Urban Forests: Reintroducing Native Species to Dalhousie University Campus.

Laura Ratcliffe, BSc. Earth Sciences, Lindsay Jones BSc. Environmental Science, Laurice Arab BSc. Environmental Science & Community Design,

Abstract

Urban forests are an important part of the community and people should aspire to maintain them in the same way they maintain their cars, homes and lawns. The benefits of an urban forest on campus are massive. The trees provide a place to play, relax, study and exercise. They also filter out carbon in the air and chemicals in the ground. They also provide sound and visual barriers. If used correctly they can also have an economic benefit. Lastly trees also provide stress relief. Unfortunately, the urban forest at Dalhousie University is in shambles, with terrible tree care and few native species. This project proposes that a new approach to tree maintenance, planning and tree selection practices be implemented. This is done by researching urban forests, interviewing experts, and by re-designing an area of campus to reflect an ideal, well maintained, native forest of Nova Scotia. By implementing this project Dalhousie could become a greener and more pleasant place to learn and grow.

Introduction

Urban forests have been around for as long as humans have lived in cities. They began as tree lined streets and lavish gardens, almost exclusively for the wealthy, and sometimes for research. Dating back as far as the 16th century these gardens provided the people with a place to meet and enjoy the "wild outdoors" often in the form of garden parties and other social gatherings. (Konijnendijk, 2005) However, as time passed these gardens began to become open to the public and more and more trees were being used to line streets and boulevards. In 1902 Ebenezer Howard created the concept of a garden city where the city was designed with concentric circles with the inner part of each circle being lined with trees, shrubs and flowers. (Konijnendijk, 2005) Howard also believed that gardens should be placed in poorer areas as this would help the people be more productive by providing respite from the difficulties of their daily lives.

Urban forests provide enormous benefits that are wide ranging. In cities they absorb heat during the day and thus prevent the city from becoming a heat island at night. The heat island concept is that cement and asphalt absorb the heat during the day and then release that heat during the night preventing the city from ever cooling down. (Moll, Ebenreck, 1989) They also block light and sound and absorb carbon. Trees can also provide more stable ground by holding soil together and can also absorb other chemicals through their roots. They also absorb excess water and thus prevent flooding. (Prendergast, 2003) Forests also provide people with a place

to play and relax; it allows its inhabitants to escape the mundane. They provide places for people to interact and exercise and have been proven to relieve people of stress. (Konijnendijk, 2005) Urban forests are also home to birds and insects and by increasing an urban forest one will increase diversity. Diversity among tress as well as its inhabitants helps protect urban forests from insect infestation and disease. Urban forests also help create an aesthetically pleasing environment. They can be used to focus someone's attention on a specific building but can also be used to hide an unsightly building or structure from view. (Buszard, 2009) They can exist as wild like spaces or constructed parks and can be used to benefit a local area economically. Trees such as maples can be used to tap for syrup and once the syrup is collected and processed sold to others in the city or kept for personal use.

However, though there are many benefits to urban forestry there are some difficulties. People often believe that the chances of an assault occurring in or near trees or among them are very high. (Simmons, 2009) To some extent this is true. Mugging and crimes of opportunity do increase in urban forests but violent crime does not. (Simmons, 2009) Regardless most people do not feel safe at night. Other issues are care for the trees. For the first few years of a trees life little care is needed but as the tree grows it may require pruning. (Simmons, 2009) Trees must also be monitored for deadfall as they can damage both cars and people. Tree roots can also be problematic to city dwellers by undermining cement sidewalks and streets. They have also been known to work their way into underground pipes and basements. Though there are issues with urban trees many of them can be managed provided the city utilizes proper practices and funding. (Simmons, 2009)

Definition

As time passed the idea and concept of an urban forest began to take shape and a definition was formed that more accurately described what an urban forest really is. Today an urban forest is any single consolidated forest composed of flora and fauna within the urbanized area that facilitates the social, economic and ecological well being of the city. (Mitchell, 2002) To put is more simply an urban forest is any and all trees within an urban area regardless of location within the area. The urban forest in Halifax includes Point Pleasant Park, the Public Gardens, all street lined trees, trees on private property and every tree in between from Dartmouth to Sackville. Dalhousie University is also part of the overall urban forest of Halifax and is the focus of this project.

