The Forests of Pippy Park

A collaboration between NCC and the Pippy Park Commission

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Table of Contents

Introduction

The Forest of Pippy Park project was undertaken by Nature Conservancy of Canada in partnership with the C. A. Pippy Park Commission ("the Commission"). The overall goal of the project is to provide a scientific understanding of the forests within Pippy Park. Geographic Information Systems and field work produced a map (attached) that will provide a better understanding of the age structure and diversity of forest types found within the park, while also informing NCC's securement goals. This report will outline the methods and results of the project and provide descriptions of the most common forest types.

Definitions

NCC – Nature Conservancy of Canada
The Commission – The C. A. Pippy Park Commission
NACP – Natural Area Conservation Plans (NCC's five year plans)
Fog Forest – NCC's Natural Area name for much of the Avalon Peninsula
Age Class – categories that describe a forest stand age
Forest Type – the ecological classification of a forest stand
FRI – Forest Resource Inventory, the provincial dataset for forest age and composition classes
Polygon – an enclosed area on a map
GIS – Geographic Information Systems or the type of software used to conduct the mapping

Pippy Park

Pippy Park was officially established in 1968 under the *Pippy Park* Act with three main goals; one of the main goals of the park is:

> *"To protect and conserve natural habitats and features"* (*Pippy Park*).

In order to conserve and protect any natural feature one must identify the natural feature in question and determine its extent and role on the landscape. A baseline understanding of a given species or ecosystem type will enable the assessment of threats and thus inform management and conservation plans.

The Commission and committees such as the Park Heritage Committee have identified research as integral to the management of the park. Nature based research is but one of the goals outlined by the Park Heritage Committee:

> *"To initiate and assist research efforts and projects pertaining to the natural, cultural and management aspects of the Park"* (*Pippy Park*).

Nature Conservancy of Canada

Nature Conservancy of Canada (NCC) is a private, not-for-profit organization that seeks to conserve ecologically significant land through donation or purchase. NCC is a nation-wide conservation land trust that has been operating on the island of Newfoundland since 1994. During the past seventeen years NCC has helped to conserve 34 properties; NCC has acquired

more than 6,600 acres via direct conservation and has assisted in conservation of another 5,700 acres.

As an active landowner, we steward the land by completing environmental assessments and baseline ecological inventories. In particular, we use conservation biology to support our land acquisition and stewardship goals. The scientific activities of NCC provide an understanding of the diverse landscapes and habitat types present in our province. Accordingly, our stewardship activities ensure that once the land is purchased it will be maintained in a natural and pristine state in perpetuity.

It is our hope that the data collected through this study will be used by both the Commission and Nature Conservancy of Canada to inform conservation planning within the park.

Conservation Planning: Natural Area Conservation Plans

In order to identify properties of interest in a certain region, NCC prepares Natural Area Conservation Plans. The major land unit that is used to inform NACPs is the ecoregion. There are nine ecoregions on the island of Newfoundland. Pippy Park is located within NCC's Fog Forest Natural Area (e.g. the Maritime Barrens ecoregion). Each NACP highlights several biodiversity targets (i.e. rare and endangered species or representative forests) and uses these targets, along with other principles of conservation biology, to prioritize properties for NCC to secure.

NCC has selected Pippy Park as a Focal Area within the Fog Forest Natural Area and it is our hope to contribute to this existing protected area. A Conservation Action (1.1.5) outlined within the Fog Forest NACP is to:

> "Secure 30 acres (12.1 ha) of land supporting target ecosystems and species in Pippy Park, St. John's by 2015" (LaFitte 2010)

Forest Resource Inventory data

The project utilized Forest Resource Inventory (FRI) data that had been previously compiled by the Department of Natural Resources (DNR), Government of Newfoundland and Labrador. The FRI data has been interpreted from aerial photographs and ground-truthed using permanent and temporary plots by DNR. Forests on the island of Newfoundland generally fall within one of seven age classes. The age classes encountered are as follows:

Table 1: Age Class Definitions for the Island of Newfoundland

Age Class	Forest State	Age
1	Regenerating	0 - 20 years
2	Immature	21 - 40 years
3	Semi-mature	41 - 60 years
4	Mature	61 - 80 years
5	Over-Mature	81 - 100 years
6	Over-Mature	101 - 120 years
7	Over-Mature	121 - 140 years

There are an additional three "Over-Mature" age classes described by the province; however stands of those ages are not found within the boundaries of Pippy Park (Government of Newfoundland and Labrador 2011). It is probable that much of the over-mature forest succumbed to fire in 1961, which burnt approximately 1200 acres (Pippy Park).

