SECTION 1: TREE INVENTORY ANALYSIS

In March and April 2018, DRG arborists, certified by the International Society of Arboriculture, assessed and inventoried trees, stumps, and planting sites along the street ROW and trees and stumps in specified parks and public facilities. A total of 8,696 sites were collected during the inventory: 7,590 trees, 537 stumps, and 569 planting sites. Within the village, 4,400 sites (3,881 trees, 203 stumps, and 316 vacant sites) were inventoried and within the town, 4,296 sites (3,709 trees, 334 stumps, and 253 vacant sites) were inventoried. Table 1 provides a detailed breakdown of the number and type of sites inventoried.

New Paltz's public street rights-of-way areas were selected by the town and village, and the Shade Tree Commission for the inventory.

Inventoried public areas include: Hasbrouck Park, Moriello Pool & Park, Peace Park, Sojourner Truth Park, New Paltz Village Hall, New Paltz Gardens for Nutrition, and the baseball fields in Clearwater Park. Hazard trees were also collected along specified trails.

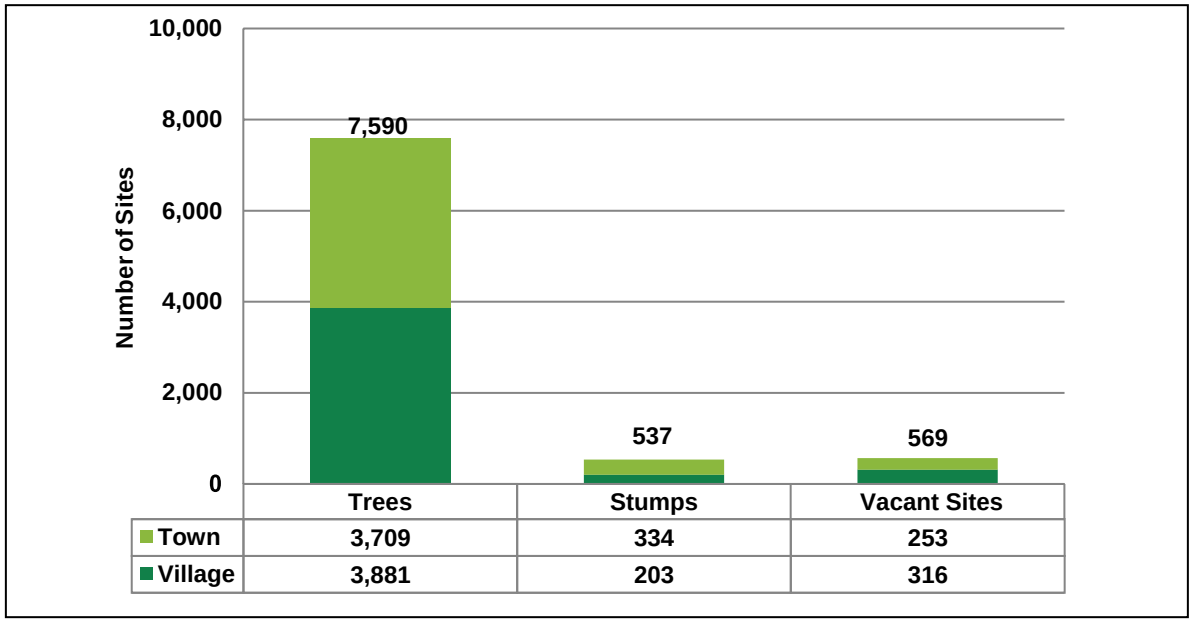


Figure 1. Sites collected during the 2018 inventory.

Assessment of Tree Inventory Data

Data analysis and professional judgment are used to make generalizations about the state of the inventoried tree population. Recognizing trends in the data can help guide short-term and long-term management planning. See Appendix A for more information on data collection and site location methods. In this plan, the following criteria and indicators of the inventoried tree population were assessed:

- *Species Diversity*, the variety of species in a specific population, affects the population's ability to withstand threats from invasive pests and diseases. Species diversity also impacts tree maintenance needs and costs, tree planting goals, and canopy continuity.
- *Diameter Size Class Distribution*, the statistical distribution of a given tree population's trunk-size class, is used to indicate the relative age of a tree population. The diameter size class distribution affects the valuation of tree-related benefits as well as the projection of maintenance needs and costs, planting goals, and canopy continuity.
- *Condition*, the general health of a tree population, indicates how well trees are performing given their site-specific conditions. General health affects both short-term and long-term maintenance needs and costs as well as canopy continuity.
- *Stocking Level* is the proportion of existing street trees compared to the total number of potential street trees (number of inventoried trees plus the number of potential planting spaces); stocking level can help determine tree planting needs and budgets.
- *Other Observations* include inventory data analysis that provides insight into past maintenance practices and growing conditions; such observations may affect future management decisions.