Purpose

Dalhousie University, like much of Halifax, is home to a large invasive urban forest. Less than 20% of all trees on campus are native and often these trees are treated poorly. (Bhatia, 2005) There are trees lining University Avenue, copses of trees around the Life Sciences Center, a copse behind the Killiam Library and sporadic trees throughout; all comprise Dalhousie's urban forest. These trees are part of the larger urban forest of Halifax and are essential to life for those who live and work on campus and in other parts of the city. The purpose of this project is to redesign and up-grade a section of urban forest on Dalhousie University campus to benefit both people and the environment.

Methods

The methods for this project involved an extensive amount of research rather than data collection. Our group employed three main methods for this research they include interviews with experts in their fields as well as people with a general interest, intensive literary review,

observation of the area and reviews of previous Environmental Science 3502 projects. The project was designed around the idea of creating a new urban forest. The interviews are purposive and questions have been created before the interview. However, other questions may arise during the interview. The people to be interviewed are:
Wayne Groszko, Environmental Science Professor at Dalhousie University
Bill Freedman, ecologist and professor at Dalhousie University
Deborah Buszard, Acting Director of Environmental Programs, professor, Dalhousie University
Peter Duinker, Professor, School for Resource and Environmental Studies
John Simmons, Supervisor Halifax regional Municipalities Urban Forestry, arborist
In order to conduct the interviews e-mails have been sent out to each person explaining our project and asking if it was possible to speak to them and when.

Procedure

For the interviews each interviewee was contacted by electronic mail and appointments were then set up. When interviewed two or more group members were present with at least one taking notes while the other asked questions. Once completed the interview was then discussed at a later date by the group. All the notes from these interviews can be found in Appendix E. The group observed Dalhousie University both together and separately. As a group a site was chosen on campus by doing a walk around and choosing a site based on its need for trees and its location. One group member went around campus and took photographs of trees on campus and posted them on the web for other group members to see. (Appendix B) A geographic information systems map was obtained from Sexton Campus at Dalhousie University.(Appendix C) Numerous books were read both on urban forestry and tree care. Books were shared among group members. These books were read using both *a priori* and *a posterior* methods. Some books and their subject and content were known to apply to this project while others were not. All books read can be found in the references section of this report. Lastly, previous projects, from the 3502 class, were examined by all group members.

Justification

Research was chosen over monitoring due to time, weather and monetary constraints. Research was done on tree types of Nova Scotia in order to determine what trees could be used in the urban forest as the project is to try and bring more native species to campus. Research was also done on tree care as well as urban forest design. The interviews were conducted because the people who were interviewed all had ties to urban forestry or urban gardening. Observations were made in order to see what site was best. However, observation was limited due to the weather and observations of how students, faculty, and staff, use the green space on campus were not possible. The purpose of redesigning one area was to demonstrate a native urban forest that could be used as an example for future projects.

Limitations

There are limitations to every undertaking and this project was no exception. One of the biggest limiting factors was the time of year. This project was assigned in January and the presentation was on April 7th, and for the majority of that time Dalhousie campus was buried under snow and ice. The weather limited us in that we could not see the site properly. An example is that our group was unaware of how extensive the concrete pathways in our chosen site were until the snow melted. Other limitations were communication with Facilities Management of which we received none. We were also unable to conduct a thorough soil sample due to a lack of time and money. Other limitations were procuring the information on the

Life Sciences Center itself. Our group could not determine what the concrete boxes explicit purpose was, although, they appear to be blocked off skylights. The biggest limitation was our own thinking. Our initial idea for site assessment turned out to be not applicable to this case and our attempts to asses' things led us to over complicate the project. Once the project became simplified it went more smoothly.