In addition to the merchantable timber polygons delineated in the FRI data, the data provided unclassified polygons for the majority of Pippy Park's land base. The underlying FRI data tables also provide the dominant species (or working group), the species composition, the area, the height and the density among others variables for all the forested stands within the Park.

Forest Site Classification: Damman Forest Types

The Forest Site Classification Manual: A Field Guide to the Damman Forest Types of Newfoundland (Meades and Moore 1994) was used to assess the forest types within the park. Damman forest types are delineated primarily using soil and vegetation criteria in concert with general site appearance and tree species dominance (Meades and Roberts 1992). The manual provides a dichotomous key as well as a highly detailed description of each forest type found in the province. Of particular interest, Damman also addressed the impacts of specific disturbances on each forest types. These successional relationships allow foresters as well as ecologist to understand what forest types will reclaim the landscape post disturbances. If this knowledge can be incorporated into existing conservation planning it may contribute to the assessment of ecosystem health within a protected area.

The vegetation communities and dominant tree species were assessed at several sites within the park and the most common forest types encountered are listed in detail in the results section.

Forest Resource Inventory Data vs. Damman Forest Site Classification

The FRI data provided the age, tree species composition and extent of particular stands throughout the province, while the Damman Forest Site Classification provides a mechanism to describe the current ecological state of a forest site. Forest stands of all age classes encountered were ground truthed and classified using the Forest Site Classification Manual and a tree increment borer. It is important to note that one cannot simply use the polygons associated with the FRI data as a baseline for mapping Damman forest types. Nonetheless, these two approaches

together provide an accurate age distribution along with detailed descriptions of the key forest types for the park.

Study Sites

The FRI data along with a high resolution aerial photograph of the park (City of St. John's) was used to select a sub-sample of forest stands in the Three Pond Barrens (or barrenlands, see Appendix 3) area of Pippy Park. In order to ground-truth each age class, eighteen study sites were selected and field visits were made throughout the month of July 2011. Five stands per age class were selected, save for the 0-20 year old (age class 1) due to its low representation in the Park.

Methods

Using a tree increment borer the average age of five stands of each age class (present in the park) was measured. Five trees per species (if available) per stand were bored in order to determine the average age of the stand. As described above the four age classes encountered were; regenerating, immature, semi-mature and mature; providing a range of one to eighty year old trees. In the case that a tree was too small (mean basal diameter of 3.8 cm or less) to bore, a horizontal slice was taken at just above ground level in order to attain an accurate age estimate, a basal "cookie" was obtained.

The underlying FRI data was augmented using simple statistics from the field studies to determine the species composition, the working group (or dominant species) and the extent of each age class present within the park.

The Pippy Park aerial photograph was interpreted and used along with the unclassified FRI polygons in order to determine the extent of scrub and heath, wetland, water and disturbed land within the park.

The result is a highly detailed map displaying the habitats present within the park alongside the differentiated forest polygons as shown in Appendix 1.

Land use zones and habitat types

The total area of Pippy Park is approximately 12.24 km² (~ 3035 acres) and is composed of a number of different land use zones. The commission has differentiated three main zones within the park and they are as follows: barrenlands, semi-rural parklands and the institutional facilities zone, as shown in Appendix 3 (Pippy Park 2011).
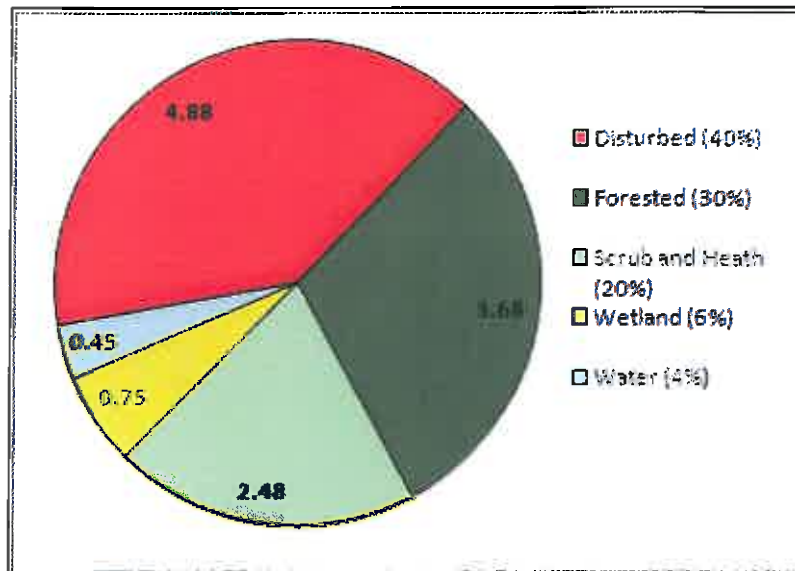

