

# Winooski Public Tree Inventory Report

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*Understanding the Results of the City's Public Tree, Conducted in 2013  
Vermont Urban and Community Forestry Program  
March 05, 2015*

## Acknowledgements

This report was created by the Vermont Urban & Community Forestry Program based on work done for the City of Winooski, Vermont during the summer of 2013. We would like to thank the Sadie Deforge, a seasonal employee for Winooski's Department of Public Works, for conducting the public tree inventory being reported. We extend gratitude to Peter Wernsdorfer, the director of the Public Works Departments in the City of Winooski for his help in planning and designing the public tree inventory project.

VT UCF is also grateful to the University of Vermont's Rubenstein School of Environment and Natural Resources (RSENR), particularly Kimbery Wallin, Ph.D. for conducting an inventory assessing the health and vigor of the City of Winooski's downtown ash and maple trees.

## About the Vermont Urban and Community Forestry Program

The field of forestry management is not confined to the natural areas and forests of Vermont, but extends to the urban and rural spaces where trees play important roles. The trees in public parks, along roadsides, town greens, and municipal forests compose our urban and community forests and merit careful stewardship. The Vermont Urban & Community Forestry (VT UCF) program is a collaborative effort between the Department of Forests, Parks, & Recreation, the University of Vermont Extension, and the USDA Forest Service. The program provides technical and financial assistance as well as educational programs and products 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, tree boards, regional officials, and state agencies.

The trees in our communities offer a wide variety of environmental, social, and economic benefits to the surrounding community, including stormwater control, CO<sub>2</sub> sequestration, and aesthetic value. VT UCF seeks to maximize these benefits by stewarding the urban forest's ecological integrity and diversity. The program assists communities with planning, planting, and caring for their community forests. With more than \$1,000,000 in competitive grants, the program has provided assistance to over 150 Vermont communities. The program also provides local training and workshops, educational brochures, and newsletters for the public. All the material and assistance provided by the program is designed to further their mission of enhancing local communities across Vermont.

## Table of Contents

Acknowledgements.....	2
About the Vermont Urban and Community Forestry Program .....	2
Introduction .....	5
Project Description .....	5
Winooski’s Urban Forest: At a Glance .....	6
Executive Summary.....	6
Summary of findings .....	7
Forest Diversity .....	7
Forest structure .....	9
Forest Cover .....	11
Forest health .....	12
Summary of recommendations .....	14
Components of a Healthy Ecosystem .....	15
Maintenance .....	17
Urban Forest Health.....	18
Assessment Tools.....	19
Conclusion.....	20
Appendix A: Complete List of Inventoried Genera and Species .....	22

# Introduction

## Project Description

VT UCF currently has a grant from the USDA Forest Service to assist twenty priority communities in Vermont in moving their forestry programs forward. The project, *Care of the Urban Forest*, is a multi-year effort that aims to support these communities in three specific ways: (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 master plan) using information from the inventory; and (3) providing technical training for volunteers and town employees to promote the proper care and management of public trees.

In recent years, The City of Winooski has made efforts better understand its' urban forest. The City hopes and expects that a better understanding of its urban forest can inform strategic maintenance, management, and community involvement.

This report includes the results from two public tree inventories conducted in Winooski, Vermont. Winooski's first urban forest inventory was conducted in the summer of 2013 and was arranged by the City's Department of Public Works and VT UCF. The public tree inventory documented the location, size, species composition, and condition of trees planted within the public right-of-way (ROW) and on town-owned land within the most populated residential areas of Winooski. Another inventory was conducted in the spring of 2014 by faculty and students from the University of Vermont's Rubenstein School of Environment and Natural Resources (UVM's RSENR). This inventory assessed the health and vigor of ash and maple trees located within Winooski's public ROW. This inventory establishes a baseline for future inventories, management decisions, and improvements to Winooski's urban forest.

## Winooski Community Profile

The City of Winooski is in Chittenden County, Vermont. Located at the mouth of the Winooski River, as of the 2013 census the city population was 7,329. It is part of the Burlington-South Burlington, VT Metropolitan Area. The Burlington Mill Company's establishment in the 1830s has long influenced Winooski's economy. The failing Mill was purchased by the American Woolen

Company over a century ago, which eventually led to Winooski's incorporation as a city in 1922. Since the closing of the City's mills in the 1950s, Winooski's economy has shifted, and is consequently increasing commercial, office, and apartment space. With a land area of approximately 1.5 square miles, Winooski is a small city, and the growing population and economy has potential for strong impacts on its surrounding natural communities and urban forest.

### **The Importance of Tree Inventory**

An inventory of urban trees provides a record of the trees present in a community. An inventory can provide information about the species, size, health, and location of each tree and future management needs. This detailed information allows town planners to estimate the monetary contributions of their community's green infrastructure. In the event of a disease outbreak or insect infestation, data from an inventory may assist in monitoring and preventing the spread of a forest health epidemic. 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 (Morales 1973; 1983) 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. Reducing stormwater runoff and improving water quality is an urban forest benefit of special importance to Winooski due to its location on the Winooski River. 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 community and contribute to keeping our families healthier and our everyday lives more fulfilling.

