

**The Trees of Pugwash, Nova Scotia:
Inventory and Recommendations for Improvement**

Peter N Duinker and Caitrin Pilkington
School for Resource and Environmental Studies
Dalhousie University
Halifax, Nova Scotia

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Foreword

On behalf of the entire Dalhousie team involved in this project, we extend a hearty thanks to the people of Pugwash, particularly Maureen Leahey of the Communities in Bloom Committee, for calling upon our knowledge services and inviting us into their properties, homes, and businesses as we engaged in the tree inventory. The project has been of great benefit to all concerned, and also of modest cost to anyone, so therefore a truly delightful enterprise. The Dalhousie team consisted of:

Peter Duinker, team leader

Bimal Aryal

Jordan Bell

David Foster

Carlisle Kent

JJ Klimek

Stephanie Maasik

Caytlyn McFadden

Caitrin Pilkington

Brynn Roach

Sydney Toni

Katherine Witherspoon

1. Introduction

1.1 Importance of Trees in Urban Settings

Trees play an important role in improving the value of urban areas, both in terms of their intrinsic as well as extrinsic values. Urban forests are an effective way to bring the best benefits of the woods to those who live in towns and cities. Louv (2012) wrote that the importance of nature “is supported by a growing body of theoretical, anecdotal, and empirical research”. Trees are the natural vegetation of most of the world, and are thus a key element to addressing Louv’s (2012) “nature deficit disorder”. In this way, trees offer abundant intrinsic benefits.

In an extrinsic sense, the presence of trees enhances recreation opportunities, draws tourists, increases the aesthetic value of an urban area, and has been proven to foster health and healing. Trees also yield economic dividends such as increased shade, reduced energy costs, and increased property value, as well as business and employment opportunities through tree planting and maintenance. Finally, from an environmental perspective, trees capture and store carbon, cool the city environment, improve air and water quality, slow stormwater flow, and conserve biodiversity.

1.2 Background to the Project

Following talks between the Pugwash Communities in Bloom Committee and lead author PD, a group of Dalhousie students descended upon the village in October 2015 to gather data for a comprehensive inventory of the village’s trees. The inventory was recommended by a Communities in Bloom adjudication committee in 2014. Dalhousie students in the School for Resource and Environmental Studies are engaged each autumn in active study of sustainable urban forests and are well-equipped to analyze urban forest environments from both biophysical and socio-cultural points of view.

1.3 Objectives of the Project

The purpose of the inventory was to document the species, size, and general health condition of most of the trees in the Village of Pugwash. Our research on urban forests shows that tree type, size, and spatial arrangement are critical to value satisfaction, as well as maximizing the delivery of the ecological services that trees provide. Having such a comprehensive inventory is the first step in determining a promising future for the tree population of the village. This report summarizes the inventory findings and provides some recommendations on promising ways to manage the village tree canopy for improved satisfaction of the myriad values provided by the trees.

2. Methods

2.1 The Inventory

Trees were measured on the 17-18 October 2015 by 11 Dalhousie students led by PD. The scope of the tree inventory included the trees on properties along the three north-south streets of the

village (Water, Russell, Church) and the six east-west streets (King, Queen, Black, Prince Albert, Victoria, Durham). The inventory was limited to species identification and diameter at breast height at each property. Within this scope, it is estimated that 90+% of all tree stems were measured.

Students used calipers (for small trees) and diameter tapes (for large trees) to measure diameter at breast height). All the data, including civic addresses, were recorded on field sheets and transferred to an electronic database at the university.

2.2 Development of Recommendations

Suggestions for improving the Pugwash canopy were developed on three bases: (a) the inventory; (b) conversations with villagers while the team was in Pugwash; and (c) PD's experience in developing urban-forest management plans in both Halifax and Charlottetown.

3. The Inventory

3.1 Results

In the Village of Pugwash, we found 65 tree species overall. It was determined that 35 of the 42 tree species native to Nova Scotia were represented in the Pugwash area (Table 1). This means that 30 of the tree species we found are not native to Nova Scotia (these are sometimes called alien or exotic species) (Table 2).

Table 1. Trees of Nova Scotia found in Pugwash (note: some trees were identified to the genus only).