Figure 1: Area in square kilometers (km²) per habitat type* (including disturbed lands) within Pippy Park.
(*Note: For the purposes of this graph Forested land and Scrub and Heath have been separated; the total area of "forest habitats" is approximately 50% of the Park or 6.17 km²)

For the purposes of this report "disturbed" land refers to any evidence of human impact including vegetated land that has been altered by human use (i.e. a golf course or camping grounds). Forest stands can occur in disturbed lands, but they cannot be considered "natural" as the stands often include ornamental trees, invasive species, no natural understory or are too small to be considered forest stands. This category encompasses the majority of the institutional facilities zone along with a decreasing proportion of both the semi-rural parkland and the barrenlands. Of the 12.24 km² approximately 4.88 km² have been impacted by human use.

The remaining four categories (forested, scrub and heath, wetland and water are primarily distributed throughout the semi-rural parklands and barrenlands with an increasing proportion within the barrenlands. Approximately 57% (excluding water) of the park is naturally vegetated as compared to the 43% that has been influenced in some way by human activities. Accordingly, the majority of the field work for this study and the forested land is found within the barrenlands.

The scrub and heath lands are mixed in nature and were therefore it was impracticable to differentiate separate polygons. That being said, there is a significant amount of open canopy black spruce forests (see Damman forest types sub-section Cladonia-Kalmia-Black Spruce for further discussion.) intertwined with then more shrubby barrens that characterize the study site. At times the scrub and heath layer may be analyzed as part of the forested layer or as a separate layer.

Extent of Forested Lands within Pippy Park

The area of forested land including scrub and heath within the boundaries of Pippy Park is approximately 6.17 square kilometers (~ 50% of the park). There is a noteworthy distribution of age classes within the park; excluding the over-mature age classes as discussed above (Figure 1). It is important to note that the three over-mature age classes (essentially 81 – 140 year old trees) are absent from Figure 2 below; this is to illustrate their absence from the park. The differentiated forest polygons along with the habitat polygons were mapped and are provided in as both digital files and in appendix 1.
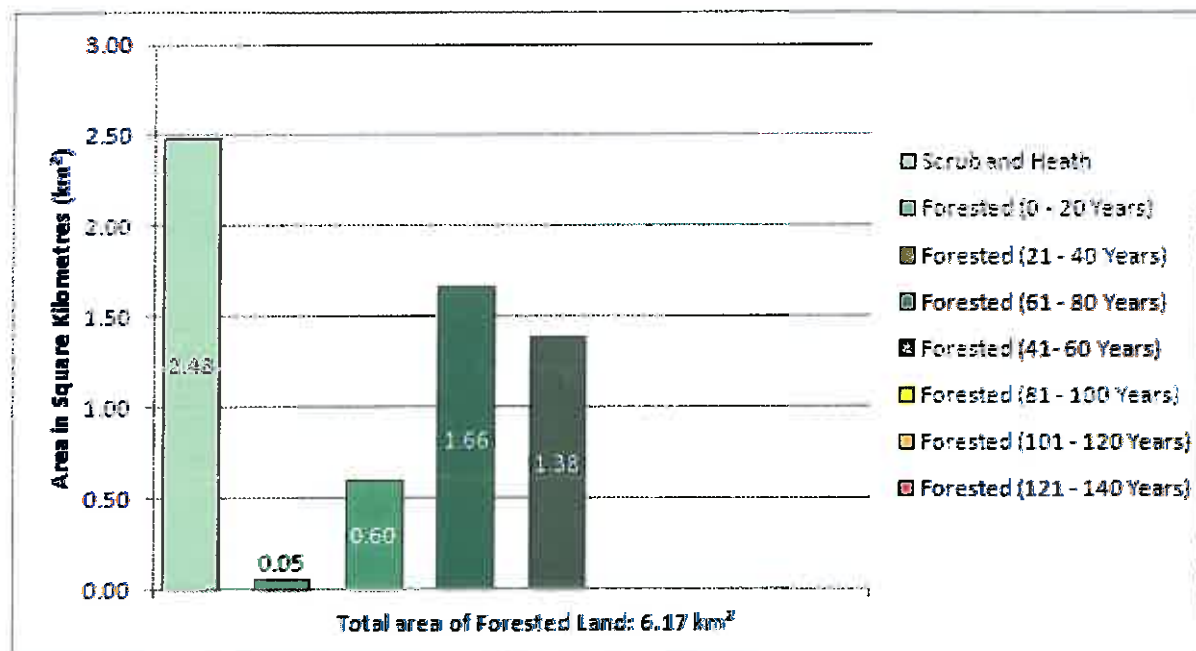

