularly as they establish after planting. 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. Volcano mulching (mounding mulch thickly and against the trunk) promotes rot, making the trunk susceptible to insect 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. Conversely, the 14 trees assessed to be in need of mulch (exposed roots, mechanical damage, young and struggling trees) should be addressed in a timely fashion.

- A significant portion (108) of Lyndonville’s public trees were assessed to be in need of pruning, and should be addressed as soon as possible.

Assessment Tools

Using free and accessible i-Tree software developed by the USDA Forest Service, we were able to assess the benefits, value, and extent of Lyndonville’s community tree canopy. i-Tree Streets allowed us to determine the economic value of the ecosystem services provided by the 244 inventoried trees in Lyndonville. The Village’s forest generates about \$17,000 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 \$70 in service or savings every year. The trees of Lyndonville 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. 1991²). 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.

² 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.

For example, hospital patients with window views of trees have been shown to recover faster than patients without such views (Ulrich 1984³).

- **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 2002⁴). 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. With a current overall canopy of 37% and 51% of land area that could potentially be converted to tree cover (and benefit from the many values that would provide), Town of Lyndon leadership should consider ways to increase canopy cover in the community forest.

³ Ulrich, R.S. (1984). View through a window may influence recovery from surgery. *Science*, 224:420-421.

⁴ 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 Lyndonville 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 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 is one component of a long-term effort by the Town of Lyndon to understand, manage, and steward its community 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 Town of Lyndon leadership based on long-term vision and capacity. Looking ahead, efforts in Lyndonville should be focused on investing in maintenance of existing trees to ensure they reach maturity, while continuing to plant new trees of diverse species. With improved monitoring, regular maintenance, and an engaged and informed citizenry, the potential for a healthy, sustainable community forest is attainable.

Appendices

Appendix A: Full Street and Site List of Lyndonville's Public Tree Inventory

Street/site name	ROW Extent (feet)	Number of trees	Number of vacant spots or strips
Alpine Street	37.5	4	0
Auburn Street	37.5	1	1
Broad Street	70	2	0
Center Street	68	7	2
Charland Street	37.5	0	6
Charles Street	49	9	0
Chase Street	30	0	1
Church Street	70	3	0
Depot Street	70	8	0
East Street	52	18	0
Elm Street	65	5	0
Essex Street	37.5	1	4
Grove Street	60	1	0
High Street	37.5	19	1
Hill Street	37.5	0	1
Main Street	70	17	1
Middle Street	70	5	0
North Prospect Street	52	3	0
Park Avenue	70	17	1
Pinehurst Avenue	52	28	6
Raymond Street	52	1	0
Rod Key Street	37.5	8	6
South Prospect Street	52	3	0
Skyline Drive	37.5	1	0
South Street	49	3	0
Westview Street	37.5	2	8
Williams Street	30	4	1
Greenspaces: Veterans Park, Norris Park, South Street Park, Bandstand Park, Pudding Hill Open Space, Lyndon Town Offices, Memorial Park	N/A	74	2
The following streets and sites were inventoried and had zero trees located within its public ROW: Lyndonville Fire Department, Maple Street, Tulip Street, Eastern Avenue, Shonyo Lane.			