Common Name	Scientific Name	Common Name	Scientific Name
Ash spp.	Fraxinus spp.	Ironwood	Ostrya virginiana
Ash, Black	Fraxinus nigra	Larch	Larix laricina
Ash, Red	Fraxinus pennsylvanica	Maple, Mountain	Acer spicatum
Ash, White	Fraxinus americana	Maple, Red	Acer rubrum
Aspen, Trembling	Populus tremuloides	Maple, Sugar	Acer saccharum
Birch, Yellow	Betula alleghaniensis	Mountain Ash	Sorbus spp.
Birch, Gray	Betula populifolia	Oak, Red	Quercus rubra
Birch, White	Betula papyrifera	Pine, Jack	Pinus banksiana
Cedar, Eastern White	Thuja occidentalis	Pine, Red	Pinus resinosa
Cherry spp.	Prunus spp.	Pine, White	Pinus strobus
Cherry, Choke	Prunus virginiana	Poplar, Balsam	Populus balsamifera
Cherry, Pin	Prunus pensylvanica	Prunus spp.	Prunus spp.
Dogwood spp.	Cornus spp.	Serviceberry	Amelanchier spp.
Elm, American	Ulmus americana	Spruce, Black	Picea mariana
Fir, Balsam	Abies balsamea	Spruce, Red	Picea rubens
Hawthorn	Crataegus spp.	Spruce, White	Picea glauca
Hemlock, Eastern	Tsuga canadensis	Sumac, Staghorn	Rhus typhina
		Willow spp.	Salix spp.

Table 2. Trees not native to Nova Scotia found in Pugwash (note: some trees were identified to the genus only).

Common Name	Scientific Name	Common Name	Scientific Name
Apple spp.	<i>Malus</i> spp.	Maple, Manitoba	<i>Acer negundo</i>
Ash, Blue	<i>Fraxinus quadrangulata</i>	Maple, Norway	<i>Acer platanoides</i>
Buckthorn, European	<i>Rhamnus cathartica</i>	Maple, Silver	<i>Acer saccharinum</i>
Butternut	<i>Juglans cinerea</i>	Oak, English	<i>Quercus robur</i>
Catalpa	<i>Catalpa</i> spp.	Oak, Pin	<i>Quercus palustris</i>
Cedar, Eastern Red	<i>Juniperus virginiana</i>	Pine, Austrian	<i>Pinus nigra</i>
Chestnut, Horse	<i>Aesculus hippocastanum</i>	Pine, Scots	<i>Pinus sylvestris</i>
Cottonwood, Eastern	<i>Populus deltoides</i>	Poplar, Carolina	<i>Populus canadensis</i>
Elm, Red	<i>Ulmus rubra</i>	Poplar, European White	<i>Populus alba</i>
Fir, Colorado White	<i>Abies concolor</i>	Poplar, Lombardy	<i>Populus nigra</i>
Ginkgo	<i>Ginkgo biloba</i>	Rowan	<i>Sorbus aucuparia</i>
Lilac	<i>Syringa</i> spp.	Spruce, Colorado Blue	<i>Picea pungens</i>
Linden spp.	<i>Tilia</i> spp.	Spruce, Norway	<i>Picea abies</i>
Locust, Black	<i>Robinia pseudoacacia</i>	Willow, Weeping	<i>Salix alba</i>
Maple, Japanese	<i>Acer palmatum</i>	Willow spp.	<i>Salix</i> spp.

As usual in urban tree inventories, some species are represented in great abundance, and some by only a few individuals (see Figure 1). Species in great abundance and presenting various issues for future management of the canopy include the non-native species Manitoba Maple, Norway Maple, European White Poplar, Linden spp., Horse Chestnut, and Lombardy Poplar. Other non-native species with considerable populations include Eastern Cottonwood, Colorado Blue Spruce, Weeping Willow and Scots Pine. We identified several native species that are abundant throughout Nova Scotia but poorly represented in the village (e.g., Sugar Maple, Yellow Birch, Eastern Hemlock) and several native species that are both rare in Nova Scotia and rare in the village (e.g., Black Ash and Ironwood).