Figure 2: The Area of Forested Land by Age Class within Pippy Park

A variety of uneven aged stands will help to provide vertical and horizontal structure to the overall forested landscape. This structure provides a multitude of niche habitats available for use by specialist and generalist species alike. Fortunately, the relative amounts of each age class found within the park in its current state may result in a healthy distribution of all age classes in the future.
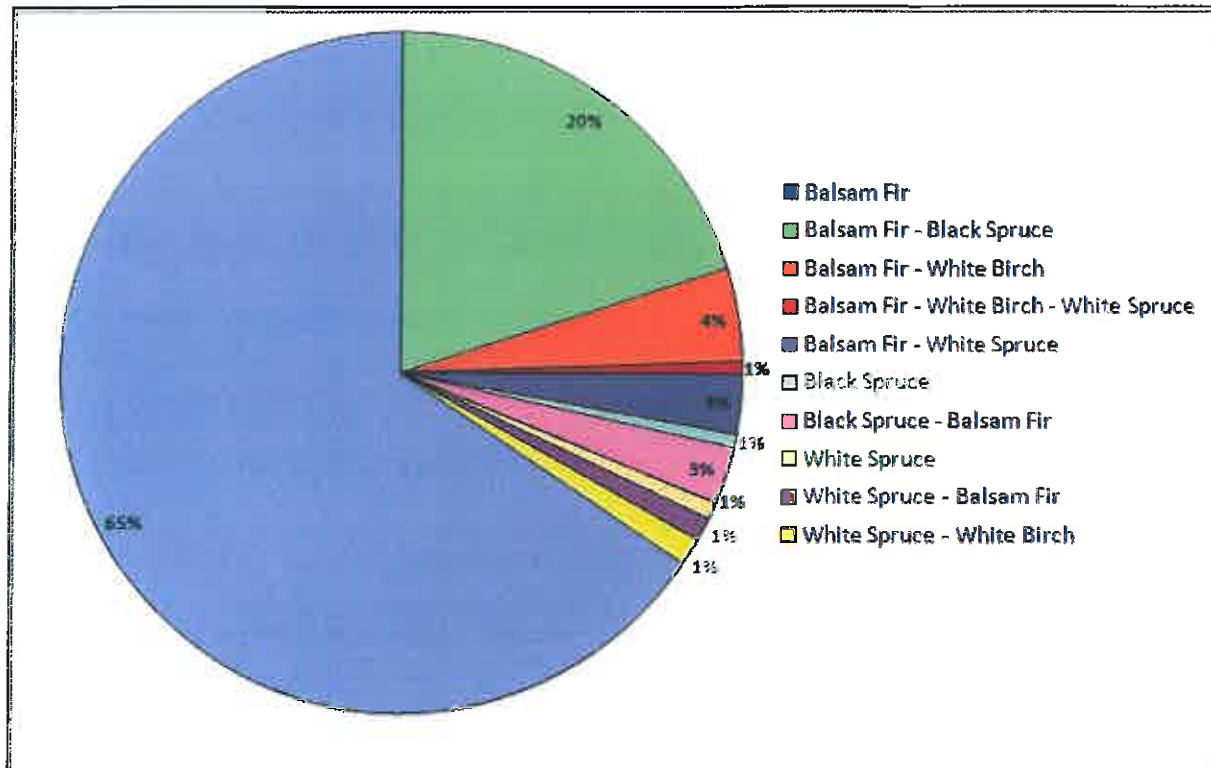