## **Winooski's Urban Forest: At a Glance**

### **Executive Summary**

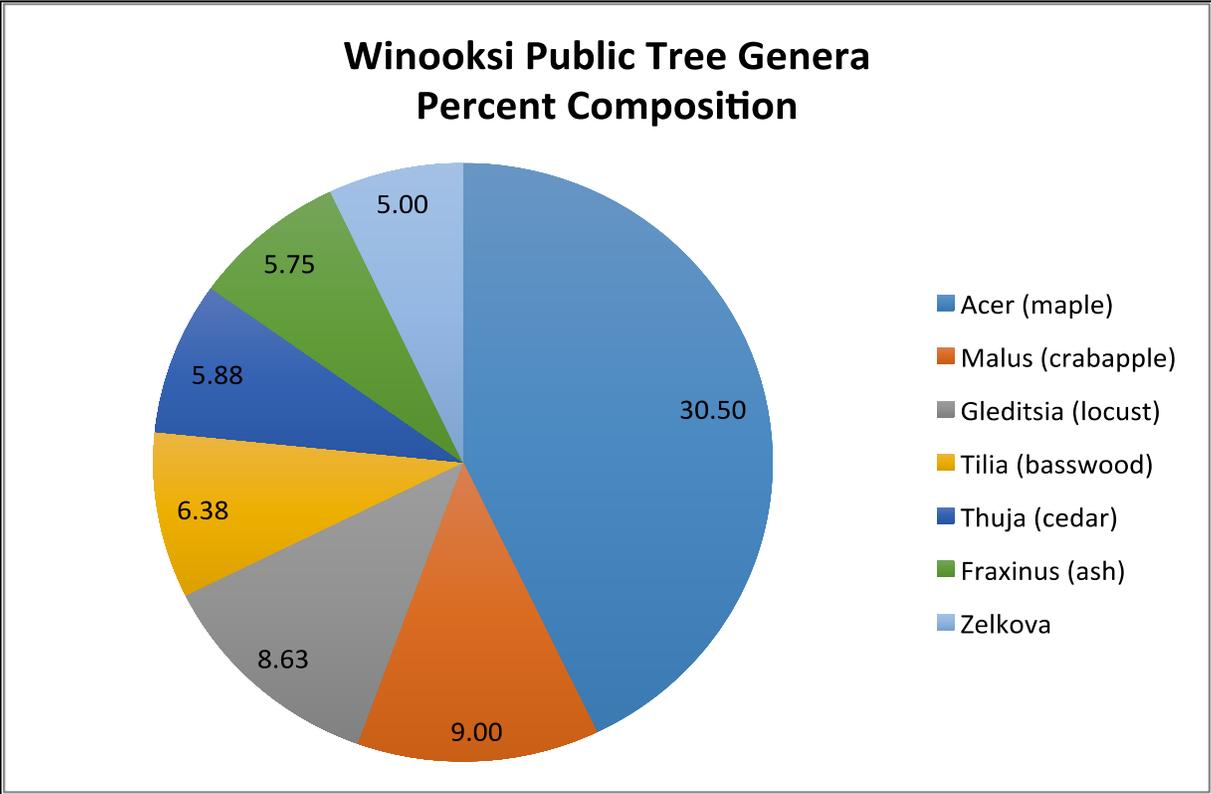
A seasonal employee in Winooski's Department of Public Works completed an inventory of **800 trees** located within the ROW of **45 streets** and on town-owned land. This inventory did not identify specific locations or strips of public land appropriate for future tree plantings. Staff from VT UCF provided technical assistance. This report was prepared in March of 2015 by a VT UCF intern, and was subsequently edited and supplemented by VT UCF program staff. It presents the results of this inventory, an ash and maple tree inventory conducted in 2014, a basic benefit assessment of the public trees in Winooski, and a UTC assessment of both private and public land within the inventory area.

Local government, conservation agencies, and private landowners all play an important role in monitoring and maintaining urban forests. Urban trees provide a number of benefits to a community, including reducing stormwater runoff, reducing air pollution, providing shade, sequestering carbon dioxide, enhancing property values, and improving the aesthetics of the community. The 800 inventoried public trees provide an estimated **\$66,309 in benefits annually** to Winooski residents. In addition to the public trees inventoried, a tree canopy assessment was completed for the full inventory area, which indicated **existing canopy cover of 31%** and a stored value carbon dioxide of over **\$771,000**.