Delimitations

The delimitations our group used to help us focus our project on a specific area. As a group we chose the courtyard in the Life Sciences Center for its lack of trees and proximity to one of Dalhousie's most utilized buildings. A second delimitation was our group's choice to use only native species. This would severely limit what could be planted in the courtyard and exclude any trees that might grow well in an urban setting but are not native to Nova Scotia.

Results

The research stage of this project identified the problems with Dalhousie's urban forest were a lack of maintenance, native species, and a continuous canopy of the existing urban forest. Following the research stage of our project it was concluded that upgrading the quality of Dalhousie's urban forest would enhance the benefits it provides. This project concluded the best way to approach upgrading the urban forest on Dalhousie campus was to redesign a section on campus that models the qualities of an ideal urban forest. In the future the attributes of our model can be used as an example that can be applied throughout campus. Our research indicates aspects of a design that will allow for the next step to be placed in creating a continuous canopy of a well maintained native urban forest on Dalhousie University campus.

The qualities of an ideal urban forest were determined through our research and can be applied to our design. The purpose of our design will be to demonstrate a forest reflective of the native Acadian Forest of Nova Scotia. It will serve as both a recreational and educational facility. It can be used to demonstrate proper tree care, species, location and layout of an urban forest on Dalhousie Campus.

Research showed there were four main considerations when designing an urban forest for Dalhousie campus, location, tree species, maintenance and design. Our findings focused on where the best locations to design an urban forests were, the species chosen for the urban forest and the maintenance of the trees following the initial planting. Further research also indicated the costs and sourcing of trees for an urban forest.

Location

Determining a location for the model urban forest began as the major focus of this project, but was later determined to only be a minor factor in the design of an urban forest. According to Bill Freedman, when assessing an area to plant trees, factors such as determining the moisture regime, exposure to light, and protection of the trees from vandalism should be considered. Freedman also indicated that the major location stressors to trees in urban setting are; air pollution, exposure to salt, construction projects severing root systems of trees, people damaging trees through activities such as weed whacking, and asphalt preventing the infiltration of water to root system.

With all of these potential stressors to trees it seems difficult to find a place where trees could grow, however trees are incredibly hardy and withstand many stressors. Freedman stated that the only thing trees really need as far as location is an open space and specified that a tree could be planted anywhere.

Both Paul Simmons and Freedman indicated that when planting trees in an urban setting planting along boulevards and streets are an excellent way to create a continuous canopy and enhance the quality of the area. Contrary to Freedman's belief that a tree should be planted anywhere the interview with Deborah Buszard suggested that there is a correct and incorrect location for a tree. Buszard feels that if you are going to plant a tree as part of an urban forest it should be done to optimize the urban design of the area. Buszard indicated that trees planted should be planted in a location that offers aesthetic value, additionally to the environmental value in order to increases the overall effectiveness of the urban forest. She also pointed out there were certain areas where Dalhousie Facilities Management would not allow trees to be planted such as in the line of site to the Henry Hicks Building which is a classic Dalhousie view.

The concept of planting trees where they offered more than one attribute was mentioned by both Buszard and Wayne Groszko. Groszko suggested that finding a practical application for trees on campus. An example of this would be to replace a metal fence with a cedar hedge; this would have a two-fold of benefit. Buszard suggested that trees should be planted in a location that will allow the public to be transported into a seemingly different world then the one in their surrounding area, a holodeck like experience. This would allow visitors a chance to relax and enjoy their surroundings.

Following the observation component of this project the location for the model urban forest was chosen to be designed in the courtyard of the Life Sciences Centre (LSC) on Studley campus. (Appendix D) This area was chosen because it offered many of the ideal location qualities identified in interviews and the literature review. The courtyard in the LSC offered the largest number of benefits.