Figure 3: The Overall Species Composition of Pippy Parks Forested Lands

The forests found within Pippy Park are dominated by Balsam Fir (*Abies balsamea* [L.] Mill) with much smaller proportions of Black Spruce (*Picea mariana*) (see Figure 2, where species are listed in order of predominance). There are a number of mixed forest types represented, such as Balsam Fir – Black Spruce (*A. balsamea – P.mariana* [20%]) and Balsam Fir – White Birch (*A. balsamea – Betula. papyrifera* [4%]) (Figure 2). An accompanying map that displays the distribution of each species has been provided in Appendix 2.

Damman Forest Types

As mentioned in the methods section each of the study sites were assessed using the Forest Site Classification Manual, which is primarily based on Damman forest types. In general, three main

forest types were encountered with additional forest types known to occur in the scrub and wetland categories. The forest types were determined using the dichotomous key provided in Meades and Moores (1994) along with a general assessment of each site. A species list was also compiled for each site in order to assist with this process (an overall species list for Pippy Park has been provided in Appendix 2).

The three main forest types were encountered within Pippy Park were Pleurozium-Balsam Fir, Holycomium-Balsam Fir and Clintonia-Balsam Fir. Much of the scrub and heath can be classified as Cladonia-Kalmia-Black Spruce due to open nature of these areas. Each forest types will be explained below.

Balsam Fir Forest Types

The ecology of Balsam Fir has ensured its dominance upon the landscape throughout Newfoundland. This is primarily due to its ability to persist under a closed canopy as a regeneration layer. This regeneration layer can persist for many years and is capable of demonstrating an increased growth rate as soon as the canopy breaks. These forest types are naturally replaced by Black Spruce forest types on extremely wet or dry nutrient poor sites. In addition, Balsam Fir stands are rarely self-replacing after fire as they produce seeds annually in the fall and winter prior to the typical fire season (Meades and Moores 1994).

Pleurozium-Balsam Fir

Pleurozium-Balsam Fir forests have a moss layer dominated by Red Stem Moss (*Pleurozium schreberi*) with a poorly developed shrub layer, especially under dense canopy cover. The sites are nutrient poor with varying moisture profiles. The forests generally progress into Kalmia (*Kalmia angustifolia*) dominated heath (Meades and Moores 1994).

Holycomium-Balsam Fir

Holycomium-Balsam Fir forests are characterized by having poorly developed shrub and herb layers along with a stair-step moss (*Holycomium splendens*) dominated moss layer. These forests are classified as having medium to rich soil with moderate moisture levels. These forests generally progress to Black Spruce-Feathermoss/Moist forests after fire (Meades and Moores 1994).

Clintonia-Balsam Fir

Clintonia-Balsam Fir forests are characterized as having a moss dominant forest floor coupled with a well developed herb layer, with a particularly high abundance of Yellow Corn Lily (*Clintonia borealis*). After fire these forests generally progress into Black Spruce-Feathermoss/Dry forests (Meades and Moores 1994). See Meades and Moores (1994) for a more detailed description of additional forest types. The moss layer is primarily stair-step moss (*Holycomium splendens*) with patches of several sphagnum species. Goldthread (*Coptis groenlandica*) was also common.

Kalmia-Black Spruce Forest Types
<u>Cladonia-Kalmia-Black Spruce</u>

It is likely that due to the natural conditions of the barrenlands within Pippy Park, the major open canopy forest type is Cladonia-Kalmia-Black Spruce. Cladonia-Kalmia-Black Spruce forests are naturally occurring due to moisture and nutrient limitations. The barrenlands can be characterized in have little to no organic soil layer due to the windswept nature of the area along with the abundance of boulders upon or within the litter, fibric and humic layers of the soil.

Conclusion

The information provided in this report will provide a base for understanding and managing forested land within the park. Efficient monitoring and conservation management will ensure that natural succession patterns will have a chance to contribute to a mixed, uneven aged forest across Pippy Park.