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

Common name	Scientific name	Number of trees	Percent of population
sugar maple	<i>Acer saccharum</i>	52	21.31%
crabapple	<i>Malus sp.</i>	38	15.57%
red maple	<i>Acer rubrum</i>	18	7.38%
eastern white cedar	<i>Thuja occidentalis</i>	11	4.51%
blue spruce	<i>Picea pungens</i>	9	3.69%
green ash	<i>Fraxinus pennsylvanica</i>	9	3.69%
Japanese tree lilac	<i>Syringa reticulata</i>	9	3.69%
white spruce	<i>Picea glauca</i>	9	3.69%
northern red oak	<i>Quercus rubra</i>	8	3.28%
cherry plum	<i>Prunus species</i>	7	2.87%
American elm	<i>Ulmus americana</i>	6	2.46%
boxelder	<i>Acer negundo</i>	6	2.46%
silver maple	<i>Acer saccharinum</i>	6	2.46%
littleleaf linden	<i>Tilia cordata</i>	5	2.05%
Norway maple	<i>Acer platanoides</i>	5	2.05%
paper birch	<i>Betula papyrifera</i>	5	2.05%
American basswood	<i>Tilia americana</i>	4	1.64%
birch	<i>Betula sp.</i>	4	1.64%
eastern white pine	<i>Pinus strobus</i>	3	1.23%
oak	<i>Quercus sp.</i>	3	1.23%
yew	<i>Taxus sp.</i>	3	1.23%
bigtooth aspen	<i>Populus grandifolia</i>	2	0.82%
black cherry	<i>Prunus serotina</i>	2	0.82%
black locust	<i>Robinia pseudoacacia</i>	2	0.82%
black spruce	<i>Picea mariana</i>	2	0.82%
broadleaf deciduous medium	N/A	1	0.82%
Euonymus	<i>Euonymus sp.</i>	1	0.82%
lilac	<i>Syringa vulgaris</i>	1	0.82%
pine	<i>Pinus sp.</i>	1	0.82%
spruce	<i>Picea sp.</i>	1	0.82%
balsam fir	<i>Abies balsamea</i>	1	0.41%
bur oak	<i>Quercus macrocarpa</i>	1	0.41%
dogwood	<i>Cornus sp.</i>	1	0.41%
grey birch	<i>Betula populifolia</i>	1	0.41%
juniper	<i>Juniperus sp.</i>	1	0.41%
yellow birch	<i>Betula alleghaniensis</i>	1	0.41%

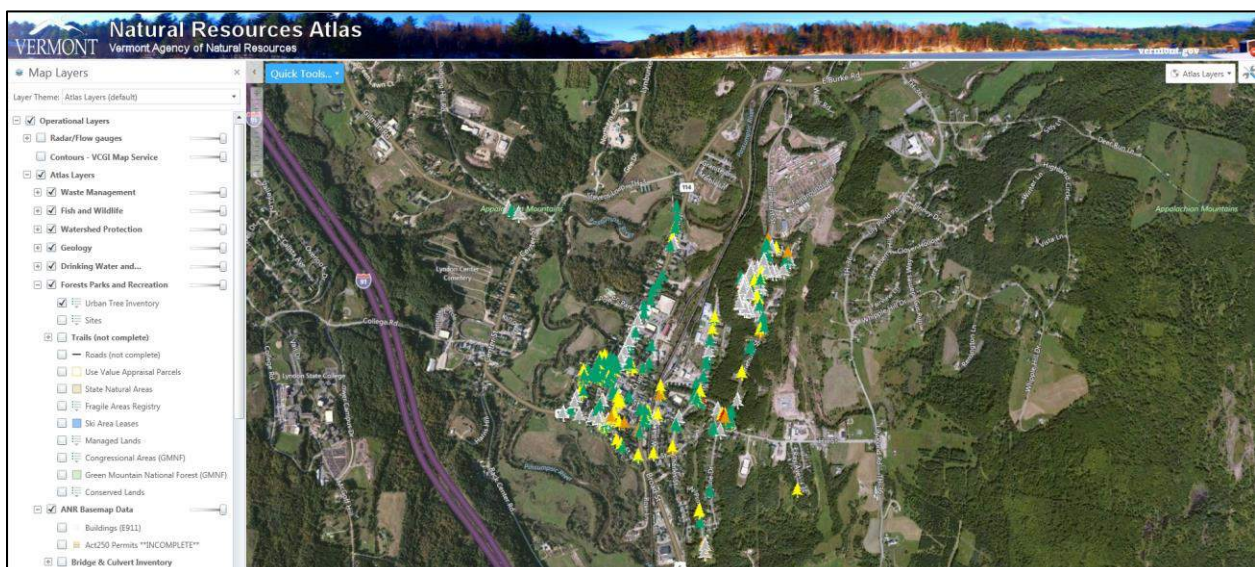
Appendix C: Leaf Area and Canopy Cover by Species Comprising Lyndonville's Community Forest