Photograph 2. Davey's ISA Certified Arborists inventoried trees along street ROW and in community parks to collect information about trees that could be used to assess the state of the urban forest.

Species Diversity

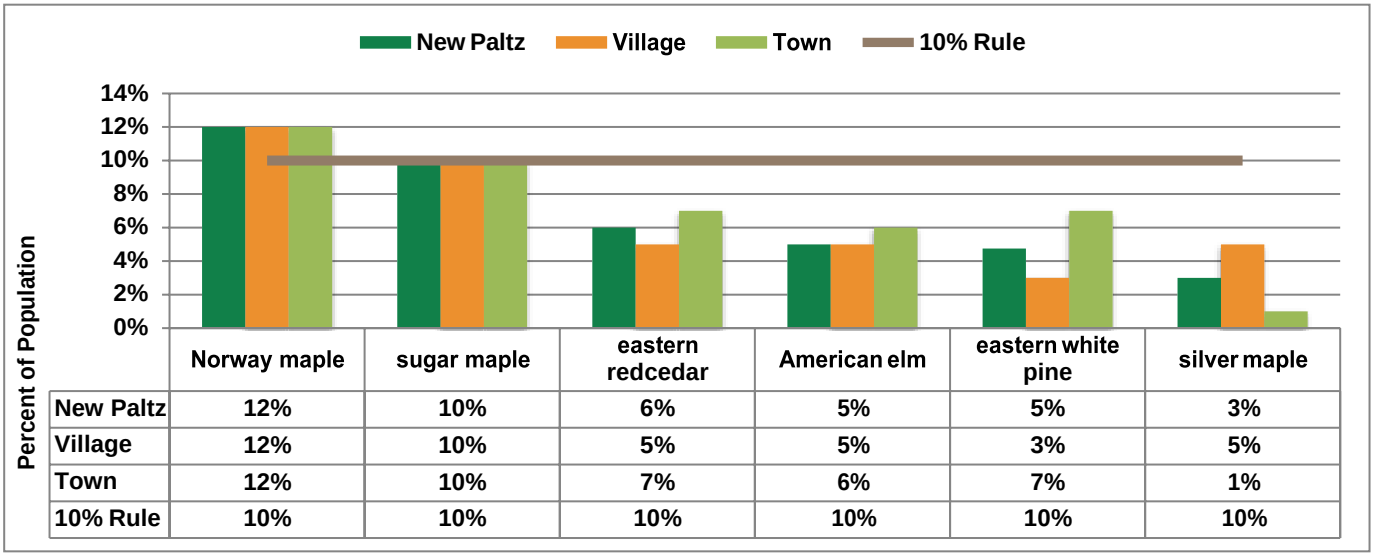
Species diversity affects maintenance costs, planting goals, canopy continuity, and the forestry program's ability to respond to threats from invasive pests or diseases. Low species diversity (large number of trees of the same species) can lead to severe losses in the event of species-specific epidemics such as the devastating results of Dutch elm disease (*Ophiostoma novo-ulmi*) throughout New England and the Midwest. Due to the spread of Dutch elm disease in the 1930s, combined with the disease's prevalence today, massive numbers of *Ulmus americana* (American elm), a popular street tree in Midwestern cities and towns, have perished (Karnosky 1979). Several Midwestern communities were stripped of most of their mature shade trees, creating a drastic void in canopy cover. Many of these communities have replanted to replace the lost elm trees. Ash and maple trees were popular replacements for American elm in the wake of Dutch elm disease. Unfortunately, some of the replacement species for American elm trees are now overabundant, which is a biodiversity concern. EAB and Asian longhorned beetle (ALB, *Anoplophora glabripennis*) are non-native insect pests that attack some of the most prevalent urban shade trees and certain agricultural trees throughout the country.

The composition of a tree population should follow the 10-20-30 Rule for species diversity: a single species should represent no more than 10% of the urban forest, a single genus no more than 20%, and a single family no more than 30%.

Findings

Analysis of New Paltz's tree inventory data indicated 58 genera and 122 species are represented.

