

The historical and extant vascular flora of Pelham Bay Park, Bronx County, New York 1947–1998¹

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DECANDIDO, R. (Department of Biology, The City College of the City University of New York, New York, NY 10031) AND E. E. LAMONT (Institute of Systematic Botany, The New York Botanical Garden, Bronx, NY 10458). The historical and extant vascular flora of Pelham Bay Park, Bronx County, New York 1947–1998. *J. Torrey Bot. Society* 131: 368–386. 2004.—This vascular flora of Pelham Bay Park, Bronx County, New York is based on collections made by H.E. Ahles in 1946–47 and by the authors from March of 1994 through October of 1998. Altogether, 123 families, 471 genera and 956 species are reported here. Of these 956 species, 583 (61.0%) are native, 321 (33.6%) non-native and 52 (5.4%) either planted or introduced and not spreading to any degree. The largest families were the Asteraceae (120 species) and the Poaceae (106 species), and the largest genera were *Carex*, *Polygonum* and *Aster*. The park's current flora is analyzed by habitat and four plant communities are described and discussed. Most of the extant plant species diversity occurs in two habitats: 255 species were found primarily in the woodland community, and 288 species usually occurred in the grassland/meadow community. According to current criteria in New York, 27 native species collected in 1994–98 are considered uncommon, rare, threatened or endangered in the state. The most pernicious non-native species that occur in PBPk are: *Acer platanoides*, *Alliaria petiolata*, *Ampelopsis brevipedunculata*, and *Rhamnus frangula*. The future of the remaining natural areas of Pelham Bay Park will depend upon the degree biologists make people aware of the significant plant species diversity remaining in New York City's second largest park.

Key words: Flora, urban, Pelham Bay Park, New York City, plant communities, H. E. Ahles.

Pelham Bay Park (PBPk), Bronx County, New York is located along the southwestern shore of the Long Island Sound (40° 52' 30" N, 73° 47' 30" W), north of Manhattan and south of New Rochelle, Westchester County. At 1119.4 hectares, it is the second largest park in New York City, and the largest under the jurisdiction of the New York City Department of Parks and Recreation. The park was established in 1884 through the efforts of the New Parks Movement (Schnitz and Loeb 1984). Since the 1930's, numerous development projects have transformed much of the park (see Monachino

1958, Kaltman 1968). Fortunately, there still remain several natural areas representing a diversity of habitats of the region.

PBPk is mostly isolated from the surrounding communities by several large water bodies and roadways, including the Long Island Sound, Hutchinson River, and the New England Thruway (Figure 1). The park is heavily used by the public from June through August, but, except for areas immediately adjacent to the water, the natural areas are not as frequently visited. The only previous extensive plant survey of PBPk was conducted in 1946–47 by Harry E. Ahles. (For a brief biography of H. E. Ahles, see Tipppo 1982.) In his two-year field study of PBPk, Ahles collected 1531 specimens, eventually donating these to the New York State Museum, but his research in PBPk has only been analyzed recently (DeCandido 2001). Ahles never published any papers based on collections he made at PBPk, and published only one paper that incorporated specimens from the Bronx (see Ahles 1951).

Landform in PBPk was largely determined by several glacial flows during the Pleistocene Period. Evidence for these glaciers in the park is in the form of roche moutonees, rock erratics, striae and groove markings. The underlying ge-