The courtyard of the LSC is in an enclosed area that is locked in the evening. This will allow for protection of trees from many of the stressors including vandalism. The enclosed space also offers the ability to create a seemingly different world for visitors to enjoy as Buszard suggested. Because the goal of this design is also to create an educational element it is appropriate that it is located in the Life Science Centre where professors of biology could take classes to show students a native Acadian Forest. Given the multiple benefits an urban forest in the LSC courtyard would offer, it is the ideal location to design a model.

When expanding the upgraded urban forest throughout the rest of campus the consideration of location must include planting trees in a manner that creates a continuous canopy. Any other opportunities to plant trees that provide multiple benefits such as insulating buildings from the wind, preventing erosion, or aiding in infiltration of water should also be taken.

Although there are many considerations of where an ideal location for a tree should be planted, our project found that it is possible to plant a tree in almost any area. Our research shows that location is not the important aspect of an upgraded urban forest because there is a type of tree for any landscape (Freedman, 2009).

Tree Species

The species of trees selected to be planted in an urban forest is very important. The selection of trees for the model urban forest will provide examples of tree species that work well on Dalhousie campus. The most important aspect in tree species selection is that the tree is native to Nova Scotia. Review of a previous ENVS 3502 project Dalhousie Urban Forest showed that only 22% (Bhatia, 2005) of trees on Dalhousie campus are species native to the Nova Scotia. Freedman estimated that there were less than 22% native species on campus and also stated that Dalhousie's horticulturist continues to plant alien species.

Research indicated there are many benefits of planting native species in urban forests. Freedman informed us that native species in Halifax have higher survival rates because they are growing in the same conditions they evolved in. There is another argument that alien species may be more appropriate for some cities due to the effect of heat islands (Bradshaw, Hunt, Walmsley, 1995). Simmons suggests that native tree species should be used but also employs the use of native maples germinated in petri dishes which have higher survival rates for Halifax's urban forest. This shows that native trees work best but need to be chosen carefully. Native trees also provide a better habitat for native fauna. Wildlife such as birds and small mammals can live in cities while having a habitat that reflective of the Nova Scotian forest. Native trees provide natural food and shelter for city animals.

Buszard was also supportive of an urban forest containing native species. As Buszard feels urban landscape should have more than one purpose and if possible a theme, native species would provide both of these aspects. Designing a model that is reflective of an Acadian Forest creates a theme and provides an educational element for visitors.

Research also showed certain native trees should be used over others. First of all the reason that the location of trees in an urban forest is not a large factor is due to the diversity of trees in the Acadian Forest. Through review of Trees of Nova Scotia (Saunders, 1970) (Appendix A) For example a beech tree is most suited for a moderately moist loam soil in a shady area, while the jack pine prefers poor moist soils and has a high tolerance for salt (Natural Resources Canada 2007). In order to determine the most appropriate tree type it is ideal to carry out a site assessment. A site assessment will determine factors such as; climate, microclimate, soil factors, structural factors, sunlight levels, irrigation levels, drainage characteristics, and other considerations. The level of depth for a site assessment can range greatly. An example of a detailed site assessment for urban forests can be found in Trees in the Urban Landscape. (Trowbridge and Bassuk, 2004)

There should be a variety of trees species used if possible. This will increase the survival rates if there is an epidemic that targets one species of tree. In the past such epidemics have targeted trees such as elm and chestnut, so these should not be planted at all (Freedman, 2009). By diversifying the type of tree in an area it prevents diseases from easily spreading.

By having an area with native species already on campus when trees in other areas on campus are planted the model urban forest can be looked to as an example of which trees grow well on Dalhousie campus. Planting native species instead of alien species is one of the first steps in enhancing Dalhousie's overall urban forest.

Maintenance

Evidence for the importance of maintaining trees after they have been planted was collected from observation of Dalhousie Campus and recommendations from interviews with experts in their fields.

