HIGH PARK WOODLAND & SAVANNAH MANAGEMENT PLAN

TORONTO
Parks & Recreation

February 2002

The City of Toronto created the High Park Citizens' Advisory Committee (HPCAC) in 1995. This group of interested citizens volunteer their time to help make High Park a better place for all. The purpose of the group is to provide the City of Toronto Parks and Recreation Division with an on-going source of public input and assistance in all matters concerning High Park.

The Natural Environment Subcommittee (NESc) provides input and direction to the City regarding ecologically sound park management and operational practices. The NESc has developed a strong Volunteer Stewardship Program that supports restoration efforts. Through this program, many volunteers take part in weeding, planting and seed collection. Through this and other HPCAC programs, concerned citizens have made a significant contribution to restoring the health of High Park's natural environment.

Cover photos: *[clockwise from left to right]* Prescribed burning in High Park in spring of 2001; Cylindric Blazing Star; Black Oak leaves; volunteer assisting with native plant restoration in spring of 2000; Lupines in flower following a prescribed burn in High Park in spring of 2000.

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Available on the City of Toronto website at www.city.toronto.on.ca/trees

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Urban Forestry Services
Parks & Recreation Division
Economic Development Culture and Tourism
City of Toronto

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1 Preface

High Park's Woodland & Savannah Management Plan is one of several working documents designed to serve as a reference and resource base for City staff, volunteers, and other individuals and organizations involved in High Park's ongoing management. This Plan provides an overview of the Park's history and natural features, identifies significant threats to the Park's ecology and outlines management approaches and techniques. More detailed information about the activities that will take place in the various management units (see *Figure 4, page 41*) are outlined in the Park's annual Operational Plans.

While the overall scope, objectives and strategies of this Management Plan (hereto referred to as "the Plan" in this document) will remain in place over the long-term, the more detailed management approaches provided in the Operational Plans are intended to be adaptive, reflecting both the dynamic nature of the habitats themselves and the potential need to alter management techniques based on information gained through implementation and monitoring.

Please note that every effort has been made to use the most current nomenclature and standards, and that the following conventions have been adopted for ease of discussion and clarity:

1. Plants are referred to using their common names, with a list of corresponding scientific (i.e., Latin) names provided in *Table 1, page 20* and a comprehensive plant list for the Park is provided in *Appendix A*. Both lists conform to the Ontario Plant List (Newmaster et al. 1998).
2. Wildlife species are referred to using common names, with corresponding scientific names provided in *Tables 2 - 5, pages 25 - 31*, and scientific names provided in the text for mammals and herpetofauna (i.e., amphibians and reptiles) not listed in the tables. Comprehensive species lists (with scientific names) of birds and butterflies observed in High Park are provided in *Appendices B & C*. All wildlife nomenclature and phylogenetic organization conforms to current Ontario Natural Heritage Information Centre (NHIC) standards (http://www.mnr.gov.on.ca/MNR/nhic/).
3. According to the most current Ecological Land Classification (ELC) system for Southern Ontario (Lee et al. 1998) High Park's community of concern is categorized as "tallgrass prairie, savannah and woodland". However, High Park's rolling uplands have been called both "Black Oak savannah" (or savanna) and "Black Oak woodland". In the Plan text, we have decided to use the older convention for the sake of simplicity and refer to these communities interchangeably as "Black Oak savannah" and "Black Oak woodland", although the current ELC community labels have been applied in *Section 7* (where they are described) and *Figures 3 & 4, pages 19 & 41*.
4. Rare and uncommon plant species (see *Tables 7 & 8, pages 36 & 37*) are defined according to the current provincial rankings set by the NHIC (Oldham et al. 1999) and regional rankings set by the Ministry of Natural Resources (Varga et al. 1999). Provincially rare plants are ranked S1 (extremely rare), S2 (very rare) or S3 (rare to uncommon). Regional rarity is based on status in the City of Toronto (as opposed to the entire GTA), and numbers assigned (i.e., R1, R2, etc.) reflect the number of stations where a given plant has been recorded. Generally, a species is considered rare if it occurs at 6 or less stations, while an uncommon species occurs at 7 to 12 stations.

2 Executive Summary

Prairies and savannahs are among the most endangered ecosystems in the Province. High Park's Black Oak woodlands and savannahs, in combination with its other unique plant communities, provide a unique refuge for plants and animals within Toronto's urban environment that is invaluable to a wide range of flora and fauna, as well as to local residents and the wider scientific community. This sizeable natural parkland on the lakefront is not only an oasis for resident rare plants and animals, but also a safe haven for migrating birds and butterflies, and a widely used centre for environmental education.

Over the years, as the population of Toronto has increased, the natural plant communities in High Park have been fragmented by the introduction of structures and related infrastructure, as well as by environmentally degrading recreational activities. The policy of fire suppression, in place until recently, also contributed to an overall degradation of the fire-adapted ecological communities in the Park by allowing the spread of invasive plants at the expense of the native plant assemblages. However, starting in 1992 a number of policies and programs supporting active restoration of High Park's endangered ecosystems were developed and adopted. From this basis, a combination of progressive management activities, including prescribed burns, invasive plant control, and use of native plants propagated from local seed and grown within the Park's own greenhouses, as well as re-introduction of native plants sourced from like ecosystems in the Province, have been tried and implemented. These ongoing management activities are continually being evaluated in terms of their effectiveness and have, on the whole, been overwhelmingly successful to date.

This document provides the context for these management activities to City staff, citizen volunteers, and other interested parties by presenting the overall restoration goals and objectives, as well as the actions and strategies that have emerged from the ongoing management efforts. This Plan also provides descriptions of the extant vegetation and wildlife in the Park, as well as descriptions of the threats to the integrity of these ecosystems, a summary of previous restoration activities and directions for future restoration, monitoring and stewardship activities. By consolidating information from various studies, some dating as far back as 1976, this plan provides a comprehensive framework for the ongoing management of High Park's valued ecosystems that is accessible to a wide range of stakeholders. It is hoped that given this framework, stakeholders will be able to contribute to the adaptive management process already set in place and described in annual work plans.

3 Overview

3.1 Plan Rationale

It is commonly believed that Ontario was once a vast unbroken forest. However, Ontario once supported as much as 2000 km^2 of prairies and open woodlands or savannahs that contained species typical of the tallgrass prairies of the mid-west. These communities were concentrated on drier alvars and sand plains, and were maintained in an open state by periodic fire or flooding (Varga 1999). Today, less than 21 km^2 remain, making prairies and savannahs some of the most endangered ecosystems in the province (Rodger 1998). Of the prairies and savannahs once found in the Toronto region, only High Park and smaller remnants such as Lambton Park have survived urban development, and even these rare remnants will be subject to further decline unless a comprehensive management plan is implemented to restore these habitats' ecological features and functions (Varga 1999).

Fortunately, the growing field of restoration ecology has led to the development of techniques and practices for managing and rehabilitating degraded natural systems. Restoration strategies for prairies and savannahs are among the best developed because these habitats have been the subject of active restoration efforts in the American Midwest since the 1950's (Packard and Mutel 1997).

The purpose of this Management Plan is to provide the framework as well as the implementation tools for preserving High Park's significant plant communities and restoring them to long-term viability. In order to accomplish this, the Plan provides baseline information about the terrestrial vegetation features within High Park and recommendations for the preservation, restoration and/or enhancement of these features using the appropriate techniques and tools.

The Plan is intended to serve as a resource for individuals involved in High Park's ongoing management, as well as for managers, staff and volunteers involved in comparable restorations. Ultimately, this document could become a "toolkit" of restoration practices for prairies and savannahs in urbanized areas. However, the ultimate success of the Plan will depend on the availability of funding, public response to the work proposed, and the commitment of politicians, City staff and volunteers to meet its stated objectives.

3.2 Goals & Objectives

3.2.1 Long-term Goals

1. To protect High Park's nationally significant Black Oak woodland and savannah, and other associated plant and wildlife features through research, restoration and active maintenance management.
2. To provide a basis for high quality educational visitor experiences based on enjoyment, appreciation and protection of the natural environment.

3.2.2 Specific Objectives

1. To assess and restore the natural communities of High Park to a healthy and self-sustaining state.
2. To manage natural vegetation communities so that native biodiversity and ecological functions are restored wherever possible.
3. To maintain and reintroduce threatened and endangered plant and animal species.
4. To enhance habitat features to attract and sustain wildlife.
5. To develop an awareness and understanding of High Park's ecological significance.
6. To foster a sustainable relationship between the community and nature by involving citizens, organizations and agencies in biodiversity conservation efforts.
7. To assess and adapt management prescriptions as necessary to achieve the goals of this Plan.

3.3 Summary of Actions & Strategies

3.3.1 Prescribed Burning

Fire is a natural process that is essential to the recovery of the oak savannah in High Park. Prescribed burning is the most economical and effective method of restoring the Park's terrestrial ecosystem.

The Plan proposes to:

- Continue to implement prescribed burns and develop a long term fire management strategy.
- Continue education, training and outreach instruction on prescribed burn techniques and benefits.
- Continue to work with City staff and volunteers to safely implement a prescribed burn program.
- Use prescribed burning to enhance growth of native species and control of exotic plant species.
- Identify White Pine stands to be retained in the Park and plan for their protection from future prescribed burns.

3.3 Summary of Actions & Strategies (cont'd)

3.3.2 Controlling Invasive Plant Species

The strategy for High Park will be to limit negative ecological impact of invasive species and promote successful competition by the native plant community through an "integrated pest management" approach (where the pest is an invasive plant rather than an insect or disease pest). Standard methods of controlling invasive species fall into three main categories: physical, chemical and biological. The results of invasive plant control efforts in Toronto and elsewhere indicate the need for a flexible approach that allows for a variety of tools and is referred to as "integrated pest management".

The Plan proposes to:

- Minimize disturbances that contribute to fragmentation of plant communities.
- Manage canopy gaps and other openings to permit regeneration of native plant communities while preventing establishment of invasive species.
- Give first priority to sustaining high quality habitats, areas that contain rare species or areas that are at the early stages of species invasion when controlling and managing invasive species.
- Monitor the establishment of invasive species and the rate of spread of existing infestations.
- Target the most sensitive life stages by considering the ecology of the species of concern when undertaking control.
- Use appropriate invasive plant control methods to achieve vegetation management objectives such as reducing non-native trees and shrubs, and reducing invasive grasses and other groundcovers.
- Establish native plant cover to limit the spread of invasive species into new areas and to recapture areas where invasive plants have been removed.
- Take steps to prevent the accidental introduction of invasive plants to new locations.
- Create and maintain a Park-based list of invasive plant species that have the potential to establish in High Park and threaten native flora, and monitor the establishment of these species.
- Educate citizens, encourage the use of native plants in gardens that surround the Park, and support the "Expanding the Borders of High Park" program.

3.3.3 Re-establishing Native Plant Communities & Species

Several studies (e.g., Apfelbaum et al. 1993, Varga 1989, Wainio et al. 1976) have cited evidence indicating the serious deterioration of High Park's plant communities. While management techniques such as prescribed burning and removal of invasive exotic plants are expected to result in significant improvements in biodiversity and ecological health, the deliberate re-introduction of native species is also necessary to ensure the long-term viability of the Park's natural systems.

The Plan proposes to:

- Use plantings and other revegetation techniques to enhance native biodiversity, increase native plant cover and improve habitat quality for plant and animal life.
- Use plantings to control erosion, mimic natural vegetation patterns and processes from the micro-site to the community scale.
- When possible, obtain seed from High Park or locally from natural stands, unless another source can provide genetically acceptable material.
- Create the disturbances necessary to stimulate seed bank germination or the growth of established plants (such as fire, removal of invasive species, canopy gaps).
- Minimize impacts to native vegetation resulting from plantings and other management activities.

3.3.4 *Restoring Rare Native Plant Populations*

Because High Park is an isolated habitat fragment, it is difficult for native plants from elsewhere to naturally offset population decline. Rare plants are generally the first species to be lost within an isolated area and the last to re-colonize them.

The Plan proposes to:

- Inventory and map locations of rare plant species.
- Maintain seed banks to conserve genotypes and exchange seed with other similar sites in southern Ontario.
- Manage threats to rare plants, such as invasive species, trampling, lack of natural disturbances and loss of specific growing requirements.
- Use trail closures, barriers and signage to reduce trampling and discourage the collection of wildflowers.
- Propagate rare species from locally collected seed, outplant into suitable sites and enhance the size of existing populations of rare plants.

3.3.5 *Restoring Tall Shrub Habitat for Migrant Songbirds*

Tall, shrubby vegetation is decreasing in abundance in the Park due to the re-introduction of fire and the manual removal of tall, invasive shrubs. A well diversified vegetation structure that includes tall shrubs is necessary to provide habitat for migrant songbirds in the spring.

The Plan proposes to:

- Increase native shrubbery in open manicured turf-grass along the eastern flank of Grenadier Pond.
- Establish a shrub swamp in the southern portion of Upper Duck Pond.
- Plant a large number of native shrubs in the open grass area just west of Lower Duck Pond.
- Increase native shrub plantings in woodlands around Lower Duck Pond.
- Close unofficial trails in the southern area of the Park such as the Ravine Trail near Colborne Lodge.

3.3 Summary of Actions & Strategies (cont'd)

3.3.6 Increasing Abundance of Cavity Trees & Woody Debris

Dead trees are crucial to the overall health of a forest ecosystem. Silvicultural guidelines recommend leaving a minimum of one cavity tree per hectare of at least 40 cm in diameter for wildlife habitat. Priorities for leaving cavity trees must be based on safety issues in High Park, rather than on wildlife priorities.

The Plan proposes to:

- Identify standing dead trees that are not hanging over trails for retention.
- Remove hazardous limbs if they hang over trails, but without converting large limbs to small pieces.
- Drop snags to the ground where they pose a safety hazard, but without cutting logs or slash unless necessary.
- Retain standing dead pines after prescribed fires wherever possible.
- Educate the public about the importance of dead wood for wildlife habitat.
- Conduct a herpetofauna survey to update and verify the inventory.

3.3.7 Reducing Trampling Damage

Native plant communities will not regenerate adequately unless steps are taken to control off-trail trampling and soil disturbance. This will require a formalized trail system, the closure of unofficial paths and other specific actions that serve to protect significant and rare plant communities.

The Plan proposes to:

- Undertake mapping of sensitive plant communities and important wildlife habitats.
- Formalize a limited number of trails to reduce impacts to natural systems.
- Avoid trail development and where possible, use appropriate barriers to prevent trampling of sensitive terrain and high quality habitats. Temporary trail closures may be used to protect nesting sites and other wildlife habitats.
- Re-vegetate closed trail systems.
- Protect natural areas by enforcing the dog "off-leash" policy and conducting public outreach around this issue.
- Develop signage to encourage Park users to stay on trails and be respectful of the Park's natural environment.
- Produce trail guides and other interpretative materials to educate the public about the natural features of High Park.

3.3.8 Restoring Hydrology

A better understanding of High Park's hydrological systems (ponds, wetlands, ground water, streams and creeks), both past and present, will be necessary before steps can be taken to re-establish more natural pattern of drainage. In the meantime, techniques that can be used to improve hydrology include the restoration and creation of wetlands, controlling invasive plants and re-introducing native plant cover.

The Plan proposes to:

- Control invasive plants and re-establish native plant cover around ponds and along Spring Creek where feasible.
- Re-establish natural surface water flow regimes and create "wetlands" where possible to meet restoration objectives.

3.3.9 Managing Grey Squirrel Populations

If future studies determine that Grey Squirrel populations are having a negative impact on the regeneration of Black Oaks, the re-introduction of the Flying Squirrel or the survival of rare breeding birds, steps should be taken to limit the population of this species in the Park.

The Plan proposes to:

- Facilitate continuing studies of the impacts caused by Grey Squirrels in High Park.
- If possible, encourage establishment of predators.
- Educate the public to prevent the feeding of squirrels.

3.3.10 Monitoring Pollution & Climate Change

The effects of pollution and climate change may challenge restoration efforts. Soil studies could help to identify specific problems, and monitoring climate change would inform management strategies. For example, if climate fluctuation becomes a trend, planting species adapted to a wider range of conditions may become appropriate.

The Plan proposes to:

- Conduct and/or facilitate a comprehensive survey and assessment of soil quality, litter and soil biota in High Park.
- Monitor success of plantings in different sites and modify restoration goals if necessary.
- Maintain records of climate and phenology (information on the timing of emergence of roots, shoots, foliage and reproductive structures such as flowers and seeds) for a selected group of invasive, and native plants.

4 Site Context

4.1 Physical Setting

High Park is a classic example of a sizeable urban Park that has, over time, become increasingly isolated from other natural areas and subject to fragmentation within its boundaries. As shown in *Figures 1* and *2*, High Park is located within an area of residential development, bounded on three sides by major roads, in close proximity to Lake Ontario, and disconnected from neighbouring natural corridors. Within the Park itself, the Black Oak savannah and woodlands have been fragmented by roads, paths, buildings and recreational facilities, as can be seen in *Figure 3, page 19*.

4.2 Classifying High Park's Ecosystems

According to Varga (1989), the historic vegetation of High Park's rolling uplands was Black Oak savannah or woodland. These terms are used interchangeably in reports, publications and by the media to describe the Park's dryland oak-dominated systems. According to the most current system, Ecological Land Classification for Southern Ontario (Lee et al. 1998), High Park's prairies are classified as tallgrass woodland (tree cover ranging from 35 to 60%), rather than tallgrass savannah (tree cover ranging from 25 to 35%) because of the number of Black Oaks on the site. For ease of discussion in the Plan, the terms Black Oak savannah and Black Oak woodland will be used with the understanding that the ecosystem in question is a mosaic of forested and grassy areas.

4.3 Recognizing High Park's Ecosystems: ANSI Designation

In 1989, the Province designated High Park's remaining Black Oak savannah/woodlands as an *Area of Natural and Scientific Interest* (ANSI), and it continues to recognize the Park's ecological significance and the management efforts undertaken to protect it (see *Appendix G*). In spite of broad-scale changes to its plant communities over the past century, High Park remains one of the most significant natural areas in the Toronto Region and constitutes a piece of the 1% of original pre-settlement cover of prairie and oak savannah remaining in Ontario (Rodger 1998). Although most of this habitat is found outside the Toronto Region (i.e., in the Windsor area, on Walpole Island and in the Pinery Provincial Park) approximately 22.7 hectares (ha) of fragmented Black Oak savannah is found within High Park.

High Park's natural areas are primarily recognized for supporting a large number of plant species with southern or prairie affinities, as well as a number of rare plant species (see *Table 8, page 37*). This diversity is remarkable in view of the Park's location near the northeastern limit of prairie/savannah in Ontario, and within a densely populated urban area. High Park is also recognized for its remnant dry deciduous forests, mesic deciduous upland forests, dry mesic mixed upland forests, and for its ability to support several plant species with northerly affinities, including two species characteristic of Great Lakes shoreline habitats (Varga 1989).

FIGURE 1. Site location map.

FIGURE 2. *Air photo of High Park and immediate surroundings, 1999.*

4.4 Natural History in Brief

High Park is located in Toronto on the Iroquois Sand Plain, a vast sandy area extending west from the Park to the Humber River. Of the Park's total area of 160 ha, ponds comprise 24 ha, natural areas 79 ha and public recreation lands, a zoo, roads and parking lots account for 57 ha. A large plateau is found in the centre of the Park, which is deeply dissected by two major stream valleys and associated tributary valleys. Grenadier Pond occupies most of the western half and contains one of the few remnant lakeshore marshes in the City.

About a third of the Park's natural environment consists of nationally rare Black Oak savannah or woodland containing a high diversity of rare plant species. Oak savannahs are open, oak-dominated woodlands containing scattered low shrubs and a rich variety of forbs and graminoids, many of which have southern or prairie affinities. Savannahs are also fire-adapted communities that depend on periodic burning for renewal and maintenance.

Historically, the dry soils of the sand plain supported spectacular oak woodlands and pine barrens, another type of open, sparsely treed community. In High Park, Black Oak woodlands and moist Red Oak forests covered the rolling uplands. In contrast, ravine bottomlands contained cool mixed swamps with many northern species. Wild Lupine occurred in abundance in the barrens (I.e., areas lacking trees) and on the oak-covered hills. The barrens contained groves of Sassafras that grew in association with Dryland Blueberry and Black Huckleberry and a variety of prairie grasses and wildflowers. Grenadier Pond was a lakeshore marsh fringed by sedges, Water-willow, Pickerel Weed and Arrow-head (Varga 1989).


Wild Lupine

High Park's idyllic landscape began to change in the early 1900's, when public demand for recreation led to the clearing of trees to create space for playing fields and toboggan runs. The most dramatic changes occurred after the 1950's, both as a result of increasing urbanization and the construction of various recreational facilities within the Park. Excessive habitat fragmentation and past management practices have led to the serious deterioration of the Park's natural environment and the outright loss of much of the original savannah habitat. In addition, the suppression of natural phenomena, such as fire and flooding, has enabled exotic trees, shrubs and other plants to invade the savannah and woodlands, and exclude the native vegetation.

It is estimated that over half of the plants documented in High Park historically have disappeared, in addition to many breeding birds, herpetofauna and savannah-related insects. One of the Park's most noteworthy extirpated species, the Melissa (Karner) Blue butterfly, foraged exclusively on the Wild Lupine, a fire-dependent plant that has been greatly reduced in numbers. Other significant species that have been lost from the Park include the Eastern Hognose Snake, the Red-headed Woodpecker, and southern dragonflies such as the Vesper Bluet and Halloween Pennant. Furthermore, many of the Park's majestic Black Oaks are approaching 200 years of age and are not successfully regenerating. To compound this, the cankerworm infestation of 1998 to 2000 accelerated the mortality of over-mature Black Oaks, resulting in a large number of dead trees in the Park in 2001.

5 Human History in Brief

Archaeological evidence indicates that native peoples inhabited the High Park area as early as 7,000 BC and that the Humber River was a well-used trade route linking native settlements between Lake Ontario and Georgian Bay. In the 1600's, an Iroquois village known as Teiaiagon flourished on the edge of the Humber valley northwest of High Park where villagers cleared surrounding lands using fire and cultivated corn, beans and maize on the sandy uplands (Heidenreich and Burgar 1999).

In 1836, City Surveyor John Howard purchased a 66 ha wooded lot on the lakeshore west of Toronto. Within a year he erected Colborne Lodge and named the estate High Park, since it is the highest point in the area. In 1873, the Howards deeded the property with conditions to the City of Toronto, and in 1876 the City acquired an additional 69 ha east of the estate. It was not until 1930 that the final 29 ha including Grenadier Pond (14 ha) was added, bringing the total size to 164 ha. However, 4.5 ha of marshland at the south end of Grenadier Pond was later given to Metro Transportation when the Queensway extension was built in the early 1950's, leaving 159.5 ha in total.

Prior to 1954, little development occurred in the Park, but a shift in policy in the 1950's led to the development of facilities such as Hillside Gardens, the swimming pool, the zoo and the tennis courts. These developments provided many amenities to the City's residents, but resulted in the loss of many of the Park's natural areas. In the late 1980's the presiding City Forester, Bill Morsink, recognized the significance of the Park's natural heritage and began to change management practices, shifting the focus to restoration.

6 Biophysical Setting

6.1 Topography & Soils

High Park is located in the Iroquois Sand Plain, a physiographic feature derived from glacial processes. Approximately 12,000 years ago, retreating glaciers formed Lake Iroquois and deposited sand and silt along the bottom of its shoreline. As the ancient lake receded, the sand plain was exposed and eroded by glacial meltwater to create a varied landscape of numerous ponds, steep-sided ravines and flat and gently rolling uplands.

Analyses of soils from three locations in High Park have indicated that the soils are sandy loams with a topsoil layer ranging from 0 to 14.5 cm in depth (Apfelbaum et al. 1993). Yellow to bright orange sands were found below a depth of 12.5 to 14.5 cm, indicating well-drained conditions and the oxidation of minerals such as iron, aluminium and manganese. Soil texture and chemical analyses also revealed a neutral pH and a low organic and nutrient content. A soil survey of nearby South Humber Park, also located on the Iroquois Sand Plain, indicated that soils were predominantly sands and sandy loams (Association for Biodiversity Conservation 2000).

6.2 Hydrology

Grenadier Pond is the largest of several ponds in High Park. Development in the surrounding drainage area has reduced its size from 19 ha in historical times to its present size of 14.2 ha. Two water retention ponds, known as the Lower and Upper Duck ponds, are located in the southeast corner of the Park. There are also three sedimentation ponds; two at the north end of Spring Creek, Howard and Ridout Ponds, and one at the north end of Grenadier Pond known as Wendigo Pond.

Grenadier Pond is primarily fed by storm sewers and run-off from land to the west and east of the pond. To the south, the pond is separated from Lake Ontario by roadways, a railway and Sunnyside Beach. Water flows into a surface outflow at the southwest corner of Grenadier Pond to the Humber River, and then empties into Lake Ontario. Water from a pond to the west of Ellis Avenue (West Pond) also flows into Grenadier Pond approximately 30 m to the north of the outflow.

It is likely that the ponds were at one time separated from Lake Ontario by a sandbar (Wainio et al. 1976). During periods of high water (e.g., spring snow melt), Lake Ontario likely flooded over the bar, resulting in occasional flushing of the ponds and elevated water levels (Gartner Lee Ltd. 1995). After the connection between Grenadier Pond and Lake Ontario was cut off by road and railway construction, an outlet weir was installed (after 1853) to regulate water levels in Grenadier Pond. The weir was subsequently modified in 1996 so that water levels could be lowered seasonally.