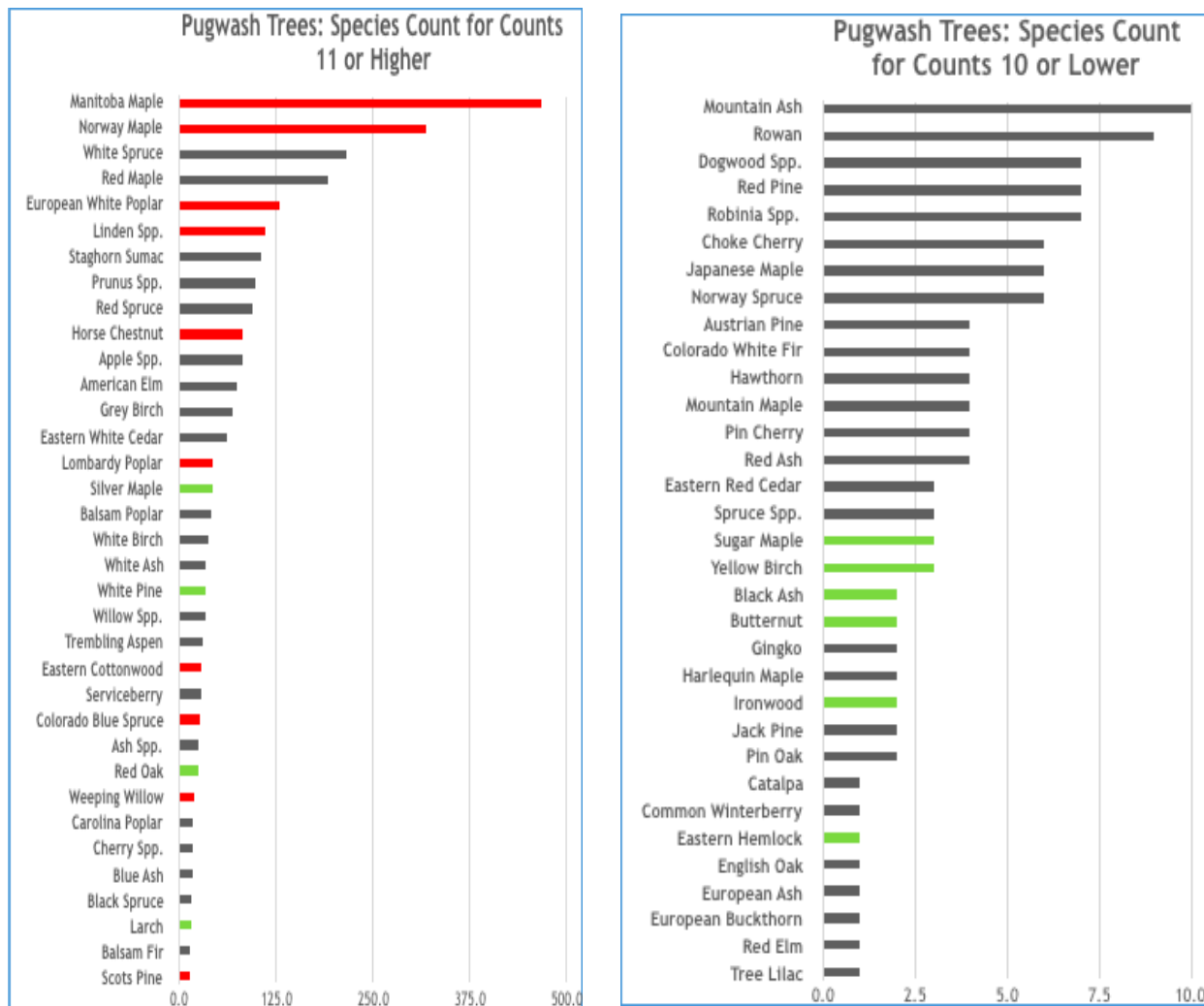


Figure 1. Abundance of 65 tree species in Pugwash. Red bars indicate species suggested to be too abundant, and green bars indicate species considered to be too few in the village.