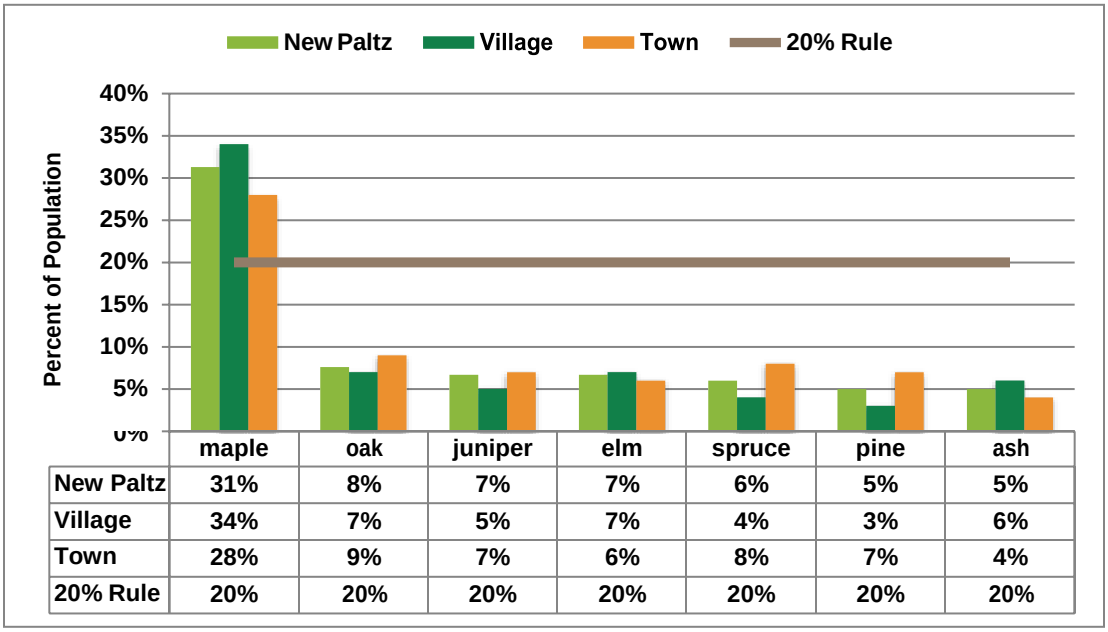
Figure 2 uses the 10% Rule to compare the percentages of the most common species identified during the inventory. *Acer plananoides* (Norway maple) exceeds the recommended 10% maximum for a single species in a population, comprising 12% of the inventoried tree population. *Acer saccharum* (sugar maple) meets the 10% threshold. Individually, both within the village and town populations species distribution is the same, Norway maple exceeds the recommended 10% and sugar maple meets the 10% threshold.



	Norway maple	sugar maple	eastern redcedar	American elm	eastern white pine	silver maple
New Paltz	12%	10%	6%	5%	5%	3%
Village	12%	10%	5%	5%	3%	5%
Town	12%	10%	7%	6%	7%	1%
10% Rule	10%	10%	10%	10%	10%	10%

Figure 2. Six most abundant species of the inventoried population compared to the 10% Rule.

Figure 3 uses the 20% Rule to compare the percentages of the most common genera identified during the inventory. *Acer* (maple) far exceeds the recommended 20% maximum for a single genus in a population, comprising 31% of the inventoried tree population. Individually, both within the village and town populations genera distribution trends similarly, maple exceeds the recommended 20% threshold.



	maple	oak	juniper	elm	spruce	pine	ash
New Paltz	31%	8%	7%	7%	6%	5%	5%
Village	34%	7%	5%	7%	4%	3%	6%
Town	28%	9%	7%	6%	8%	7%	4%
20% Rule	20%	20%	20%	20%	20%	20%	20%

Figure 3. Seven most abundant genera of the inventoried population compared to the 20% Rule.

Discussion/Recommendations

Norway maple dominates the streets and parks of both village and town populations. This is a biodiversity concern because its abundance in the landscape makes it a limiting species. Continued diversity of tree species is an important objective that will ensure New Paltz's urban forest is sustainable and resilient to future invasive pest infestations.

Considering the large quantity of maple in the village and town's population, along with its susceptibility to pests, the planting of maple should be limited to minimize the potential for loss in the event that Asian longhorned beetle threaten New Paltz's urban tree population. See Appendix B for a recommended tree species list for planting.

Diameter Size Class Distribution

Analyzing the diameter size class distribution provides an estimate of the relative age of a tree population and offers insight into maintenance practices and needs.

The inventoried trees were categorized into the following diameter size classes: young trees (0–8 inches DBH), established (9–17 inches DBH), maturing (18–24 inches DBH), and mature trees (greater than 24 inches DBH). These categories were chosen so that the population could be analyzed according to Richards' ideal distribution (1983). Richards proposed an ideal diameter size class distribution for street trees based on observations of well-adapted trees in Syracuse, New York. Richards' ideal distribution suggests that the largest fraction of trees (approximately 40% of the population) should be young (less than 8 inches DBH), while a smaller fraction (approximately 10%) should be in the large-diameter size class (greater than 24 inches DBH). A tree population with an ideal distribution would have an abundance of newly planted and young trees, and lower numbers of established, maturing, and mature trees.