Mapping sources indicate that the surface catchment area for Grenadier Pond was much larger historically (47.7 ha) than it is today (24.5 ha), and extended as far north as St. Clair Avenue. When the lands surrounding Grenadier Pond were developed, the drainage system was extensively channelized into storm sewers, and much of the runoff from hard surfaces was diverted out of the catchment. These changes have resulted in a substantial drop in the annual volume of water directed to the pond from groundwater contributions. Structurally, the pond has been "renovated" in successive waves of development, particularly on the eastern and western shorelines (Gartner Lee Ltd. 1995). Wainio et al. (1976) describe the land use changes that have occurred around the perimeter of Grenadier Pond since 1947, after which approximately 4.45 ha were filled to accommodate an expansion of the Queensway roadway.

Major efforts to rehabilitate Grenadier Pond began in 1994. These included fish stocking (Largemouth Bass and Northern Pike), water quality surveys, and the propagation of native shoreline plants at the High Park nursery. The restoration of the Grenadier Pond shoreline began in the southeast corner in 1995, and the southwest corner, East Cove and Maple Leaf shoreline in 1996. Shoreline plantings were implemented to enlarge the remnant areas of wetland remaining around the pond and to reduce the impact of waterfowl on the water quality of the pond (nutrient loading).

Improvements to & management of Grenadier Pond over 1995 - 2000

- Modification of Hillside Garden irrigation system to recycle pond water.
- Vegetation/habitat surveys of plant & fish communities by Toronto & Region Conservation Authority (TRCA).
- Installation of brush bundles to improve fish habitat.
- Re-construction of a stormwater management sedimentation pond (Wendigo Pond) at the north end of Grenadier Pond
- Outlet weir restructuring to allow water levels to fluctuate more naturally.
- Shoreline restoration.

Largemouth Bass

7 Description of Ecosites & Vegetation Types

The ANSI report written by Varga (1989) provides the most recent botanical analysis of the major plant communities found in High Park. Varga's species and community descriptions have been used as a basis to define community types using the first approximation of the Ecological Land Classification (ELC) system (Lee et al. 1998). Brief descriptions of High Park's ELC community types (as shown in *Figure 3, page 19*) are provided in this section. However, the base vegetation mapping predates the development of the ELC system in southern Ontario and still requires updating.

7.1 Overview

High Park's vegetation is transitional between the Carolinian zone, a floristic region that reaches its northeasterly limit near Toronto, and the mixed hardwood zone, which extends north and east through central Ontario and Quebec. The Carolinian zone contains a high proportion of Canada's endangered habitats and approximately 65% of Ontario's rare species (Varga 1989).

Generally, the plateau and upper ravine slopes of High Park support dry oak forests and savannahs with a prairie understory. Lower ravine slopes and slopes facing north and east contain moist deciduous forests dominated by Red Oak with Black Cherry and Red Maple as secondary species. Mixed forests of Eastern Hemlock, Eastern White Pine and Red Oak are restricted along the lower slopes of Spring Road Ravine (Varga 1989). Currently, a variety of exotic plants are invading the oak savannah and other natural areas and are posing a serious threat to the continued existence of native species.

7.2 Natural Terrestrial Ecosystems

7.2.1 Dry Black Oak – White Oak Tallgrass Woodland Type

In High Park, this type is represented by savannahs or open woodlands dominated by mature Black Oak that also contain scattered Red Oak, White Oak and the occasional Eastern White and Red Pine. Black Oak savannah/woodland occurs on dry upper slopes and tablelands.

Shrubs found in this type include a variety of species characteristic of tallgrass woodlands such as: Black Huckleberry, Bush Honeysuckle, Common Blackberry, Dryland Blueberry, Low Sweet Blueberry, New Jersey Tea, Upland Willow, Smooth Wild Rose and Poison Ivy. Representative herbaceous species that occur include: Bastard Toadflax, Showy Tick-trefoil, Eastern Bracken Fern, Common Cinquefoil, Early Goldenrod, Gray Goldenrod, Large-leaved Aster, Pale-leaved Woodland Sunflower, Round-headed Bush-clover, Wild Lupine, Rough Woodland Sunflower, Big Bluestem, Little Bluestem, Indian Grass, and Hay Sedge.

New Jersey Tea Judy Shore

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FIGURE 3. ELC Mapping for High Park
(11 x 17 folded accordion style to 8.5 x 11 size)

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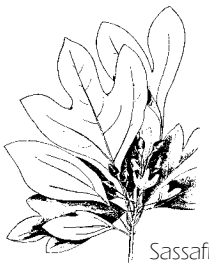
TABLE 1. Common and scientific names of plants listed in this document.

Common Name	Scientific Name	Common Name	Scientific Name
Alligatorweed +	*Alternanthera philoxeroides*	Eastern Bracken Fern	*Pteridium aquilinum var. latiusculum*
American Beech	*Fagus grandifolia*	Eastern Hemlock	*Tsuga canadensis*
American Mountain Ash	*Sorbus americana*	Eastern White Pine	*Pinus strobus*
Arrow-head	*Sagittaria sp.*	European Water-horehound +	*Lycopus europaeus*
Arrow-leaved Aster	*Aster sagittifolius*	False Dragonhead	*Physostegia virginiana*
Asian Bittersweet +	*Celastrus orbiculatus*	False Solomon's Seal	*Maianthemum racemosum*
Bastard Toad-flax	*Commandra umbellata*	Garlic Mustard +	*Alliara petiolata*
Beaked Hazel	*Corylus cornuta*	Glossy Buckthorn +	*Rhamnus frangula*
Big Bluestem	*Andropogon geradii*	Goldthread	*Coptis trifolia*
Black Cherry	*Prunus serotina*	Gray Goldenrod	*Solidago nemoralis*
Black Huckleberry	*Gaylussacia baccata*	Hay Sedge	*Carex siccata*
Black Oak	*Quercus velutina*	Himalayan Balsam +(2)	*Impatiens glandulifera*
Bluebead Clintonia	*Clintonia borealis*	Indian Grass	*Sorghastrum nutans*
Blue-stem Goldenrod	*Solidago caesia*	Interrupted Fern	*Osmunda claytoniana*
Broad-leaved Cattail	*Typha latifolia*	Japanese Knotweed +	*Polygonum cuspidatum*
Bunchberry	*Cornus canadensis*	Klamathweed +	*Hypericum perforatum*
Bush Honeysuckle	*Diervilla lonicera*	Large-leaved Aster	*Aster macrophyllus*
Butterfly Weed	*Asclepias tuberosa*	Lily-of-the Valley +	*Convallaria majalis*
Carolina Poplar	*Populus X canadensis*	Little Bluestem	*Schizachyrium scoparius*
Celandine+	*Chelidonium majus*	Low Sweet Blueberry	*Vaccinium angustifolium*
Choke Cherry	*Prunus virginiana ssp. virginiana*	Manitoba Maple	*Acer negundo*
Common Blackberry	*Rubus alleghaniensis*	Maple-leaved Viburnum	*Viburnum acerifolium*
Common Buckthorn+	*Rhamnus cathartica*	Mayapple	*Podophyllum peltatum*
Common Cinquefoil	*Potentilla simplex*	Mountain Maple	*Acer spicatum*
Common Hairgrass	*Deschampsia flexuosa*	Nannyberry	*Viburnum lentago*
Crack Willow +	*Salix fragilis*	New Jersey Tea	*Ceanothus americanus*
Cup-plant	*Silphium perfoliatum var. perfoliatum*	Northern Beech Fern	*Thelypteris phegopteris*
Dog-strangling Vine +(1)	*Cynanchum spp.*	Northern Blue Flag	*Iris versicolor*
Dryland Blueberry	*Vaccinium pallidum*	Norway Maple +	*Acer platanoides*
Early Goldenrod	*Solidago juncea*	Norway Spruce +	*Picea abies*
Early Meadow-rue	*Thalictrum dioicum*	Pale-leaved Woodland Sunflower	*Helianthus strumosus*

TABLE 1 (cont'd). Common and scientific names of plants listed in this document.

Common Name	Scientific Name	Common Name	Scientific Name
Pasture Rose	*Rosa carolina*	Spicebush	*Lindera benzoin*
Pennsylvania Sedge	*Carex pennsylvanica*	Spiked Blazing Star	*Liatris spicata*
Pickerel Weed	*Pontederia cordata*	Stiff Gentian	*Gentianella quinquefolia*
Poke Milkweed	*Asclepias exaltata*	Sugar Maple	*Acer saccharum ssp. saccharum*
Poison Ivy	*Rhus radicans ssp*	Sweet Fern	*Comptonia peregrina*
Purple Loosestrife +	*Lythrum salicaria*	Sweet Flag	*Acorus calamus*
Queen Anne's Lace +	*Daucas carota*	Tartarian Honeysuckle +	*Lonicera tatarica*
Red Baneberry	*Actaea rubra*	Trailing Arbutus	*Epigaea repens*
Red Maple	*Acer rubrum*	Upland Willow	*Salix humilis*
Red Oak	*Quercus rubra*	Water-horehound	*Lycopus americanus*
Red Pine	*Pinus resinosa*	Water-willow	*Decodon verticillatus*
Red Trillium	*Trillium erectum*	White Ash	*Fraxinus americana*
Red-osier Dogwood	*Cornus stolonifera*	White Baneberry	*Actaea alba*
Rose-twisted Stalk	*Streptopus roseus*	White Birch	*Betula papyrifera*
Rough Woodland Sunflower	*Helianthus divaricatus*	White Cedar	*Thuja occidentalis*
Round-headed Bush-clover	*Lespedeza capitata*	White Elm	*Ulmus americana*
Round-leaved Dogwood	*Cornus rugosa*	White Oak	*Quercus alba*
Running Serviceberry	*Amelanchier stolonifera*	White Sweet-clover +	*Melilotus alba*
Sassafras	*Sassafras albidum*	White Trillium	*Trillium grandiflorum*
Sheep Fescue +	*Festuca longifolia*	Wild Geranium [3]	*Geranium maculatum*
Showy Tick-trefoil	*Desmodium canadense*	Wild Lupine	*Lupinus perennis*
Siberian Elm +	*Ulmus pumila*	Wild Sarsaparilla	*Aralia nudicaulis*
Silver Maple	*Acer saccharinum*	Witch-hazel	*Hamamelis virginiana*
Smooth Brome +	*Bromus inermis ssp. inermis*	Wood Anemone	*Anenome quinquefolia*
Smooth Wild Rose	*Rosa blanda*	Yellow Birch	*Betula alleghaniensis*
Snowberry	*Symphoricarpos albus*	Yellow Iris +	*Iris pseudacorus*
Speckled Alder	*Alnus rugosa*	Zig-zag Goldenrod	*Solidago flexicaulis*

NOTES: *+ = exotic species, * = native but not indigenous to High Park.*
[1] Dog-strangling Vine includes both Cynanchum nigrum (Black Swallow-wort) and Cynanchum rossicum (Pale Swallow-wort).
[2] Himalayan Balsam is an alternate common name for Pink Touch-me-not
[3] Wild Geranium is an alternate common name for Spotted Crane's-bill



Sassafras leaf

7.2 Natural Terrestrial Ecosystems (cont'd)

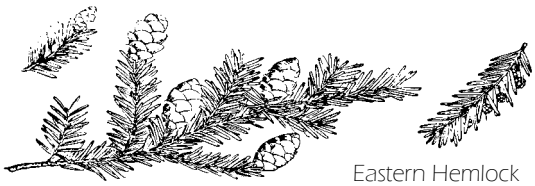
7.2.1 Dry Black Oak – White Oak Tallgrass Woodland Type (cont'd)

Although most of the species found in the Black Oak tallgrass woodlands of High Park are typical of more southerly regions or prairies, a few species with boreal or mixed forest affinities also occur, such as Red Pine, Common Hairgrass and False Dragonhead.

Almost 80% of High Park's rare species are restricted or partially restricted to woodlands dominated by Black Oak. These include the nationally rare Wild Lupine, Spiked Blazing Star, Cylindric Blazing Star and Cup-plant. In total, Varga (1989) recorded 29 regionally rare plants in this vegetation type.

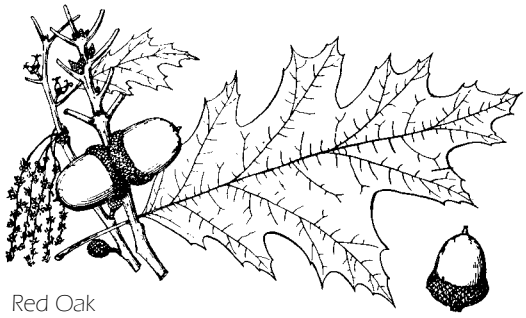
7.2.2 Dry – Fresh Hardwood – Hemlock Mixed Forest Type

This type is confined to three small stands along the eastern slopes of Spring Road Ravine. Eastern Hemlock is dominant, and Red Oak, Black Oak, Red Maple and Eastern White Pine are strong secondary species. White Oak, White Cedar, White Birch, Black Cherry and Yellow Birch are less frequent. The shrub and herbaceous layers are similar to those described for the dry mesic /mesic deciduous forests.


Eastern Hemlock

7.2.3 Dry – Fresh Red Oak Deciduous Forest Type

Two small stands of dry Red Oak deciduous forest dominated by Red and White Oak occur on sand ridges in the south-central portion of the Park. The understory is transitional between that found in dry Black Oak tallgrass woodland and dry to mesic Red Oak forests. In other dry sites, the forest canopy is almost entirely comprised of Red Oak or associated with Black Cherry.


Red Oak

Moister forests are restricted to the northwest and east-facing slopes of Spring Road Ravine, and the north facing slopes of Deer Pen Road Ravine. In these locations, Red Oak is strongly associated with Red Maple. Other common tree species include Black Cherry, Eastern Hemlock, White Birch and American Beech.

Unlike the low shrub and prairie understory found in the dry, tallgrass woodlands in High Park, the understory of moist, Red Oak forests are characterized by tall shrubs and spring flowering herbs. Beaked Hazel, Choke Cherry, Maple-leaved Viburnum, Mountain Maple, Nannyberry, Red-osier Dogwood, Round-leaved Dogwood and Witch-hazel form a dense shrub layer. Typical herbs include: False Solomon's Seal, Wild Sarsaparilla, Early Meadow-rue and Blue-stem Goldenrod.

Moister sites also support Mayapple, Red Baneberry, White Baneberry, White Trillium, Red Trillium, Wild Geranium, Canada Mayflower, Wood Anemone, and Zig-zag Goldenrod. Scattered patches of herbaceous species more typical of the Boreal or Mixed Forest Zones are found on mesic lower slopes. These communities formerly included Bluebead Clintonia, Northern Beech Fern, Rose-twisted Stalk, Bunchberry and Goldthread (Varga 1989), however only Rose-twisted Stalk and Bluebead Clintonia have been recently recorded (C. Kinsley, pers. comm. 2001).

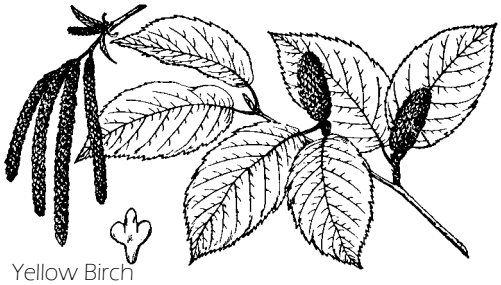
7.2.4 Dry – Fresh Oak – Red Maple Deciduous Forest Type

This association is restricted to a small tributary valley entering Spring Road Ravine. Black Cherry, Red Maple and White Ash are dominant, with Red Oak and White Birch occurring less frequently. The species composition of the shrub and herb layers is similar to that found in dry - fresh Red Oak forest in High Park (see *Section 7.2.3*).

Red Maple

7.2.5 Fresh – Moist Willow Lowland Deciduous Forest Type

In southern Ontario, this community type often results from cultural influences such as clearing, planting and other disturbances. It is often associated with riparian zones and terraces, streambanks and floodplains. In High Park, this forest type is found in Wendigo Ravine and along the western side of Spring Road ravine. Manitoba Maple is the dominant tree species. Other species present are Carolina Poplar, Crack Willow, Yellow Birch, White Elm and planted Silver Maple.



Yellow Birch

7.3 Cultural Terrestrial Ecosystems

7.3.1 Cultural Plantations

Plantations consisting of Red Oak, American Mountain Ash and Norway Spruce are found in the central portion of High Park east of the tennis courts and along small sections of the Deer Pen Road Ravine on the north side.

American Mountain Ash

7.3.2 Mixed Exotic Forests

Exotic forests, dominated by Manitoba Maple (a species native to southern Ontario but non-indigenous to High Park) and stands of exotic trees, particularly Siberian Elm and Norway Maple, occur along margins of natural areas, in disturbed upland sites and along Wendigo Ravine and Spring Road Ravine. The understory consists of a variety of native and exotic species.

7.3.3 Cultural Meadows

Old fields and meadows are scattered throughout the Park in formerly disturbed areas. This type is dominated by exotic grasses, and contains a mixture of native and exotic forbs.

7.4 Aquatic Ecosystems

7.4.1 Red-osier Mineral Thicket Swamp Type

Varga (1989) describes small areas of shrub-rich "marshes" as existing in locations where meadow marsh ecosites predominate. These communities have a shrub layer dominated by Red-osier Dogwood, and also contained Speckled Alder before this species was eradicated by Beaver in the late 1990's. The understory is similar to that noted for organic meadow marsh ecosites (see next type). As late as 1989, a small thicket swamp dominated by Speckled Alder occurred in a U-shaped ravine in the southeastern portion of High Park.

7.4.2 Bluejoint Organic Meadow Marsh Type

Small areas of meadow marsh intermixed with shrub-rich marsh are found in bottomlands along the west side of Spring Road Ravine between Deer Pen Road and Spring Road, and along a tributary stream on the east side which feeds into Spring Road Ravine. Grasses and sedges are absent along west Spring Road Ravine because of high disturbance resulting from stormwater scouring. These wetlands are maintained by water seepage from the base of ravine slopes.

Red-Osier Dogwood is the dominant shrub in this type, which also contained scattered patches of Speckled Alder until the late 1990's. The understory vegetation is similar to that noted for meadow marshes.

7.4.3 Cattail Mineral Shallow Marsh Type

Broad-leaved Cattail marshes are located in the northern and southwestern corners of Grenadier Pond. Purple Loosestrife and European Water-horehound have invaded these areas.

Emergent marshes dominated by Sweet Flag, a regionally rare species, and exotic Yellow Iris fringe the western shoreline of Grenadier Pond. Other common plants include Northern Blue Flag, Broad-leaved Cattail, European and native Water-horehound.

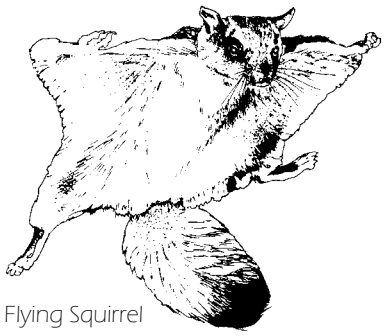
7.4.4 Pondweed Submerged Shallow Aquatic Type

This wetland type is confined to Grenadier Pond. Shallow areas of open water along the shoreline support an aquatic plant community dominated by pondweed. Aquatic plants are virtually absent towards the centre of the pond.

Sweet Flag

8 Description & Assessment of Wildlife Attributes

This section provides an overview of the wildlife in High Park based on what is known to be in the Park and what could potentially live there given the existing and potential habitat conditions. Most of the wildlife information has been compiled from secondary sources by Brian Henshaw (GLL 2001), with additional comments and observations provided by George Bryant and Bob Yukich. Historical records have been incorporated into the lists for birds and butterflies (see *Appendices B & C*).



Southern Flying Squirrel

8.1 Mammals

A comprehensive survey of High Park's mammals has not been undertaken. Historically, a variety of mammal species were present, but many have disappeared from the Park. Examples include Southern Flying Squirrel, which was reported in the mid-1970s (Wainio et al. 1976) but not subsequently. The current list is provided in *Table 2* below, and includes only species that have been recently recorded or that are likely to occur within the Park.

All the mammals listed in *Table 2* are urban tolerant. Only the Eastern Cottontail and Flying Squirrel could be considered unusual in an urban environment. Notably, the Flying Squirrel is considered to be rare to uncommon in Ontario (provincial rank S3) by the Ontario Natural Heritage Information Centre (NHIC) , and is therefore a species of conservation concern.

TABLE 2. Mammals currently on record High Park (GLL 2001; G. Bryant, pers. comm. 2001).

Common Name	Scientific Name	Current Status Notes
Virginia Opossum	*Didelphis virginiana*	increasing, recent records, uncommon
Big Brown Bat	*Eptesicus fuscus*	common
Little Brown Bat	*Myotis lucifugus*	common
Eastern Cottontail	*Sylvilagus floridanus*	scarce, may now be absent
Southern Flying-Squirrel	*Glaucomys volans*	none have been reliably recorded since ~1976
Woodchuck	*Marmota monax*	uncommon
Grey Squirrel	*Sciurus carolinensis*	abundant
Eastern Chipmunk	*Tamais striatus*	common
Red Squirrel	*Tamiasciurus hudonsicus*	uncommon
Beaver	*Castor canadensis*	present in 1994
Meadow Vole	*Microtus pennsylvanicus*	present
House Mouse	*Mus musculus*	common
Deer Mouse	*Peromyscus maniculatus*	common
Muskrat	*Ondatra zibethicus*	pond area only
Norway Rat	*Rattus norvegicus*	increasing in Toronto
Coyote	*Canis latrans*	resident
Red Fox	*Vulpes vulpes*	less common, but still occurs
Raccoon	*Procyon lotor*	common
Striped Skunk	*Mephitis mephitis*	common

8.2 Amphibians & Reptiles

High Park's Grenadier Pond contains a number of unusual turtle records, however most of these are likely to have originated from captive animals that were released into the pond. One recent record of Common Map Turtle (*Graptemys geographica*) is thought to refer to a released captive since the netted specimen was found to have a drilled hole in its carapace. It is however likely that some individuals present for this and Blanding's Turtle (*Emydoidea blandingii*) are of wild origin. A local resident (J. Palock) has released American Toads, Northern Leopard Frogs, Green Frogs, Bullfrogs (*Rana catesbeiana*), Spring Peeper (*Pseudacris crucifer*), Wood Frog (*Rana sylvatica*), Grey Tree Frog (*Hyla versicolor*), Eastern Garter Snake, Brown Snake, Redbelly Snake (*Storeria occipitomaculata*) and Northern Water Snake (*Nerodia sipedon sipedon*) in the Park (B. Yukich, pers. comm. 2001). However, it is unlikely that habitat conditions can support the long term survival of all of these species and monitoring should be conducted to evaluate the success of these releases.

A decline in the aquatic and wetland environments of the Park over the past decades has led to a reduction in the number of amphibian species present in the ponds, and limited historical data is available for analysis. The Toronto Region Conservation Authority (TRCA) found no breeding amphibians during calling count surveys in 1996 and 1997, although American Toad adults and tadpoles were seen at Grenadier Pond during that period (T. Chipperfield, pers. comm. 2000). *Table 3* below provides information on the most likely species to occur that have also been recorded recently. A lack of well-oxygenated over-wintering habitat may limit the ability of frog species to persist at the Park. Mortality on roads and resulting from capture (collecting) may also be reducing numbers. Generally, the amphibian and reptile community is impoverished and could benefit from habitat restoration activities.

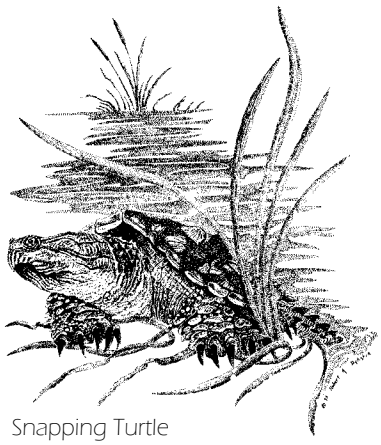

Snapping Turtle

TABLE 3. Amphibians and reptiles currently on record in High Park (GLL 2001; B. Yukich, pers. comm. 2001).

Common Name	Scientific Name	High Park Status Notes
Northern Redback Salamander	*Plethodon cinereus*	found in Northeast section of the park
American Toad	*Bufo americanus*	now present, but uncommon; reintroduced in 1997 after 14 year absence
Northern Leopard Frog	*Rana pipiens*	known to be present in 1970s; recent releases
Green Frog	*Rana clamitans*	none known since about 1990, other than releases
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*	likely still present, recent known releases
Snapping Turtle	*Chelydra serpentina*	common
Midland Painted Turtle	*Chrysemys picta marginata*	common at the pond, declining in number
Red-eared Slider	*Trachemys scripta*	common at the pond; non-native species, frequently released and apparently able to over-winter
Little Brown Snake	*Storeria dekayi*	present around greenhouses, recent known releases

8.3 Current Breeding Birds

Historical records are not included in the assessment of this attribute. However, *Appendix A* lists all bird species reported in High Park and indicates the historical breeding status for each. *Table 4* lists the current breeding bird community. In addition to the species in *Table 4, page 28*, at least three species visit the Park directly from their nest locations to feed. These are Black-crowned Night-Heron, Common Nighthawk and Double-crested Cormorant. The Black-crowned Night-Heron is a colonial nesting species that, as a breeding bird, is known only from a colony on Leslie Street Spit, although the birds disperse widely to forage in lakeshore marshes in the late afternoon and evening. Non-breeding birds are widespread from May to October. The Common Nighthawk has declined in Ontario over the past few decades. Although the reasons for this are uncertain, one possible explanation is predation by crows (B. Yukich, pers. comm. 2001). This species nests on flat roof-tops of tall city buildings and forages on moths and other insects in the Park, especially over woodland areas. Lake Ontario populations of Double-crested Cormorants have been visiting since the 1970's, and this species is now more numerous in the Park than at any time in its previously recorded history. Increases in its population size have slowed in recent years and although their negative impact on vegetation is of some concern, it is likely that population size will be kept in check by natural controls such as the Newcastle Disease (Weseloh and Collier 2000).