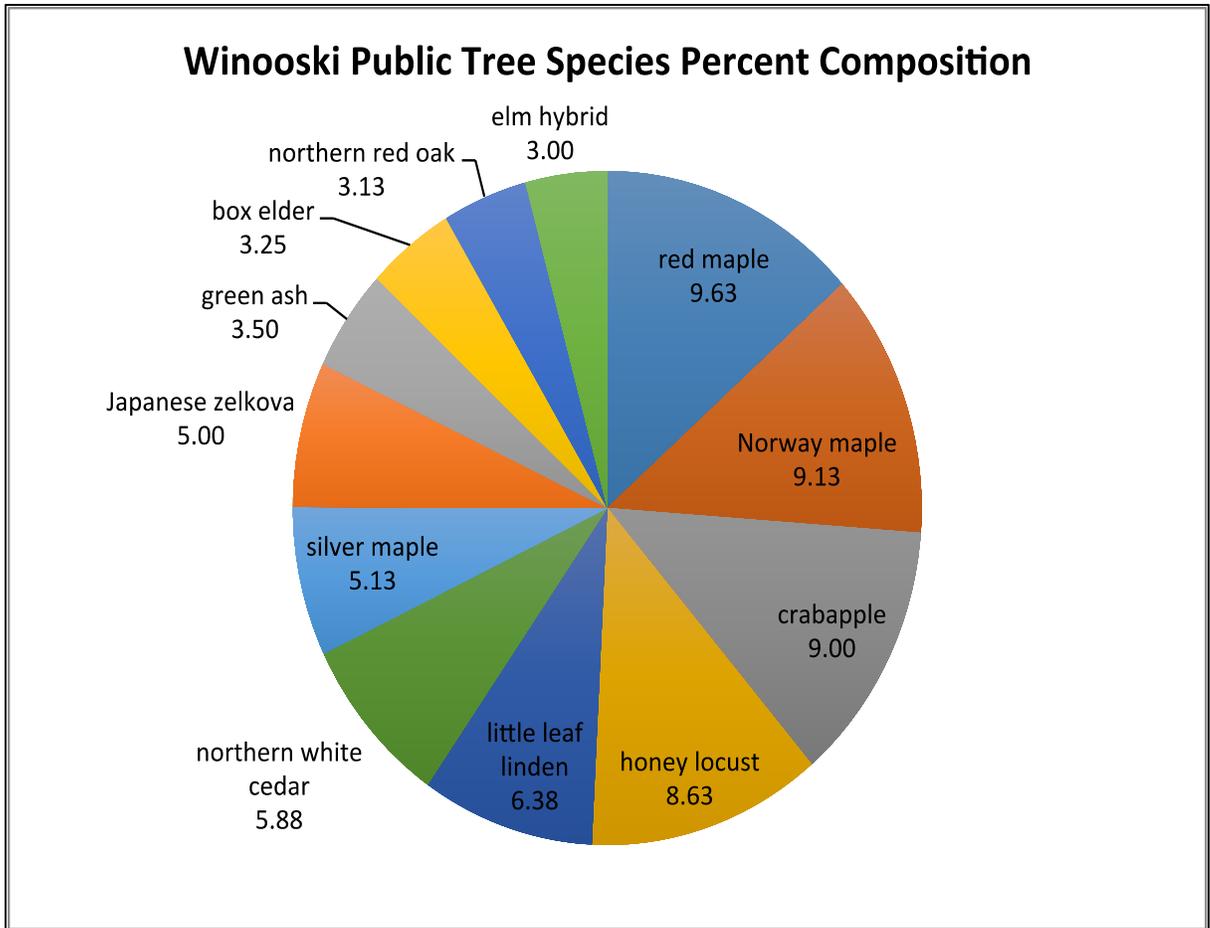
## Summary of findings

### Forest Diversity

- Of the 800 public trees, there are 42 different species in 27 different genera (see appendix B for the full lists).
- The top five most common tree genera: *Acer* (maple), *Malus* (crabapple), *Gleditsia* (locust), *Tilia* (basswood), and *Thuja* (cedar), comprise 60.38% of the urban forest (Figure 1).
- 36.25% of the trees are either *Acer* (ash) or *Fraxinus* (maple) (Figure 1). Both of these genera are currently threatened by invasive tree pests, the Asian longhorned beetle (ALB) and the emerald ash borer (EAB), respectively.
- The top five most common species: red maple (9.63%), Norway maple (9.13%), crabapple (9.00%), honey locust (8.63%), and little leaf linden (6.38%) comprise 42.75% of the stocking (Figure 2).



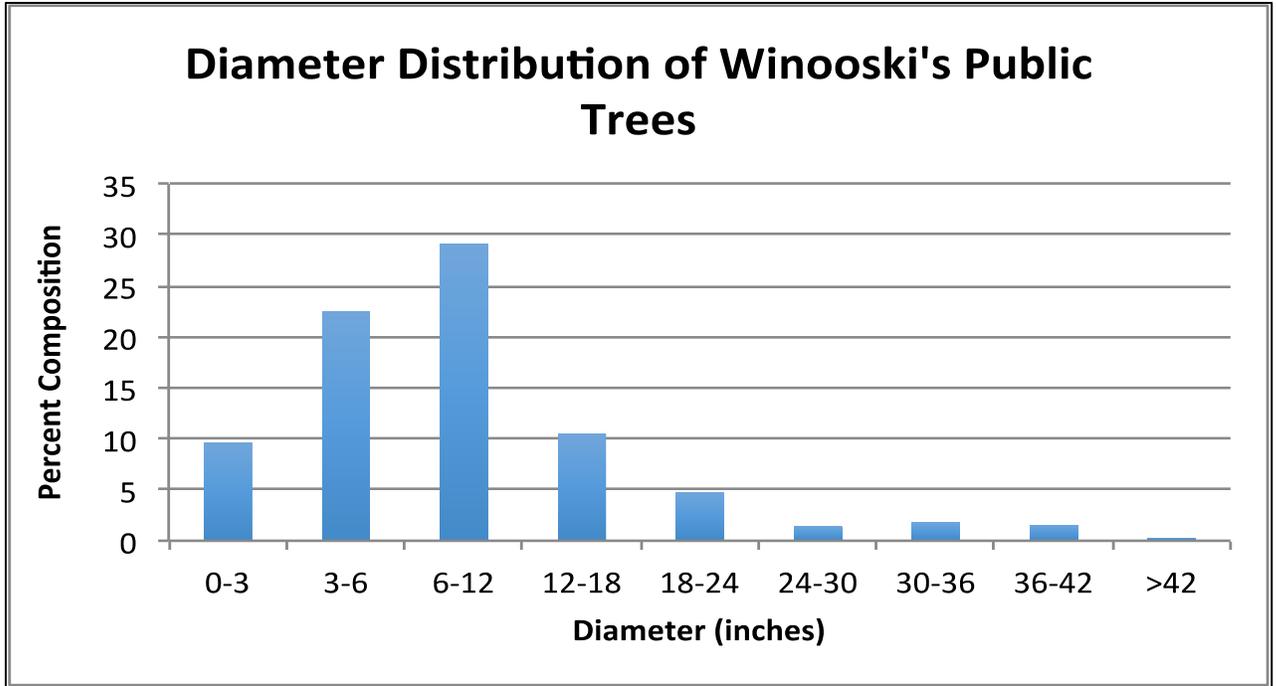
**Figure 1.** Percent composition of the most common genera present in Winooksi’s urban forest