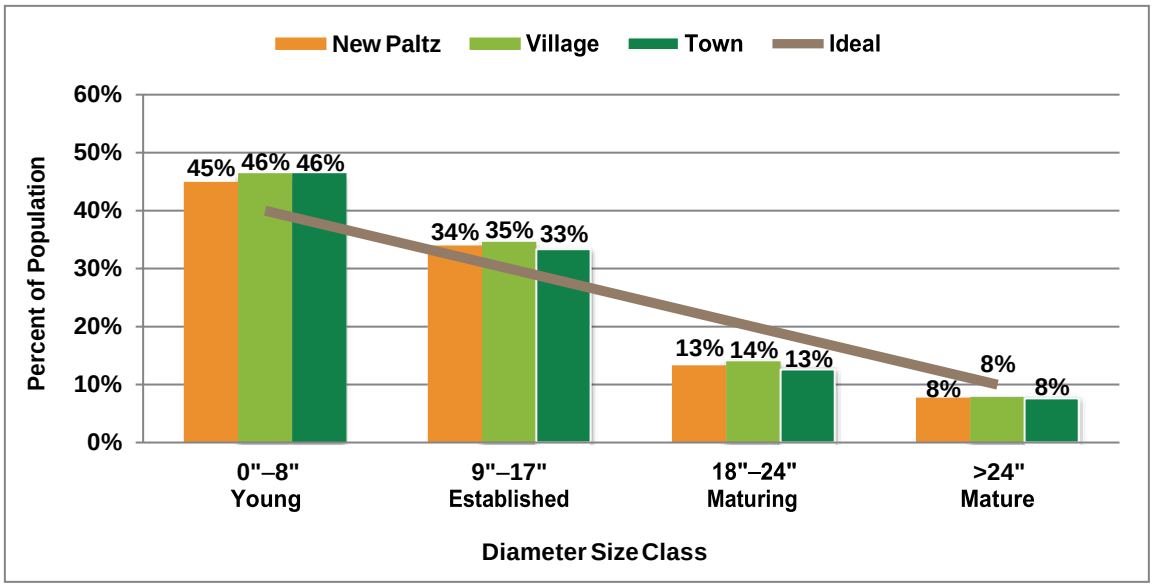


Figure 4. Comparison of diameter size class distribution for inventoried trees to the ideal distribution.

Findings

Figure 4 compares New Paltz's diameter size class distribution of the inventoried tree population to the ideal proposed by Richards (1983). New Paltz's distribution trends towards the ideal; young trees exceed the ideal by over 5%, established trees exceed the ideal by 4%, while maturing and mature diameter size classes fall short of the ideal, 7% and 2%, respectively. Individually, both within the village and town populations size distribution trend similarly.

Discussion/Recommendations

Even though it may appear that New Paltz may have too many young trees, this is not the case. Actually, New Paltz has too few maturing, and mature trees, which indicates that the distribution is skewed. One of New Paltz's objectives is to have an uneven-aged distribution of trees at the street, park, village and town, and communitywide levels. DRG recommends that New Paltz support a strong planting and maintenance program to ensure that young, healthy trees are in place

to fill in gaps in tree canopy and replace older declining trees. New Paltz must promote tree preservation and proactive tree care to ensure the long-term survival of older trees. Additionally, tree planting and tree care will allow the distribution to normalize over time. See Appendix C for planting suggestions and information on species selection.

Planting trees is necessary to increase canopy cover and replace trees lost to natural mortality (expected to be 1%–3% per year) and other threats (for example, invasive pests or impacts from weather events such as storms, wind, ice, snow, flooding, and drought). Planning for the replacement of existing trees and identifying the best places to create new canopy is critical.

Condition

DRG assessed the condition of individual trees based on methods defined by the International Society of Arboriculture (ISA). Several factors were considered for each tree, including: root characteristics, branch structure, trunk, canopy, foliage condition, and the presence of pests. The condition of each inventoried tree was rated Good, Fair, Poor, or Dead.

In this plan, the general health of the inventoried tree population was characterized by the most prevalent condition assigned during the inventory.

Comparing the condition of the inventoried tree population with relative tree age (or size class distribution) can provide insight into the stability of the population. Since tree species have different lifespans and mature at different diameters, heights, and crown spreads, actual tree age cannot be determined from diameter size class alone. However, general classifications of size can be extrapolated into relative age classes. The following categories are used to describe the relative age of a tree: young (0–8 inches DBH), established (9–17 inches DBH), maturing (18–24 inches DBH), and mature (greater than 24 inches DBH).

Figures 5 and 6 illustrate the general health and distribution of young, established, mature, and maturing trees relative to their condition.