The breeding bird community is dominated by edge tolerant and/or urban tolerant species. There are a few species listed in *Table 4* that indicate the remnants of both successional-associated and forest-associated communities (e.g., Brown Thrasher and Wood Thrush respectively). However, a lack of interior forest conditions (i.e., areas more than 100 m from a forest edge), the intensity of recreational activities and the surrounding urban environment have likely limited the ability of the Park to support productive habitat for these species. Attempting to attract forest-associated breeding birds to the Park is not likely to be successful, and therefore future wildlife management objectives should recognize this functional constraint and focus on other wildlife attributes that are supportable within the Park.

While High Park does not support a breeding bird community of significance, there are a number of individual breeding species that warrant special attention. These include: Sharp-shinned Hawk, Eastern Screech Owl, Red-headed Woodpecker, Carolina Wren and Orchard Oriole. Each of these species is represented by one or two pairs at High Park, although most do not breed every year. Their rarity within the Toronto Region means that management activities should consider the possible impacts on these species.

TABLE 4. *Summary of current breeding birds recorded in High Park* (Gartner Lee Ltd. 2001; B. Yukich, pers. comm. 2001).

Common Name	Scientific Name	Comments
Canada Goose	*Branta canadensis*	breeds at the Pond
Mute Swan	*Cygnus olor*	controlled by egg oiling, breeds at Pond
Wood Duck	*Aix sponsa*	Grenadier Pond
Gadwall	*Anas strepera*	lower Duck Ponds, summer 2001
Mallard	*Anas platyrhynchos*	breeds near the Pond
Sharp-shinned Hawk	*Accipiter striatus*	bred in 2000, rare breeder in Toronto
Virginia Rail	*Rallus limicola*	historically bred at the Pond (1998); scarce breeder in Toronto
Killdeer	*Charadrius vociferus*	
Spotted Sandpiper	*Actitis macularia*	breeds around the Pond
Rock Dove	*Columba livia*	
Mourning Dove	*Zenaida macroura*	
Eastern Screech-Owl	*Otus asio*	scarce breeder in Toronto, needs mature trees
Belted Kingfisher	*Ceryle alcyon*	
Red-headed Woodpecker	*Melanerpes erythrocephalus*	prefers open woodland, rare breeder in Toronto, declining in Ontario
Downy Woodpecker	*Picoides pubescens*	
Northern Flicker	*Colaptes auratus*	
Eastern Wood-Pewee	*Contopus virens*	one or two pairs may breed annually, scarce in Toronto
Eastern Phoebe	*Sayornis phoebe*	breeds occasionally
Great Crested Flycatcher	*Myiarchus crinitus*	
Eastern Kingbird	*Tyrannus tyrannus*	
Warbling Vireo	*Vireo gilvus*	
Red-eyed Vireo	*Vireo olivaceus*	
Blue Jay	*Cyanocitta cristata*	
American Crow	*Corvus brachyrhynchos*	
Purple Martin	*Progne subis*	uses Purple Martin houses
Tree Swallow	*Tachycineta bicolor*	
N. Rough-winged Swallow	*Stelgidopteryx serripennis*	likely nests in most years
Barn Swallow	*Hirundo rustica*	
Black-capped Chickadee	*Peocile atricapillus*	
Red breasted Nuthatch	*Sitta Canadensis*	bred in 2001
White-breasted Nuthatch	*Sitta carolinensis*	prefers larger areas of mature forest, open/closed canopy, common in GTA
Carolina Wren	*Thryothorus ludovicianus*	prefers thickets in open woodland, rare breeder in Toronto & GTA
House Wren	*Troglodytes aedon*	regular breeder
Blue-gray Gnatcatcher	*Polioptila caerulea*	prefers larger areas of forested riparian habitat, scarce breeder in Toronto & GTA
Wood Thrush	*Hylocichla mustelina*	prefers closed canopy deciduous forest, 1 or 2 pairs breed, rare breeder in Toronto, common in GTA but declining
American Robin	*Turdus migratorius*	
Gray Catbird	*Dumetella carolinensis*	
Brown Thrasher	*Toxostoma rufum*	1 or 2 pairs breed, prefers large areas of successional habitat

TABLE 4 (cont'd). Summary of current breeding birds recorded in High Park (Gartner Lee Ltd. 2001; B. Yukich, pers. comm. 2001).

Common Name	Scientific Name	Comments
European Starling	*Sturnus vulgaris*	
Cedar Waxwing	*Bombycilla cedrorum*	
Yellow Warbler	*Dendroica petechia*	a few breed near the Pond
Northern Cardinal	*Cardinalis cardinalis*	
Indigo Bunting	*Passerina cyanea*	prefers larger areas of successional habitat
Chipping Sparrow	*Spizella passerina*	
Song Sparrow	*Melospiza melodia*	
Red-winged Blackbird	*Agelaius phoeniceus*	
Common Grackle	*Quiscalus quiscula*	
Brown-headed Cowbird	*Molothrus ater*	
Orchard Oriole	*Icterus spurius*	prefers open woodland, one-two pairs breed, rare breeder in Toronto & GTA
Baltimore Oriole	*Icterus galbula*	
House Finch	*Carpodacus mexicanus*	
American Goldfinch	*Carduelis tristis*	
House Sparrow	*Passer domesticus*	

NOTES: *Underlined species require larger areas of habitat for breeding;* ***Bold*** *indicates rare breeding species in Toronto/GTA.*

8.4 Migrant Birds

Migrant birds often stop along natural areas close to Lake Ontario. This is particularly true for High Park, which is an oasis of green within a matrix of urban development and acts as a haven for northbound migrants seeking food and shelter in spring after crossing Lake Ontario from the south. In spring, vegetation with vertical structure (e.g., shrubs and trees) is favoured habitat, especially on warm, south-facing slopes. Grassland species generally do not occur in natural areas along the north shore in large numbers during spring migration, but other small songbirds (e.g., flycatchers, thrushes, warblers and vireos) are often numerous during the spring peak from April through May. The southern fall migration is protracted (late July through November), as shelter and food opportunities are generally greater after the growing season. In addition, birds are not compromised by the location of Lake Ontario, which lies beyond the Park in terms of their direction of flight. Therefore the spring migration is considered important in terms of evaluating wildlife attributes and functions at High Park.

High Park has also become well known for the large number of migrating hawks that can be seen flying over the Park from August through November. These birds follow the lakeshore, most notably during periods of northerly winds and clearing weather. However, relatively few of these high-altitude migrants actually use the Park environment as a stopover during migration.

Evidence for the importance of High Park for migrant birds can be found in the extensive list of migrant species (see *Appendix A*) that have been observed in the Park over the past few decades. This list (excluding species reported from Sunnyside Park) includes 263 species, a number of which are rare. The Park is an important stopover area during spring and autumn migration, and as such, the area has long been a target destination for birdwatchers (Yukich 1998).

8.5 Butterflies

High Park is known to the naturalist community as a good place to enjoy butterflies. The species list for the Park (see *Appendix B*) is comprised of 62 species. Of these, 11 are considered historical records or records of species that occur only as migrants. Six of these species (Pipevine Swallowtail, Southern Cloudywing, Karner Blue, Variegated Fritillary, Tawny Cresent, and Fiery Skipper) are rare or scarce in the Province today. They are not being considered in this Management Plan because they may never breed, or for some species, ever occur in High Park again in the future. However, the occurrence of migrant and visiting butterflies, like birds, in areas along the north shore of Lake Ontario indicates the importance of butterfly habitat in High Park for migrant and visiting species.

Clouded (Common) Sulphur

Of the remaining species, 7 that likely breed on a regular basis, or may do so in the future, are considered by the NHIC (http://www.mnr.gov.on.ca/MNR/nhic/) to be provincially significant (i. e., ranked S3/S4 or S3). These species, along with their preferred larval food plants, are indicated in *Table 5* below. Because these species are of conservation concern and because they may be regular breeders at High Park, now or in the future, they should be considered in the Plan, along with their food plants.

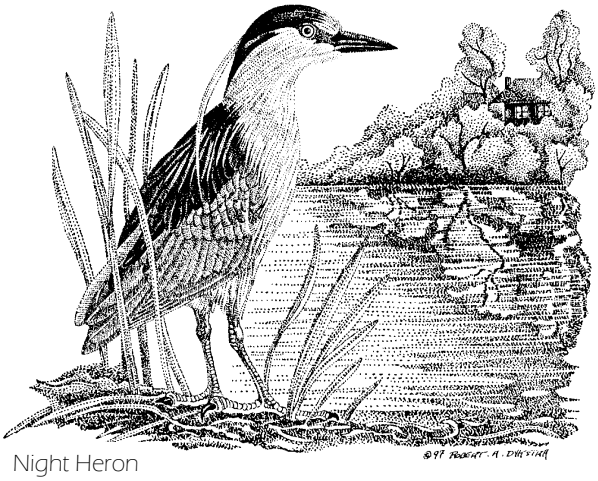
TABLE 5. Breeding butterflies of conservation concern at High Park (GLL 2001; B. Yukich 2001).

Common Name	Scientific Name	NHIC Rank	Food Plants at High Park	Notes
Spicebush Swallowtail	*Papilio troilus*	S3/S4	Sassafras (also Spicebush)	Open areas, edges of woods, over-winters as a pupa, two broods, adults May & July
Edwards' Hairstreak	*Satyrium edwardsii*	S3/S4	Black Oak, Red Oak incl. saplings	Edges of woods, over-winters as an egg, one brood, adults in July, associated with ants
Hickory Hairstreak	*Satyrium caryaevorum*	S3/S4	Hickories, oaks & others	Edges of woods, over-winters as an egg, one brood, adults July
Silvery Checkerspot	*Chlosyne nycteis*	S4/S5	Composites	Rare in Toronto, uncommon breeder, over-winters as a larva, open areas, edges of woods, especially near streams
Little Glassywing	*Pompeius verna*	S3/S4	Grasses	Long grass, prefers moist areas, over winters as a larvae (?), adults July
Crossline Skipper	*Polites origenes*	S4	Grasses incl. bluestems	Rare in High Park
Delaware Skipper	*Anatrytone logan*	S3/S4	Grasses incl. bluestems, Switch Grass	Open spaces, woodland glades, over-winters as larvae or pupa, one brood, adults usually July

NOTES: *S3 = NHIC provincially rare ranking; S3/S4 = NHIC provincially rare or uncommon (status uncertain)*

8.6 Summary of Key Wildlife Attributes

High Park provides habitat for a wide variety of wildlife including butterflies (as well as other insects such as moths and dragonflies), amphibians, reptiles, mammals and birds. In considering the most appropriate management options for the Park, it is necessary to undertake an assessment of the most "important" wildlife attributes. By definition, this will be somewhat subjective, as it partly reflects public interest in resources and knowledge about them. However, in *Table 6* below an attempt has been made to identify the functions that may be important and/or productive, or are significant for other reasons (e.g., species rarity).



Night Heron

TABLE 6. Summary of key wildlife attributes at High Park (GLL 2001; B. Yukich, pers. comm. 2001).

Key Wildlife Function	Attribute	Comments
Habitat for migrant birds, especially during spring	Many thousands use High Park each year, 263 species recorded	Tall shrubs (>0.5m) & trees particularly important, especially on south facing slopes; also coniferous trees, north-south valley features
Potential Habitat for provincially rare mammal	Southern Flying Squirrel (S3)	Not recorded over past 25 years; at High Park, prefers oak habitat with mature trees; need to establish if a population still exists in the Park
Habitat for provincially rare breeding birds	Red-headed Woodpecker (S3) Carolina Wren (S3/S4)	Woodpecker prefers open habitats with large trees Wrens prefer thickets and tangles in open woodland
Habitat for breeding bird species that are rare in Toronto or the GTA	Eastern Screech Owl Blue-gray Gnatcatcher Wood Thrush Orchard Oriole	Owls prefers woodland or forest with mature trees Gnatcatchers prefer larger or riparian trees Thrushes prefer large areas of closed deciduous forest Orioles prefer open woodland with mature trees
Amphibian breeding habitat	American Toad	Probably in marsh areas of Grenadier Pond
Feeding area for colonial nesting species	Black-crowned Night-Heron	Feeding in wetland areas, likely commuting to and from Leslie Street Spit
Habitat for migrant butterflies	62 species have been recorded; many occur as migrants	Open habitats, some use of trees especially in southern portions of the Park
Breeding habitat for butterflies of conservation concern	Spicebush Swallowtail Edwards' Hairstreak Hickory Hairstreak Silvery Checkerspot Little Glassywing Crossline Skipper Delaware Skipper	These species generally prefer open areas/woodland Food plants include grasses, weeds, composites, oaks & Sassafras

NOTES: *S3 = NHIC provincially rare ranking; S3/S4 = NHIC provincially rare or uncommon (status uncertain)*

9 Threats & Stressors to Rare Terrestrial Ecosites & Wildlife

9.1 Fire Exclusion

Prior to European settlement, fire played a major role in maintaining the mosaic of prairie, oak savannah and oak forests that once extended across southern Ontario. The species that make up these communities have co-existed with fire for thousands of years, and many are dependent on periodic burning for their continued survival. To withstand the effects of fire, prairie and savannah plants have developed special adaptations, such as extensive root systems (grasses) and thick bark (oaks). Ecologists have identified fire exclusion as an important factor contributing to the decline of oak dominated communities in High Park (Apfelabum et al. 1993; Varga 1999).

Historically, fires occurred naturally as a result of lightning strikes, and were also deliberately set by First Nations communities who used fire to clear areas for agriculture and increase deer populations. The natural frequency of fires in the High Park area is not known, although the mean fire interval for the oak savannah of Pinery Provincial Park is believed to have been 18 years (Crabe 1988). Historical information indicates that tallgrass prairies burned more frequently, as often as every 3 or 4 years (Rodger 1998).

Early spring burning increases the vigour of many prairie and savannah species, resulting in larger plants and increased seed production. This effect is partially due to the combustion of litter, which releases nutrients and allows sunlight to reach the soil surface earlier in spring. The deposition of a thin layer of darkened ash also contributes to soil warming, as heat is absorbed by dark surfaces (Woodliffe 1999).

Fire also helps to reduce competition from invading exotic species and fire sensitive native plants. When fires are excluded from grasslands and savannahs, trees and shrubs tend to invade and shade out sun-loving species. This is a particular problem for savannahs on the east slope of Grenadier Pond.

Fire disturbance is also important in maintaining High Park's forested systems. The suppression of fires can lead to canopy closure and the development of a dense shrub and sapling layer that is often dominated by exotic species. Overshading of the ground layer can result, which limits the regeneration of fire-tolerant native species such as oaks. This problem is clearly evident in the ravine systems found in the south end of the Park, where a dense understory of non-native Common Buckthorn has developed.

The loss of community diversity that results from the exclusion of fire also impacts wildlife. As native savannah plant species are shaded out, animals and insects lose valuable food sources. Oak saplings, for example, are food for the Hickory Hairstreak and Edwards' Hairstreak butterflies (see *Section 8.5*). Butterflies and some bird species require the open oak woodlands as habitat. In the absence of fire, woodland canopy closes and the open habitat is lost. Fire also benefits other organisms such as wood fungi and wood/fungi-eating forest beetles (Sauer 1998).

9.2 Invasive Plant Species

The establishment and spread of invasive plant species is one of the most serious threats to the ecological integrity of High Park. Most invasive plants found in the Park are of exotic origin; that is, they are native to areas outside of the Toronto Bioregion, and in many cases, North America. The term "invasive" refers to the ability of these species to aggressively invade natural areas and replace native plants. Often, invasive plants form dense colonies that dramatically alter the composition, structure and function of natural ecosystems. A variety of traits may enable them to do so, such as the ability to produce abundant seed and propagules, secrete substances that are toxic to other plants (i.e., allelochemicals) and thrive in nutrient enriched soils. Plant invasions most often occur in natural areas that have been degraded and are vulnerable to a variety of stressors, although non-native species are also sometimes able to establish and out-compete native species in high quality habitats. Other factors that can facilitate the spread of invasive plants include: soil compaction and trampling of native vegetation, the creation of canopy gaps, pedestrian traffic along footpaths and trails, pollution, climate change and hydrological changes.

A variety of exotic species have become established in the Park and are seriously impacting the native plant communities. Of these, Common and Glossy Buckthorn, Tartarian Honeysuckle, Garlic Mustard, Himalayan Balsam, Japanese Knotweed, Norway Maple and Dog-strangling Vine are of particular concern. Other species may be present in lower densities because they have not had sufficient time to demonstrate their invasive potential. The process of introduction and invasion is continual, and additional exotics are expected to emerge in future years.

Dog-strangling Vine in High Park .

9.2 Invasive Plant Species (cont'd)

Open oak woodlands and savannahs are especially threatened by Dog-strangling Vine, a twining milkweed that favours open habitats and wooded edges. Other significant invasive species in these communities include Tartarian Honeysuckle, Common Buckthorn, Sweet-white Clover and Asian Bittersweet, a woody vine that can overrun natural vegetation. Sheep Fescue, a remnant of the turfgrass planted in the 1950's, is also an invasive concern.

In moist woodlands and floodplains, Common Buckthorn, Tartarian Honeysuckle, Garlic Mustard, Himalayan Balsam and Japanese Knotweed are the primary threats. Celandine is also of concern. Purple Loosestrife is invading moist meadow communities along Grenadier Pond, however, "leaf eating" beetles released as biocontrols are limiting its spread (L. Stephenson, pers. comm., 2000).

Invasive plants that exclude native plants can threaten the survival of dependent wildlife such as butterflies. Butterfly larvae require specific plant hosts to feed on (i.e. Edwards' Hairstreak feeds exclusively on oak saplings). Consequently, if the host plants are displaced, the larvae have a diminished food supply and perish. Although native butterfly adults will feed on the nectar of many plants including Purple Loosestrife and Queen Anne's Lace, many do not thrive on exotic plant nectar (GLL 2001).

9.3 Reduction in Shrub Cover

Native shrub cover in the Park is declining for several reasons. On the savannah, native shrubs have been out-competed and replaced by tall invasive species, such as Common Buckthorn and Tartarian Honeysuckle. City staff and volunteers are now working to remove these invasive species from the savannah as part of the restoration efforts. Removing the tall shrubs will reduce valuable habitat for migrating birds. Such habitat structure is generally available in backyards and other nearby parks, however migrant birds are more susceptible to predation by cats in residential neighborhoods. Native savannah shrubs, such as the regionally rare Sweet Fern and Dryland Blueberry are typically low, creeping shrubs and, once re-introduced, will not provide the same habitat as the tall invasive shrubs. They might, however, provide the proper growing conditions for the regeneration of Black Oak. Currently, native shrubs are present in the Park in low numbers and must be encouraged to proliferate if the oak savannah and woodlands are to be restored. Tall shrub habitat or young trees that provide like structure for migrating birds will have to be created and sustained in other areas of the Park.

9.4 Trampling

Off-trail recreational use of natural areas is a serious cause of damage to soils and vegetation in High Park. Compaction leads to the breakdown of soil structure, kills beneficial soil fungi, and diminishes soil nutrient and moisture holding capabilities. Like pavement, compacted soils repel rainwater, which leads to increased runoff, soil erosion and sedimentation. Even low levels of trampling are sufficient to negatively affect forest understory communities. When trampling is intense, complete loss of cover and creation of bare areas often result. In some areas of the park, off-trail use is leading to serious erosion problems and the channelization of runoff. Consequently, all natural areas are being negatively impacted by the proliferation of paths and extraneous trails. The loss of native vegetation also encourages the establishment of non-native plants that are better able to withstand soil compaction, erosion and habitat fragmentation. When plant communities are fragmented by trail development, they are subject to increased edge effects (increased wind and light exposure along trails that results in drying of the microsite). Habitat fragmentation also negatively impacts populations of insects and other wildlife such as snakes, which are often run over by bikes or stepped on. Excessive disturbance by humans and unleashed dogs may also prevent some ground nesting species, like Ovenbirds that nested in the Park prior to the 1940's (Yukich 1998), from breeding in the Park.

9.5 Altered Hydrological Regimes

Hydrological change resulting from urban development and alterations to natural flow regimes may also be negatively affecting terrestrial plant communities in High Park. In addition to the channelization of water flow into storm sewers, flow regimes have been altered by wetland loss and the conversion of natural vegetation to pavement and turf, which sheds runoff almost as effectively as pavement. The volume of flow in Spring Creek fluctuates more dramatically during storm events due to large stormwater inputs. Changes to subsurface flow can result in drier conditions that cause shifts in species composition. Alterations to surface water flow can lead to unnatural flooding, increased sedimentation and changes in the composition of riparian and floodplain communities.

The natural recharge of Spring Creek has been impacted by the development of picnic areas and roads in former natural floodplains that consisted of wet meadows and shrub thickets. John Howard prepared a survey of Lot numbers 55, 56 and 57 in 1864 (see *Appendix D*) that shows some of the former watercourses in the area of High Park. Spring Road and Deer Pen Road are established on top of former creeks that fed into Spring Creek. Natural shoreline habitats had already been affected by the cessation of natural water level fluctuations that would normally occur in a lakefront marsh when it was bounded by a natural gravel bar fronting Lake Ontario. The weir now used to control water flow between the lake and the pond is not being used to replicate the natural water level fluctuations, but is instead used for stormwater management. Deteriorating water quality caused by increased input of stormwater may be damaging terrestrial plant communities.

9.6 Loss of Species Diversity

9.6.1 Rare Species

One of High Park's most noteworthy features is its high diversity of uncommon and rare plants, as listed in *Tables 7 &8, pages 36 &37*. Many of these species have southern or prairie affinities and are restricted to the oak savannah community in High Park. In 1989, Varga reported 30 of a total of 41 prairie/savannah species known to have historically occurred in the park could still be found, and considered this to be a significant floristic assemblage not replicated elsewhere in the region. Unfortunately, some of the rare plants identified in Varga's survey have since disappeared from the park (i.e., Speckled Alder, Trailing Arbutus and Bunchberry). However, current botanical inventories conducted from 1989 to 2001 (see *Appendix A*) indicate that there are still 58 regionally rare plant species, including 4 that are also provincially rare, present in High Park, as well as 3 species considered extirpated from the City of Toronto. Three of these (Butterfly Weed, Cup Plant and Pasture Rose) have been re-introduced to the Park through volunteer plantings. Nonetheless, species attrition will continue unless steps are taken to control threats to rare plants (e.g., invasive species, trampling, and collecting) and to enhance populations of existing species. Threats to rare wildlife species are identified and discussed in *Section 8* of this document.

9.6.2 Genetic Deterioration

The loss of genetic fitness, both as a result of small population sizes and High Park's isolation from other habitat patches, may be a threat to the long-term survival of some native plants and animals. Genetic diversity is essential to the long-term health of a population, because it greatly enhances vigour and resiliency in the face of environmental change. When small populations become isolated from each other and the larger local population, the continual flow and exchange of genes that characterizes healthy populations may be disrupted. This tends to reduce the population's genetic variability and ability to adapt to changing environments, and can cause increased mortality rates, physiological defects and reproductive failure.

TABLE 7. Regionally uncommon plants currently on record in High Park.

Common Name	Scientific Name
Low Serviceberry	*Amelanchier spicata*
Wood Anenome	*Anenome quinquefolia*
Groundnut	*Apios americana*
Canada Blue-joint	*Calamagrostis canadensis*
Porcupine Sedge	*Carex hystericina*
Stellate Sedge	*Carex rosea*
Bastard Toad-flax	*Commandra umbelata*
Pointed-leaved Tick-trefoil	*Desmodium glutinosum*
Virginia Stickseed	*Hackelia virginiana*
Rough Woodland Sunflower	*Helianthus divaricatus*
Bottlebrush Grass	*Hystrix patula*
Pale Touch-me-not	*Impatiens pallida*
Michigan Lily	*Lilium michiganense*
Indian-pipe	*Monotropa uniflora*
Wire-stem Muhly	*Muhlenbergia frondosa*
Common Evening-primrose	*Oenothera biennis*
Rough-leaved Rice Grass	*Oryzopsis asperifolia*
Hairy Panic Grass	*Panicum acuminatum var. acuminatum*
Common Cinquefoil	*Potentilla simplex*
Pin Cherry	*Prunus pensylvanica*
Smooth Wild Rose	*Rosa blanda*
Early Goldenrod	*Solidago juncea*
Foamflower	*Tiarella cordifolia*

***NOTES:* Regionally uncommon** *indicates occurrence of this plant is restricted to between 7 and 12 stations within the City of Toronto as per the MNR (Varga et al. 1999).*

TABLE 8. Provincially and regionally rare species currently on record in High Park .