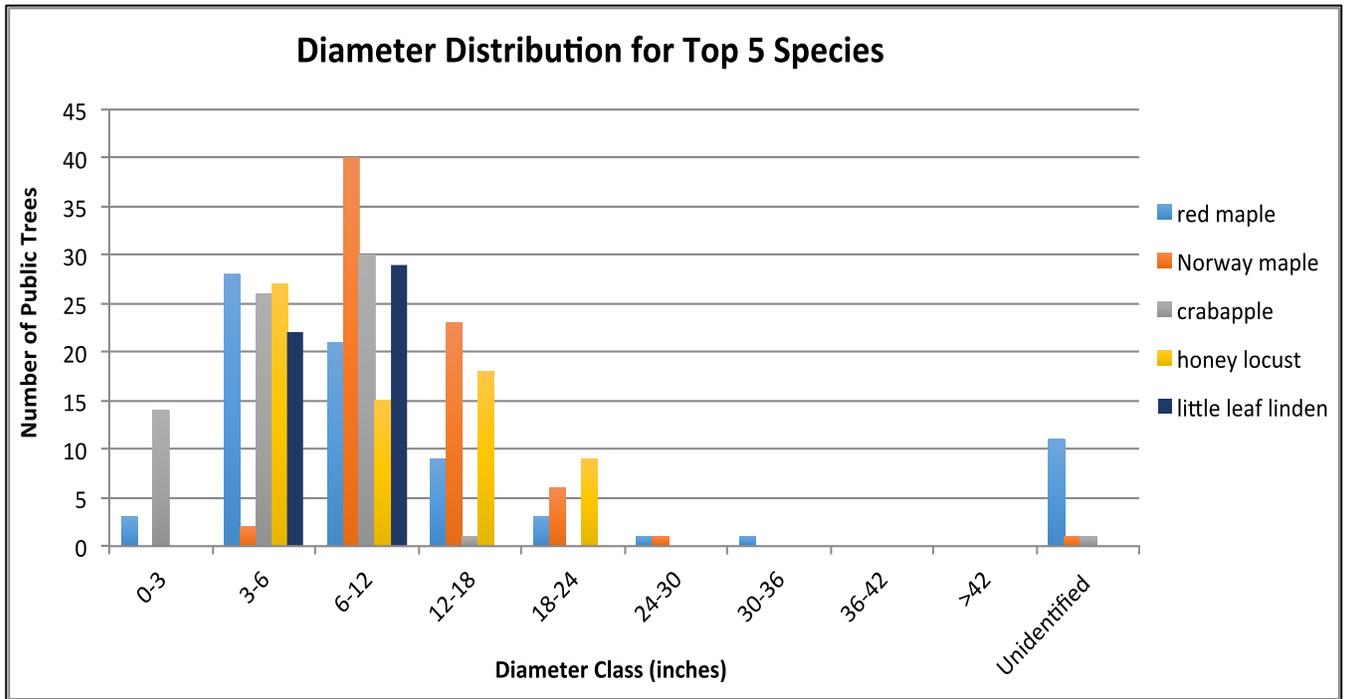
**Figure 2.** Percent composition of the most common species found in Winooski’s urban forest.

### Forest structure

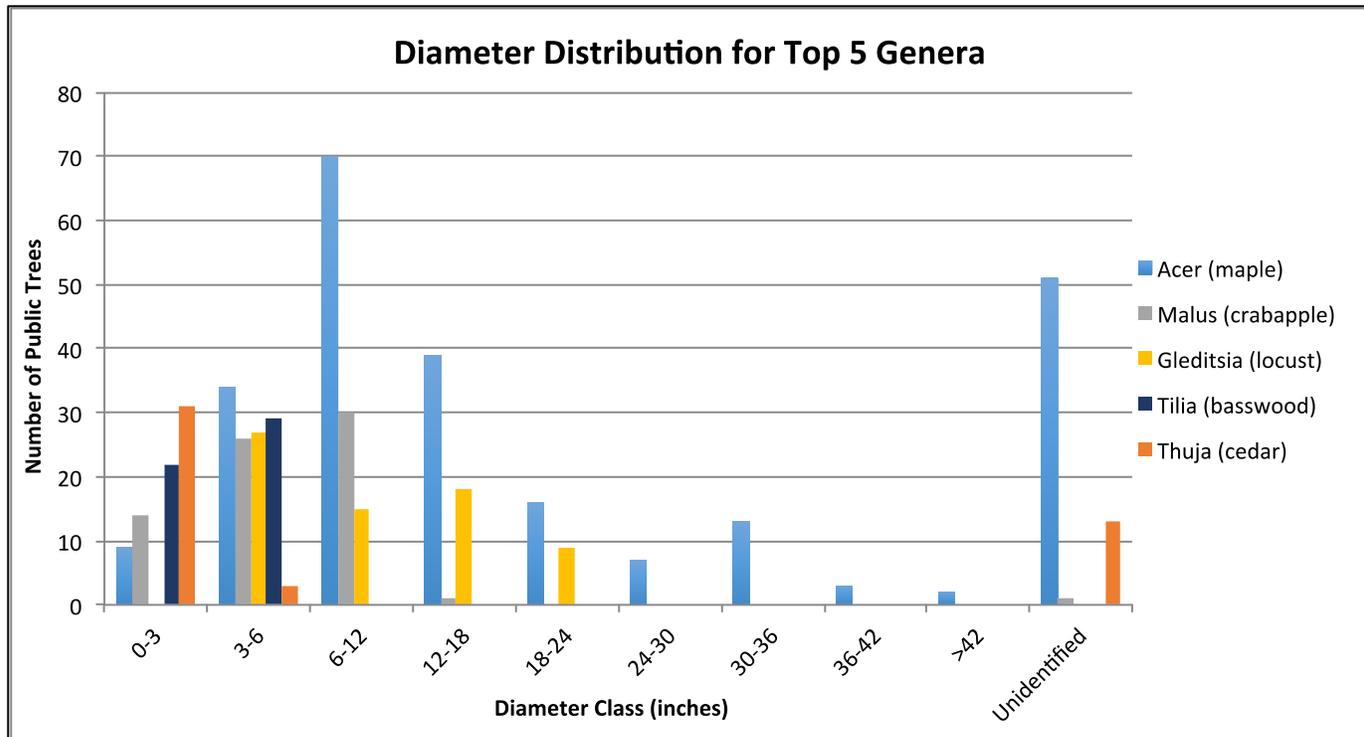
- The majority of trees (413 or 51.63%) have diameter measurements falling between 3-12 inches (Figure 3).
- 84 trees (10.50%) fall within the 12-18” diameter size class.
- 77 trees (9.63%) fall within the 0-3” diameter size class.
- The remaining 71 trees (9.63%) are greater than 18” in diameter.
- 154 inventoried trees (19.25%) have no assigned diameter classes.
- Canopy cover (public and private property) was assessed to be at approximately 31% (Figure 6).