References

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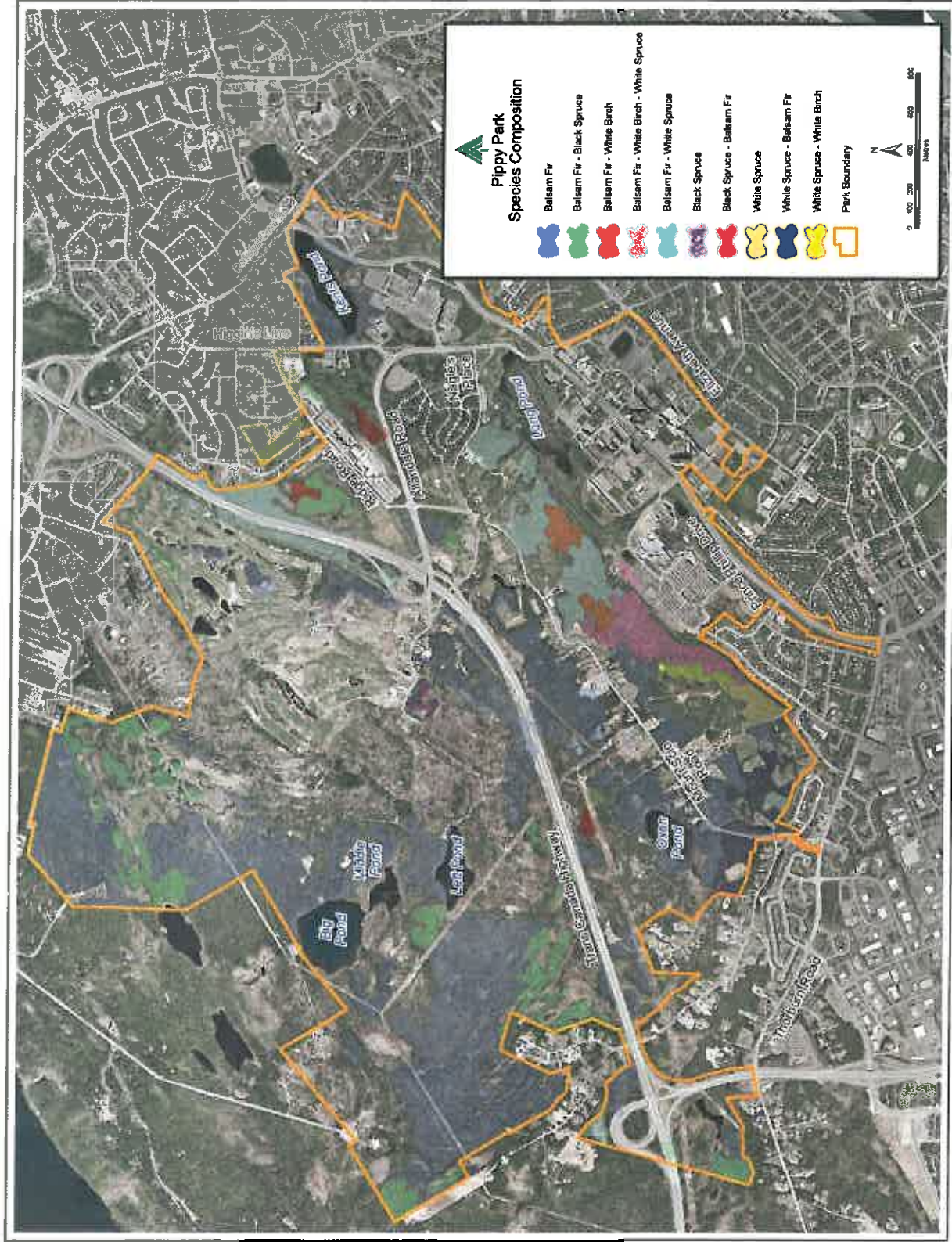
Pippy Park, 2011b. Land Use Zones Map. Digital.

Appendix 1: Pippy Park Forest Classification Map

Appendix 2: Pippy Park Species Composition Map

Pippy Park
Species Composition

Balsam Fir

Balsam Fir - Black Spruce

Balsam Fir - White Birch

Balsam Fir - White Birch - White Spruce

Balsam Fir - White Spruce

Black Spruce

Black Spruce - Balsam Fir

White Spruce

White Spruce - Balsam Fir

White Spruce - White Birch

Park Boundary

Appendix 3: Pippy Park Land Use Zones Map