Species count is just one way of representing the character of the village tree population. However, a mere count is unable to reveal how dominant the various species are in the canopy, for which size of the trees is necessary information. We measured tree diameter so that we could calculate both size-class distributions and basal area. Basal area is a calculation of the cross-sectional area of the tree trunk at the point where diameter was measured (i.e., 1.3 m from the ground). Basal area is a reasonable proxy for other dimensions of trees such as the amount of crown, which of course is responsible for many of the values we ascribe to urban trees. Therefore, we have also calculated basal area for each of the tree species in the village, and we show in Figure 2 how the basal-area measure presents a different picture of species dominance in the village. For example, while there are many more Manitoba Maples by species count, European White Poplar is far more dominant ecologically in Pugwash on account of their large size. Indeed, when one makes a quick tour of the village for a reconnaissance view of the canopy, the European White Poplars soar above all other trees and are conspicuous to the eye.

We also note that the Horse Chestnuts in town are both relatively abundant and relatively large.

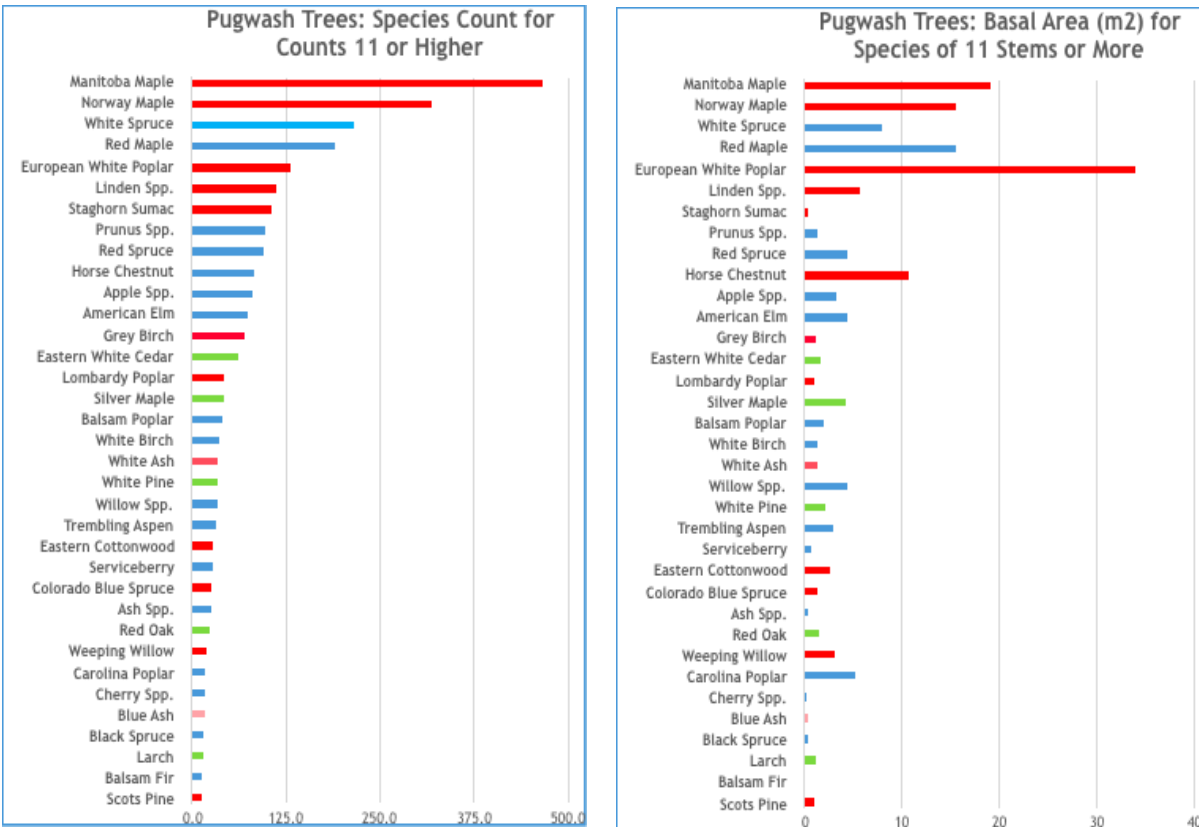


Figure 2. Counts and basal areas for tree species with more than ten individuals in the Pugwash inventory. Red bars indicate species suggested to be too abundant, and green bars indicate species considered to be too few in the village.