**Figure 3.** Percent composition of all inventoried public tree's diameter class. Please note that 154 of the 800 inventoried public trees did not have a specified diameter class and are therefore not represented in this figure.



**Figure 4.** The number of trees within each diameter class for the five most common species in Winooski's urban forest. Please note 13 trees within the five most common species did not have specified diameter classes.



**Figure 5.** The number of trees within each diameter class for the five most common genera in Winooski’s urban forest. Please note 65 trees within the five most common genera did not have specified diameter classes.

### Forest Cover

- There is existing urban tree canopy (UTC) cover of 31% in the City of Winooski (Figure 6).
- Trees could potentially cover an additional 34.27% of the City’s land surface; these “possible UTC” areas include grass, agricultural land, and impervious surfaces (e.g. parking lots, paved playgrounds, and the ROW) (Figure 6).
- The remaining 34.20% of the City’s area is buildings, streets, water, and other permanent features that are generally unsuited to UTC improvement (Figure 6).

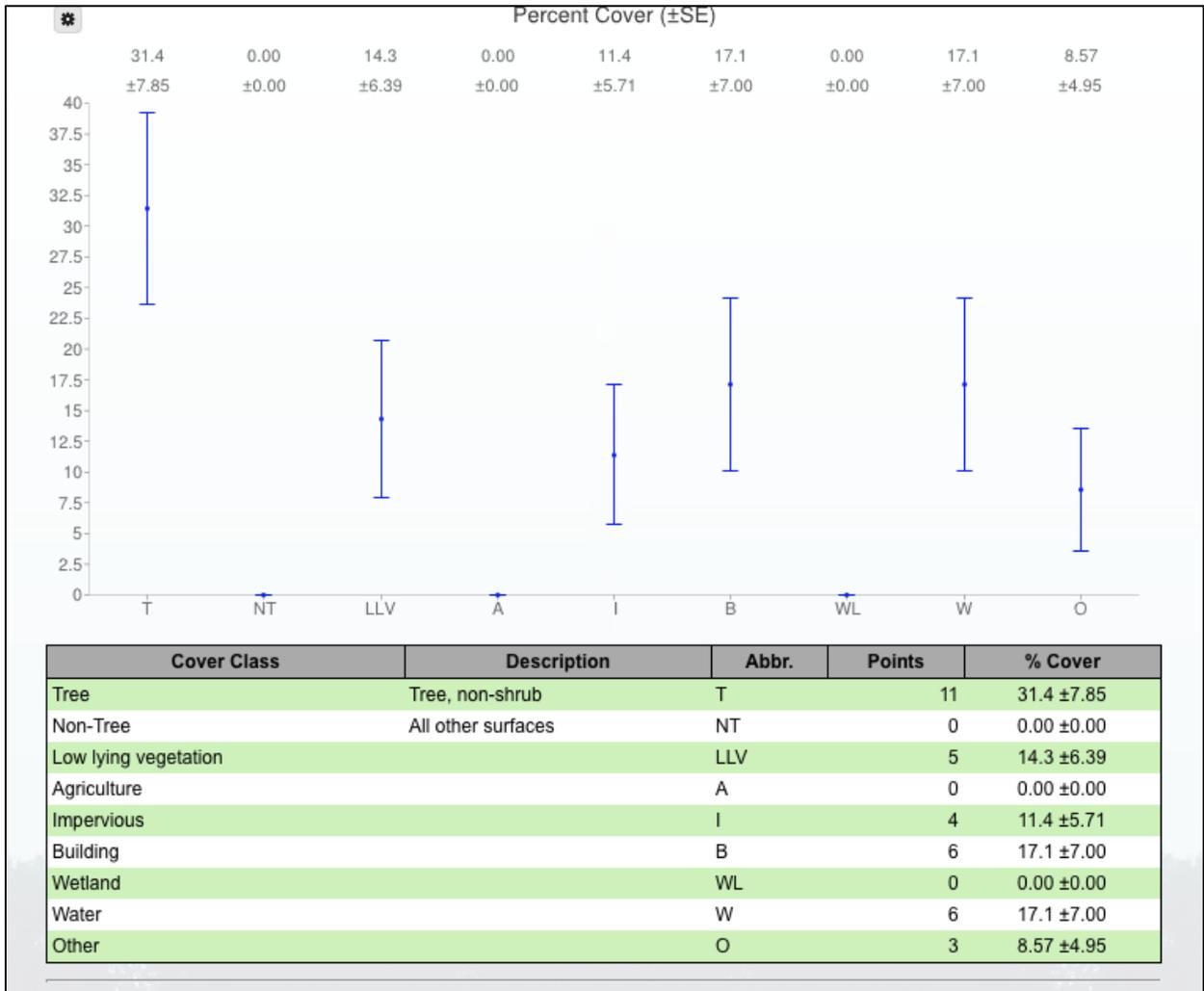
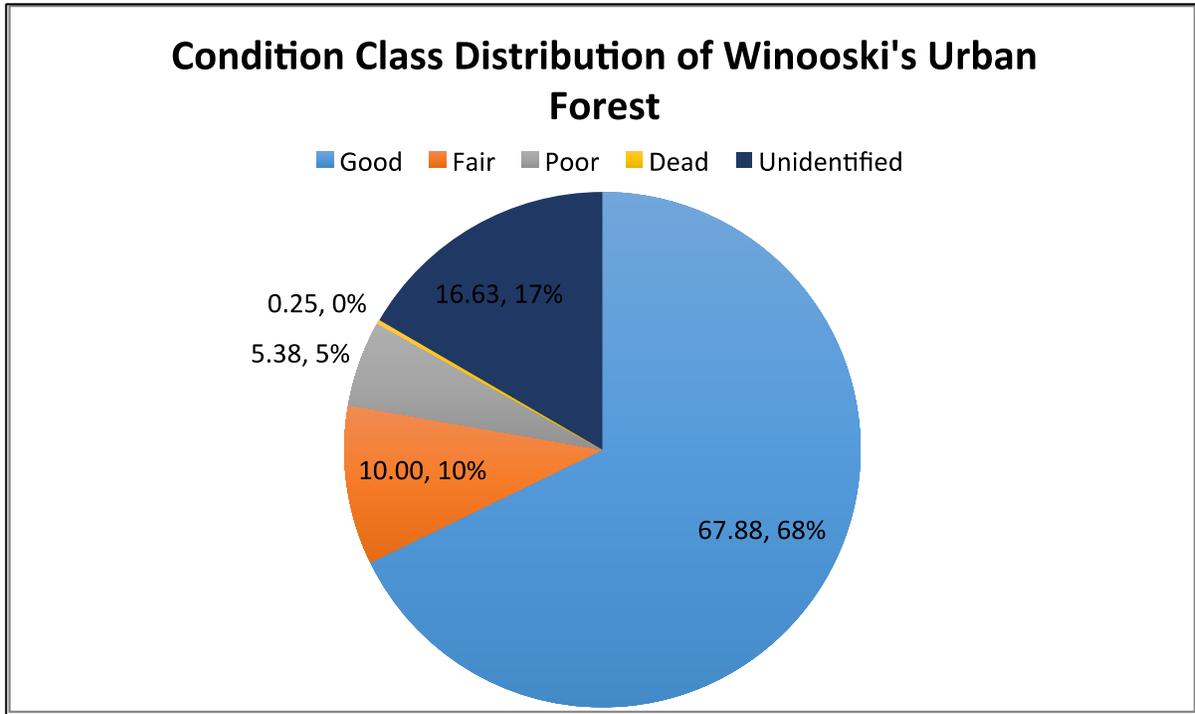