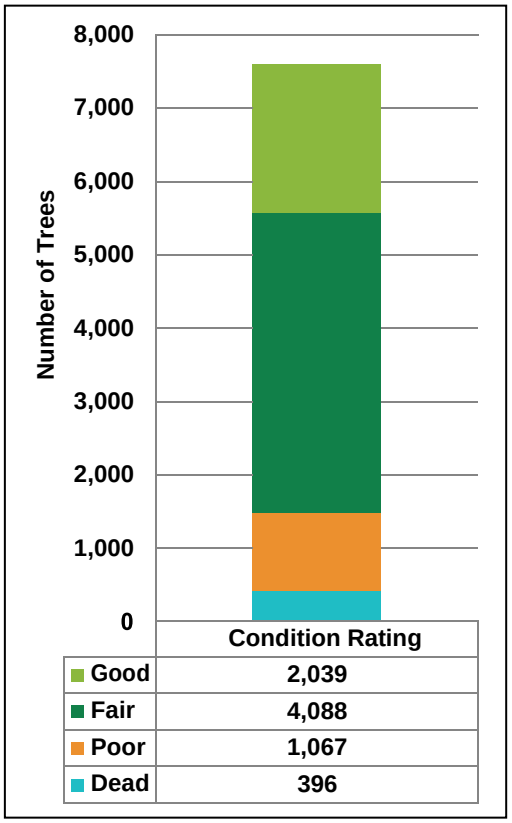


Figure 5. Conditions of inventoried trees.

Findings

Most of the inventoried trees were recorded to be in Fair condition, 54% (Figure 5). Based on these data, the general health of the overall inventoried tree population is rated Fair. Figure 6 illustrates that most of the young, established, maturing, and mature trees were rated to be in Fair condition.

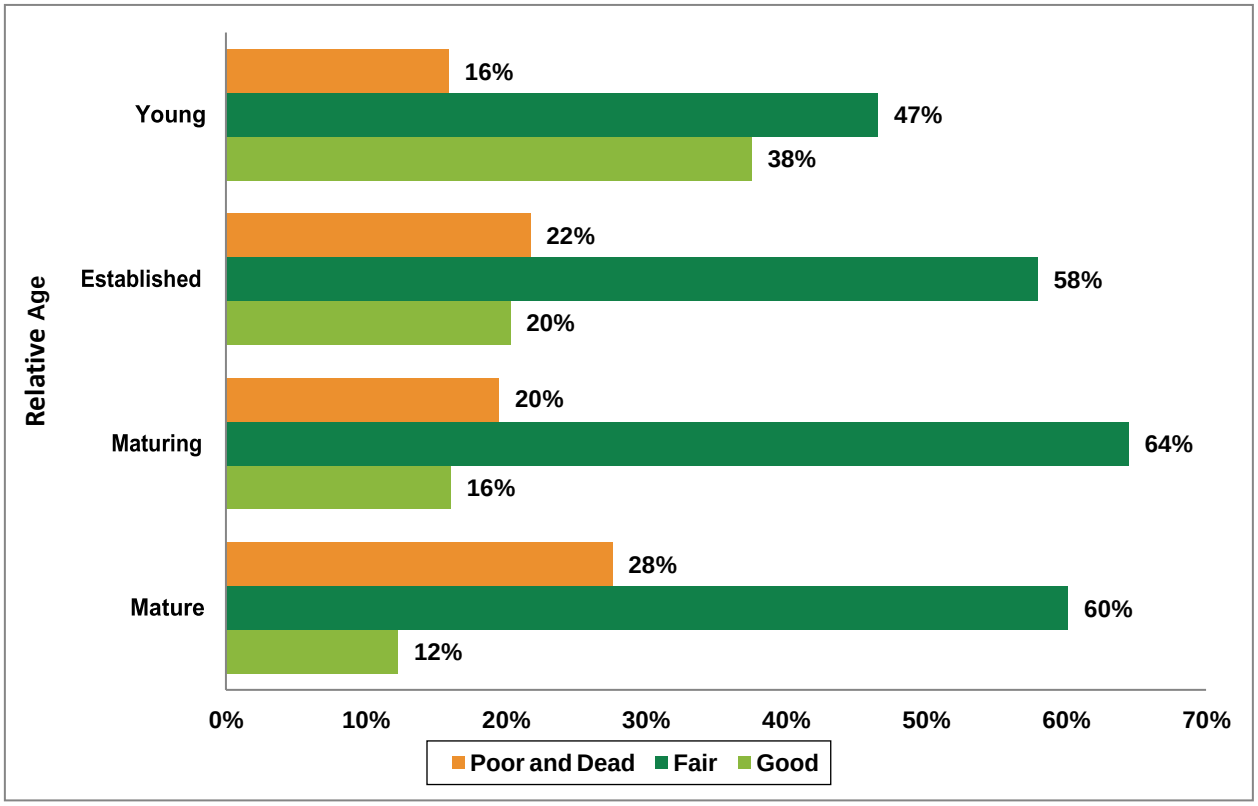


Figure 6. Tree condition by relative age during the 2018 inventory.