Status	Scientific Name	Common Name	Status	Scientific Name	Common Name
R2	*Acorus calamus*	Sweet Flag	S3, R1	*Liatris cylindracea*	Cylindric Blazing Star
R1	*Agrimonia pubescens*	Soft Agrimony	S2, R1	*Liatris spicata*	Spiked Blazing Star
R3	*Amelanchier stolonifera*	Low Serviceberry	S3, R2	*Lupinus perennis*	Wild Lupine
R7	*Andropogon gerardii*	Big Bluestem Grass	R1	*Lysimachia quadrifolia*	Whorled Loosestrife
R4	*Antennaria parlinii ssp. fallax*	Parlin's Pussy toes	R4	*Osmunda claytoniana*	Interrupted Fern
E	*Asclepias tuberosa*	Butterfly Weed	R6	*Physalis heterophylla*	Clammy Ground Cherry
R6	*Aster oolentaganiensis*	Azure Aster	R1	*Phytostegia virginiana*	False Dragonhead
R2	*Aster urophyllus*	Arrow-leaved Aster	R3	*Pinus resinosa*	Red Pine
R3	*Bidens vulgata*	Tall Beggar-ticks	R*	*Polygala polygama*	Racemed Milkwort
R3	*Calystegia spithamaea ssp. spithamaea*	Low Bindweed	R5	*Quercus velutina*	Black Oak
R5	*Carex laevivaginata*	Smooth-sheathed Sedge	R5	*Rhus radicans ssp. negundo*	Climbing Poison Ivy
R3	*Carex muhlenbergii*	Muhlenberg's Sedge	R	*Rosa carolina*	Pasture Rose
R3	*Carex retrorsa*	Retrose Sedge	R4	*Rubus flagellaris*	Northern Dewberry
R3	*Carex siccata*	Hay Sedge	E	*Rubus hispidus*	Swamp Dewberry
R*	*Carex tonsa var. tonsa*	Dark Green Sedge	R4	*Rubus pubescens*	Dwarf Raspberry
R3	*Ceanothus americanus*	New Jersey Tea	R4	*Rudbeckia laciniata*	Cut-leaved Coneflower
R6	*Clintonia borealis*	Bluebead Clintonia	R3	*Salix humilis*	Upland Willow
R1	*Comptonia peregrina*	Sweet Fern	R5	*Sassafras albidum*	Sassafras
R1	*Deschampsia flexuosa*	Hairgrass	R2	*Schizachyrium scoparius*	Little Bluestem
R6	*Elymus canadensis*	Canada Wild Rye	S2, R4	*Silphium perfoliatum var. perfoliatum*	Cup-plant
R5	*Epilobium angustifolium*	Fireweed	R1	*Solidago bicolor*	White Goldenrod
R3	*Galium boreale*	Northern Bedstraw	R2	*Solidago squarrosa*	Stout Goldenrod
R2	*Gaylussacia baccata*	Black Huckleberry	E	*Sorbus americana*	American Mountain Ash
R2	*Helianthemum canadense*	Frost-wort	R2	*Sorgastrum nutans*	Indian Grass
R4	*Helianthus decapetalus*	Thin-leaved Sunflower	R6	*Trientalis borealis ssp. borealis*	Star-flower
R4	*Helianthus strumosus*	Pale-leaved Woodland Sunflower	R2	*Vacciniium angustifolium*	Low Sweet Blueberry
R*	*Hieracium canadense*	Canada Hawkweed	R1	*Vaccinium myrtilloides*	Velvetleaf Blueberry
R6	*Iris versicolor*	Northern Blue Flag	R3	*Vaccinium pallidum*	Dryland Blueberry
R2	*Lechea intermedia*	Savanna Pinweed	R1	*Verbena stricta*	Hoary Vervain
R3	*Lepidium virginicum*	Virginia Peppergrass	R1	*Vicia americana*	Purple Vetch
R2	*Lespedeza hirta*	Hairy Bush-clover	R1	*Viola sagittata var. ovata*	Oval-leaved Violet

NOTES: ***S1 - S3*** *= provincial rarity as per the NHIC (Oldham 1999).* ***S1*** *= Extremely rare; 5 or fewer occurrences in the province or very few remaining individuals;* ***S2*** *= Very rare; 5 to 20 occurrences in the province or many individuals in fewer occurrences;* ***S3*** *= Rare to uncommon; 20 to 100 occurrences in the province or fewer occurrences but with a large number of individuals in some populations.* ***R1 - R7*** *= regional rarity as per the MNR (Varga et al. 1999). The number indicates the number of stations where the species has been recorded within the City of Toronto;* ***E*** *= extirpated within the City .* ***R**** *= rare and present in High Park (C. Kinsley, pers. comm. 2001; T. Jovan pers. comm. 2002), but R status for Toronto unknown.*

9.7 Overabundance of Grey Squirrels

Like many other urban parks in eastern North America, High Park is home to a large Grey Squirrel population (Black Squirrels are a colour phase of the same species). The destruction of acorn crops by birds (i.e., Common Grackles), insects and Grey Squirrels may be an important factor contributing to poor oak regeneration, although this has not been demonstrated quantitatively. A study undertaken by Bellocq (1997) found few viable over-wintering Black Oak acorns in 1996 even though production was high that year. The author considered predation by Grey Squirrels and insects to be the most likely cause. Other factors that may be involved in poor oak regeneration include fire exclusion, low native shrub cover, acorn collection by humans and climate change.

The proliferation of Grey Squirrels in the Park may be at least partly responsible for the extirpation of the Southern Flying Squirrel from the Park (GLL 2000). Grey Squirrels are tolerant of urban conditions and are being fed by people. They could be out-competing the Flying Squirrel for habitat and food. Grey Squirrels are also known to prey on the eggs and nestlings of birds.

Grey Squirrel in High Park
Gera Dillon

9.8 Climate Change

Global climate change is expected to cause a dramatic northward shift in regional vegetation communities over the next 50 to 100 years. Changes in the distributions of individual species may already be occurring. The overall impact of climate change on the Toronto Region will depend on the rate and magnitude of change, and the vulnerability of individual species and communities to climate variation. Degraded ecosystems, which are already under considerable stress, may be particularly sensitive to climate change impacts. Many experts predict that global warming will promote the expansion of populations of invasive plants, as well as increase the rate of successful new introductions (Dukes 2000).

The hotter, drier climate that may accompany global warming may benefit species such as Black Oak. However, there is also evidence to suggest that climate change may already be responsible for regeneration failure in some oaks, and other trees of the Deciduous Forest Zone, such as American Beech (Sauer 1998).

9.9 Pollution

The effects of air and water borne contaminants on native plant communities have been consistently underestimated. Poor air quality, largely resulting from the burning of fossil fuels, has been associated with the declining health and immunity of many native trees and some species, such as Sugar Maple and Eastern White Pine, are known to be sensitive to urban air pollution (Hightshoe 1988).

Levels of certain contaminants (including lead, arsenic, vanadium, chromium) have been shown to be much higher in soils and organic matter in natural areas in Toronto than in natural areas located 150 km west of the City. High contaminant levels have also been positively correlated with sharp declines in forest ground flora diversity in the vicinity of Toronto (Hutchinson 1999).

Although generally associated with aquatic systems, excess nitrogen loading (i.e., eutrophication) is also a serious problem in terrestrial ecosystems. High nitrogen levels change soil structure, primarily by reducing soil fungal populations and increasing populations of bacteria. This shift causes a reduction in soil respiration and the amount of oxygen available to root systems. Higher nutrient levels affect the competitive ability of many native plants, which are generally adapted to low nitrogen levels. Many invasive species, on the other hand, benefit from increased nitrogen.

10 Management Units & Target Plant Communities

The natural areas in High Park have been divided into management units primarily for the purpose of conducting prescribed burn management. The management units and boundaries were developed from recommendations of the ANSI report by Varga (1989), identification of natural fire-breaks such as roads and trails, and information gathered from field work.

Management unit size varies from 0.19 ha to 7.95 ha. Each unit has been labelled in reference to the numbering of natural areas used in Varga's ANSI report (1989), and a suffix letter has been added to define individual management units. A list of these units and their respective names and areas are provided below. Additional information regarding each unit's location and target vegetation community (or communities) is provided in *Figure 4, page 41*, while a comprehensive list of the plant species occurring in each management unit (as of summer 2001) is provided in *Appendix A*.

1A – North Wendigo Ravine (3.81 ha)
1B – South Wendigo Ravine (3.92 ha)
1C – North Grenadier Pond (3.60 ha)
1D – West Grenadier Restaurant (1.99 ha)
1E – Tableland (5.5 ha)
3A – South Grenadier Pond (1.35 ha)
3B – South Howard Monument (1.5 ha)
4A – West Deer Pen Ravine (2.40 ha)
4B – North Colborne Lodge (3.60 ha)
4C – South Colborne Lodge (1.08 ha)
5A – Sandy Knoll, Lower Duck Pond (1.34 ha)
6A – South Adventure Playground (3.81 ha)
7A – Tennis Club (5.05 ha)
7B – West-facing Slope, Spring Creek Ravine (5.53 ha)
7C – Parkside Drive (2.69 ha)
8A – East Greenhouse (3.60 ha)
8B – East Deer Pen Ravine (2.66 ha)
9A – Forest School (3.46 ha)
9B – Indian Grass Knoll (6.52 ha)
9C – Dream Site (7.95 ha)
10A – Bloor St. (7.59 ha)
11A – Maple Leaf Shoreline Restoration Site (0.19 ha)

Preliminary demonstration burns in 1997 and 1998 took place in relatively small areas, while subsequent burns have been larger in scale, covering a number of units spatially distributed throughout the Park. The first large-scale prescribed burn in 2000 covered 8 ha, and the second in 2001 covered 14 ha. The results to date have been very encouraging and additional burns are planned for the future, assuming the appropriate environmental conditions. For each year, burning of carefully selected units has been strategically designed and timed to include a range of habitat types, avoid harmful impacts to wildlife, and work towards the established vegetation community targets.

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FIGURE 4. *Management Units & Target Vegetation Communities*
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11 Summary of Restoration Activities: 1991—2001

In addition to providing an assessment of High Park's natural areas, the ANSI report (Varga 1989) included recommendations to help guide the restoration of its more degraded natural areas. The following actions and activities ensued:

1987 - 89	City Forester promotes significance of Black Oak savannah in High Park and begins to implement alternative management protocols to prevent further degradation.
1992	City of Toronto adopts proposals for the restoration and management of High Park in recognition of the ANSI designation.
1992	High Park greenhouses start propagating native plants from the park.
1994	A consulting firm is retained by the Department of Parks and Recreation to produce a detailed restoration strategy for High Park. The study leads to a better understanding of the oak savannah system and outlines a test plot program to measure the effectiveness of proposed restoration techniques, including prescribed burning (Apfelbaum et al. 1993).
1995	High Park Citizens' Advisory Committee (HPCAC) is established by the City of Toronto to assist in exercising appropriate park stewardship and facilitating ongoing public input.
1995	A consulting firm is retained by the Department of Parks and Recreation to produce a rehabilitation plan for Grenadier Pond and associated wetlands (GLL 1995).
1996	A native plant nursery is created to provide a local source of plants and seed.
1996	Parks and Recreation implement the recommended test plot program in partnership with the Volunteer Stewardship Program (VSP) established by HPCAC.
1997 - 98	The results of demonstration plot burns encourage the City to develop a full-scale prescribed burn program for High Park.
1999	A Draft Vegetation Management Plan is presented for public review in December of 1999 (City of Toronto 1999).
2000	On April 15, the first of a series of proposed burns is successfully carried out in several areas of the park. A seasonal restoration crew is also hired in 2000 to implement and refine the vegetation management prescriptions proposed in the Draft Vegetation Management Plan.

Between 1994 and 2001 extensive restoration work has been jointly undertaken by the City and the Volunteer Stewardship Program (VSP) established by HPCAC, as illustrated in *Figure 5, page 43*. This group is responsible for developing one of the largest volunteer programs in Toronto and for providing assistance with such significant activities as the re-introduction of thousands of seedlings to the park, shoreline and marsh naturalization projects, the removal of exotic plants, test plot monitoring, and demonstration projects. The volunteers have contributed towards the reintroduction of rare and extirpated plants such as Stiff Gentian, Butterfly Weed and Spiked Blazing Star.

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FIGURE 5. High Park Volunteer Stewardship Program Restoration Activities 1994—2001
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12 Restoration in 2001 – 2010: Techniques & Guidelines

This section outlines the major areas of focus for restoration tasks in High Park. Each area of focus is described and general guidelines are provided to help direct restoration efforts. In addition, key actions and strategies are provided for each area of focus to help direct the specific work being done in High Park. A summary of these actions and strategies is also presented in *Section 3.3, pages 7 - 12*.

12.1 Prescribed Burning Activities, Impacts & Mitigation

Prescribed burning is a management technique typically recommended for and applied to restoration and maintenance of tallgrass prairie and savannah ecosystems (Packard and Mutel 1997; Delaney et al. 2000). As mentioned in previous sections, fire is a natural process that is essential to the recovery of the oak savannah in High Park. Of the available management techniques, prescribed burning is one of the least manipulative methods, and is the most economical and effective method of restoring the Park's terrestrial ecosystems.

Key factors considered at High Park in developing a prescribed burn schedule

- The site-specific requirements of the different ecosites.
- The need to achieve a spatial distribution of burned areas to accommodate public use.
- Safety concerns.

These factors were addressed by planning burns at non-adjacent sites and at intervals that recognize the regeneration needs of each unit.

Following the initial 8-year restoration phase, a less intense, long-term schedule of burning will continue for maintenance purposes.

Following two seasons of successful test plot trials in selected areas in 1997 and 1998, more comprehensive prescribed burns were planned and took place in 2000 and 2001 (as shown in *Figure 6, page 45*). In 1999, the natural areas of the Park were divided into management units (see *Section 10* and *Figure 4, page 41*) for the purpose of developing a prescribed burn plan. Dry areas were considered for burning over a period of 2 to 3 consecutive years at approximately 10-year intervals, while mesic areas were considered for burning once or twice every 15 to 25 years. A preliminary schedule of burning was developed in consultation with ecologists and prescribed burn experts who proposed the phased burning of some of the natural areas in the Park over a period of eight years. The overall objective is to burn a number of the identified units each year so that the prescribed burns are spatially distributed throughout the Park in a manner that meets both safety and restoration objectives.

The preliminary burn schedule will be reconsidered and adjusted over time as the effects of fire on High Park's natural systems become better understood, and to reflect the advice of experts and public feedback. Careful monitoring of changes in species composition, woody regeneration and understory development will guide the development of a long-term prescribed burn schedule.

The City will continue to work with staff and volunteers to develop the expertise necessary to safely implement prescribed burns in High Park. Toronto Fire Services will also be consulted to develop a plan for fighting wildfires in High Park that is consistent with the restoration goals and specific principles of prescribed burn management.

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FIGURE 6. Prescribed Burn Areas 2000—2001
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12.1 Prescribed Burning Activities, Impacts & Mitigation (cont'd)

12.1.1 Impact of Fire on Vegetation

At least in the first few years, prescribed burns will be conducted in the early spring when optimal conditions for burning are most likely to occur. Early spring burning is also preferable because it:

- helps control Garlic Mustard and other early emerging exotics,
- inhibits the growth of thin-barked, woody exotics such as Common Buckthorn,
- releases nutrients for immediate uptake by emerging vegetation, and
- increases early soil warming.

In general, fire renews and invigorates fire-adapted plant communities, and increases species diversity over time. The growth of prairie forbs, in particular, is increased by fire. Following prescribed burning in 2000, a number of beneficial effects on plant communities were almost immediately apparent in various management units. Heavy rainfall during the spring and early summer also likely contributed to enhanced growth of native plants. Some notable effects of the 2000 and 2001 prescribed burns in selected management units were:

- higher than expected stem kill of Common Buckthorn and Tartarian Honeysuckle in savannah (Units 1C, 1D and 1E) and moist woodland communities (Unit 3B),
- high mortality of Garlic Mustard seedlings, and good initial control of adult plants (Unit 3B),
- expansion of patches of native species such as Wild Geranium, Mayapple, Early Meadow-rue, Interrupted Fern and various sedges in moist woodlands (Unit 3B), and the appearance of these species in new locations,
- expansion of a colony of Dryland Blueberry in savannah tablelands (Unit 10A) by about 50%, expansion of a colony of Indian Grass in savannah tablelands (Unit 9B) by more than 200%, and increase in plant size of Big Bluestem, Rough Woodland Sunflower, Arrow-leaved Aster, goldenrods and sedges,
- increase in the size of Wild Lupines in savannah (Unit 1E) and increase in the seed crop.

Big Bluestem Judy Shore

Indian Grass Judy Shore

Further impacts on the vegetation in High Park will be observed and recorded each year as the burn schedule progresses. Each burn unit is slightly different in terms of plant composition and structure, land topography and size. The weather conditions and extent of greening at the time of the burn in each year will also determine the results of the prescribed burn. The effect of the prescribed burn on specific plants will vary depending on the heat generated by the fire, which in turn is dependent on the amount and condition of fuel, as well as other factors such as relative humidity, temperature and wind. As such, each burn is unique and will produce a unique set of results. For example, the spring 2000 burn had near optimal conditions and consequently had promising results in all units except 1A where the burn was conducted to late in the day resulting in a patchy burn with poor control of woody vegetation.

Burning non-adjacent units will help maintain and reintroduce transitional gradients between vegetation types where species richness is generally highest. Because fuel loads were initially low in the Park, managed sites have burned unevenly, resulting in a patchy pattern of burned and unburned areas. This pattern of burning helps promote the development of diverse plant communities, while leaving habitat islands that function as refugia for plants, insects and wildlife.

Over time, the increased sun and growing space resulting from the prescribed burns is causing an increase in fine fuels, grasses and leaves. These fuels have a low kindling point, hence there is a greater chance of fire being ignited, particularly in the spring and late summer. Surface fine fuel loads have increased dramatically following the first burns. For example, an estimated 100% fuel load increase occurred in management unit 1D following the burn in 2000, and fuel loads have increased 400% in savannah areas following the 2001 burn.

The current window of opportunity for optimal burning days to meet the Plan objectives is about 3 to 5 days. As restoration progresses and the fuel loads increase, this window should increase to 5 to 10 days. The total number of days when the selected locations within the Park can potentially burn (although not at optimum conditions for meeting the Plan objectives) is currently about 19 days. Outside of these days, an effective fire cannot be sustained due to increased fuel moisture or site greening. It is hoped that, over time, the number of days when the site can potentially burn will be increased to 30 days, however, this scenario will be reached only if and when the site is fully restored.

Pennsylvania Sedge flourishes following the prescribed burn in High Park in 2001, and Tartarian Honeysuckles are partially or totally stem killed.

12.1 Prescribed Burning Activities, Impacts & Mitigation (cont'd)

12.1.2 Impact of Fire on Wildlife

It is generally expected that prescribed burning will have an overall positive effect on native wildlife communities (GLL 2001), and that the impact on mammals will be minimal. Resident foxes and coyotes can easily move away from advancing fire as long as the fire is lit along one line and advances in one general direction. Squirrels are generally out of reach of the fire in the tops of trees. Small ground mammals, such as field mice can out run a fire line or find shelter in the ground or under large logs, and will be expected to experience subsequent population growth after a fire due to the increase in suitable ground cover as habitat and food.

Recommendations for increasing the availability of food plants & mitigating the effects of burns at High Park for butterflies

- Rotate burn units to limit the extent of Sassafras burned in a given year.
- Plant Spicebush in appropriate locations (e.g., along Spring Creek and in any future wetland restoration areas) not designated for burns.
- Establish breeding areas and conduct a pilot volunteer pupa search prior to burning, so pupae can be relocated or protected.
- Where pupa are to be protected, ensure that some Sassafras are protected from the burn as well.

In general, amphibian populations will not be affected by the burn itself as their habitat is not part of the fire regime. Summer habitat for the Northern Leopard Frog and the American Toad is being improved by burning, as herbaceous ground cover is generally increased.

Although mature birds can easily avoid fires, the ecological impacts of burning their habitat can be significant, depending on the species. To avoid burning eggs and newborns of nesting species, fires should be planned for early April. Some species will benefit from a regime of prescribed burns. For example, the provincially rare Red-headed Woodpecker, and the locally rare Eastern Screech Owl and Orchard Oriole prefer open woodland habitat with mature trees, dead snags and cavity trees. Conversely, the provincially rare Carolina Wren prefers tangles and thickets within open woodlands as habitat. In spite of the expected increase in young regenerating Black Oaks, an overall reduction in shrub and thicket cover is expected as a result of prescribed burn management, and this may in turn reduce habitat opportunities for this species. (See *Section 12.5, page 59* for a more detailed plan).

In general, both migrant and resident butterflies will benefit from prescribed burning in the Park. Specifically, they will benefit from the increase in open savannah and woodland that support the plants that serve as larval hosts and nectar sources for adults. Edwards' Hairstreak could benefit from the regeneration of oak saplings, the Silvery Checkerspot will benefit from an increase in composite flowers, such as sunflowers, and the Delaware Skipper will benefit from an increase in Big Bluestem and Switch Grass. Native butterflies do not thrive on introduced flora and there is no butterfly of conservation concern that requires introduced flora, so the elimination of exotics by fire can only serve to benefit the butterflies by increasing the amount of area available for native plant establishment.

Two butterfly species of particular conservation concern are the Spicebush Swallowtail and Edward's Hairstreak. This swallowtail may have bred periodically in the past (i.e., last collected in 1955) and has recently bred at High Park, but may not persist even in the absence of burns. The use of Sassafras by its larvae and their habit of over-wintering as pupae within the fire zone renders the very small High Park population of this provincially rare species susceptible to impact by prescribed burns. However, measures can be taken to increase the availability of food plants and mitigate the effects of burns for this species, as well as others found in High Park, as described in the text box on this page and in *Table 9, page 49*.

12.1.3 Mitigative Measures for Species at Risk

Table 9 below presents a summary of potential effects of prescribed burning on species or groups of species of conservation concern, and also provides suggestions for mitigative actions. This table lists all the species of concern identified in *Section 8* of this Management Plan.

TABLE 9. Potential effects of prescribed burns on species of conservation concern.

Species	Potential Burn Effects	Mitigative Action
Migrant Songbirds	Reduction of habitat due to fewer shrubs and understorey trees	Consider managing hydrology & planting southern part of Upper Duck Pond with Spicebush & other shrubs Increase shrubs along Spring Creek and west side of Grenadier Pond Increase shrub plantings in Unit 3B and the south part of 6A (Dry-Fresh Oak Deciduous Forest ecosite)
Southern Flying Squirrel	Likely minimal (assuming species is still present)	Determine if population is still present at the park and, if so, develop a species-specific management plan
Red-headed Woodpecker	Improvement in habitat	No action necessary
Carolina Wren	Marginal reduction in habitat, but existing habitat likely not productive	No action necessary
Eastern Screech Owl	Marginal improvement in habitat	Consider specialized squirrel-proof nestbox program or squirrel management
Blue-gray Gnatcatcher	No effect likely	No action necessary
Wood Thrush	No effect likely	No action necessary
Orchard Oriole	Improvement in habitat	Include some coniferous trees (used but not required by the species) in planting program outside of burn areas
American Toad	No effect likely	No action necessary
Black-crowned Night-Heron	No effect likely	Consider increasing internal structure in ponds
Migrant & visiting butterflies	Improvement in habitat values	Consider creating mud-puddling areas by restoring shorelines or by other methods
Spicebush Swallowtail	Habitat may increase but could reduce host plant and breeding population	Ensure appropriate rotation of burn areas Consider plantings of Spicebush as alternate food plant Conduct search for pupae and relocate or protect
Edwards' Hairstreak	Improvement in habitat	Ensure appropriate rotation of burn areas Plant oak saplings
Hickory Hairstreak	Improvement in habitat	No action necessary
Silvery Checkerspot	Improvement in habitat	A small population may exist in Unit 7B & should be considered for protection from prescribed burns
Little Glassywing	Marginal improvement in habitat	No action necessary, although any wetland restoration initiatives could consider this species

12.1 Prescribed Burning Activities, Impacts & Mitigation (cont'd)

12.1.4 Ethical Considerations for Wildlife

Although it is generally accepted that prescribed burning is beneficial to wildlife, it cannot be forgotten that fire can kill individual animals if they are caught off guard. *Table 10* below lists steps that the City can take to reduce the potential for harm to wildlife in general.

In addition, staff from the City of Toronto, Toronto Animal Services Section, will be encouraged to attend all prescribed burns to provide care to wildlife, should this be required, as well as to provide guidance to City staff in the prevention of injury to wildlife. In the event that they are not available, assistance from the Toronto Wildlife Centre, a private agency, will be sought.

TABLE 10. Potential mitigative actions to protect wildlife and anticipated results.

Mitigative Actions	Anticipated Result for Wildlife
Burn prior to late April or after late July	Avoids harm to nestling birds and eggs
Ensure escape routes for wildlife	Medium-sized mammals can move from burning unit into habitat safe from fire and predators
Ensure unburned similar habitat is adjacent	Enables animals to be safe and secure (e.g., adjacent open park may be unsuitable for cottontails)
Limit number of volunteers along trails	Wildlife may be expected to use the trail system to escape danger if all trails are not occupied by humans
Ignite fire along consistent front	Fleeing wildlife does not become disoriented by multiple ignition areas; encourages an orderly movement away from advancing flames
Manage fire planning to avoid excessive intensity	Many arboreal wildlife species can survive low to moderate intensity fires
Encourage patchy burning to provide refugia	Allows small mammals and insects to survive on unburned habitat "islands"
Consider using volunteers to sweep areas prior to ignition	Flushes some small- and medium-sized animals to safety (can be used to search for Spicebush Swallowtail pupae)
Encourage retention of large logs on woodland floor	Provides fire shelter
Have plan for humane capture and treatment of injured wildlife (including euthanasia if necessary)	Minimize suffering

12.1.5 *Key Actions & Strategies for The Application of Prescribed Burns*

A. Continue to implement prescribed burns and develop a long-term fire management strategy.

B. Continue education, training and outreach instruction on prescribed burn techniques and benefits.

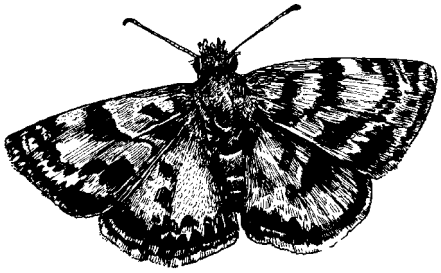
C. Continue to work with City staff and volunteers to develop the expertise necessary to safely implement a prescribed burn program.