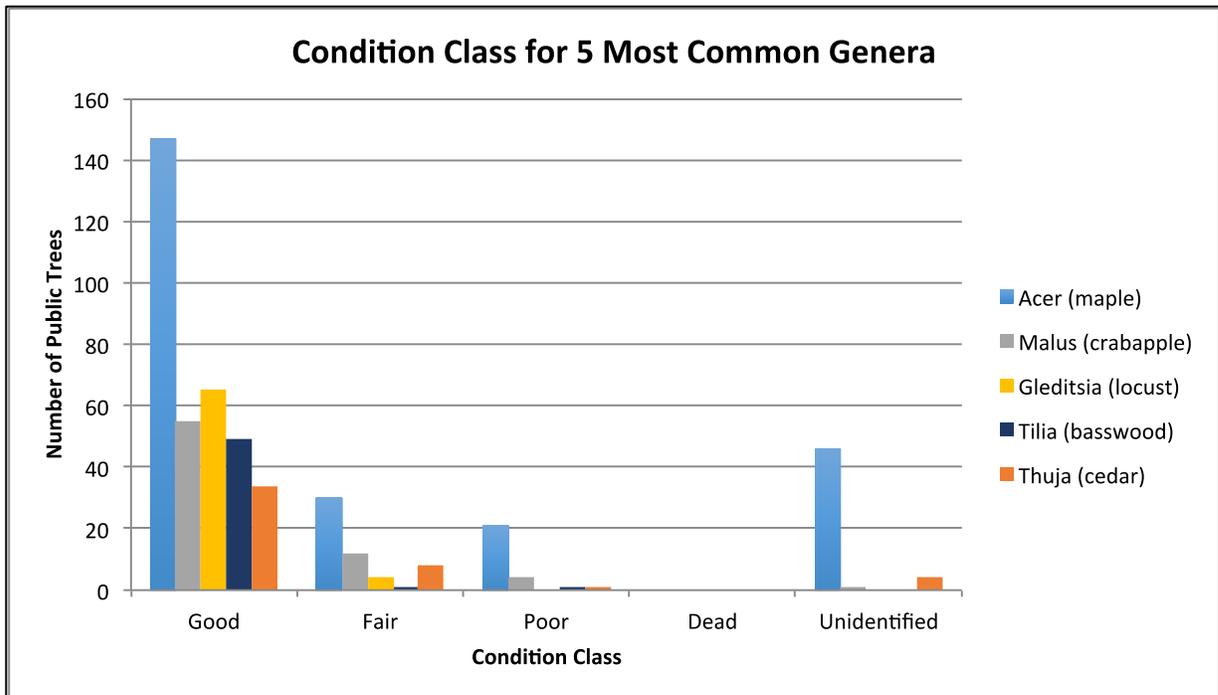
Figure 6. Urban Tree Canopy cover assessment created in iTree Canopy software.