For ease of understanding the size distribution of the trees in Pugwash, we put all the trees of the most abundant species into 10-cm diameter classes. The data make clear that small trees (i.e., up to 20 cm diameter) are the most abundant in the village. The different species, however, do have unique size distributions.

3.2 Discussion

As expected and as normal for most urban tree populations, Pugwash has an uneven representation of tree species. It is encouraging to note that 35 of Nova Scotia's native tree species exist in Pugwash. However, some native species remain severely underrepresented in terms of both tree count and basal area. There are far too many trees of some non-native tree species such as Manitoba Maple and European White Poplar, and far too few trees of some native tree species such as Sugar Maple and White Pine. Sustained effort to plant these inadequately represented native trees and discourage the overabundance of a few alien species will bring about a healthier ecosystem.

In addition, diversifying tree species is a crucial part of maintaining tree health in the community. In the event of pests or diseases, having only a few species planted in an urban space can wipe out entire urban forest populations within a few years. Overplanting of a single species in suburban streets has contributed to the catastrophic sweep of diseases such as Dutch Elm Disease, which killed more than 40 million elm trees in the United States, and the majority of elm in Eastern Canada also died of the disease. Tree diversity also encourages a variety of species that make up natural ecosystems and prevents the spread of invasive species. Genetic diversity also brings about healthier stock, which means more resistance to inadequate soil nutrition, climate change, and other stressors (Petit and Hampe, 2006). The long-term health of urban forests depends on species diversity.

Diversity of tree sizes for each tree species is another factor which ensures long-term forest sustainability. Plentiful young trees ensure that there will be old and large trees later on, and the latter are strong contributors to biodiversity conservation and neighbourhood character. Overall, the inventory shows that the size class of 10-20 cm is the most well represented for many species, meaning that efforts should be made to protect and encourage larger trees and establish many new trees. Providing for species and age diversity in the urban forest is the most significant way to ensure long-term forest health.

4. Recommendations for Improvement of Pugwash's Urban Forest

- *Celebrate the trees you have* — walkabouts, dissemination of the inventory, and planting events create a sense of community, enrich feelings of community pride, and foster an appreciation for nature.
- *Plant lots of new trees* — plant new trees every year so that the age-class structure (size structure) becomes diversified.

Start with smaller stock, and look into acquiring trees (with permission!) from nearby woodland.

Favour planting Nova Scotian native species (Table 3), especially native species that are poorly represented in, or missing from (Table 4), the inventory.

- *Phase out problem species* — Manitoba Maple and Norway Maple may gradually be diminished by avoiding them in new plantings, preventing natural regeneration by cutting saplings, and by planting desirable species under the canopies of these species.
- When considering planting non-native species, there are species to favour (Tables 5 and 6) and species to avoid (Table 5).
- *Plant strategically* — the density of trees could quite easily be greatly increased without overloading the village in shade.
 - Fill empty spaces: areas that currently exist as empty grass lots, such as the fields around Pugwash District High School, present a great deal of potential for new

- growth.
- Plant close to the street: by planting close to the street, Pugwash residents will experience the maximum benefits associated with a flourishing tree canopy such as reduced heat stress on pavement, shade, and a more aesthetically pleasing street view.
 - Plant in copse formations, which ultimately yield both social and ecological benefits.
- *Educate yourselves* — Stock some quality tree books (such as Farrar’s (1995) “Trees in Canada”) in the Pugwash library and promote the use of online tools for learning about tree species (such as <http://novascotia.ca/natr/forestry/treeid/>). These resources will help villagers develop strong understandings and appreciations of trees.

Table 3. Existing native tree species in Pugwash. Species in green background are high priority for retention and planting.