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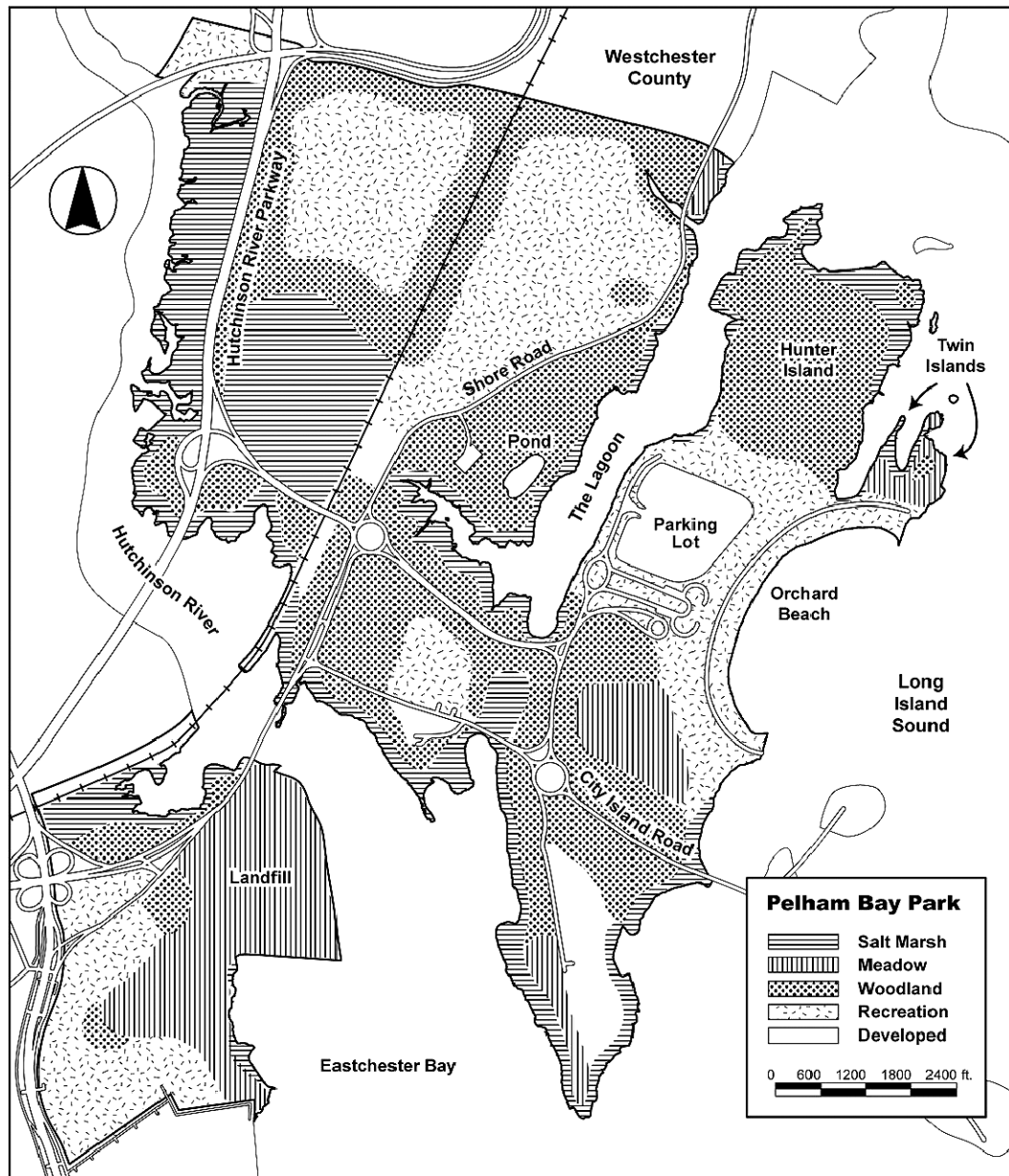


FIG. 1. Map of Pelham Bay Park, Bronx County, New York City showing the different habitats of the park.

ology of PBPK is primarily metamorphic in origin and includes felsic gneisses, sillimanite schists and amphibolites, with extensive veins of quartz (Schubert 1968, Leveson and Seyfert 1969). These rocks are classified as part of the Hutchinson River Group that is correlative with the Hartland Formation of western Connecticut and southeastern New York (Merguerian and Sanders 1993).

Pre-historical evidence of Native American

land use exists in the form of recovered Indian artifacts as well as oyster and clam middens, remnants of which can still be found today (Bolton 1922, Kaeser 1970). Recovered *Zea mays* pollen indicates that Native Americans were utilizing PBPK at least by 1175 A.D., \pm 100 years (Loeb 1998a). From 1888–1934, much of the park remained an open canopy woodland and grassland, since trees were selectively removed by the City of New York Department of Parks

and Recreation from Hunter Island and other areas of PBPK (Loeb 1998b). Other more grand-scale projects, such as those undertaken by the WPA in the 1930s, changed water flow patterns through the larger salt marshes and even some of the woodlands of PBPK. From 1934–1948, the New York City Department of Parks under the direction of Robert Moses made significant changes to the park by filling in the original Pelham Bay for use as a parking lot, creating Orchard Beach (Caro 1974). Beginning in 1964, approximately 105 acres in the southern portion of the park were taken over by the Department of Sanitation and converted to a landfill (Kaltman 1968). This site was eventually closed in the 1970s, but not before it had become the highest point in the eastern Bronx (Pons 1987). During the last fifty years, one major roadway (the New England Thruway) has been built through PBPK, while another (the Hutchinson River Parkway) has been expanded. Today, the more serious forms of disturbance continue to be anthropogenic in nature, including intentionally set fires, abandonment of stolen cars, off-trail dirt biking and jet-skiing in the water bodies adjacent to the park. In the late 1990s, it was estimated that 28% of the PBPK was mixed deciduous woods, 24% marine, 7% salt marsh, 6% salt flats, 3% meadows and 2% shrub or scrub land (Wells 1998). The remaining 33% of the park has been classified as developed, including golf courses, parking lots, buildings, a New York City Police Department Pistol Range and the man-made Orchard Beach (Wells 1998).