Species	Number of Trees	% of Total Trees	Leaf Area (ft ²)	% of Total Leaf Area	Canopy Cover (ft ²)	% of Total Canopy Cover
Sugar maple	52	21.31	145,522.95	35.52	37,698.53	28.49
Apple	38	15.57	21,028.29	5.13	10,325.75	7.80
Red maple	18	7.38	37,194.41	9.08	10,445.03	7.89
Northern white cedar	11	4.51	1,873.93	0.46	1,427.21	1.08
Japanese tree lilac	11	4.51	1,077.42	0.26	714.36	0.54
White spruce	9	3.69	6,182.13	1.51	2,318.99	1.75
Green ash	9	3.69	18,384.53	4.49	6,759.74	5.11
Blue spruce	9	3.69	12,894.36	3.15	5,357.07	4.05
Northern red oak	8	3.28	30,979.41	7.56	11,901.66	9.00
Cherry plum	7	2.87	2,787.54	0.68	1,709.11	1.29
American elm	6	2.46	11,785.87	2.88	3,148.76	2.38
Boxelder	6	2.46	4,174.46	1.02	2,314.89	1.75
Silver maple	6	2.46	37,296.24	9.10	10,169.07	7.69
Paper birch	6	2.46	7,655.13	1.87	2,627.98	1.99
Littleleaf linden	5	2.05	5,186.23	1.27	1,801.14	1.36
Norway maple	5	2.05	3,300.84	0.81	1,786.67	1.35
American basswood	4	1.64	5,233.58	1.28	1,836.73	1.39
Birch	4	1.64	14,390.85	3.51	4,439.37	3.36
Yew	3	1.23	484.25	0.12	143.44	0.11
Eastern white pine	3	1.23	7,909.04	1.93	3,394.89	2.57
Oak	3	1.23	5,228.90	1.28	1,718.77	1.30
Black locust	2	0.82	2,882.05	0.70	1,110.11	0.84
BDL OTHER	2	0.82	4,558.39	1.11	1,665.66	1.26
Black spruce	2	0.82	1,835.61	0.45	664.87	0.50
Spruce	2	0.82	5,272.69	1.29	2,263.26	1.71
BDS OTHER	2	0.82	118.97	0.03	67.96	0.05
BDM OTHER	2	0.82	1,590.21	0.39	273.49	0.21
Bigtooth aspen	2	0.82	8,483.60	2.07	2,787.62	2.11
Pine	2	0.82	1,738.21	0.42	724.77	0.55
Dogwood	1	0.41	59.49	0.01	33.98	0.03
Balsam fir	1	0.41	419.14	0.10	98.23	0.07
Gray birch	1	0.41	795.10	0.19	136.74	0.10
Bur oak	1	0.41	1,318.10	0.32	420.58	0.32
CEM OTHER	1	0.41	8.44	0.00	22.28	0.02
Total	244	100.00	409,650.36	100.00	132,308.71	100.00

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

Anyone with Internet access can view all of the inventoried Lyndonville 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" in your web browser).
2. Zoom in to Lyndonville 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 village 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