Observations of Dalhousie trees showed trees that had their trunk filled with cement, tree roots damaged by snow ploughs, trees incorrectly supported by wires to make them grow straight, and most significantly improper pruning techniques. (Appendix B) These observations were compared to the recommended care of trees in The Tree Doctor (Prendergast, 2003), and shows that many trees have been incorrectly cared for.

Freedman described how improper pruning and lack of care around the trunk of the tree accounts for many tree deaths. Simmons informed our group that a tree actually needs zero maintenance, only protection, in the first three years of its life. Following the first three years of a trees life proper maintenance then needs to include not damaging the tree with poor pruning methods and ensuring the tree receives the nutrients, water and space it needs to grow (Prendergast, 2003).

Simmons indicated that most tree damage does not occur from vandalism but improper pruning techniques by those responsible for the tree's care. Proper training should be provided to the caretakers of the model urban forest to ensure trees are not damaged while being maintained. With a successful maintenance regime for a model urban forest these techniques can then be applied to the trees on the rest of campus.

Design

The benefits of urban forest are largely attributed to the aesthetic and pleasing value it gives people in their surroundings. Buszard recommended a design be created to enhance these values. The concept of the model urban forest is to create a beautiful space that is interesting and exciting to visit. Having visitors enjoy coming to an area that is representative of the Acadian Forest will provide them with a break in their workday. The proposed design of the model forest can be viewed in Appendix C.

The design aspect of the urban forest focuses on creating secondary benefits for the area. The design will allow of an aesthetically pleasing educational environment. Several methods were employed to achieve this goal.

Having many wandering paths composed of natural material circling around the area will create the sense of a much larger area then what is actually there. It will also create a sense of excitement to know what will be around the next corner. (Buszard, 2009). Benches will provide visitors a chance to sit and enjoy their natural surroundings. Small plaques with educational pieces of information throughout the forest will also allow visitors to learn about the Acadian Forest and its importance to Nova Scotia.

The design of the model urban forest does not necessarily need to be applied to the rest of campus because the goal of an upgraded urban forest main focus is to have a continuous canopy of native trees. That being said, the enjoyment of the model urban forest and understanding the potential for multiple benefits of trees may increase support to apply the concepts of the model urban forest across campus. The design aspect of the urban forest can be mimicked to create enjoyable urban forests across campus.

Sourcing and Cost

There are surprisingly few nurseries that provide native species to the public; most nurseries tend to sell alien species. Dalhousie University has an advantage in acquiring these trees because it is a larger institution and therefore will be able to make orders large enough to make distant nurseries worthwhile. The trees from the urban forest on the southern peninsula of Halifax (Point Pleasant Park) are from a combination of two nurseries in Ontario and one in Nova Scotia. There is also a nursery specializing in native species in Prince Edward Island. These nurseries are: Dutchmasters and Common in Ontario, Springvale in Annapolis Valley and Mcphail Woods on Prince Edward Island. (Simmons, 2009) Though, these nurseries do sell native species not one of them sells all the species native to Nova Scotia. This means that Dalhousie would have to purchase trees from more than one nursery.

Based on the prices of trees purchased to supply Point Pleasant Park the cost of one 40-60 mm tree is 200 to 400$, plus labor. It is estimated that including labor cost each tree would cost a total of 400-600$. Though this drives up the price of an urban forest on Dalhousie the benefits and longevity of the trees will eventually earn a return.

Discussion, Recommendations, and Conclusions

The results of our research provide substantial information for designing, maintaining and upgrading the urban forest of Dalhousie campus. Our research identified issues with the Dalhousie's urban forest and found solutions to these problems.

In theory our proposed solution of creating a model urban forest that could demonstrate the qualities of an ideal urban forest and would be an excellent solution to the issues facing Dalhousie's trees. There are several unknown aspects to this proposal however and questions must be raised; who will provide the funding? Who will oversee the implementation of this project? What will insure the longevity of the model urban forest? Will permission be granted to upgrade this space into an urban forest? Will the trees grow and survive? Will severe weather damage the urban forest and what will be done if this happens? As these questions demonstrate the implementation of our project could be difficult. But also provides further evidence as to why a small scale model project is the next step towards upgrading Dalhousie's urban forest.