Since no comprehensive flora of PBPK had ever been published, and no systematic plant collections made in fifty years, the authors initiated the present study. Our objectives were to study the plants that H.E. Ahles collected in 1946–1947 and incorporate them into the present research; collect and identify extant plant species of Pelham Bay Park; determine the relative status of each species collected in 1994–1998 (rare, uncommon, common); and describe several of the more distinctive habitats in the park. By compiling these data, we hope to make it possible for future researchers to assess long-term changes in plant species diversity in PBPK and facilitate comparisons with other parks in the region.

Methods. Pelham Bay Park was sampled a minimum of two times per week, from April through August, and at least once per week in February and March, as well as September and

October, from 1994 to 1998 (inclusive) for a total of at least 200 field days over five years by the senior author. The park was walked for about five hours each visit, in such a way that all areas of the park were sampled at least every other week. Voucher specimens of each taxon with collection notes were deposited at the New York State Museum in Albany in 1999. These voucher specimens have since been transferred to the Brooklyn Botanic Garden.

The plant specimens of PBPK that H.E. Ahles collected in 1946–1947, and now held at the New York State Museum at Albany, were examined along with his field notes for those two years (Ahles 1947, 1948). Ahles spent a total of 33 days of the 1946 field season making his collections (from 10 March to 6 October) in PBPK. During 1947, Ahles did not record the specific date a species was collected, so it is not known how many total days he spent in the field that year. If the nomenclature by which a species was known and listed by Ahles in 1946–1947 has been changed, the authors made the appropriate updates to those adopted by Mitchell and Tucker (1997) and Mitchell (2000). In one instance a paper by Lamont (1994) was consulted for information regarding a species collected by Ahles in 1946.

The species checklist of PBPK (Appendix A) presents an inventory of the vascular plants found in PBPK by H. E. Ahles in 1946–47 or for at least one season in the years from 1994–1998 with one exception (see DeCandido 1991). Appendix A includes native species, naturalized alien (non-native) species, species that have escaped from cultivation and have become established in the park, and species planted by the New York City Department of Parks and Recreation. Alien species are those not native to the northeastern United States. These are designated by a leading asterisk (*). All planted or escaped species (those not reproducing to any significant degree) are enclosed by brackets []. Vascular plants are preceded by a plus (+) sign if they were only collected as part of the 1994–98 survey, and not by Ahles in 1946–47. Vascular plants collected only by Ahles in 1946–47, but not collected or observed by the authors in 1994–1998 are listed in Appendix A by a leading minus (–) sign. These species are considered to be extirpated from the park. Vascular plants collected both by Ahles and during 1994–1998 have no special leading designation unless they are not native to the area.

Identification of specimens was made using

Table 1. Comparison between plant species diversity of Pelham Bay Park found in 1946–1947 by H. E. Ahles and the 1994–1998 flora.

| | Pteridophytes | | Conifers | | Dicots | | Monocots | | Total | | Total 1947+1998 |
|--------------------|---------------|------|----------|------|--------|------|----------|------|-------|------|--------------------|
| | 1947 | 1998 | 1947 | 1998 | 1947 | 1998 | 1947 | 1998 | 1947 | 1998 | |
| Native Species | 15 | 12 | 1 | 2 | 327 | 326 | 139 | 102 | 481 | 442 | 582 |
| Non-native Species | 0 | 0 | 2 | 1 | 154 | 240 | 31 | 59 | 187 | 300 | 321 |
| Planted Species | 0 | 0 | 1 | 7 | 2 | 43 | 0 | 0 | 3 | 50 | 52 |
| Total Species | 15 | 12 | 4 | 10 | 483 | 609 | 170 | 161 | 672 | 792 | 956 |
| Genera | 11 | 9 | 2 | 5 | 268 | 345 | 73 | 72 | 354 | 431 | 471 |
| Families | 7 | 6 | 2 | 5 | 85 | 96 | 14 | 10 | 108 | 117 | 123 |

Gleason and Cronquist (1991). Nomenclature followed Mitchell and Tucker (1997) the minor revisions in Mitchell (2000). For the data analysis, subspecies and varieties were treated as full species. Clemants (1990), the New York Flora Association (1990) and Clemants (1999) were the primary references used to verify the historical occurrence(s) of particular species in the Bronx and New York City.