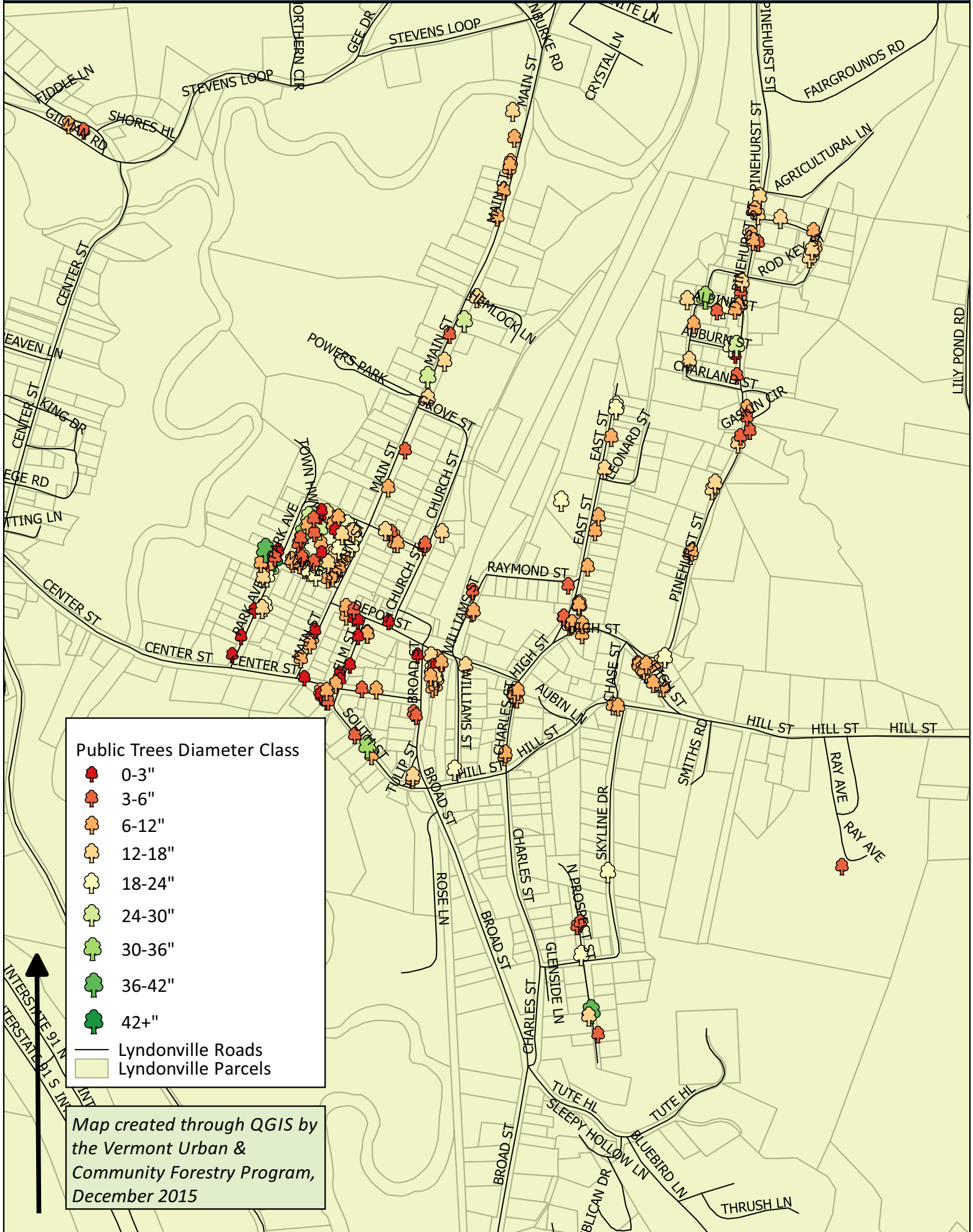
1. All Public Trees Inventoried in Lyndonville
2. All Public Trees Inventoried in Lyndonville by Diameter Class
3. All Public Trees Inventoried in Lyndonville by Condition Class
4. All Public Trees Inventoried in Lyndonville that should be Monitored
5. All Public Ash Trees in Lyndonville
6. Potential Public Tree Planting Locations in Lyndonville