### Forest health

- The majority (67.88%) of inventoried public trees was assessed as being in “Good” condition; of the remaining trees 123 were considered to be in “Fair” or “Poor” condition and only 2 were dead (Figure 7).
- 133 inventoried trees (16.63%) have no assigned condition class (Figure 7).
- 169 inventoried trees were flagged as in need of a future consultation.
- 134 trees’ need of consult was not specified.



**Figure 7.** Percent composition of all inventoried public trees within each condition class. The number located on the left represents the calculated percent composition, while the number to right represents the rounded percent value. Please note 133 of the 800 inventoried public trees had no specified condition class.



**Figure 8.** The number of public trees within each condition class. For the five most common genera present in Winooski's urban forest. Please note 51 of public trees inventoried within the five most common genera had no specified condition class.

## Summary of recommendations

We recommend that the City of Winooski complete their urban forest inventory. The City should prioritize collecting missing data within the 2013 inventory dataset. Specifically, a future inventory should identify diameter classes for the 154 inventoried trees with no assigned diameters, condition classes for the 133 inventoried trees with no assigned condition, flag any of the 134 inventoried trees unspecified as in need of consult, and inventory any 'vacant' locations or strips of land suitable for future tree plantings. Winooski should generally work to **increase the diversity** of tree species to ensure the long-term health of individual trees and the City's complete urban forest. Once 'vacant' locations are identified in Winooski's public ROW, plant a mix of species versus high-density stands of the same species, whose close proximity may be conducive to the spreading of disease and pests.

**Monitor** tree health, specifically for signs and symptoms of EAB, ALB, and other forest pests and diseases. (Refer to UVM's RSENr's Winooski Maple and Ash Tree Inventory Report in Appendix C).

**Maintain** tree health by ensuring that those caring for Winooski's public trees are trained in best tree care practices. Prune all public trees to promote long-term structural integrity, irrigate newly-planted trees, and prevent mechanical damage to trees.

**Plan** for the arrival of EAB by developing a community preparedness and response plan.

**Re-Inventory** the public trees with missing data.

**Inventory** the remaining public trees over time to develop a comprehensive record of Winooski's public trees.

**Establish** a routine systematic trimming cycle for all public trees to reduce future tree failures due to poor structure, minimize conflicts with people and infrastructure, improve lines of sight, reduce storm damage, and protect public safety.

**Develop** a comprehensive management and urban forest master plan based on this (and future) inventory report(s).

**Communicate** the benefits of Winooski's public trees at local events, increase local stewardship, and encourage participation in VT UCF educational programming such as the *Stewardship of the Urban Landscape* course and the *Forest Pest First Detectors* trainings.

# A Vibrant Urban Forestry Program

## Components of a Healthy Ecosystem

### 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: maples) in a tree population and no more than 10% of one species (for example: sugar maple). Resistance to disease and insect infestation is one of the many reasons that diversity within the urban forest is of paramount concern. A more diverse forest will be more resistant to environmental stressors, and therefore remain healthy and resilient in the face of change. Furthermore, by maintaining higher diversity a community can prevent a rapid loss of canopy due to insect and disease issues.

In Winooski, 30.50% of inventoried public trees were in the maple (*Acer*) genus, which is over ten percent greater than the recommended representation within the community's urban forest. Specifically, red maple, Norway maple, silver maple, boxelder, sugar maple, and striped maple represent 9.63%, 9.13%, 5.13%, 3.25%, 2.25%, and 1.13% of the *Acer*'s species diversity respectively. Norway maple is the second most prevalent species in Winooski, 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

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 community 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 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.

well as other invasive plant species. *Fraxinus* (ash) species comprise 5.75% of Winooski's public tree canopy. Invasive tree pests currently threaten both *Fraxinus* and *Acer* trees; the emerald ash borer (EAB) threatens the former and Asian longhorned beetle (ALB) threatens the latter.

In the spring of 2014, the University of Vermont's Rubenstein School of Environment and Natural Resources collaborated with the City of Winooski and VT UCF to conduct a forest ecosystem health report on the *Acer* (maple) and *Fraxinus* (ash) genera population within Winooski's public right-of-way. This report was conducted on a subset (189) of the earlier-inventoried (summer 2013) 290 public *Acer* and *Fraxinus* trees. The report concluded that Winooski's *Acer* and *Fraxinus* public trees are generally in good health. No significant signs of ALB or EAB were present, but routine surveys were recommended for the 16% of *Acer* and *Fraxinus* trees inventoried as in "Fair" or "Poor" condition. Approximately 36% of the 290 public *Acer* and *Fraxinus* trees inventoried in 2013 were reported to be in "Fair" or "Poor" condition, and although no signs of ALB or EAB were detected, their condition warrants future consults.

While neither of these pests has been discovered in Vermont, the largest ALB infestation in North America is a little over 50 miles 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.

**Recommendation:**

***Develop species, structural, and age diversity by planting new species and increasing the number of lesser represented species using best management practices in order to promote long-term health and resilience of individual trees and Winooski's urban forest.***

**Recommended action practices:**

- We advise against planting high-density stands of the same species (monocultures) whose close proximity may be conducive to the spreading of disease.
- We suggest planting tree species that have grown successfully in the area that do not show any signs of diseases and deformity, and that are not non-native invasive species (specifically Norway maple).

- Existing ash trees should be consulted and regularly monitored for signs of EAB, and the planting of additional ash trees should be limited.
- Plan for the arrival of EAB by using the Community Preparedness Toolbox, available at [www.vtinvasives.org/tree-pests/community-preparedness](http://www.vtinvasives.org/tree-pests/community-preparedness).
- Encourage Winooski citizens to participate in the Vermont Forest Pest First Detector Training to expand local capacity to identify and monitor for invasive forest pests.
- In planning for future tree plantings, consider obstructions above ground (power lines) and below ground, minimize grey infrastructure conflicts (sidewalks, streets, buildings, etc.) available soil volume, species mature size (height and spread), branching patterns, environmental tolerances (exposure, salt, and drought), and desired function when choosing species. For more information on site assessment and species selection, refer to the VT Tree Selection Guide available at [www.vtcommunityforestry.org](http://www.vtcommunityforestry.org).
- Encourage residents to plant trees on their properties to increase species diversity, age structure, and overall tree canopy benefits to the community.