Our research also show the benefits that could be provided by our model and plan to upgrade Dalhousie's urban forest will justify the effort and initial monetary costs of implementation. The evidence of long term benefits also suggest that some costs such as campus maintenance will be reduced and property value increased (Freedman 2009).

There are some solutions to the problems this project addressed which can be implemented immediately to start upgrading Dalhousie's urban forest. Planting exclusively native species on Dalhousie campus is a great start. Also insuring someone is responsible for proper maintenance of Dalhousie's trees will increase their survival rate.

In addition to the idealized model of the LSC courtyard, there are many other pockets on campus that have the potential to be upgraded. A campus with as many pockets of ideal Acadian Forest and other native habitats such as the ocean pond will create an excellent network of spaces. This would provide benefits for the whole Dalhousie community from the students to the birds.

There are many more aspects of research that can be studied relative to urban forests. A site assessment of all of Dalhousie campus would provide information on which tree is best suited for each area. A tree care and maintenance plan could be created to ensure the trees on campus will have better survival rates. Another consideration for the future of urban forests is the

effect of climate change on trees. This topic currently being studied by Peter Duinker in Dalhousie's Faculty of Management and his research should be consulted for future planning.

Conclusion

In conclusion we have found that upgrading Dalhousie's urban forest will yield worthwhile results. We recommend a further study be carried out to determine the next steps in implementing a model urban forest in the courtyard of the LSC. Following the implementation of this ideal urban forest it should be used a model and source of information when planting more trees on campus. Furthermore, a design should be created that identifies spaces on campus where trees could be planted in a layout that they would create a continuous canopy. Any step, no matter how small, towards the final goal of upgrading Dalhousie's Urban Forest will create positive benefits for the Dalhousie. The potential of a native urban forest running through Dalhousie campus would create a natural habitat for many animals and plants, and allow students and faculty alike the joy of being surrounded by their natural environment.

Reference

Bhatia, Sonja, MacCallum, Andrew, Morgan, Alice, White, Nicole. *Dalhousie University Tree Inventory: In depth framework development and inventory of northwest corner of Studley Campus*. Environmental Science 3502, 2005.

Bradley, Gordon A. Urban Forest Landscapes: Integrating Multidisciplinary Perspectives. London: University of Washington Press, 1995.

Bradshaw, Anthony and Hunt, Ben. Trees in the Urban Landscape: Principals and Practice. New Practice. New York: E & FN Spon, 1995.

Buszard, Deborah. Personal Interview. March 8th, 2009.

Chapman, Graham Keith. Urban and Rural Planning, Thesis. Technical University of Nova Scotia, 1995.

Craul, Philip J. Urban Soil in Landscape Design. New York: John Wiley and Sons Inc., 1992.

Duinker, Peter. Personal Interview. March 26th, 2009.

Freedman, Bill. Personal Interview. March 6th, 2009.

Groszko, Wayne. Personal Interview. 2009.

Konijnendijk, Cecil C. Et al. Urban Forests and Trees. Springer, 2005

Mitchell, Peter. Canada's Urban Forest: A Collection of Stories. Guelph: Center for Land and Water Stewardship, 2002.

Prendergast, Erin. Prendergast, Daniel. The Tree Doctor: A Guide to Tree and Care Maintenance. United States: Firefly Books, 2003.

Saunders, Gary L. Trees of Nova Scotia. Nova Scotia: Department of Lands and Forests, 1970.

Shigo, Alex L. A New Tree Biology. Durham, New Hampshire: Shigo and Trees, 1989.

Shigo, Alex L. Tree Pithy Points. Durham, New Hampshire: Shigo and Trees, 1999.

Simmons, John. Personal interview. April 4th, 2009.

Thomas, Peter. Trees: Their Natural History. Cambridge: Cambridge University Press, 2000.