Lyndonville Public Trees












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

Lyndonville Public Trees by Diameter Class



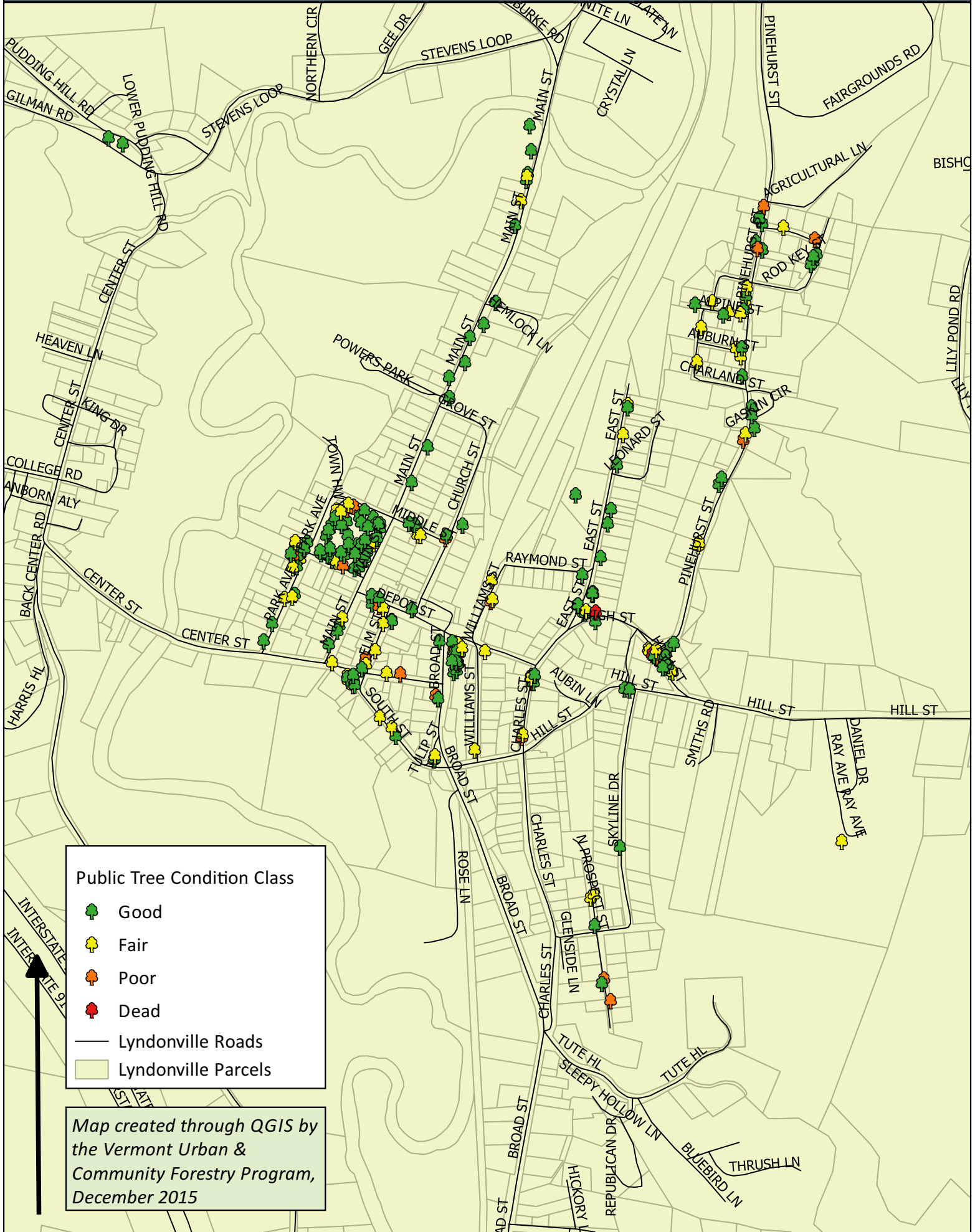
Public Trees Diameter Class

-  0-3"
-  3-6"
-  6-12"
-  12-18"
-  18-24"
-  24-30"
-  30-36"
-  36-42"
-  42+"