## **Maintenance**

Proper tree maintenance, especially pruning, can extend the life and health of trees, as well as reduce public safety issues. There are four main pruning practices of note:

- Crown cleaning: removes dead, diseased, and damaged limbs
- Crown thinning: selective removal of stems and branches to increase light penetration and air movement throughout the crown of a tree
- Crown raising: the removal of lower branches over two inches in diameter to provide clearance for pedestrians and vehicles
- Crown reduction: removing individual limbs from structures or utility wires

In addition to pruning, proper and regular mulching for soil health, moisture retention, and to protect from mechanical damage is encouraged. Finally, for newly planted trees, an irrigation regime should be in place to ensure proper establishment and tree root regeneration.

### **Recommendation:**

***Establish a routine maintenance cycle, implemented by trained professionals and overseen by***

*the City of Winooski's Department of Public Works, for all public trees to promote tree health and reduce any threat to public safety.*

**Recommended action practices:**

- Complete a full inventory of all public trees in Winooski (resurvey inventoried trees with unidentified diameter and condition classes, identify 'vacant' or future planting locations) in order to establish a routine maintenance regime for all town-managed trees.
- Work with VT UCF to ensure municipal tree maintenance staff is trained in best management practices.
- Establish a systematic pruning cycle to reduce branch and tree failures due to poor structure, minimize conflicts with people and infrastructure, improve line of sight, and reduce storm damage. When trees are located near electrical utility lines, it is important to work directly with the local utility company.
- Encourage Winooski citizens to participate in VT UCF's Stewardship of the Urban Landscape training course to continue to build local capacity to care for and promote Winooski's canopy.

**Urban Forest Health**

Overall, Winooski appears to have a healthy population of public trees. Approximately 15% (123) of Winooski's public trees were considered to be in "Fair" or "Poor" condition and 2 trees were identified as "Dead". Concentrations of "Fair" and "Poor" trees were highest on West Allen Street, Pine Street, Gilbrook Road, and in Winooski Falls Park. The two dead trees were bigtooth aspens, and are located on Riverwalk Road. Please note that 133 (approximately 17%) public trees were not assigned a condition class during Winooski's urban forest inventory. 169 public trees were flagged for consult, and 134 public trees were not specified. Many of the public trees in need of consult overlap with those inventoried as in "Fair" or "Poor" condition, but others were noted because of conflict with utility wires or other infrastructure. 249 inventoried public trees were assessed as in need of pruning.

Low soil volume and fertility, exposure to salt spray, root damage, mechanical damage to the stem, poor pruning, and improper planting are some of the contributing factors that may lead to decreased tree health in an urban setting.

**Recommendation:**

***Continue to monitor trees in “Good” and “Fair” condition, plan to lose, and potentially replace trees in “Poor” condition, and remove dead trees to increase overall urban forest health.***

**Recommended action practices:**

- Complete Winooski’s urban forest inventory, being sure to assign diameter and condition classes, and need of consult to the (154, 133, and 134, respectively) inventoried public trees lacking that information.
- Visit and assess the 169 trees flagged for consultation in a systematic and timely fashion.
- Remove the 2 dead public trees identified.
- Closely monitor the health of the 43 public trees in “Poor” condition and plan for their removal and replacement in the near future.
- Continue to monitor the health of the trees in “Good” and “Fair” condition and record any changes in tree health.
- Focus efforts in Winooski Falls Park, an area of high-use and high-value to the public that contains a high number of trees in “Poor” condition.

## **Assessment Tools**

The value of Winooski’s urban forest was assessed using free i-Tree software developed by the USDA Forest Service. i-Tree Streets allowed us to determine the economic value of the ecosystem services provided by the 800 inventoried public trees in Winooski . Winooski’s urban forest annually generates \$61,645 through the benefits of air quality improvement, carbon sequestration, energy (electric and natural gas) conservation, aesthetics, and storm water control. On average, each tree offers \$95.57 in service or savings every year. When also considering the cumulative benefit of long-term carbon storage, Winooski’s urban forest is valued at \$66,309 each year, with an average value of \$102.80 for each tree. The trees of Winooski provide services to the town in the following ways:

**Aesthetics:** Urban 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). In monetary terms, presence of shade trees can significantly increase property value. There are also numerous health benefits to trees. For example, hospital patients with window views of trees have been shown to recover faster than patients without such views (Ulrich 1984).

**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. Over 100 million trees have been established around residences in the U.S. and it saves \$2 billion annually in reduced energy costs (Akbari et al. 1988).

**Stored Carbon Dioxide:** Urban trees can affect climate change by storing carbon in their tissues and reducing emissions through lowered building energy use. Urban trees in the contiguous United States store 770 million tons of carbon, which is valued at \$14.4 billion (Nowak and Crane 2002).

**Storm water run-off:** Trees and soil improve water quality and reduce costs associated with storm water 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.

**Recommendation:**

*Use the information generated through i-Tree to promote investment in urban forest management and local stewardship.*

## **Conclusion**

Trees in our urban 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 City of Winooski to understand, manage, and steward its urban forest. The recommendations outlined in this report are based on Winooski's Department of Public Works', UVM's RSENr's, and VT UCF intern's collaborative observations and data analyses. This

report is the first step in understanding Winooski's urban forest, and is intended to inform and encourage future inventories, maintenance, and the development of Winooski's long-term vision and current capacity.

# Appendix A: Complete List of Inventoried Genera and Species