D. Use prescribed burning to achieve vegetation management objectives such as enhancing the growth of native species and the control of exotic plant species. Specific targets associated with these objectives are as follows:

- Patchy distribution of 5 age classes of Black and White Oak in the oak savannah and woodland communities (age classes will include seedlings, saplings, young trees, mature trees and over-mature trees).
- Continuous native grass, sedge and forb ground-story that incorporates spatial variability.
- Black Oak – White Oak savannah and woodland stand structure with light gaps that support ground layer vegetation (30-50% of ambient light).

E. Increase availability of specific food plants such as Spicebush for the Spicebush Swallowtail.

F. Identify Eastern White Pine stands to be retained in the Park and plan for their protection from future prescribed burns, at least until trees are mature enough to resist fire impact.



Mottled Duskywing Judy Shore

12.2 Controlling Invasive Plant Species

Generally, invasive plant control aims to reduce invasive species to some acceptable level and limit their rate of spread. The broader management goal in High Park is to limit negative ecological impacts and promote successful competition by native species. Control will focus on preventing new species invasions and protecting high quality habitat and other significant features, such as populations of rare plants. Eradication may be an appropriate goal when populations are small in size and/or low in number. Reducing the size of extensive infestations is generally of lower priority because of the time and labour required, and may be attempted when time and resources permit. For example, the control of large Himalayan Balsam colonies may be feasible in the short-term, because this species is an annual and is easily reduced by stem cutting done by student volunteers (i.e., MNR Stewardship Rangers).

Standard methods of controlling invasive species fall into three main categories: physical, chemical and biological controls. The results of invasive plant control efforts in Toronto and elsewhere indicate the need for a flexible approach that allows for a variety of tools, including low-toxicity herbicides. The use of a combination of approaches is sometimes referred to as "integrated pest management". Continuing research will undoubtedly lead to new approaches and methods.

12.2.1 Physical Control of Invasive Species

A variety of physical methods may be applied in controlling invasive plants in High Park, such as digging, hand-pulling, tilling, girdling, cutting/mowing, and prescribed burning. Hand removal can be an effective technique when used on a small scale, but is very labour intensive. Another disadvantage is that it often results in soil disturbance and trampling, which can promote further invasions by exotics. In sensitive areas, only the flower tops may be removed from undesirable species to prevent seed production and limit disturbance. Mowing may be used to control invasive annuals such as Himalayan Balsam and weedy biennials like White Sweet-clover, particularly in areas that are accessible to machinery and have relatively even terrain. Generally, mowing and cutting alone are not sufficient to control persistent perennials such as Japanese Knotweed and Dog-strangling Vine, which can withstand several years of top-growth removal. The effective control of these species requires the use of herbicides, or a combination of herbicide and manual methods.

Fire is also an important management tool for combating invasive species in High Park. Prescribed burning is being used to reduce the density of woody species (i.e., Tartarian Honeysuckle and Common Buckthorn), control aggressive groundcovers such as Garlic Mustard and Celandine, and reduce the extent of exotic turf grasses such as Sheep Fescue.

12.2.2 Chemical Control of Invasive Species

Chemical control is often the most efficient and realistic approach to diminishing large infestations of persistent herbaceous and woody species. In High Park, chemical control of invasive species is being limited to the application of non-persistent, low toxicity herbicides (i.e., glyphosate) to foliage or cut stems. Other effective, biodegradable herbicides may be considered as they are approved for use in Ontario. A summary of the safety data pertaining to glyphosate is provided in *Appendix E*.

As a rule of thumb, repeated applications of herbicide (once or twice per growing season) will kill the root systems of most invasive perennials within 2 to 3 years. Herbicide is applied in a targeted manner using wick applicators or other devices that enable controlled application to individual plants. The use of spot application techniques greatly minimizes the risk of damage to non-target species, including humans and wildlife.

Woody exotics such as Common Buckthorn re-sprout vigorously after cutting and burning, making manual treatments alone impractical. Control of exotic woody vegetation can be greatly improved by integrating chemical treatments with manual methods of control, such as stem cutting and girdling. Herbicide injectors can also be used to treat larger stems.

Dog-strangling Vine following herbicide treatment in High Park.

12.2.3 Biocontrol of Invasive Species

Biological control involves the use of host-specific biotic agents to control the population of a species. Natural enemies or predators that are not native to an area are introduced after rigorous testing to ensure that the risk to native species is not significant. Biological control may be the only method of effectively controlling abundant or widespread invasive plants over the long-term. However, this method is not a quick fix. On average, 10 or more years of rigorous lab and field testing are required before an organism can be approved for release, and a further 3 or more years of observation may then be necessary to determine whether potential biocontrols are effective in local areas.

The biological control of Klamathweed (also called Common St. Johnswort) in the United States started in 1953 is estimated to have provided $2.7 million benefit over 40 years (Huffaker et al. 1976; DeBach 1964; Gutierrez et al. 1999). This is an example of a successful biocontrol program that restored productive rangelands in western North America with releases of leaf-feeding beetles.

Even with this and other successes such as the biocontrol program for Alligatorweed initiated in 1976 (Andres 1977; Gutierrez et al. 1999), such programs need to be approached with caution due to the potential impacts on non-target organisms (Hager and McCoy 1998). However, in cases where invasive plants are resilient to other forms of control, biocontrol may be the most suitable management option.

In July of 1998 and 1999, leaf-feeding beetles (of European origin) were released in High Park to test the effectiveness of biocontrol as a method of limiting the spread of Purple Loosestrife around Grenadier Pond. The Toronto and Region Conservation Authority is monitoring the long-term results of this program. At present, four beetles are being studied for possible release into North America to control Garlic Mustard. If one or more of these organisms is approved, a biological control for this species may be available for use in a few years. Other biotic agents may also be considered for use in controlling invasive species in High Park as they become available for this purpose. The development of innovative methods of integrating biological control with physical and chemical controls could lead to greatly improved invasive plant species management.

12.2.4 Key Actions & Strategies for Controlling Invasive Plant Species

A. Minimize disturbances that contribute to fragmentation of plant communities.

B. Manage canopy gaps and other openings to permit regeneration of native plant communities while preventing establishment of invasive species.

C. When controlling and managing invasive species, give first priority to sustaining high quality habitats or areas that contain rare species. When using control methods other than prescribed burning, give priority to areas that are at the beginning of invasion, or are not yet heavily infested, unless a heavy infestation is in proximity to a high quality site, or can be controlled without high labour/cost inputs. When treating heavy infestations, begin at the edges of the infestation and work towards the centre.

D. Monitor the establishment of invasive species and the rate of spread of existing infestations.

E. When undertaking control, target the most sensitive life stages by considering the ecology of the species of concern (i.e., important life cycle stages such as timing of emergence, flowering, seed production, dispersal).

F. Use appropriate invasive plant control methods to achieve vegetation management objectives such as reducing non-native trees and shrubs, and reducing invasive grasses and other groundcovers. Specific targets associated with these objectives are as follows:

- Reduce invasive shrubs by 85%.
- Reduce native saplings and tree cover (Manitoba Maple, Green Ash and others) to create ambient light availability of 30-50% (as required for establishment of savannah groundcovers).
- Reduce by 90% (or more) invasive ground layer plants including Dog-strangling Vine, Japanese Knotweed, Himalayan Balsam.
- Reduce by 60% European Brome and Sheep Fescue Grass.

City staff wicking weeds in High Park.

G. Establish native plant cover to limit the spread of invasive species into new areas and to recapture areas where invasive plants have been removed.

H. Take steps to prevent the accidental introduction of invasive plants to new locations (i.e., avoiding importing soils from other locations, dumping plant clippings into natural areas, planting potentially invasive ornamentals in locations adjacent to natural areas).

I. Create and maintain a Park-based list of invasive plant species that have the potential to establish in High Park and threaten native flora, and monitor for the establishment of these species.

J. Support the "Expanding the Borders of High Park" theme developed by volunteers to educate citizens about invasive plants and encourage the use of native plants in gardens that surround the Park.

12.3 Re-establishing Native Plant Communities & Species

Several studies (e.g., Apfelbaum et al. 1993, Varga 1989, Wainio et al. 1976) have cited evidence indicating the serious deterioration of High Park's plant communities. While management techniques such as prescribed burning and removal of invasive exotics are expected to result in significant improvements in biodiversity and ecological health (Apfelbaum 1999; City of Toronto 1999), the deliberate re-introduction of native species is also necessary to ensure the long-term viability of natural systems.

Re-introductions of native plants will be used to:

- promote re-establishment of populations of extirpated, rare and declining species,
- improve and enlarge habitat for native plants and wildlife,
- improve habitat connectivity and create new habitat,
- control erosion, and
- regenerate closed trails.

12.3.1 Site Preparation & Seed Sources

Often, the reduction or eradication of invasive plants will be necessary before native species can be introduced. Other forms of habitat manipulation, such as canopy thinning, may also be necessary to create the environmental conditions required by some species. Planting plans will reflect natural patterns of distribution and abundance of species found in a particular vegetation community.

Only genetically appropriate seed, propagules or nursery stock grown from such material are being used for restoration purposes. When possible, plant material is derived from seed or propagules obtained locally from natural stands. "Local seed" means seed derived from an area in the vicinity of High Park which is subject to similar climatic and environmental influences. High Park will be the first choice as a seed source for direct seeding and nursery propagation, unless a need for genetic diversity suggests otherwise. The second choice will be seed or stock obtained from a roughly semi-circular area extending 30 to 35 kilometres from the centre of the Park. When necessary or desirable, seed shall be collected within homologous ecosystems within an area of Southern Ontario bounded by Port Dover, Stratford, Barrie, Peterborough, Trenton, Grimsby and the northern shore of Lake Ontario (HPCAC 1997). When seed is required which is unavailable from the above area, the radius of the search may be progressively increased dependent on the need and desirability of the species in question. In all cases the overriding principle ratio of 'desire over distance' shall be weighed and applied.

Notably, the re-establishment of some species may not be possible because the environmental conditions required for survival may no longer exist, such as a lack of appropriate pollinators.

12.3 Re-establishing Native Plant Communities & Species (cont'd)

12.3.2 Plant Community Structure Goals

The augmentation of native shrub diversity is a high management priority in all communities, but is most critical to restoring the oak savannah. Historically, an assortment of native dryland shrubs occurred in High Park, which included: three species of blueberry, Black Huckleberry, Snowberry, Smooth Wild Rose, Pasture Rose, New Jersey Tea, Bush Honeysuckle and Sweet Fern. At present, native shrub cover in dryland communities is nearly absent in some parts of the Park, perhaps because of past mowing practices. It is possible that insufficient understory shading may be limiting the growth of Black Oak seedlings, which favour moist microsites. In healthy oak savannahs (undisturbed by past mowing) shrub cover ranges from about 15 to 35%. The establishment of native grasses and sedges in oak woodlands and savannah habitats is also a restoration priority.

In high quality wooded areas (i.e., *Sections 7.2.2 - 7.2.5, pages 22 - 23*), management is focussed on restoring native biodiversity and vegetation structure (or layering). Under-planting is being carried out to re-introduce canopy, sub-canopy and ground layer species that are poorly represented or are no longer present. Besides increasing plant cover and improving structure, enhancing the amount of "core" habitat may help to improve conditions for plant and animal species sensitive to fragmentation. Dense, layered habitat consisting of native trees, shrubs, vines and herbaceous species are being established around the perimeter of wooded areas to help buffer more sensitive inner woodland environments and reduce the amount of edge. Wherever possible, plantings are used to increase the size of existing habitat fragments.

12.3.3 Plant Community Restoration Priorities

The priority for planting in communities dominated by exotic species or with a large exotic component will be: 1) heavily degraded lowland forests with an exotic understory, 2) open fields and thickets, 3) forests dominated by exotic trees.

Opportunities to link sizeable areas of formerly connected habitat through plantings and other management techniques are limited in High Park. However, a potential connection may exist between dryland habitats across an east-west gradient north of Grenadier Pond. Woody and herbaceous cover are being established in the tablelands by planting large blocks and creating widely spaced habitat "islands".

Open fields and thicket communities created by forest fragmentation are being restored through phased successional plantings that mimic the composition of existing or original wooded communities. Once a cool microclimate begins to develop, pioneer species are under planted with shrubs, grasses and herbs characteristic of semi-open conditions. Managed succession may require the thinning of pioneer species over time to allow the establishment of desired canopy species. It may also require removal of trees such as Sugar Maple that have been planted inappropriately in savannah areas of the Park and which will ultimately degrade underlying savannah plants if allowed to mature.

12.3.4 *Key Actions & Strategies for Re-establishing Native Plant Communities & Species*

A. Plantings and other revegetation techniques will be used to enhance native biodiversity, increase native plant cover and improve habitat quality for plant and animal life. Specific targets associated with this are as follows:
   - Native shrubs will be reintroduced in groups (minimum of 10 shrubs per group) not more than 120 m apart.
   - Eastern White Pines will be introduced within the hardwood-Hemlock mixed forest areas, or along the perimeter of significant oak-dominated plant communities, where they can be isolated from fire.

B. Plantings will mimic natural vegetation patterns and processes from the micro-site to the community scale. For example, woodland herbs may be distributed in clumps or as scattered individuals, or may occur in association with certain other species. At a larger scale, some species are naturally scarce or restricted to certain soil types or topographical locations.

C. Plantings will be used to control soil erosion in the following manner:
   - Stabilize soils with a minimum of 70% plant coverage of the ground.
   - Re-introduce native sedges, grasses and forbs where seed banks are not viable.
   - Re-introduce dry site species on south and west exposed slopes, on ridge tops and on coarser soils.
   - Re-establish species of cooler, moist sites on mid and lower slopes, on northern and eastern sites, and at slope bottoms on west and south slopes.
   - Use existing plant communities and known ecological habits as a model for development of planting plans.

D. Only seed of known origin or nursery stock grown from such seed is to be used for restoration purposes. When possible, seed should be obtained from High Park or locally from natural stands, unless another source can provide genetically acceptable material.

E. Create the disturbances necessary to stimulate seed banks or the growth of established plants (such as fire, removal of invasive species, canopy gaps).

F. Minimize impacts to native vegetation resulting from plantings and other management activities. Plantings will only be carried out in sites where the introduction of additional plants or propagules is expected to have a beneficial effect on native plant populations or communities.

G. Periodically assess the need to plant in an area or introduce additional propagules. If regeneration is occurring naturally, further additions may not be necessary. On the other hand, some species may require repeated re-introductions before they become established.

12.4 Restoring Rare Native Plant Populations

The protection and reintroduction of rare plants poses greater restoration challenges than for common or widespread species. Many rare plants have very specific pollination and dispersal requirements, small population sizes, slow rates of growth, altered gene pools and narrow environmental tolerances. For many species, the specific environmental conditions required for successful reintroduction may no longer exist because of changes to the Park's natural environment. Furthermore, because High Park is an isolated habitat fragment, it is difficult for native plants to disperse from other savannah or prairie fragments and offset population declines. Rare plants are generally the first species to be lost from isolated areas and the last to re-colonize them, for the reasons listed above.

Steps will be taken to conserve rare genotypes by maintaining seed banks, establishing new populations of declining or extirpated species and augmenting natural populations with material propagated from local sources. Seed exchanges with other similar sites may be undertaken to enhance the genetic fitness of populations of certain species.

Butterfly Weed Judy Shore

12.4.1 Key Actions & Strategies for Restoring Rare Native Plant Populations

A. Inventory and map locations of rare plant species

B. Maintain seed banks to conserve genotypes, and exchange seed with other similar sites in southern Ontario.

C. Manage threats to rare plants, such as invasive species, trampling, lack of natural disturbances, and loss of specific growing requirements (e.g., seepage or wetland edge).

D. Use trail closures, barriers and signage to reduce trampling and discourage the collection of wildflowers.

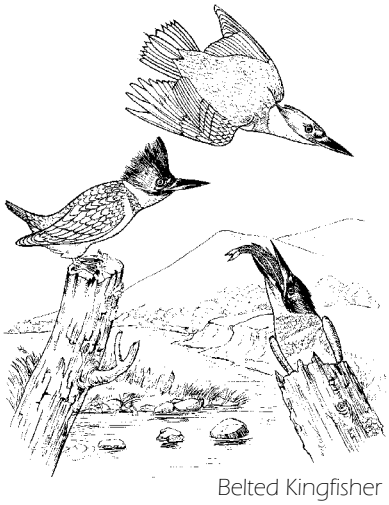
E. Propagate rare species from locally collected seed, outplant into suitable sites and enhance the size of existing populations of rare plants. Plant along a habitat gradient to assess tolerance to varying microsite conditions.

F. Augment declining plant populations to allow outcrossing and prevent selfing and gene pool deterioration. As a general rule, larger scale introductions are preferable, within practical considerations. Minimum viable population sizes are not known for most species. Follow general rules such as using diverse genotypes scattered over the planting site, and use high stocking density to increase cross fertilization

G. Monitor carefully and review monitoring results.

Before establishing populations of extirpated or declining species, an attempt will first be made to stimulate soil seed banks, since some plants can persist for decades in a dormant condition in the soil until the appropriate conditions for growth and germination occur. For example, a single prescribed burn was sufficient to stimulate the seed banks of some native woodland herbs in 2000. If re-introductions are deemed appropriate or necessary, the selection of appropriate reintroduction sites will be critical. Environmental factors that must be carefully considered include the presence of pollinators, slope, microclimate, soil type and moisture regimes. More often than not, rare plant introductions are unsuccessful, and repeated attempts are often necessary before an introduced plant population begins replacing itself and dispersing beyond the reintroduction site. However, volunteers and City staff have been successful in propagating and reintroducing a few rare species to High Park including Wild Lupine and Butterfly Weed. In 2000, signage was erected to discourage Park visitors from collecting these and other plants.

12.5 Restoring Tall Shrub Habitat for Migrant Songbirds



Belted Kingfisher

A well-diversified vegetation structure provides vital habitat for migrant songbirds. One component of this is the tall, shrubby vegetation that is decreasing in abundance in the Park due to the re-introduction of fire and the manual removal of invasive shrubs. Tall shrubs such as Buckthorns provide habitat for migrant songbirds in spring and an excellent food source in autumn when berries provide essential lipids required to build winter fat reserves. The presence of such shrubby vegetation in the south portion of the Park, along Spring Creek Ravine and along the east shore of Grenadier Pond is particularly important to spring migrants. However, vegetation restoration plans are examining ways to increase native shrub cover in these key areas to replace what is being removed. Many of the woodlands where shrubs can be replaced are mesic rather than dry, or are highly altered, and so opportunities to plant shrubs in currently open areas, particularly those that are outside the savannah, are being considered.

12.5.1 Key Actions & Strategies for Restoring Tall Shrub Habitat for Migrant Songbirds

A. Increase native shrub cover in open manicured turf-grass along eastern flank of Grenadier Pond.

B. After hydrological manipulation, establish a shrub thicket swamp in the southern portion of Upper Duck Pond (e.g., Spicebush).

C. Implement extensive native shrub plantings in the open grass area just west of Lower Duck Pond.

D. Increase native shrub plantings in woodlands around Lower Duck Pond (i.e., Units 5A & 6A).

E. Close unofficial trails in the southern area of the park (i.e., the ravine trail near Colborne Lodge.)

12.6 Increasing Abundance of Cavity Trees & Woody Debris

Dead trees are crucial to the overall health of a forest ecosystem. Silvicultural guidelines recommend leaving at least one cavity tree per hectare that is at least 40 cm in diameter. These cavity trees increase habitat for cavity nesting wildlife species such as woodpeckers, racoons, and Southern Flying Squirrels. Priorities for leaving cavity trees must be based on safety issues in High Park, rather than on wildlife priorities, as identified by Naylor et al. (1996). All cavity trees that can be retained are being retained, and fire staff will identify these and plan for them in regular prescribed burn plans.

Young pine trees are not fire resistant and may be killed by prescribed fires. Most of the Austrian Pines in High Park that died following the prescribed burn in 2001 were left standing to enhance wood boring insect populations and improve habitat for woodpeckers and small cavity nesters such as chickadees and bats.

Downed woody debris over 10 cm diameter provides multiple benefits, including an increase of habitat for amphibians and reptiles. Abundant downed woody debris also provides cover habitat for terrestrial amphibians. Several snakes, including Milk Snake, commonly lay their eggs in the rotting wood of stumps and fallen logs, and seek these out, as well as hollow trees. Hollow logs should be left intact where possible, either standing or fallen. In this way reptile hibernation and gestation sites might be protected or created (OMNR 2000).

12.6.1 Key Actions & Strategies for Increasing Abundance of Cavity Trees & Woody Debris

A. Identify standing dead trees that are not hanging over trails for retention.

B. Remove hazardous limbs if they hang over trails. Large limbs should not be cut into small pieces.

C. Drop snags to the ground where they pose a safety hazard without cutting logs or slash unless necessary.

D. Retain standing dead pines after prescribed fires.

E. Educate the public about the importance of dead wood for wildlife habitat.

F. Conduct a herpetofaunal survey to update and verify the inventory.

G. Work closely with Parks and Forestry staff to develop better practices governing dead wood retention in the park.

Standing cavity tree in High Park.

12.7 Reducing Trampling Damage

Native plant communities will not regenerate unless steps are taken to control off-trail trampling and soil disturbance. This will require a formalized trail system, the closure of unofficial paths, and the installation of interpretive signage in appropriate locations. Additionally, it may be necessary to apply other measures to protect significant plant communities and rare species.

The City of Toronto is currently developing guidelines for trail development in Toronto area parks. Once these guidelines become available, they can be tailored to specifically address recreation and habitat protection concerns in High Park. Mapping of sensitive plant communities will precede the development of a trail network.

12.7.1 Key Actions & Strategies for Reducing Trampling Damage

A. Undertake mapping of sensitive plant communities and important wildlife habitats.

B. Formalize a limited number of trails to reduce impacts to natural systems.

C. Avoid trail development and where possible, use appropriate barriers to prevent trampling of sensitive terrain, high quality habitats or areas with sensitive or rare species.

D. Temporary trail closures may be used to protect nesting sites and other wildlife habitats.

E. Re-vegetate closed trail systems.

F. Protect natural areas by enforcing the dog "off-leash" policy, and conducting public outreach around this issue.

G. Develop signage to encourage Park users to stay on trails and be respectful of the Park's natural environment.

H. Produce trail guides and other interpretative materials to educate the public about the natural features of High Park and the importance of preserving such a unique area.

I. Use trail-surfacing materials that are not easily displaced from trails to adjacent vegetation and which do not alter the chemical or biophysical properties of nearby soils.

Fenced pedestrian and cycling trail in High Park. Boardwalks help to keep people from straying into sensitive plant communities.

12.8 Restoring Hydrology

The hydrological system includes surface water (ponds and wetlands), subsurface flow (groundwater) and riparian systems (streams and creeks). A clear understanding of the Park's hydrology, both past and present, is necessary before steps can be taken to re-establish more natural patterns of drainage. Re-instating historic patterns of water flow will is not possible because alterations to the Park's natural hydrologic regime have been too extensive.

Major efforts have already been made to rehabilitate Grenadier Pond and a portion of lower Duck Pond (see *Section 7.4, page 24*). Techniques that can be used to improve hydrology include the restoration and creation of "wetlands" (including swales and temporary ponds), structural changes to watercourses, controlling invasive species and re-introducing native plant cover. In addition to enhancing groundwater recharge and discharge, wetlands can also help to improve water quality by filtering excess nutrients and other pollutants, and by increasing oxygen levels.

The establishment of dense vegetation cover along watercourses can help to reduce sedimentation and soil erosion. However, it may not be possible to recreate wetlands in areas where they formerly existed because of insufficient groundwater or incompatible land uses.

12.8.1 Key Actions & Strategies for Restoring Hydrology

A. Where feasible, re-establish native plant cover around ponds and along Spring Creek.

B. Control invasive plants and use plantings of dense native vegetation, such as graminoids and shrubs to reduce sedimentation and stabilize shorelines.

C. Where possible, re-establish natural surface water flow regimes and create "wetlands" to meet various restoration objectives (such as stormwater management, the creation of breeding habitat and cover for wildlife, improved groundwater infiltration, and the re-establishment of aquatic plant communities).

12.9 Managing Grey Squirrel Populations

If future studies determine that Grey Squirrel populations are having a significant negative impact on the regeneration of Black Oaks, the re-introduction of the Southern Flying Squirrel or the survival of rare breeding birds, steps could be taken to limit the population of this species in the Park. Over time, predation by coyotes and foxes may lead to a natural decline in Grey Squirrel populations.