Discussion/Recommendations

Even though the condition of New Paltz's inventoried tree population is typical, data analysis has provided the following insight into maintenance needs:

- Younger trees rated in Fair or Poor condition may benefit from improvements in structure that may improve their health over time. Pruning should follow *ANSI A300 (Part 1)* (ANSI 2008).
- Poor condition ratings among mature trees were generally due to visible signs of decline and stress, including decay, dead limbs, sparse branching, or poor structure. These trees will require corrective pruning, regular inspections, and possible intensive plant health care to improve their vigor.
- Proper tree care practices are needed for the long-term general health of the urban forest. Following guidelines developed by ISA and those recommended by *ANSI A300 (Part 6)* (ANSI 2012) will ensure that tree maintenance practices ultimately improve the health of the urban forest.

Replacement Value

Replacement value describes the historical investment in trees over time. Replacement value on a species level gives urban forest managers a look into the landscape value of their species populations. Values will reflect species population, stature, and condition.

Findings

New Paltz's public trees are an important municipal asset valued at $21,013,872. Over time, this value should increase as trees mature, provided the trees are properly maintained. The average replacement value is approximately $2,769 per tree. Sugar maple is shown to have the highest replacement value of all inventoried species at $2,075,033, or 10% of New Paltz's historical investment.

Discussion/Recommendations

A healthy, well-placed tree will become more valuable over time as it grows from a young tree to a mature tree. DRG recommends that New Paltz focus on tree care practices that will make the most of species diversity, size distribution, and health of the urban forest. Focusing on these things can provide a greater return on investment.

Stocking Level

Stocking is a traditional forestry term used to measure the density and distribution of trees. For an urban/community forest such as New Paltz's, stocking level is used to estimate the total number of sites along the street ROW that could contain trees. Park trees and public property trees are excluded from this measurement.

Stocking level is the ratio of street ROW spaces occupied by trees to the total street ROW spaces suitable for trees. For example, a street ROW tree inventory of 1,000 total sites with 750 existing trees and 250 planting sites would have a stocking level of 75%.

For an urban area, DRG recommends that the street ROW stocking level be at least 90% so that no more than 10% of the potential planting sites along the street ROW are vacant.

Street ROW stocking levels may be estimated using information about the community, tree inventory data, and common street tree planting practices. Inventory data that contain the number of existing trees and planting sites along the street ROW will increase the accuracy of the projection. However, street ROW stocking levels can be estimated using only the number of trees present and the number of street miles in the community.

To estimate stocking level based on total street ROW miles and the number of existing trees, it is assumed that any given street ROW should have room for 1 tree for every 50 feet along each side of the street. For example, 10 linear miles of street ROW with spaces for trees to grow at 50-foot intervals along each side of the street account for a potential 2,110 trees. If the inventory found that 1,055 trees were present, the stocking level would be 50%.

The potential stocking level for a community with 10 street miles is as follows:

5,280 feet/mile ÷ 50 feet = 106 trees/mile

106 trees/mile × 2 sides of the street = 212 trees/mile

212 trees per street mile × 10 miles = 2,110 potential sites for trees

1,055 inventoried trees ÷ 2,120 potential sites for trees = 50% stocked

When the estimated stocking level is determined using theoretical assumptions, the actual number of planting sites may be significantly less than estimated due to unknown growing space constraints, including inadequate growing space size, proximity of private trees, and utility conflicts.

New Paltz's inventory data set included planting sites. Since the data included vacant planting sites, the stocking level can be more accurately projected and compared to the theoretical stocking level.

Findings

The inventory found 569 planting sites and 487 stumps along the street ROW. Of the inventoried planting sites, 211 were potential planting sites for large-size trees (8-foot-wide and greater growing space size); 45 were potential sites for medium-size trees (6- to 7-foot-wide growing space sizes); and 313 were potential sites for small-size trees (3- to 5-foot-wide growing space sizes, or had overhead utilities). Based on the data collected during this inventory, New Paltz's current street ROW tree stocking level is 86%.

Discussion/Recommendation

Fully stocking the street ROW with trees is an excellent goal. Inadequate tree planting and maintenance budgets, along with tree mortality, will result in lower stocking levels. Nevertheless, working to attain a fully stocked street ROW is important to promote canopy continuity and environmental sustainability. The village and town should consider improving its street ROW population's stocking level of 86% and working towards achieving the ideal of 90% or better. Generally, this entails a planned program of planting, care, and maintenance for the village's and town's street trees.