Trowbridge, Peter J. and Bassuk, Nina L. Trees in the Urban Landscape. Hoboken, New Jersey: John Wiley and Sons, Inc., 2004. Pg. 7.

MacDougal, Daniel. Tree Growth. Leiden, Holland: Chronica Botanica Company, 1938.

Moll, Gary and Ebenreck, Sara. Shading Our Cities. Washington D.C.: Island Press, 1989.

Appendix A

Native Softwood Trees of Nova Scotia

	Life expectancy	Mature height	Shade tolerance	Moisture preference	Soil	PH level	Salt tolerance
Softwoods							
Balsam Fir	70-150 yrs	21 m	High to moderate	Moderate	Wide Range	Neutral to acid	Low to moderate
Tamarack	100-180 yrs	23 m	Low	High	Wide Range	Acid to neutral	High
White Spruce	100-200 yrs	24 m	Moderate	Moderate to high	Wide Range	Acid to neutral	High
Black Spruce	150-250 yrs	17 m	High to moderate	High	Wide range	Acid to neutral	Moderate
Red Spruce	250-350 yrs	26 m	Very High	High	Sandy Loam	Acid to neutral	Moderate
Jack Pine	80-130 yrs	19 m	Low	Moderate to low	Sandy/ poor soils	Acid to neutral	High
Red Pine	150-200 yrs	26 m	Low	Low	Sandy	Neutral to acid	Low
White Pine	200-400 yrs	35 m	Moderate	Moderate	Sandy Loam	Neutral to acid	Low
White Cedar	150-350 yrs	15 m	High to moderate	High	Wide Range	Alkaline to neutral	Low to moderate
Eastern Hemlock	300-400 yrs	21 m	Very high	High	Sandy Loam	Acid to neutral	Low

Native Hardwood Trees of Nova Scotia

	Life Expectancy	Mature Height	Shade Tolerance	Moisture Preference	Soil	PH Level	Salt Tolerance
Hardwoods							
Red Maple	80-130 yrs	22 m	Moderate	Moderate	Wide Range	Acid to neutral	Moderate to low
Sugar Maple	150-250 yrs	28 m	Very High	Moderate	Loamy Sand	Neutral to acid	Low
Yellow Birch	150-250 yrs	25 m	Moderate	High	Loamy Sand	Neutral	Moderate
White Birch	80-130 yrs	24 m	Low	Moderate	Sandy Loam	Acid to neutral	Moderate to high
Grey Birch	20-50 yrs	11 m	Low	Moderate to low	Wide range	Acid to neutral	Moderate
Beech	100-200 yrs	24 m	Very High	Moderate	Loam	Acid to neutral	Low
White Ash	100-200 yrs	23 m	Moderate to low	Moderate	Loam	Neutral to alkaline	Moderate to high
Black Ash	80-130 yrs	18 m	Moderate to low	High	Poorly drained	Acid to neutral	Moderate
Hophornbeam	50-100 yrs	12 m	High	Low to moderate	Loamy sand	Neutral to acid	Low
Balsam Poplar	80-150 yrs	24 m	Low	High	Sandy to loam	Neutral	Moderate to low
Largetooth Aspen	60-100 yrs	22 m	Low	Moderate to low	Sandy/ wide range	Neutral to acid	High
Trembling Aspen	60-100 yrs	18 m	Low	Moderate	Wide range	Acid	Moderate to high
Red Oak	200-250 yrs	24 m	Moderate to low	Moderate	Sandy loam	Neutral to acid	High
White Elm	150-200 yrs	27 m	Moderate	Moderate	Sandy loam	Alkaline to neutral	Moderate

A Handbook of Maritime Trees. Natural Resources Canada, 2007. Retrieved April 1st, 2009.

http://cfs.nrcan.gc.ca/subsite/maritimetrees/maritimetrees

Trees of Nova Scotia: A Guide to the Native and Exotic Species. Nova Scotia Department of Land and Resources. 1970.