12.9.1 Key Actions & Strategies for Managing Grey Squirrel Populations

A. Facilitate continuing studies of the impacts caused by Grey Squirrels in High Park.
B. If possible, encourage establishment of predators.
C. Educate the public to prevent their excessive feeding of squirrels.

12.10 Monitoring Pollution & Climate Change

The ecological effects of pollution and climate change may be difficult to discern because they are so pervasive. Soil studies may help to identify specific problems that can challenge restoration efforts, such as heavy metal loading, poor soil structure and the loss of soil biota. Once soils are damaged, they may not support the suite of native species that would normally be expected on a site. Climate change may have similar implications for restoration goals. For example, if climate fluctuation becomes a trend, planting species adapted to a wide range of conditions may become an appropriate management strategy.

12.10.1 Key Actions & Strategies for Monitoring Pollution & Climate Change

A. Conduct and/or facilitate a comprehensive survey and assessment of soil quality, litter and soil biota in High Park.
B. Monitor success of plantings in different sites and modify restoration goals (desired vegetation) if necessary.
C. Maintain records of climate and phenology (i.e., information on the timing and emergence of roots, shoots, foliage and reproductive structures such as flowers and seeds) for a selected group of invasive and non-invasive, native plants. Over time, this information may yield insights into the effects of annual climate variation on native and exotic vegetation.

13 Ongoing Monitoring Activities

Monitoring is an essential component of a restoration plan because it informs adaptive approaches to a work plan and measures progress in meeting established goals and objectives. While monitoring some aspects of the Plan requires the involvement of City staff with specific skill sets, some components can be monitored effectively by knowledgeable and dedicated naturalists and volunteers. For example, local stakeholders with special interests in butterflies or herpetofauna continue to offer their expertise, and are often eager to share their sightings and provide their input regarding the success or failure of various restoration efforts with respect to their area of expertise. Students and researchers are also be encouraged to study aspects of the Park ecosystem, particularly those aspects that are most poorly understood.

13.1 Monitoring Prescribed Burn Effects

A long-term monitoring program was initiated in 2000 to assess the effects of prescribed burning on High Park's oak savannah and other plant communities. This program will involve the collection of data from 30 permanent photomonitoring stations and permanent transects (see *Appendix F* for details). In 1997 and 1998, prescribed burn test plot monitoring was carried out using $1m^2$ quadrants and time meander searches (Apfelbaum and Larson 1995). The test plot program demonstrated an increase in native sedges, grasses and forbs, a reduction in non-native species and some regeneration of oak seedlings and shrubs such as blueberries and Beaked Hazel (Apfelbaum 1999). Successful regeneration of Black Oaks is one of the key factors used for evaluating the success of the restoration work.

Example of a photomonitoring plot in High Park.

13.2 Monitoring Invasive Plants

Field trials and test plot studies have been and will continue to be undertaken to evaluate existing and potential methods of controlling invasive plants, and to obtain a better understanding of the ecology of certain species. This research will help to develop the best management practices for controlling invasive plants found in the Toronto area. At present, most information about the ecology and control of invasive species is based on research undertaken in the United States, where ecological conditions and priorities for control can be much different. For example, some species that are seriously invasive in High Park, such as Himalayan Balsam, are not of significant concern in similar habitats elsewhere.

13.3 Monitoring Native Plant Re-introductions

Monitoring of re-introduced native plants (and seeds) will involve careful recording of the number and types of species planted, location, genetic diversity of stock, health and reproduction, and any site preparation or maintenance/management undertaken. This will be followed by careful monitoring of the planted sites over several years to evaluate the success of the re-introduction experiments.

13.4 Monitoring Wildlife Re-introductions

A local resident, Jay Palock, has released a number of herpetofauna into the Park since 1997 (B. Yukich, pers. comm. 2001), as described in *Section 8.2, page 26*. These, as well as other possible releases of fauna, should be recorded and monitored. Further, a policy concerning such releases should be developed by High Park Citizens' Advisory Committee (HPCAC) and the City of Toronto to ensure that these independent activities are consistent with the Plan's overall restoration objectives.

14 Ongoing Stewardship Activities

14.1 Data Collection & Resource Inventory

Existing botanical inventories of High Park are either outdated or incomplete. In particular, there is a need to update rare species records and plant community mapping. In 2000, a plant resource inventory was initiated to provide a better understanding of the Park's natural systems, as well as the baseline information necessary to guide management activities (see *Appendix A*). This ongoing botanical inventory will include collection of voucher plants, and mapping and documentation of:

- native plant communities
- populations of significant native species and invasive species
- critical habitat for rare or threatened species, and
- locations where plantings and other management/maintenance has been carried out.

14.2 Native Plant Propagation Program

In 1996, a native plant nursery was established in the High Park greenhouses to provide a source of plants and seed for restoration purposes, and act as a demonstration site and an educational resource. The propagation program is specifically tailored to preserving the plants found in High Park's oak savannahs and other significant ecosystems, although material derived from other sources in the Toronto Region is also grown. The High Park Nature Centre and the Volunteer Stewardship Committee have successfully propagated rare species like Stiff Gentian and Butterfly Weed in the Park's greenhouses, and plan to attempt the propagation and re-introduction of additional rare species including Poke Milkweed, Pasture Rose and Snowberry in 2002 (T. Hovan, pers. comm. 2002). The ability of these various species to establish themselves is being monitored

Volunteers at High Park, summer 2000.

The nursery has received extensive support from the Volunteer Stewardship Program, and has, in turn, provided educational opportunities around plant propagation, restoration and the ecology of oak savannahs. The "Expanding the Borders of High Park" theme, initiated and developed by volunteers with support from the City, encourages area residents to plant species native to the oak savannah in their yards. Public sales of native plants propagated and sold by City staff and volunteers are conducted several times a year to help support these efforts.

14.3 "Adopt a Plot" Program

In 1999, the Volunteer Stewardship Program launched the "Adopt-A-Plot" program, which provides an opportunity for groups to focus their restoration efforts in a specific area of the Park. Individuals can "adopt" plots within a designated area and plant or seed them with native species for the purpose of restoring the site. At present, the plots are limited to the tablelands near the restaurant. So far, the program has helped to re-establish a variety of native savannah plants, such as Wild Lupine, Butterfly Weed, Indian Grass, Big Bluestem and Little Bluestem.

15 Glossary

The following definitions have been adapted from OMNR 2000, Wright 1976, Delaney et al. 2000, Dunster and Dunster 1996, and Van Horn and Van Horn 1996.

exotic species – A species accidentally or purposefully introduced into an area where it did not previously occur. Typically, describes a plant or animal that is not native or foreign to the region in question, having originated in another region. Exotic species often, but not always, have undesirable effects on native species and the ecological integrity of the ecosystem.

forb – a herbaceous plant with broad leaves, excluding the grasses and grasslike plants.

gene pool – The sum of all genes among scattered populations of a given species

genotype – The entire genetic constitution, or the sum total of genes of an organism. The genotype interacts with the environment to produce an individual whose appearance is referred to as its' phenotype.

graminoid – A member of the grass family (Poaceae). A grass is any plant having narrow leaves with parallel veins, small flowers and stems, and with joints that appear as easily visible bulges where the leaves attach.

hydrology – The study of the hydrologic cycle, that is, the circulation of water from the ocean (fluid) to the atmosphere (vapour) to the land (rainfall) and back to the ocean (runoff). The hydrologic cycle involves processes of evaporation, transpiration, precipitation, runoff, infiltration and storage.

invasive plant – A plant that reproduces so aggressively that it displaces other plant species in the area, threatening their survival. An invasive exotic plant in a non-native plant that threatens the survival of a native plant.

mesic – Any habitat containing a moderate amount of moisture. Mesic sites have average moisture conditions for a given climate. In contrast to humid sites (referred to as hydric) or dry sites (xeric).

microsite – A portion of a site that is uniform in microtopography and surface soil materials. It can range in size from less than 1 square metre to occasionally over 5 square metres. Microsites are dynamic in that their characteristics are ever changing, imperceptibly or suddenly.

native species – Usually, a species known to have existed on a site prior to the influence of humans. Typically describes a plant or animal that has evolved in a given climate or region and is locally adapted to the site conditions in that region.

naturalization – Any effort to convert managed landscapes to more natural and naturally evolving landscapes, relatively free of human intervention.

outcrossing= outbreeding – Mating of unrelated parents; mating in which close relatives do not usually breed.

perennial – A plant that continues growth from year to year and has a life span of more than two growing seasons. Many perennial plants are woody, such as trees, shrubs and some vines, but other include non-woody plants where the above-ground parts die-back to leave perennating organs such as tubers, corms or bulbs underground.

phenology – The study of the timing of periodic phenomena, such as flowering, growth initiation and cessation in plants, especially as they relate to seasonal changes in temperature, etc..

photomonitoring – Documentation of change over time using photo images. In itself, photomonitoring does not provide quantitative information needed to evaluate the success of restoration projects. When applied using a standardized methodology and in conjunction with some quantitative measurement, it can provide data that is adequate for the evaluation of restoration projects.

prescribed burn – The deliberate application of fire to a site within pre-determined boundaries, considering weather, fuel, and topography to fulfill an ecological, silvicultural, wildlife management, sanitary or hazard reduction requirement.

quadrant – One quarter of a circle.

restoration – A process of returning ecosystems or habitats to their original structure and species composition. Restoration requires a detailed knowledge of the (original) species, ecosystem functions, and interacting processes involved.

savannah – A major global biome consisting of open grasslands and scattered trees or shrubs. In southern Ontario, this ecological community contains widely spaced oak, Red Cedar, hickory, ash, Plum or hawthorn trees, at a density of 1 to 16 trees per ha (Lee et al. 1998).

sedge – A grass-like herbaceous plant belonging to the sedge family, often having triangular stems.

selfing = self pollination – Pollination of a female flower by pollen taken from the same plant or a clone.

succession – A series of natural changes that occur in an ecological community over time – for example, the changes that occur as an old field becomes colonized with trees and gradually turns into a forest. These dynamic changes in ecosystem structure, function and species composition over time occur as one group of organisms dominates over another. These transitions may or may not lead to a potential climax stage that is more static.

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APPENDIX A. High Park botanical inventory (based on 1989—2001 data). (Sources: Varga 1989, Apfelbaum et al. 1993, Apfelbaum & Larson 1995, ECO-FOR 1997, Tony Jovan pers. comm. 1999 & 2002, Cora Thompson & Vojka Miladinovic of HPRC 2000).

Type	Botanical name	Common Name	Management Unit
tree	*Acer negundo (1)**	Manitoba Maple	1A, 10A, 1E
tree	*Acer platanoides (1)+*	Norway Maple	1A, 1E, 3B
tree	*Acer rubrum*	Red Maple	1A, 3B
tree	*Acer saccharinum*	Silver Maple	1A, 1E
tree	*Acer saccharum ssp.*	Sugar Maple	1D, 1E
tree	*Aesculus hippocastanum*	Horse Chestnut	1A, 3B
tree	*Alianthus altissima (2)+*	Tree-of-heaven	1D, 7B, 8A-2
tree	*Berberis thunbergi (3)+*	Japanese Barberry	1B, 7B, 8A
tree	*Betula alleghaniensis*	Yellow Birch	1A
tree	*Betula papyrifera*	White Birch	1A
tree	*Betula pendula (1)+*	European White Birch	1D, 1E
tree	*Carya ovata*	Shagbark Hickory	4C, 9C-2
tree	*Catalpa speciosa**	Catalpa	9A
tree	*Cercis canadensis**	Redbud	9A
tree	*Fagus grandifolia*	American Beech	7A
tree	*Fraxinus americana*	American Ash	7A
tree	*Fraxinus excelsior (p)+*	European Ash	10A
tree	*Fraxinus nigra*	Black Ash	1A
tree	*Fraxinus pennsylvanica*	Green Ash	1A, 3B
tree	*Gleditsia triancanthos**	Honeylocust	1E
tree	*Juglans cinerea*	Butternut	8A-2
tree	*Juglans nigra*	Black Walnut	7B, 8A-2, 8B, 9B,
tree	*Malus pumila +*	Common Apple	1A, 10A
tree	*Morus alba (1)+*	White Mulberry	1A, 10A, 1E, 3B
tree	*Picea abies +*	Norway Spruce	9A, 4B
tree	*Pinus nigra +*	Austrian Pine	1A, 1E, 3B
tree	*Pinus resinosa*	Red Pine	1E, 10A
tree	*Pinus strobus*	Eastern White Pine	10A, 1E
tree	*Pinus sylvestris (2)+*	Scots Pine	1E
tree	*Populus alba (2)+*	European White Poplar	1E
tree	*Populus deltoides ssp.*	Eastern Cottonwood	1A
tree	*Populus X canadensis (4)+*	Carolina Poplar	11A, 3B
tree	*Populus grandidenta*	Large tooth Aspen	1A, 1E
tree	*Populus tremuloides*	Trembling Aspen	1A
tree	*Prunus avium (p)+*	Sweet Cherry	1A
tree	*Prunus japonicus +*	Japanese Cherry	1A, 1E
tree	*Prunus serotina*	Black Cherry	1A, 10A, 3B, 1E
tree	*Prunus domestica var.*	Common Plum	3B
tree	*Quercus alba*	White Oak	1A, 10A, 3B
tree	*Quercus palustris*	Pin Oak	10A
tree	*Quercus rubra*	Red Oak	1A, 10A, 1E, 3B
tree	*Quercus velutina*	Black Oak	1A. 10A, 1E, 3B

Type	Botanical name	Common Name	Management Unit
tree	*Robinia pseudo-acacia (2)**	Black Locust	1A, 10A
tree	*Salix fragilis (3)+*	Crack Willow	1B
tree	*Salix X rubens (3)+*	Hybrid White Willow	11A
tree	*Salix X sepulcralis +*	Weeping Willow	1D, 1E
tree	*Sassafras albidum*	Sassafras	1A, 3B, 1E
tree	*Sorbus americana*	American Mountain Ash	1A
tree	*Thuja occidentalis*	Eastern White Cedar	7A, 7B
tree	*Tilia americana*	Basswood	1A
tree	*Tilia cordata (p)+*	European Linden	1D, 3B, 7A, 7B, 8,
tree	*Tsuga canadensis*	Eastern Hemlock	10A
tree	*Ulmus americana*	American Elm	3B, 1D, 7A, 7B
tree	*Ulmus glabra (4)+*	Scotch Elm	3B
tree	*Ulmus pumila (2)+*	Siberian Elm	1D, 1E, 3B, 10A
shrub	*Acer spicatum*	Mountain Maple	8A, 3B
shrub	*Amelanchier spicata*	Low Serviceberry	1A
shrub	*Amelanchier stolonifera*	Running Serviceberry	1A
shrub	*Ceanothus americanus*	New Jersey Tea	10A, 1E
shrub	*Celastrus orbiculatus (2)+*	Asian Bittersweet	10A
shrub	*Comptonia peregrina*	Sweet Fern	1A
shrub	*Cornus alternifolia*	Alternate-leaved	1A, 10A, 3B
shrub	*Cornus foemina ssp.*	Grey Dogwood	1A, 10A
shrub	*Cornus rugosa*	Round-leaved Dogwood	1A, 3B
shrub	*Cornus stolonifera*	Red-osier Dogwood	1D, 1E, 10A
shrub	*Corylus avellana +*	European Hazel	1A
shrub	*Corylus cornuta*	Beaked Hazel	3B, 4B, 9A, 9B,
shrub	*Crataegus spp.*	Hawthorn	5A
shrub	*Diervilla lonicera*	Bush Honeysuckle	1A, 10A, 3B
shrub	*Euonymus europeus (3)+*	European Euonymus	1A, 1B, 7B,8, 10A
shrub	*Gaylussacia baccata*	Black Huckleberry	1A
shrub	*Hamamelis virginiana*	Witch-hazel	10A, 3B
shrub	*Lonicera tartarica (1)+*	Tartarian Honeysuckle	1A, 3B, 1E
shrub	*Parthenocissus inserta*	Virginia Creeper	1A
shrub	*Prunus pensylvanica*	Pin Cherry	1A
shrub	*Prunus virginiana ssp.*	Choke Cherry	1A, 3B
shrub	*Rhamnus cathartica (1)+*	Common Buckthorn	1A, 1E, 10A
shrub	*Rhamnus frangula (1)+*	Glossy Buckthorn	3B, 1E
shrub	*Rhus radicans ssp.*	Poison Ivy	1A, 3B, 10E
shrub	*Rhus typhina*	Staghorn Sumac	1D
shrub	*Ribes americanum*	Wild Black Currant	1A
shrub	*Rosa blanda*	Smooth Wild Rose	1A, 1E
shrub	*Rosa multiflora (1)+*	Multiflora Rose	1A
shrub	*Rubus allegheniensis*	Common Blackberry	3B

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Type	Botanical name	Common Name	Management Unit
shrub	*Rubus flagellaris*	Northern Dewberry	1A
shrub	*Rubus hispidus*	Swamp Dewberry	1A
shrub	*Rubus idaeus ssp. idaeus*	Red Raspberry	1A, 3B
shrub	*Rubus occidentalis*	Black Raspberry	1A
shrub	*Rubus pubescens*	Dwarf Raspberry	1A
shrub	*Salix humilis*	Upland Willow	10A
shrub	*Sherperdia canadensis*	Soapberry	
shrub	*Symphoricarpos albus*	Snowberry	
shrub	*Vaccinium angustifolium*	Low Sweet Blueberry	1A, 10A
shrub	*Vaccinium myrtilloides*	Velvetleaf Blueberry	10A
shrub	*Vaccinium pallidum*	Dryland Blueberry	1A, 10A
shrub	*Viburnum acerifolium*	Maple-leaved	1A
shrub	*Viburnum lantana* +	Wayfaring Tree	3B, 1D
shrub	*Viburnum lentago*	Nannyberry	
shrub	*Vitis riparia*	Riverbank Grape	1A, 1E, 3B
forb	*Acalypha virginica var*	Three-seeded Mercury	1A
forb	*Achillea millefolium* +	Yarrow	1A
forb	*Acorus calamus*	Sweet Flag	11A
forb	*Actaea pachypoda*	White Baneberry	3B
forb	*Actaea rubra*	Red Baneberry	
forb	*Agrimonia pubescens*	Soft Agrimony	3B
forb	*Agropyron repens* +	Quack Grass	1A
forb	*Allium tricoccum*	Wild Leek	1D
forb	*Alliaria petiolata (1)*+	Garlic Mustard	3B, 1D, 10A
forb	*Althaea officinalis* +	Marsh Mallow	1A
forb	*Ambrosia artemissifolia*	Common Ragweed	1A, 1E
forb	*Andropogon gerardii*	Big Bluestem	1A, 10A, 1E
forb	*Anemone acutiloba*	Sharp-lobed Hepatica	10A
forb	*Anenome quinquefolia*	Wood Anenome	1A
forb	*Antennaria neglecta*	Field Pussytoes	1E, 8A
forb	*Antennaria parlinii*	Plantain-leaved Pussy	7B, 9C
forb	*Apios americana*	Groundnut	3B
forb	*Apocynum*	Spreading Dogbane	1A
forb	*Apocynum cannabinum*	Indian Hemp	10A
forb	*Aquilegia canadensis*	Wild Columbine	1A
forb	*Aralia nudicaulis*	Wild Sarsaparilla	1A, 3B
forb	*Arctium minus ssp. minus* +	Common Burdock	1A, 1E
forb	*Asarum canadense*	Wild Ginger	8A
forb	*Asclepias syriaca*	Common Milkweed	1A, 1E
forb	*Asclepias tuberosa*	Butterfly Weed	1E
forb	*Asparagus officinalis* +	Asparagus	1A
forb	*Aster cordifolius*	Heart-leaved Aster	1A, 1D, 3B, etc.

Type	Botanical name	Common Name	Management Unit
forb	*Aster ericoides var. ericoides*	Heath Aster	1A, 1E
forb	*Aster laevis var. laevis*	Smooth Aster	9A
forb	*Aster lanceolatus ssp. lanceolatus*	Panicled Aster	3B
forb	*Aster lateriflorus var. ?*	One-sided Aster	1E
forb	*Aster macrophyllus*	Large-leaved Aster	1A, 3B, 1D, 1E
forb	*Aster novae-angliae*	New England Aster	11A, 1E
forb	*Aster oolentangiensis*	Azure Aster	1A, 10A, 3B,1E
forb	*Aster urophyllus*	Arrow-leaved Aster	1A, 1E
forb	*Athyrium filix-femina var. angusum*	Northern Lady Fern	3B
forb	*Bidens vulgata*	Tall Beggar-Ticks	1A
forb	*Bromus inermis ssp. inermis (4)*+	Smooth Brome	1A
forb	*Calamagrostis canadensis*	Canada Blue-joint	1A
forb	*Calystegia spithamaea ssp.*	Low Bindweed	1A
forb	*Campanula rotundifolia*	Harebell	1A, 1E, 10A
forb	*Carex hystericina*	Porcupine Sedge	11A
forb	*Carex laevivaginata*	Smooth-sheathed	10A
forb	*Carex meritt-fernaldii*	Merritt's Sedge	1E
forb	*Carex muhlenbergii var. muhlenbergii*	Muhlenberg's Sedge	1A
forb	*Carex pensylvanica*	Pennsylvania Sedge	1A, 3B, 1E
forb	*Carex retrorsa*	Retrose Sedge	11A
forb	*Carex rosea*	Stellate Sedge	3B
forb	*Carex siccata*	Hay Sedge	1A, 1E, 3B
forb	*Carex tonsa var. tonsa*	Dark Green Sedge	1E
forb	*Carex vulpinoidea*	Fox Sedge	11A
forb	*Chelidonium majus*	Celandine	4B
forb	*Chenopodium album var. album* +	Lamb's Quarters	1A, 1E
forb	*Chichorium intybus* +	Chickory	10A
forb	*Circaea sp*	Enchanter's	1D
forb	*Cirsium arvense (1)**	Canada Thistle	1A, 1E
forb	*Clintonia borealis*	Bluebead Clintonia	7A, 7B
forb	*Convallaria majalis (3)*+	Lily-of-the-Valley	8C
forb	*Conyza canadensis* +	Horseweed	1D, 1E, 10A
forb	*Cynanchum nigrum (1)*+	Black Swallow-wort	1A
forb	*Cynanchum rossicum (1)*+	Pale Swallow-wort	1A, 1D, 10A
forb	*Dactylis glomerata (3)*+	Orchard Grass	1A, 3B, 1E
forb	*Daucus carota* +	Wild Carrot	1A, 1E, 10A
forb	*Deschampsia flexuosa*	Common Hairgrass	3B
forb	*Desmodium canadense*	Showy Tick-trefoil	1A, 1D, 10A
forb	*Desmodium glutinosum*	Pointed-leaved Tick-	3B
forb	*Digitaria sanguinalis* +	Large Crab Grass	1A, 1E
forb	*Echinocystis lobata*	Wild Cucumber	1A
forb	*Elymus canadensis*	Canada Wild Rye	11A, 1E