New Paltz estimates that it plants 15 trees per year. With a current total of 569 planting sites and 487 stumps along the street ROW, it would take approximately 20 years for New Paltz to reach the recommended stocking level of 90%. If budgets allow, DRG recommends that New Paltz increase the number of trees planted each year to 100. This planting rate will move street tree stocking level to 90% in 3 years (without consideration or replanting recommended removals). If possible, exceed this recommendation to better prepare for impending threats, a 1–3% natural mortality rate of existing populations, and to increase the benefits provided by the urban forest.

Calculations of trees per capita are important in determining the density of the New Paltz's urban forest. The more residents and greater housing density the village and town possess, the greater the need for trees to provide benefits.

The Village of New Paltz's ratio of street trees per capita is 0.57 and is more than the mean ratio of 0.37 reported for 22 U.S. cities (McPherson and Rowntree 1989). According to the villagewide study, there is 1 tree for every 1.76 residents of the village. The Village of New Paltz's potential is 1 tree for every 1.5 residents.

The Town of New Paltz's ratio was not calculated because not all street trees were inventoried.

Other Observations

Defects

Defects were recorded during the inventory to further describe a tree's health and structure.

Findings

Dead and dying parts was most frequently observed and recorded (21% of inventoried trees). Of these 1,623 trees, 1,159 were recommended for pruning, 451 were recommended for removal, and 211 were rated as High or Moderate Risk trees.

Table 1. Defects Recorded During the Tree Inventory

Defects	Number of Trees	Percent
Dead and Dying Parts	1,623	21%
Broken and/or Hanging Branches	482	6%
Cracks	23	0%
Weakly Attached Branches and Codominant Stems	439	6%
Missing or Decayed Wood	414	5%
Tree Architecture	505	7%
Root Problems	122	2%
Other	852	11%
N/A	3,130	41%
Total	7,590	100%

Discussion/Recommendations

Unless slated for removal, trees with noted defects should be regularly inspected and those of High or Moderate Risk should be inspected more often than those of Low Risk. Corrective actions, pruning or removal, should be taken when warranted. If condition of the tree worsens, removal may be required. The costs for maintaining deficient trees must be considered to determine whether removing and replacing the tree is the more viable option.

Overhead Utilities

In an urban setting, space is limited both above and below ground. Trees in this environment may conflict with utility wires, which may pose risks to public health and safety. Existing or possible conflicts between trees and utility lines were recorded during the inventory. The type of utility line was not recorded. All aboveground lines connected to power poles are considered energized and thus recorded as present (conflicting or not conflicting) when lines pass through tree canopy or exist within the safe approach distance. The presence of overhead utility lines above a tree or planting site was noted; it is important to consider this data when planning pruning activities and selecting tree species for planting.

Findings

There were 53 trees recorded that were conflicting with overhead utilities. Most of these trees were large- or medium-growing trees. Common conflicting species were sugar maple and callery pear. Another 2,729 sites were recorded as utility lines present and not conflicting. Of these 2,729 sites, 272 sites are recommended for planting small-growing trees only, 2,244 are trees, and 213 are stumps. Norway maple, sugar maple, eastern white pine, eastern redcedar, and Norway spruce are the most common species present near overhead utilities yet not conflicting at the time of the inventory.

Table 2. Overhead Utilities

Conflict	Presence	Number of Trees	Percent
Overhead Utilities	Present and Conflicting	53	1%
	Present and Not Conflicting	2,729	31%
	Not Present	5,914	68%
Total		**8,696**	**100%**

Discussion/Recommendations

Planting only small-growing trees within 20 feet of overhead utilities, medium-size trees within 20–40 feet, and large-growing trees outside 40 feet will help improve future tree conditions, minimize future utility line conflicts, and reduce the costs of maintaining trees under utility lines.

Further Inspection

This data field indicates whether a particular tree requires further inspection, such as a Level III risk inspection in accordance with ANSI A300, Part 9 (ANSI, 2011), insect/disease monitoring, or periodic inspection due to particular conditions that may cause it to be a safety risk and, therefore, hazardous. If a tree was noted for further inspection, New Paltz staff should investigate as soon as possible to determine corrective actions.

Findings

DRG recommended 187 trees for further inspection. Of these 187 trees, 166 are recorded for insect/disease monitoring; 61% are ash trees and 38% are eastern hemlock. Level III and annual assessments were recommended for 8 trees and 13 trees, respectively.

Discussion/Recommendations

An ISA Certified Arborist should perform inspections of the Level III annual assessments. If it is determined that these trees exceed the threshold for acceptable risk, the defective part(s) of the trees should be corrected or removed, or the entire tree may need to be removed.