— Lyndonville Roads
 □ Lyndonville Parcels

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

Lyndonville Public Trees by Condition Class

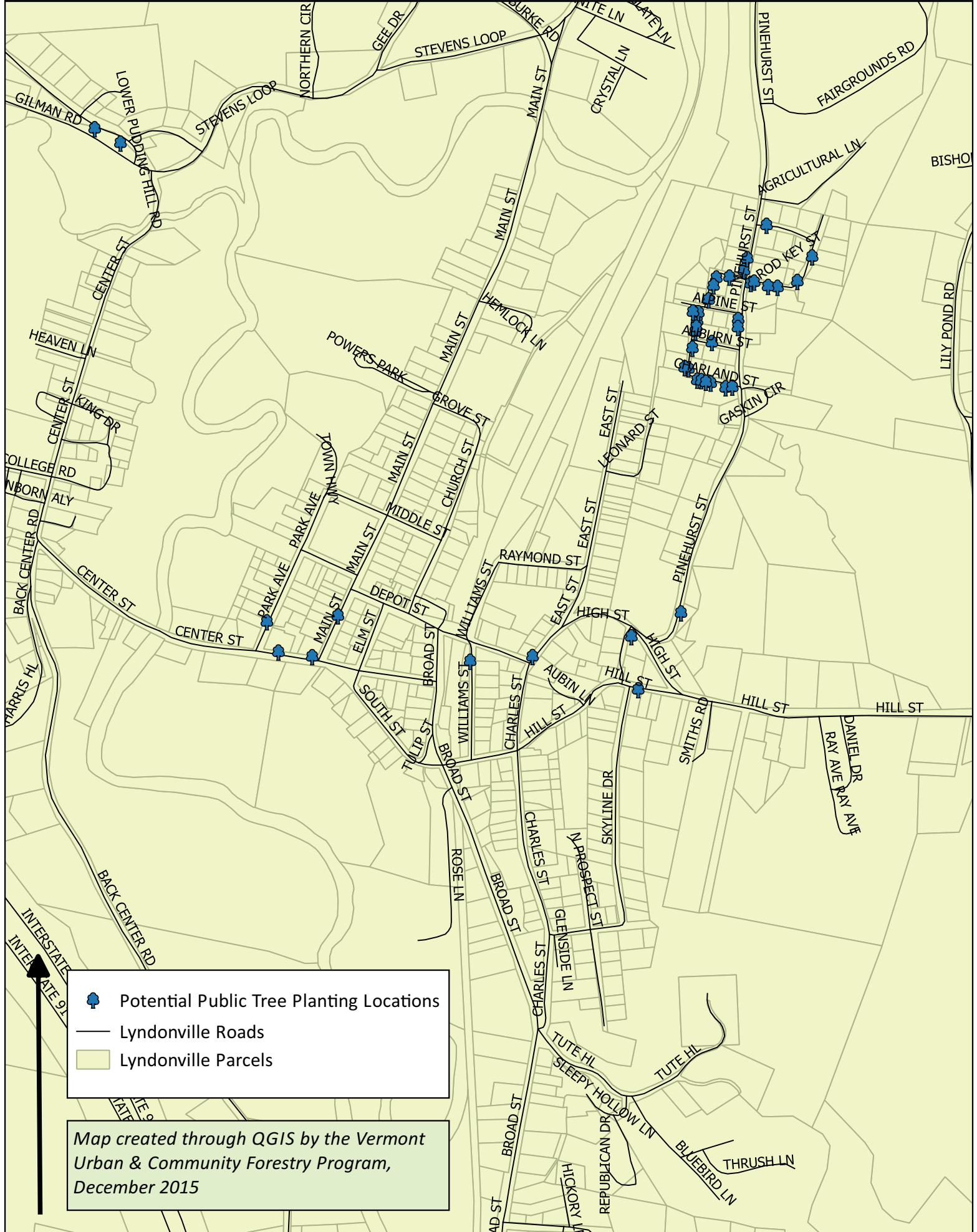


Public Tree Condition Class

- Good
- Fair
- Poor
- Dead
- Lyndonville Roads
- Lyndonville Parcels

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

Potential Public Tree Planting Locations in Lyndonville



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