Common Name	Scientific Name	Common Name	Scientific Name
Ash spp.	Fraxinus spp.	Ironwood	Ostrya virginiana
Ash, Black	Fraxinus nigra	Larch	Larix laricina
Ash, Red	Fraxinus pennsylvanica	Maple, Mountain	Acer spicatum
Ash, White	Fraxinus americana	Maple, Red	Acer rubrum
Aspen, Trembling	Populus tremuloides	Maple, Sugar	Acer saccharum
Birch, Yellow	Betula alleghaniensis	Mountain Ash	Sorbus spp.
Birch, Gray	Betula populifolia	Oak, Red	Quercus rubra
Birch, White	Betula papyrifera	Pine, Jack	Pinus banksiana
Cedar, Eastern White	Thuja occidentalis	Pine, Red	Pinus resinosa
Cherry spp.	Prunus spp.	Pine, White	Pinus strobus
Cherry, Choke	Prunus virginiana	Poplar, Balsam	Populus balsamifera
Cherry, Pin	Prunus pensylvanica	Prunus spp.	Prunus spp.
Dogwood spp.	Cornus spp.	Serviceberry	Amelanchier spp.
Elm, American	Ulmus americana	Spruce, Black	Picea mariana
Fir, Balsam	Abies balsamea	Spruce, Red	Picea rubens
Hawthorn	Crataegus spp.	Spruce, White	Picea glauca
Hemlock, Eastern	Tsuga canadensis	Sumac, Staghorn	Rhus typhina
		Willow spp.	Salix spp.

Table 4. Trees native to Nova Scotia not currently represented in the Pugwash inventory.

Common Name	Scientific Name
Aspen, Largetooth	<i>Populus grandidentata</i>
Beech, American	<i>Fagus grandifolia</i>
Cherry, Black	<i>Prunus serotina</i>
Maple, Striped	<i>Acer pensylvanicum</i>

Table 5. Non-native species in Pugwash. Species recommended for promotion are in green background, and species to avoid are in red background.

Common Name	Scientific Name	Common Name	Scientific Name
Apple spp.	<i>Malus</i> spp.	Maple, Manitoba	<i>Acer negundo</i>
Ash, Blue	<i>Fraxinus quadrangulata</i>	Maple, Norway	<i>Acer platanoides</i>
Buckthorn, European	<i>Rhamnus cathartica</i>	Maple, Silver	<i>Acer saccharinum</i>
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Cottonwood, Eastern	<i>Populus deltoides</i>	Poplar, Carolina	<i>Populus canadensis</i>
Elm, Red	<i>Ulmus rubra</i>	Poplar, European White	<i>Populus alba</i>
Fir, Colorado White	<i>Abies concolor</i>	Poplar, Lombardy	<i>Populus nigra</i>
Ginkgo	<i>Ginkgo biloba</i>	Rowan	<i>Sorbus aucuparia</i>
Lilac	<i>Syringa</i> spp.	Spruce, Colorado Blue	<i>Picea pungens</i>
Linden spp.	<i>Tilia</i> spp.	Spruce, Norway	<i>Picea abies</i>
Locust, Black	<i>Robinia pseudoacacia</i>	Willow, Weeping	<i>Salix alba</i>
Maple, Japanese	<i>Acer palmatum</i>	Willow spp.	<i>Salix</i> spp.

Table 6. Non-native species not currently in Pugwash and recommended for planting.

Common Name	Scientific Name
Basswood	<i>Tilia americana</i>
Beech, European	<i>Fagus sylvatica</i>
Butternut	<i>Juglans cinerea</i>
Black Walnut	<i>Juglans nigra</i>
Chestnut, American	<i>Castanea dentata</i>
Hackberry	<i>Celtis occidentalis</i>
Hickories	<i>Carya</i> spp.
Honey-Locust	<i>Gleditsia triacanthos</i>
Hornbeam (Blue-beech)	<i>Carpinus caroliniana</i>
Maple, Freeman	<i>Acer freemanii</i>
Oak, Bur	<i>Quercus macrocarpa</i>
Oak, White	<i>Quercus alba</i>
Tulip Tree	<i>Liriodendron tulipifera</i>

5. Conclusion

We heartily congratulate the people of Pugwash for initiating and taking such a strong interest in this inventory of the village's trees. The current tree population serves as an excellent foundation for continued improvements in both the quantity and quality of trees in the village. A promising next step would be to develop a detailed tree management plan for the village. Successive generations of Pugwash residents will benefit greatly from clever efforts today to strengthen the tree population of the village.

6. References

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