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Type	Botanical name	Common Name	Management Unit
forb	*Elymus hystrix*	Bottlebrush Grass	3B, 10A
forb	*Elymus riparius*	Riverbank Wild Rye	11A
forb	*Eonyza canadense* +	Horseweed	1D,1E, 10A
forb	*Epilobium angustifolium*	Fireweed	1A
forb	*Epilobium parviflorum* +	Willow-herb	11A
forb	*Epipactis helleborine* +	Helleborine	1A
forb	*Equisetum arvense*	Field Horsetail	1A, 10A
forb	*Erigeron annuus*	Daisy Fleabane	1A, 1E
forb	*Erucastrum gallicum* +	French Rocket	1A
forb	*Eupatorium maculatum ssp.*	Spotted Joe-pyeweed	11A
forb	*Eupatorium perfoliatum*	Common Boneset	11A
forb	*Festuca longifolia* +	Sheep Fescue	1A, 1E, 10A
forb	*Festuca pratensis* +	Meadow Fescue	1A, 10A
forb	*Festuca rubra* +	Red Fescue	1A
forb	*Fragaria virginiana ssp.*	Common Strawberry	1A
forb	*Galium boreale*	Northern Bedstraw	3B, 10A
forb	*Gentianella quinquefolia*	Stiff Gentian	
forb	*Geranium maculatum*	Spotted Crane's-bill	1A, 3B
forb	*Geum aleppicum*	Yellow Avens	1A
forb	*Geum canadense*	White Avens	1A
forb	*Geum urbanum* +	Avens	3B
forb	*Hackelia virginiana*	Virginia Stickseed	1A
forb	*Helianthemum canadense*	Frost-wort	1A
forb	*Helianthus decapetalus*	Thin-leaved Sunflower	10A
forb	*Helianthus divaricatus*	Rough Woodland Sunflower	1A, 10A, 1E
forb	*Helianthus strumosus*	Pale-leaved Woodland	1A, 1E, 10A
forb	*Hemerocallis fulva (4)*+	Tawny Day Lily	3B
forb	*Heracleum lanatum*	Cow-parsnip	10A
forb	*Hieracium canadense*	Canada Hawkweed	1A
forb	*Hieracium X floribundum (3)*	King Devil Hawkweed	
forb	*Hydrophyllum virginianum* +	Virginia Water-leaf	1A, 10A
forb	*Hypericum prolificum (4)*+	Shrubby St. John's-wort	1A, 1E
forb	*Impatiens capensis*	Spotted Touch-me-not	
forb	*Impatiens glandulifera (1)*+	Pink touch-me-not	3B
forb	*Impatiens pallida*	Pale Touch-me-not	3B
forb	*Iris pseudocorus*	Yellow Iris	Grenadier Pond
forb	*Iris versicolor*	Northern Blue Flag	11A
forb	*Juncus tenuis*	Path Rush	Grenadier Pond
forb	*Lapsana communis (p)*+	Nipplewort	3B
forb	*Lechea intermedia*	Savanna Pinweed	1A
forb	*Leonurus cardiaca ssp.*	Motherwort	1A, 1E
forb	*Lepidium virginicum*	Virginia Pepper-grass	1A, 1E
forb	*Lespedeza capitata*	Round-headed Bush-clover	1A, 10A, 1E
forb	*Lespedeza hirta*	Hairy Bush-clover	1A
forb	*Liatris cylindracea*	Cylindric Blazing Star	1A, 1E
forb	*Liatris spicata*	Spiked Blazing Star	11A
forb	*Lilium michiganense*	Michigan Lily	1C
forb	*Linaria vulgaris (4)*+	Butter-and-eggs	1A, 1E
forb	*Lupinus perennis ssp. perennis*	Wild Lupine	1E
forb	*Luzula multiflora ssp. multiflora*	Common Wood Rush	1A, 1E
forb	*Lycopus europaeus (3)*+	European Water-horehound	11A
forb	*Lysimachia quadrifolia*	Whorled Loosestrife	3B
forb	*Lythrum salicaria (1)*+	Purple Loosestrife	11A
forb	*Maianthemum canadense*	Canada Mayflower	1A
forb	*Maianthemum racemosum ssp.*	False Solomon's Seal	1A, 10A
forb	*Maianthemum stellatum*	Starry False Solomon's Seal	1A, 10A
forb	*Medicago lupulina (4)*+	Black Medic	1A
forb	*Melilotus alba (2)*+	White Sweet-clover	11A, 1E
forb	*Melilotus officinalis (2)*+	Yellow Sweet-clover	1D, 1E, 10A
forb	*Monarda fistulosa*	Wild Bergamot	1A, 1E, 10A
forb	*Monotropa uniflora*	Indian-pipe	1D, 1E, 10A
forb	*Muhlenbergia frondosa*	Wirestem Muhly	3B
forb	*Oryzopsis asperifolia*	Rough-leaved Rice Grass	9C
forb	*Oenothera biennis*	Common Evening-primrose	1A, 1E
forb	*Osmunda claytoniana*	Interrupted Fern	3B
forb	*Oxalis stricta* +	Upright Yellow Wood-sorrel	1A
forb	*Panicum acuminatum var.*	Hairy Panic Grass	11A
forb	*Panicum virgatum*	Switch Grass	1E
forb	*Penstemon hirsutus*	Hairy Beard-tongue	1E
forb	*Phleum pratense* +	Timothy	1A, 1E
forb	*Phragmites australis (1)**	Common Reed	N. Grenadier
forb	*Physalis heterophylla*	Clammy Ground-cherry	1A, 1E
forb	*Phytostegia virginiana*	False Dragonhead	11A, S.
forb	*Plantago major* +	Common Plantain	1A
forb	*Plantago minor* +	Lance-leaved Plantain	1D, 1E, 10A
forb	*Poa compressa*	Canada Blue Grass	1A,11A
forb	*Poa nemoralis* +	Wood Blue Grass	3B
forb	*Poa pratensis ssp. pratensis (2)*+	Kentucky Blue Grass	1A, 1E, 1D
forb	*Podophyllum peltatum*	Mayapple	3B
forb	*Polygala polygama*	Racemed Milkwort	9C
forb	*Polygonatum pubescens*	Hairy Solomon's Seal	3B, 10A,
forb	*Polygonatum biflorum*	Smooth Solomon's Seal	3B
forb	*Polygonum aviculare* +	Common Knotweed	1A
forb	*Polygonum cuspidatum (2)*+	Japanese Knotweed	1A, 3B, 4C
forb	*Polygonum lapathifolium*	Pale Smartweed	1A

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Type	Botanical name	Common Name	Management Unit
forb	*Potentilla argentea*	Silvery Cinquefoil	1A
forb	*Potentilla simplex*	Common Cinquefoil	1A, 1E
forb	*Prenanthes sp.*	Wild White Lettuce	1D, 1E, 10A, 3B
forb	*Prunella vulgaris ssp. lanceolata* +	Heal-all	1A
forb	*Pteridium aquilinum var.*	Eastern Bracken Fern	1A, 3B
forb	*Ranunculus acris* +	Tall Buttercup	3B
forb	*Rudbeckia hirta*	Black-eyed Susan	1E, 1D,
forb	*Rudbeckia laciniata*	Cut-leaved Coneflower	11A
forb	*Rumex crispus* +	Curly Dock	1A, 1E
forb	*Schizachyrium scoparius*	Little Bluestem	1A,1E
forb	*Setaria sp* +	Foxtail species	1A, 1E
forb	*Silene latifolia* +	Bladder Campion	1A
forb	*Silphium perfoliatum var.*	Cup-plant	3B
forb	*Smilax herbacea*	Herbaceous Carrion Flower	1A
forb	*Solanum dulcamara (3)*+	Bittersweet Nightshade	1A
forb	*Solidago altissima var. altissima*	Tall Goldenrod	1A, 10A, 3B, 1E
forb	*Solidago bicolor*	White Goldenrod	1A
forb	*Solidago caesia*	Blue-stem Goldenrod	1A
forb	*Solidago canadensis*	Canada Goldenrod	10A, 1D
forb	*Solidago flexicaulis*	Zig-zag Goldenrod	3B
forb	*Solidago gigantea*	Giant Goldenrod	3B
forb	*Solidago juncea*	Early Goldenrod	1A, 1E
forb	*Solidago nemoralis ssp. nemoralis*	Gray Goldenrod	1A, 1E
forb	*Solidago squarrosa*	Stout Goldenrod	1A
forb	*Sonchus oleraceus* +	Common Sow-thistle	1A, 1E
forb	*Sorghastrum nutans*	Indian Grass	1E, 3B
forb	*Taraxacum officinale* +	Common Dandelion	1A, 1E
forb	*Thalictrum dioicum*	Early Meadow-rue	3B
forb	*Tiarella cordifolia*	Foamflower	7
forb	*Tragopogon dubius* +	Doubtful Goat's-beard	1A, 1E
forb	*Trientalis borealis ssp. borealis*	Star-flower	3B
forb	*Trifolium pratense (4)*+	Red Clover	1A
forb	*Trifolium repens (4)*+	White Clover	1A
forb	*Trillium grandiflorum*	WhiteTrillium	3B
forb	*Typha latifololia*	Broad-leaved Cattail	Lower Duck &
forb	*Urtica dioica ssp.dioica* +	European Stinging Nettle	8A
forb	*Verbascum thapsus* +	Common Mullein	1D, 1E, 10A
forb	*Verbena hastata*	Blue Vervain	11A
forb	*Verbena stricta*	Hoary Vervain	1E, 3B
forb	*Veronica peregrina ssp. peregrina*	Purslane Speedwell	1A
forb	*Vicia americana*	Purple Vetch	1A
forb	*Vicia cracca (2)*+	Cow Vetch	1A, 1E
forb	*Viola sagittata var. ovata*	Oval-leaved Violet	1D, 1E, 9C, 10A

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APPENDIX B. Bird species recorded at High Park (excluding Sunnyside Beach) (Sources: B. Yukich, pers. comm. 2001 & 2002; Yukich 1998; ; GLL 1995; Wainio 1976; Saunders 1947).

Common Name	Scientific Name	Status at High Park
Red-throated Loon	*Gavia stellata*	M, R
Common Loon	*Gavia immer*	M
Pied-billed Grebe	*Podilymbus podiceps*	M
Horned Grebe	*Podiceps auritus*	M
Red-necked Grebe	*Gavia stellata*	M
Double-crested Cormorant	*Phalacrocorax auritus*	M, S
American Bittern	*Botaurus lentiginosus*	M, R
Least Bittern	*Ixobrychus exilis*	M, R
Great Blue Heron	*Ardea herodias*	M, S
Great Egret	*Casmerodius albus*	M, R
Green Heron	*Butorides striatus*	M
Black-crowned Night-Heron	*Nycticorax nycticorax*	M, S
Turkey Vulture	*Cathartes aura*	M
Snow Goose	*Chen caerulescens*	M
Canada Goose	*Branta canadensis*	M, S, W, B
Brant	*Branta bernicula*	M
Mute Swan	*Cygnus olor*	S, W, B
Tundra Swan	*Cygnus columbianus*	M
Wood Duck	*Aix sponsa*	M
Gadwall	*Anas strepera*	M, B
Eurasian Wigeon	*Anas penelope*	M,R
American Wigeon	*Anas americana*	M
American Black Duck	*Anas rubripes*	M
Mallard	*Anas platyrhynchos*	M, S, W, B
Blue-winged Teal	*Anas discors*	M, historical breeder
Northern Shoveler	*Anas clypeata*	M, W
Northern Pintail	*Anas acuta*	M
Green-winged Teal	*Anas crecca*	M
Canvasback	*Aythya valisineria*	M, R
Redhead	*Aythya americana*	M
Ring-necked Duck	*Aythya collaris*	M
Greater Scaup	*Aythya marila*	M
Lesser Scaup	*Aythya affinis*	M
Harlequin Duck	*Histrionicus histrionicus*	R
White-winged Scoter	*Melanitta fusca*	M
Long-tailed Duck (Oldsquaw)	*Clangula hyemalis*	M
Bufflehead	*Bucephala albeola*	M, W
Common Goldeneye	*Bucephala clangula*	M, W
Hooded Merganser	*Lophodytes cucullatus*	M
Common Merganser	*Mergus merganser*	M, W
Red-breasted Merganser	*Mergus serrator*	M
Ruddy Duck	*Oxyura jamaicensis*	M
Osprey	*Pandion haliaetus*	M
Bald Eagle	*Haliaeetus leucocephalus*	M
Northern Harrier	*Circus cyaneus*	M
Sharp-shinned Hawk	*Accipiter striatus*	M, B
Cooper's Hawk	*Accipiter cooperi*	M, W
Northern Goshawk	*Accipiter gentilis*	M
Red-shouldered Hawk	*Buteo lineatus*	M
Broad-winged Hawk	*Buteo platypterus*	M
Swainson's Hawk	*Buteo swainsoni*	R
Red-tailed Hawk	*Buteo jamaicensis*	M, S, W
Rough-legged Hawk	*Buteo lagopus*	M
Golden Eagle	*Aquila chrysaetos*	M
American Kestrel	*Falco sparverius*	M
Merlin	*Falco columbarius*	M
Peregrine Falcon	*Falco peregrinus*	M
Ring-necked Pheasant	*Phasianus colchicus*	E, historical breeder
Yellow Rail	*Coturnicops noveboracensis*	M, R
Virginia Rail	*Rallus limicola*	M, B
King Rail	*Rallus elegans*	M, R
Sora	*Porzana carolina*	M, historical breeder
Common Moorhen	*Gallinula chloropus*	M, historical breeder
American Coot	*Fulica americana*	M
Sandhill Crane	*Grus canadensis*	M, R
Black-bellied Plover	*Pluvialis squatarola*	M
Semipalmated Plover	*Charadrius semipalmatus*	M
Killdeer	*Charadrius vociferus*	M, S, B
Greater Yellowlegs	*Tringa melanoleuca*	M
Lesser Yellowlegs	*Tringa flavipes*	M
Solitary Sandpiper	*Tringa solitaria*	M
Spotted Sandpiper	*Actitis macularia*	M, S, B
Upland Sandpiper	*Bartramia longicauda*	M, R
Whimbrel	*Numenius phaeopus*	M, R
Ruddy Turnstone	*Arenaria interpres*	M
Sanderling	*Calidris alba*	M, R
Semipalmated Sandpiper	*Calidris pusilla*	M
Least Sandpiper	*Calidris minutilla*	M
Baird's Sandpiper	*Calidris bairdii*	M
Pectoral Sandpiper	*Calidris melanotos*	M
Dunlin	*Calidris alpina*	M
Stilt Sandpiper	*Calidris himantopus*	M
Short-billed Dowitcher	*Limnodromus griseus*	M
Common Snipe	*Gallinago gallinago*	M
American Woodcock	*Scolopax minor*	M, historical breeder
Red Phalarope	*Phalaropus fulicaria*	M, R
Parasitic Jaeger	*Stercorarius parasiticus*	M, R
Laughing Gull	*Larus atricilla*	M, R
Franklin's Gull	*Larus pipixcan*	M, R
Little Gull	*Larus marinus*	M, R
Bonaparte's Gull	*Larus philadelphia*	M
Mew Gull	*Larus canus*	R
Ring-billed Gull	*Larus delawarensis*	M, S, W
Heerman's Gull	*Larus heermanni*	M, R
Herring Gull	*Larus argentatus*	M, S, W

Legend: M = migrant; S = occurs in summer (non-breeding); W = occurs regularly in winter; B = breeds; R = rare; E = extirpated.

APPENDIX B (cont'd). Bird species recorded at High Park (excluding Sunnyside Beach) (Sources: B. Yukich, pers. comm. 2001 & 2002; Yukich 1998; ; GLL 1995; Wainio 1976; Saunders 1947).

Common Name	Scientific Name	Status at High Park
Iceland Gull	*Larus glaucoides*	M, W
Lesser Black-backed Gull	*Larus fuscus*	M, W
Slaty-backed Gull	*Larus schistisagus*	R
Glaucous Gull	*Larus hyperboreus*	M, W
Great Black-backed Gull	*Larus marinus*	M, S, W
Black-legged Kittiwake	*Rissa tridactyla*	M, R
Caspian Tern	*Sterna caspia*	M, S
Common Tern	*Sterna hirundo*	M, S
Black Tern	*Chlidonias niger*	M
Rock Dove	*Columba livia*	S, W, B
Mourning Dove	*Zenaida macroura*	M, S, W, B
Black-billed Cuckoo	*Coccyzus erythropthalmus*	M, occasionally breeds
Yellow-billed Cuckoo	*Coccyzus americanus*	M
Eastern Screech-Owl	*Otus asio*	S, W, B
Great Horned Owl	*Bubo virginianus*	W
Barred Owl	*Strix varia*	W, R
Long-eared Owl	*Asio otus*	M, W, R
Short-eared Owl	*Asio flammeus*	M, W, R
Northern Saw-whet Owl	*Aegolius acadicus*	M
Common Nighthawk	*Chordeiles minor*	M, S
Whip-poor-will	*Caprimulgus vociferus*	M
Chimney Swift	*Chaetura pelagica*	M, S
Ruby-throated Hummingbird	*Archilochus colubris*	M
Belted Kingfisher	*Ceryle alcyon*	M, S, W, B
Red-headed Woodpecker	*Melanerpes erythrocephalus*	M, S, occasional breeder
Red-bellied Woodpecker	*Melanerpes carolinus*	M, R
Yellow-bellied Sapsucker	*Sphyrapicus varius*	M
Downy Woodpecker	*Picoides pubescens*	S, W, B
Hairy Woodpecker	*Picoides villosus*	M, W
Black-backed Woodpecker	*Picoides arcticus*	W, R
Northern Flicker	*Colaptes auratus*	M, B
Pileated Woodpecker	*Dryocopus pileatus*	R
Olive-sided Flycatcher	*Contopus borealis*	M
Eastern Wood-Pewee	*Contopus virens*	M, S, B
Yellow-bellied Flycatcher	*Empidonax flaviventris*	M
Acadian Flycatcher	*Empidonax virescens*	M, R
Alder Flycatcher	*Empidonax alnorum*	M
Willow Flycatcher	*Empidonax traillii*	M
Least Flycatcher	*Empidonax minimus*	M
Eastern Phoebe	*Sayornis phoebe*	M, occasional breeder
Vermilion Flycatcher	*Pyrocephalus rubinus*	M, R
Great Crested Flycatcher	*Myiarchus crinitus*	M, S, B
Eastern Kingbird	*Tyrannus tyrannus*	M, S, B
Loggerhead Shrike	*Lanius ludovicianus*	M, R

Common Name	Scientific Name	Status at High Park
Northern Shrike	*Lanius excubitor*	W, R
White-eyed Vireo	*Vireo griseus*	M, R
Yellow-throated Vireo	*Vireo flavifrons*	M
Blue-headed Vireo	*Vireo solitarius*	M
Warbling Vireo	*Vireo gilvus*	M, S, B
Philadelphia Vireo	*Vireo philadelphicus*	M
Red-eyed Vireo	*Vireo olivaceus*	M, S, B
Blue Jay	*Cyanocitta cristata*	M, S, W, B
American Crow	*Corvus brachyrhynchos*	M, S, W, B
Common Raven	*Corvus corax*	M, R
Horned Lark	*Eremophila alpestris*	M
Purple Martin	*Progne subis*	M, S, B
Tree Swallow	*Tachycineta bicolor*	M, S, B
N. Rough-winged Swallow	*Stelgidopteryx serripennis*	M, S, B
Bank Swallow	*Riparia riparia*	M, S
Cliff Swallow	*Hirundo pyrrhonota*	M
Barn Swallow	*Hirundo rustica*	M, S, B
Black-capped Chickadee	*Pooetes atricapillus*	M, W, S, B
Boreal Chickadee	*Parus hudsonicus*	M, R
Red-breasted Nuthatch	*Sitta canadensis*	M, W, B
White-breasted Nuthatch	*Sitta carolinensis*	M, W, S, B
Brown Creeper	*Certhia americana*	M, W
Carolina Wren	*Thryothorus ludovicianus*	S, W, possible breeder
House Wren	*Troglodytes aedon*	M, B
Winter Wren	*Troglodytes troglodytes*	M
Sedge Wren	*Cistothorus platensis*	M, R
Marsh Wren	*Cistothorus palustris*	M
Golden-crowned Kinglet	*Regulus satrapa*	M, W
Ruby-crowned Kinglet	*Regulus calendula*	M
Blue-gray Gnatcatcher	*Polioptila caerulea*	M, S, B
Eastern Bluebird	*Sialia sialis*	M, B
Veery	*Catharus fuscescens*	M
Gray-cheeked Thrush	*Catharus minimus*	M
Swainson's Thrush	*Catharus ustulatus*	M
Hermit Thrush	*Catharus guttatus*	M
Wood Thrush	*Hylocicla mustelina*	M, S, possible breeder
American Robin	*Turdus migratorius*	M, W, S, B
Varied Thrush	*Ixoreus naevius*	W, R
Gray Catbird	*Dumetella carolinensis*	M, S, B
Northern Mockingbird	*Mimus polyglottos*	M, R
Brown Thrasher	*Toxostoma rufum*	M, S, B
European Starling	*Sturnus vulgaris*	M, S, W, B
American Pipit	*Anthus rubescens*	M, R
Bohemian Waxwing	*Bombycilla garrulus*	W, R
Cedar Waxwing	*Bombycilla cedrorum*	M, S, W, B
Blue-winged Warbler	*Vermivora pinus*	M

Legend: M = migrant; S = occurs in summer (non-breeding); W = occurs regularly in winter; B = breeds; R = rare; E = extirpated.

APPENDIX B. Bird species recorded at High Park (excluding Sunnyside Beach) (Sources: B. Yukich, pers. comm. 2001 & 2002; Yukich 1998; ; GLL 1995; Wainio 1976; Saunders 1947).

Common Name	Scientific Name	Status at High Park
Tennessee Warbler	*Vermivora peregrina*	M
Orange-crowned Warbler	*Vermivora celata*	M
Nashville Warbler	*Vermivora ruficapilla*	M
Northern Parula	*Parula americana*	M
Yellow Warbler	*Dendroica petechia*	M, S, B
Chestnut-sided Warbler	*Dendroica pensylvanica*	M
Magnolia Warbler	*Dendroica magnolia*	M
Cape May Warbler	*Dendroica tigrina*	M
Black-throated Blue Warbler	*Dendroica caerulescens*	M
Yellow-rumped Warbler	*Dendroica coronata*	M
Black-throated Green Warbler	*Dendroica virens*	M
Blackburnian Warbler	*Dendroica fusca*	M
Yellow-throated Warbler	*Dendroica dominica*	M, R
Pine Warbler	*Dendroica pinus*	M
Kirtland's Warbler	*Dendroica kirtlandii*	M, R
Prairie Warbler	*Dendroica discolor*	M, R
Palm Warbler	*Dendroica palmarum*	M
Bay-breasted Warbler	*Dendroica castanea*	M
Blackpoll Warbler	*Dendroica striata*	M
Cerulean Warbler	*Dendroica cerulea*	M, R
Black-and-white Warbler	*Mniotilta varia*	M
American Redstart	*Setophaga ruticilla*	M, S
Prothonotary Warbler	*Protonotaria citrea*	M, R
Worm-eating Warbler	*Helmitheros vermivorus*	M, R
Ovenbird	*Seiurus aurocapillus*	M
Northern Waterthrush	*Seiurus noveboracensis*	M
Louisiana Waterthrush	*Seiurus motacilla*	M, R
Kentucky Warbler	*Oporornis formosus*	M, R
Connecticut Warbler	*Oporornis agilis*	M, R
Mourning Warbler	*Oporornis philadelphia*	M
Common Yellowthroat	*Geothlyphis trichas*	M, possible breeder
Hooded Warbler	*Wilsonia citrina*	M, R
Wilson's Warbler	*Wilsonia pusilla*	M
Canada Warbler	*Wilsonia canadensis*	M
Yellow-breasted Chat	*Icteria virens*	M, R
Summer Tanager	*Piranga rubra*	M, R
Scarlet Tanager	*Piranga olivacea*	M
Eastern Towhee	*Pipilo erythrophthalmus*	M
American Tree Sparrow	*Spizella arborea*	M, W
Chipping Sparrow	*Spizella passerina*	M, S, B
Clay-colored Sparrow	*Spizella pallida*	M, R
Field Sparrow	*Spizella pusilla*	M
Vesper Sparrow	*Pooecetes gramineus*	M
Lark Sparrow	*Chondestes grammacus*	R, historical breeder
Savannah Sparrow	*Passerculus sandwichensis*	M
Grasshopper Sparrow	*Ammodramus savannarum*	M, R
Henslow's Sparrow	*Ammodramus henslowii*	M, R
Fox Sparrow	*Passerella iliaca*	M
Song Sparrow	*Melospiza melodia*	M, B
Lincoln's Sparrow	*Melospiza lincolnii*	M
Swamp Sparrow	*Melospiza georgiana*	M
White-throated Sparrow	*Zonotrichia albicollis*	M
White-crowned Sparrow	*Zonotrichia leucophrys*	M
Dark-eyed Junco	*Junco hyemalis*	M, W
Snow Bunting	*Plectrophenax nivalis*	M,W
Northern Cardinal	*Cardinalis cardinalis*	S, W, B
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	M
Indigo Bunting	*Passerina cyanea*	M, S, B
Bobolink	*Dolichonyx oryzivorus*	M
Red-winged Blackbird	*Agelaius phoeniceus*	M, S, B
Eastern Meadowlark	*Sturnella magna*	M
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	M, R
Rusty Blackbird	*Euphagus carolinus*	M
Common Grackle	*Quiscalus quiscula*	M, S, B
Brown-headed Cowbird	*Molothrus ater*	M, S, B
Orchard Oriole	*Icterus spurius*	M, S, B
Baltimore Oriole	*Icterus galbula*	M, S, B
Pine Grosbeak	*Pinicola enucleator*	M, W, irruptive
House Finch	*Carpodacus mexicanus*	M, W, S, B
Purple Finch	*Carpodacus purpureus*	M, W, irruptive
Red Crossbill	*Loxia curvirostra*	M, W, irruptive
White-winged Crossbill	*Loxia leucoptera*	M, W, irruptive
Common Redpoll	*Carduelis flammea*	M, W irruptive
Hoary Redpoll	*Carduelis hornemanni*	M, W, R
Pine Siskin	*Cardeulis pinus*	M, W, irruptive
American Goldfinch	*Cardeulis tristis*	M, S, W, B
Evening Grosbeak	*Coccothraustes vespertinus*	M, W, irruptive
House Sparrow	*Passer domesticus*	S, W, B

Legend: M = migrant; S = occurs in summer (non-breeding); W = occurs regularly in winter; B = breeds; R = rare; E = extirpated.