The inventoried ash trees that showed signs and symptoms of EAB should be monitored and treated or removed. Once the ash tree is removed, the site should be inspected for a potential replacement. For a more thorough look into the emerald ash borer situation, visit the emerald ash borer strategy discussion in Section 4.

Photographs 3 and 4. This ash tree near 200 Hugenot Street has emerald ash borer and has been marked for insect/disease monitoring. The tree will need to be removed if not treated for the pest. New Paltz staff should investigate and determine corrective actions as soon as possible.

Potential Threats from Pests

Insects and diseases pose serious threats to tree health. Awareness and early diagnosis are essential to ensuring the health and continuity of street and park trees. Appendix D provides information about some of the current potential threats to New Paltz trees and includes websites where more detailed information can be found.

Many pests target a single species or an entire genus. The inventory data were analyzed to provide a general estimate of the percentage of trees susceptible to some of the known pests in New York and the rest of the country (see Figure 7). It is important to note that the figure only presents data collected from the inventory. Many more trees throughout New Paltz, including those on public and private property, may be susceptible to these invasive pests.

Findings

Asian longhorned beetle (ALB or *Anoplophora glabripennis*) and gypsy moth (*Lymantria dispar*) are known threats to a large percentage of the inventoried public trees (38% and 23%, respectively). These pests were not detected in New Paltz, but if they were detected New Paltz could see severe losses in its tree population. Both pests are present within the state of New York.

There were 376 ash trees inventoried in New Paltz, and the majority of the population showed signs and symptoms of emerald ash borer (EAB, *Agrilus planipennis*). Of the 376 ash trees inventoried, 275 ash trees were recommended for removal. Private trees were not part of this inventory and signs and symptoms of infestation were present. In some capacity, such as near street ROW, ash trees on private property may be a concern for New Paltz as well.

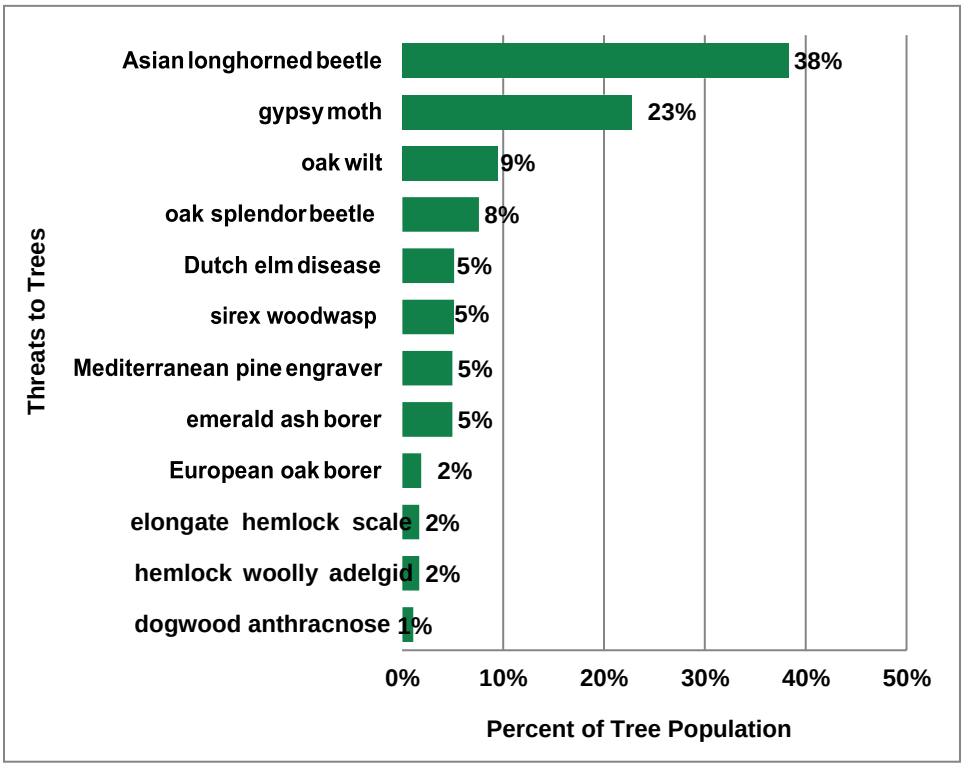


Figure 7. Potential impact of insect and disease threats noted during the 2018 inventory.

Discussion/Recommendations

New Paltz should be aware of the signs and symptoms of potential infestations and should be prepared to act if a significant threat is observed in its tree population or a nearby community. An integrated pest management plan should be established. The plan should focus on identifying and monitoring threats, understanding the economic threshold, selecting the correct treatment, properly timing management strategies, recordkeeping, and evaluating results. Visit Section 4 as an example strategy.