Common Name	Scientific Name	Status in High Park	Status in Ontario	Host Plant(s)	Comments
SWALLOWTAILS	**PAPILIONIDAE**				
Pipevine Swallowtail	*Battus philenor*	rare southern immigrant	rare immigrant in the southwest to Lake Ontario shoreline	pipevines (Aristolochia)	occasionally breeds in province where host plant is available; a few fresh individuals recorded in High Park in late August 2000 probably emerged nearby
Black Swallowtail	*Papilio polyxenes*	fairly common	common mainly in the south	parsley family	
Eastern Tiger Swallowtail	*Papilio glaucus*	common	common mainly in the southwest and at least north to the Toronto region	cherry, ash, tulip tree, hop tree	
Spicebush Swallowtail	*Papilio troilus*	rare to uncommon	uncommon to common in the southwest	spicebush, sassafras	bred in High Park in 1999 (2 broods) and 2000, possibly in other years also; over-wintering pupa within foot of ground; certainly uses abundant sassafras here; small, isolated population makes it vulnerable
WHITES AND YELLOWS	**PIERIDAE**				
Cabbage White	*Pieris rapae*	common	common and widespread	mustard family	
Clouded Sulphur	*Colias philodice*	common	common and widespread	white clover, alfalfa, vetch	
Orange Sulphur	*Colias eurytheme*	common southern immigrant	common and widespread immigrant	alfalfa, white clover	breeds after its arrival producing at least two more generations; often abundant in southern Ontario; not known to over-winter in province
Little Yellow	*Eurema lisa*	rare southern immigrant	rare immigrant mainly in the south	Cassia	does not over-winter in the province; not known to breed in our area
GOSSAMER-WINGS	**LYCAENIDAE**				
American Copper	*Lycaena phlaeas*	historical record	locally common throughout	sheep sorrel, curled dock	
Bronze Copper	*Lycaena hyllus*	historical record	locally common, especially in the south	curled dock, water dock, smartweed	wetland species
Coral Hairstreak	*Satyrium titus*	uncertain	locally common in the south	cherry, plum	reported from High Park in the 1980's
Acadian Hairstreak	*Satyrium acadica*	uncertain	widespread, mostly in the south	willows	records at least from 1950's and 1960's, may still be present in High Park
Edwards' Hairstreak	*Satyrium edwardsii*	uncommon	locally uncommon to common in the south	oak saplings	declining in High Park
Banded Hairstreak	*Satyrium calanus*	fairly common	common mainly in the south	oak, walnut, hickory	
Hickory Hairstreak	*Satyrium caryaevorum*	rare to uncommon	rare to uncommon in the south	hickories, oaks and others	can be a difficult species to identify due to its similarity to *S. calanus*
Striped Hairstreak	*Satyrium liparops*	uncommon	uncommon throughout	heath and rose families including hawthorn, cherry, plum	

APPENDIX C. Butterfly species recorded at High Park (Sources: Bob Yukich pers. comm. 2002, GLL 2001).

Common Name	Scientific Name	Status in High Park	Status in Ontario	Host Plant(s)	Comments
GOSSAMER-WINGS	**LYCAENIDAE**				
Gray Hairstreak	*Strymon melinus*	rare southern immigrant	uncommon immigrant (resident?) in the extreme southwest; a resident population breeds locally in the north	variety of "weedy" plants; sweetfern in the north	a few recorded in 1999 in High Park; likely bred producing a second generation that emerged in the fall - none recorded in 2000
Eastern Tailed-Blue	*Everes comyntas*	common	common mainly in the south	pea family including tick trefoil	in some years it is very common in High Park, in others it is almost absent
Spring Azure	*Celastrina ladon*	uncommon	common and widespread	wide variety including cherry, blueberry, viburnums	appears to be declining within the city
Summer Azure	*Celastrina neglecta*	common	common in the south, less so in the north	wide variety including dogwoods, viburnums, new jersey tea	much more common than *C. ladon* within the city
Karner Blue	*Lycaeides melissa samuelis*	extirpated	extirpated around 1991	wild lupine	last recorded in High Park around 1926
BRUSHFOOTS	**NYMPHALIDAE**				
Variegated Fritillary	*Euptoieta claudia*	rare southern immigrant	rare immigrant mainly in the south	wide variety including violets, flax, stonecrop, plantain	does not usually breed in province
Great Spangled Fritillary	*Speyeria cybele*	uncommon	common and widespread	violets	
Atlantis Fritillary	*Speyeria atlantis*	historical record	common in the north; absent from the southwest	violets	2 old specimens from High Park in the ROM
Silvery Checkerspot	*Chlosyne nycteis*	uncertain	locally common throughout but more common in the north	composites such as sunflowers, asters	2 individuals recorded in test plot M, Unit 1B (location of very first test burn) in High Park in July 2000 - first known record for park; likely bred; only known colony in Toronto is at Eglinton Flats
Pearl Crescent	*Phyciodes tharos*	uncommon	uncommon to common in the south	asters	
Northern Crescent	*Phyciodes cocyta*	uncommon	common and widespread	asters	both species of crescent are scarce in High Park; identification of either can be problematic at times
Tawny Crescent	*Phyciodes batesii*	historical record	locally uncommon throughout	asters	one old specimen from High Park in the ROM
Question Mark	*Polygonia interrogationis*	uncommon to common southern immigrant	uncommon to common immigrant throughout	nettles, elms, hops	not known to over-winter in province

Common Name	Scientific Name	Status in High Park	Status in Ontario	Host Plant(s)	Comments
BRUSHFOOTS	**NYMPHALIDAE**				
Eastern Comma	*Polygonia comma*	uncommon	uncommon to common throughout	nettles, elms, hops	
Compton Tortoiseshell	*Nymphalis vau-album*	uncommon	uncommon throughout	willow, birch, poplar	often recorded in High Park in early spring; these are likely migrants from the north that, having arrived the previous fall, hibernated over the winter; I know of one recent summer record; breeding uncertain
Mourning Cloak	*Nymphalis antiopa*	common	common and widespread	wide variety including willows, elms, poplars	
American Lady	*Vanessa virginiensis*	uncommon to common southern immigrant	uncommon to common immigrant throughout	everlastings, wormwoods, burdocks, ironweed	breeds after its arrival producing one or more generations; over-wintering in province uncertain
Painted Lady	*Vanessa cardui*	rare to common southern immigrant	rare to common immigrant throughout	composites including thistles, knapweed, burdock, sunflowers	usually rare but in certain years quite common; often breeds after its arrival producing one or more generations; does not over-winter in province
Red Admiral	*Vanessa atalanta*	uncommon to common southern immigrant	uncommon to common immigrant throughout	nettles	breeds after its arrival producing one or more generations; may occasionally over-winter, as an adult only
Common Buckeye	*Junonia coenia*	rare to uncommon southern immigrant	uncommon to common immigrant, mainly in the south	gerardia, toadflax, plantain	will sometimes colonize; does not over-winter; in 1999 quite common throughout much of southern Ontario
White Admiral	*Limenitis arthemis arthemis*	uncommon	common in the north, mostly absent from the southwest	willow, aspen, poplar, birch	
Red-spotted Purple	*Limenitis arthemis astyanax*	uncommon	common in the south; mainly absent from the north	cherries, poplars, oaks	intermediates between *astyanax* and *arthemis* often seen in the Toronto region
Viceroy	*Limenitis archippus*	uncommon	common throughout, especially in the south	willows, poplars	
Northern Pearly-Eye	*Enodia anthedon*	uncommon	locally common throughout	various grasses including purple oat and reed canary	
Little Wood-Satyr	*Megisto cymela*	common to abundant	common to abundant throughout, especially in the south	various grasses including blue grass and orchard grass	

APPENDIX C. Butterfly species recorded at High Park (Sources: Bob Yukich pers. comm. 2002, GLL 2001).

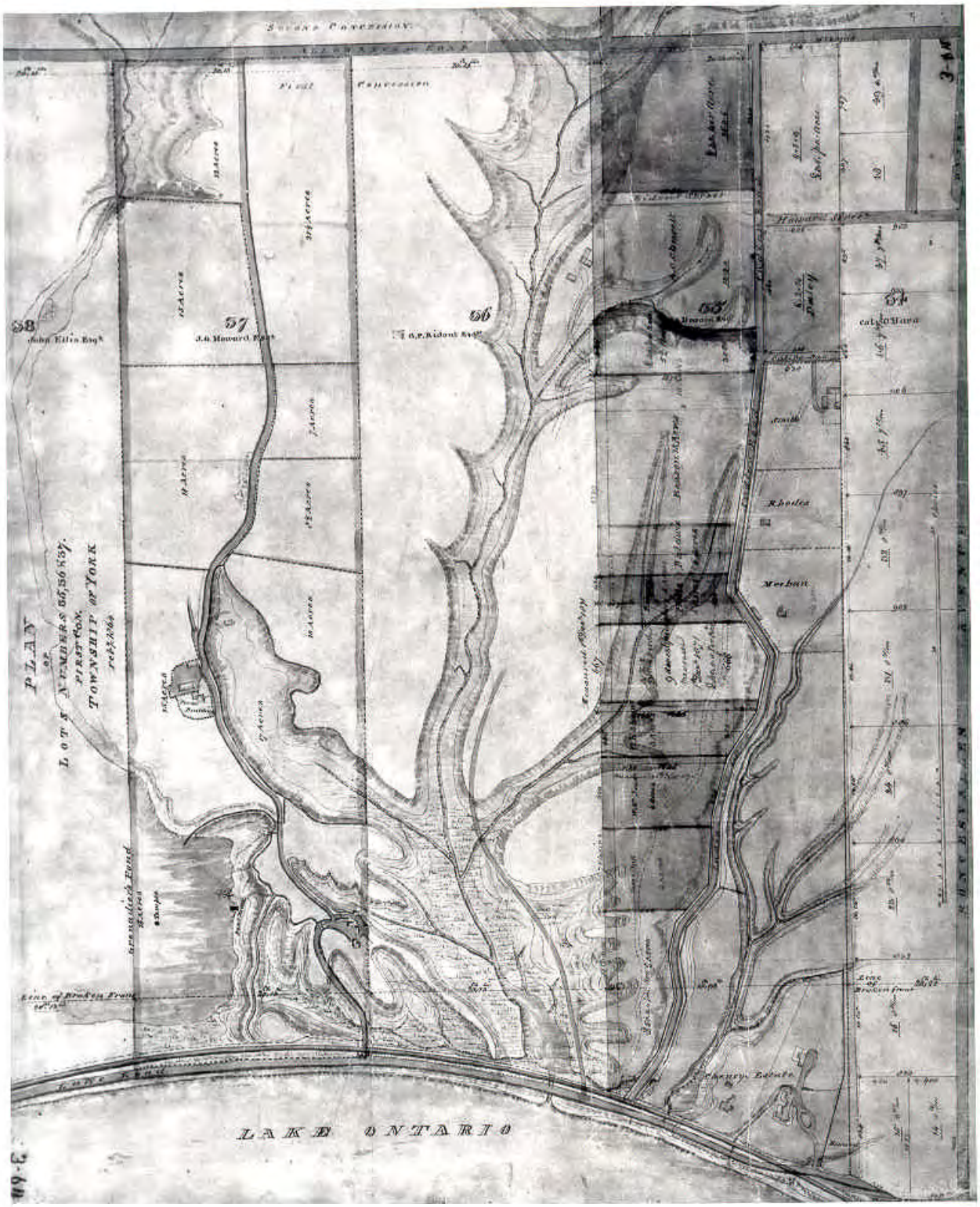
Common Name	Scientific Name	Status in High Park	Status in Ontario	Host Plant(s)	Comments
BRUSHFOOTS	**NYMPHALIDAE**				
Common Wood-Nymph	*Cercyonis pegala*	fairly common	common throughout	various grasses including wild oat, bluestem, purpletop	
Monarch	*Danaus plexippus*	common southern immigrant	common and widespread	milkweeds	does not over-winter
SKIPPERS	**HESPERIIDAE**				
Silver-spotted Skipper	*Epargyreus clarus*	uncommon	locally fairly common mainly in the south	black locust, hog peanut, showy tick trefoil	
Southern Cloudywing	*Thorybes bathyllus*	historical record	locally rare to uncommon in extreme south	legumes	one old specimen from High Park in the ROM - possible stray but can't rule out breeding
Northern Cloudywing	*Thorybes pylades*	common	common and widespread	legumes including tick trefoil and vetch	
Dreamy Duskywing	*Erynnis icelus*	historical record	common and widespread throughout	poplar, aspen, willow, birch	
Juvenal's Duskywing	*Erynnis juvenalis*	historical record	common and widespread, mainly in the southern part of the province	oaks	
Mottled Duskywing	*Erynnis martialis*	historical record	very rare and local	new jersey tea	declining in the province; apparently common in High Park in the early 1900's
Funereal Duskywing	*Erynnis funeralis*	very rare southern immigrant	very rare immigrant in the south	legumes	stray only; does not breed in province; I recorded one along Grenadier Pond in August 1999; fourth record for Ontario and Canada
Columbine Duskywing	*Erynnis lucilius*	historical record	widespread, mainly in the southern part of the province	wild columbine	
Least Skipper	*Ancyloxypha numitor*	uncommon	common in the south and central regions	wetland grasses including blue grass, rice cut grass, marsh millet	mostly near wetlands in High Park
European Skipper	*Thymelicus lineola*	common to abundant	common to abundant throughout	grasses including timothy and red top	
Fiery Skipper	*Hylephila phyleus*	rare southern immigrant	rare immigrant in southern Ontario	various weedy grasses	common in High Park in 1999; bred after its arrival in July producing two more generations

Common Name	Scientific Name	Status in High Park	Status in Ontario	Host Plant(s)	Comments
SKIPPERS	**HESPERIIDAE**				
Peck's Skipper	*Polites peckius*	uncommon	locally uncommon to common throughout	grasses including rice grass	
Tawny-edged Skipper	*Polites thermistocles*	uncommon	common and widespread	grasses including panic grass	
Crossline Skipper	*Polites origenes*	uncommon	locally uncommon to common mainly in the south	grasses including purpletop and little bluestem	
Long Dash	*Polites mystic*	uncommon	common and widespread	grasses including blue grass, quack, barnyard, timothy	
Northern Broken-Dash	*Wallengrenia egeremet*	common	locally common mainly in the south	grasses including panic grass and crab grass	
Little Glassywing	*Pompeius verna*	uncommon	locally uncommon in the south	grasses including purpletop	
Delaware Skipper	*Anatrytone logan*	uncertain	locally uncommon to common in the south	grasses including bluestem, switch, woolly beard	I observed a fresh individual (first for High Park?) in meadow on north side Centre Rd. at Spring Creek in July 2000
Hobomok Skipper	*Poanes hobomok*	common	common and widespread	grasses including panic and blue grass	
Dun Skipper	*Euphyes vestris*	common	common and widespread	sedges	

Note: ***All species listed are known to or assumed to breed in High Park unless otherwise noted.***

The species abundance designations are based on a skilled observer being in the appropriate habitat at the right time of year, with favourable weather conditions.

abundant:.....recorded in large numbers on all visits
common: .....normally recorded on all visits; hard to miss
fairly common:.....should be recorded on most visits
uncommon: .....present in small numbers; can be missed on most visits
rare:.....can be less than annual in occurrence
very rare:.....often several years between sightings; not to be expected



Plan of Survey showing some of the former watercourses in High Park, prepared by former City Surveyor John G. Howard, dated 1864 (City of Toronto Archives MT 01052-W).

What is glyphosate?

Glyphosate is the common name for N-(phosphonomethyl)glycine. Glyphosate is the active chemical ingredient in the herbicide Roundup or Transorb®. Currently, Transorb® is used on a limited basis to control invasive plant infestations in High Park.

How does glyphosate work?

Glyphosate works by inhibiting the production of specific amino acids (a protein), found only in plants, that are required for growth. It must be applied to green leaves or stems of actively growing plants. It is absorbed by the plant and moves to the roots by a process known as translocation. The chemical can take 4 days to 2 weeks to visibly affect the plant. It causes the weed to wilt, turn yellow and then brown.

Will glyphosate harm people, pets or wildlife?

The results from extensive testing by both the manufacturer (Monsanto) and independent laboratories indicate that there is essentially no danger to humans or animals. The application methods used by the City are designed to minimize the applicator's contact with the product. Glyphosate has a low vapour pressure, therefore it is extremely unlikely that applicators or bystanders will breath any vapours.

Glyphosate is highly water soluble, meaning that if it is accidentally absorbed or ingested by people, pets or wildlife, it will not remain in the body, but will be excreted. Glyphosate does not accumulate (repeated exposure does not lead to high levels of chemical in the body), nor does it bioaccumulate in the food chain. Extensive scientific testing has proven that glyphosate has a very low toxicity to wildlife and fish, and does not cause cancer, birth defects or nerve damage. It is therefore considered non toxic.

If glyphosate is safe, why do people applying herbicide have to wear protective clothing?

Herbicides are regulated by Agriculture Canada who requires prudent safety measures be taken in order to limit exposure to workers. All herbicides should be treated with respect.

What is the acute toxicity of glyphosate?

The toxicity is measured as the dose required to kill 50% of test animals (LD 50). The LD 50 for glyphosate is 5000mg/kg. This means that a living thing must ingest 5000mg of glyphosate for each kilogram of body weight to obtain a possible lethal dose.

Are there any health risks from glyphosate?

Glyphosate can cause skin and eye irritations if applied directly to these areas of the body. If this occurs, wash exposed areas thoroughly with soap and water. For eyes, flush immediately with large volumes of clean water for at least 15 minutes. Contact a physician.

Is glyphosate persistent in the environment?

The halflife of glyphosate is 60 days (50% of the chemical has broken down by this point) and 90% of glyphosate is degraded in less than 6 months after being applied. Glyphosate that hits the ground is quickly bound to soil particles. It binds tightly, making it practically immobile in most soils. As such, it is unlikely to leach through the soil to groundwater supplies.

How does glyphosate decompose?

Living microbes in the soil decompose Glyphosate. These microbes break the chemical down into its basic, natural components; carbon dioxide, water, nitrogen and phosphorus.

How is glyphosate used in High Park?

The City uses glyphosate in the form of Roundup® to control the spread of invasive plants in the park. Specifically, Roundup® is used against Dog-strangling Vine, also known as Pale or Black Swallow-wort (*Cynanchum spp.*). The Roundup® is wiped on to the leaves of the plant using a hand-held wick. In this way, it is not broadcast to nearby desirable plants or bystanders. Nor is any wasted by landing on bare soil. The herbicide dries quickly, usually within an hour. Areas being treated are posted with warning signs 24 hours before the work is done. These signs remain on site for 48 hours after the treatment is completed. All City staff applying herbicide are trained and licensed by the Ontario Ministry of the Environment.

Other Sources of Information on Glyphosate and Transorb®

- Monsanto – phone: 1-800-667-4944, Fax: 1-306-975-1147
- Environment Canada: 416-739-4826 or 416-327-5510
- Pest Management Information Service: 1-800-267-6315

Web Sites

- Pest Management Information Service – www.hc-sc.gc.ca/pmra-arla/
- Toxnet – toxnet.nlm.nih.gov/
- U.S. Environmental Protection Agency – www.epa.gov

Method 1: Photomonitoring

A photomonitoring plot consists of two stakes set 10 metres apart. One stake is designated as the photo point and the second stake is designated as the reference point. An observer stands at the photo point and directs the camera lens towards the reference point. At the reference point, a plywood board, 2.5m tall and 30cm wide, is held up by another person. The width of the plot is determined by the width of the area captured by the camera lens (a 50 mm lens). The board is divided into five sections, each 0.5m high, and alternately painted white and black. The camera is held horizontally and positioned to focus on a white patch on the middle of the board. Several photographs using different light settings should be taken to ensure at least one good exposure.

Once the photos have been taken, the following information is recorded on a data sheet:

1. Percent of tree canopy cover between the two points.
2. Percent of the area of each black and white section of the board obscured by vegetation (as seen from the photo point).
3. A list of all tree species (>2m tall) in the plot, including those trees outside the plot with crowns hanging over the plot.
4. A list of all shrub species (0.5-2m tall) in the plot.
5. A list of all herbaceous and low woody vegetation (<0.5m) in the plot. The top three most abundant species should be identified and ranked on a scale of 1-3, where 1 is the highest rating.
6. Note any management that has been undertaken in the plot (burning, herbicide treatment, recent plantings)
7. Note any trails that cross the plot and their size/width, and the extent of any bare ground in the plot (percentage of total plot area).
8. Record the location of the photo point and reference point in case stakes are removed.

All plant species are recorded using the Floristic Quality Assessment System for southern Ontario (Oldham et al 1995). This system creates a code for each plant species using the first three letters of the genus name and the first four letters of the species name. For example, the latin name *Quercus velutina* becomes QUEVELU.

Ideally, monitoring should be conducted twice per season, in late June and mid September. Monitoring should be continued for at least 5 years so that changes in vegetation structure and composition can be detected.

Establishing a Photomonitoring Plot

Photomonitoring plots are located in areas where changes in vegetation over time are expected as a result of management. For example, areas proposed for burning, areas with heavy infestations of invasive plants, or wooded areas designated for thinning would all be suitable for long-term photomonitoring. The photos will provide a visual time sequence of change as management progresses.

When a plot location is chosen, it is marked on a map for future reference. A data sheet is also filled out (see attached). Information recorded on the sheet includes the objective for the site, its GPS co-ordinates, if possible and the date on which the plot was established.

Permanent signs indicating the site as a photomonitoring plot are installed on metal t-bars (one at each end of the plot) after a stakeout has been done to ensure that there are no wires, pipes or cables underground.

Method 2: Transect Monitoring

Long-term monitoring in Management Units 1C and 7B/7C has been initiated using transect lines that run through each of the units. Data is collected along the transect line as described below. Data should be collected every 2 to 5 years in order to assess changes in vegetation structure over time and to monitor the success of management.

The transect lines were established in 1993 by Steven Apfelbaum of Applied Ecological Services Inc. There are six lines that run west from West Road and three lines that run east-west across Howard Park Drive. The lines vary in length from 50 m to 150 m. The starting point of each line corresponds to a permanently numbered concrete light pole.

Maps provided by Apfelbaum in 1993 identify the hydro poles used, the length of each transect and the direction of each line given as a compass bearing. However, the compass bearings provided were inconsistent and it was necessary to standardize the direction of all bearings as follows: 1) All lines running west fall along the compass bearing 275□ from North, 2) All lines running east fall along the compass bearing 85□ from North. The new standardized transect lines have been marked at 20 m intervals with wooden stakes. Tree tags were installed in the Autumn of 2000 to create permanent reference points. The distance of individual trees from transect lines will also be recorded.

Data Collection

Herbaceous Plants

Sampling of herbaceous ground flora is carried out by placing a square 1m quadrat along a transect at intervals of every 10 m, starting at metre 5 (to avoid sampling the road). All species within the quadrat are identified to species, and the percent of the total area covered by each species is estimated. The percent cover of bare soil, fine fuel (leaf litter), and coarse fuel (woody debris) is also recorded. In some plots, layering of vegetation may result in a total percent cover estimate exceeding 100%.

Shrubs and Vines

Shrubs are considered to be any woody plant greater than 1m tall, with a diameter at breast height (DBH) less than 5 cm. Vines are included with shrubs.

All shrubs along the left side of the transect and less than 1m away from the line are sampled. Each shrub is identified to species and listed as either alive or dead. The size of the shrub is measured along the transect line as a canopy intercept (from X metre to Y metre), which is then converted to a total intercept (Y – X), and finally to a percent cover (Y – X / length of transect x 100)

Trees

To be included in this category, trees must have a DBH of 5 cm or greater. Trees are sampled within 1m of the transect line on both sides (left and right) of the line. Each tree is identified to species and recorded as dead or alive. The DBH of each tree is noted according to the following classes:

1. 5-15 cm	5. 45-55 cm
2. 15-25 cm	6. 55-65 cm
3. 25-35 cm	7. 65-75 cm
4. 35-45 cm	8. 75 cm+

The transect length intersected by each tree species in the canopy is recorded and converted to a percent cover estimate (see shrubs section for procedure). At each 25m transect interval (starting at metre 25), the basal area of the surrounding trees is measured using a prism with a factor of two.

Ministry of Natural Resources
Ministère des Richesses naturelles
Ontario

50 Bloomington Road West
Aurora, ON L4G 3G8

February 3, 2002

Mr. Richard Ubbens
City Forester
Toronto Parks and Recreation
18 Dyas Road
Toronto ON M3B 1V5

FAX: (416) 392-1915

Dear Mr. Ubbens:

The Ministry of Natural Resources would like to thank the City of Toronto and the tremendous efforts of the staff at Toronto Parks and Recreation for their work on restoring the oak savannahs at High Park and Lambton Park. Both parks support globally endangered oak savannahs noted for their open grown Black Oak trees and their provincially and locally rare wildflowers and grasses.

In 1989, at the request of the City of Toronto, the Ministry carried out a biological inventory of High Park. The Ministry recognizes the natural portion of High Park as a provincial Area of Natural and Scientific Interest (ANSI) and Lambton Park has recently been identified as a candidate ANSI. The Ministry continues to provide technical assistance to park staff.

The City of Toronto's prescribed burn program in High Park and in Lambton Park have resulted in an incredible rejuvenation of the oak savannahs at these sites. Ministry staff has noted that the provincially rare Wild Lupines have greatly increased in numbers and so have all the other wildflowers and native grasses that are unique to the oak savannahs. There has also been good reproduction of Black Oak seedlings, which are needed to replace the older trees as they reach the end of their life span.

The City's management of exotic plants at High Park has been a great success. Exotic species such as european honeysuckles had been crowding out rare native plants. Ministry staff has observed areas once dominated by exotic species now coming back with native species due to the efforts of city field crews and volunteers.

The City of Toronto's planting of native species has also been a great success. Its staff and volunteers have collected seeds of rare native plants, germinated them and planted them back into the park in areas being restored.

We are also amazed by the enthusiastic local support for restoring High Park's oak savannahs. This includes the volunteer program the City of Toronto has initiated to assist city staff in park restoration and its community outreach efforts with local residents and naturalists to develop management plans.

Finally we commend the City of Toronto and staff at Parks and Recreation for its excellent High Park Woodland and Savannah Management Plan. Its program of prescribed burns, native plantings and exotic plant removal will ensure the protection and restoration of one of the most significant natural areas in the Greater Toronto Area.

The Ministry has enjoyed working with city staff and acknowledges their dedication and professionalism. Our biological and forestry staff will be happy to provide continued technical support to the City of Toronto in its long-term management woodlands and savannahs at High Park and Lambton Park.

Yours truly,

Rob Messervey
District Manager
Aurora District

City of Toronto. 2002. High Park Woodland & Savannah Management Plan. Corporate Printing. Toronto, Ontario, 93 p.

Available on the City of Toronto website at www.city.toronto.on.ca/trees