In Appendix A, following the scientific name of all native and non-native species is the current status in PBPK as follows. *Rare*: if an herbaceous species then it must only have been present at three different sites or fewer, with no more than 25 individuals present at any one site; or, present at one site with no more than 50 total plants. If a tree or shrub, it must only have been present at six or fewer locations, with no site having more than five individuals; or present at one site with no more than 10 individuals found at that location. *Uncommon*: if an herbaceous species then it must have been present at four to six sites with no more than 50 individuals at any one of those sites; or present at one locality only, with no more than 100 individuals found at that site. If a tree or shrub, the species must have been present at 7 to 10 sites with no stand greater than five individuals; or, present at one site only with 15 or fewer individuals. A species was listed as extirpated if it was found during one or more field seasons, but not seen subsequently, despite several attempts at relocating plants at the site or in other likely areas of PBPK. Species

that were abundant or common are not designated with any symbol on this list. Species that are indicated as planted have not been evaluated regarding their status in the park.

Results. Appendix A, the vascular flora of PBPK, lists 123 families, 471 genera and 956 species with the H.E. Ahles flora of 1947–1948 combined with the 1994–1998 flora. Of these, 583 (61.0%) were native, 321 (33.6%) were non-native and 52 (5.4%) were planted and not spreading to any degree (Table 1). One species, *Hibiscus laevis*, originally collected in 1991 (DeCandido 1991) and since extirpated, was new to New York State (Mitchell and Tucker 1997, Mitchell 2000). In addition, PBPK is one of only two sites in New York State for *Lactuca floridana*. New records for the park (as compared to the 1946–1947 unpublished list compiled by Ahles) number 284 species. These included 102 native species that Ahles probably overlooked, 135 non-native species, and 47 species that have been planted and are not reproducing in the park. By comparison, 142 native and 25 non-native species were collected by Ahles and not found during the course of this study. Most likely, these 167 species have been extirpated from PBPK in the last 50 years (DeCandido 2004). A comparison of numbers of species from PBPK collected by Ahles (1946–1947) and the current authors during 1994–1998 is presented in Table 1. According to Table 2, collections made in Bronx County since the late

Table 2. Statistical summary of the plant species diversity found in Pelham Bay Park in 1946–1947 and 1994–1998, as well as Bronx County (1850–2000) and New York City (1850–2000).

| Locale | Families | Number of Species | | | |
|----------------|----------|-------------------|-------------|------------|-------|
| | | Native | Non-Native | Planted | Total |
| PBPK 1946–1947 | 108 | 483 (71.8%) | 187 (27.8%) | 3 (0.4%) | 672 |
| PBPK 1994–1998 | 117 | 442 (55.8%) | 300 (37.9%) | 50 (6.3%) | 792 |
| Bronx County | 146 | 988 (65.3%) | 417 (27.7%) | 106 (7.0%) | 1511 |
| New York City | 161 | 1357 (62.3%) | 610 (28.0%) | 210 (9.6%) | 2177 |

19th century and kept at the State Museum at Albany (NYFA 1990) show that there have been at least 146 families of plants present in the boro, with 1511 total species. Of this species total, 988 are native (65.3%), 417 non-native (27.7%) and 106 were planted (7.0%). For all of New York City (see DeCandido et al. 2004), 2177 species in 161 families have been found. Of these, 1357 have been native species (62.3%), 610 have been non-native species (28.0%), and 210 species were planted (9.6%).

When the Ahles' flora and the present flora are combined, the families with the greatest species richness at PBPK are the Asteraceae (120 species) and the Poaceae (106 species), and the largest genera are *Carex* (35 spp.), *Aster* (18) *Polygonum* (18) and *Panicum* (15). The families in the flora (collections from 1994–98) with the greatest species richness are the Asteraceae with 45 genera and 101 species, and the Poaceae, with 48 genera and 88 species. Together, they comprise 21.8% of all genera and 23.9% of all species collected from 1994–98. Other large families are the Fabaceae (21 gen., 35 spp.), Rosaceae (15 gen., 32 spp.), Brassicaceae (18 gen., 29 spp.), Cyperaceae (5 gen., 29 spp.), Liliaceae (18 gen., 23 spp.) and the Caryophyllaceae (11 gen., 20 spp.). The largest genera are: *Carex*, *Polygonum* (each with 16 spp.), *Aster* (15 spp.), *Quercus* (10 spp.), *Eupatorium*, *Solidago* (each with 8 spp.), and *Acer*, *Panicum* (each with 7 spp.). When extant flora was analyzed by habitat, (see Reschke 1990), 30 species were found primarily in the maritime plant community that was periodically inundated with brackish or marine water. By comparison, 255 species occurred mostly in the woodland community including gaps within the forest; 288 species usually occurred in the grassland/meadow community; 139 species occurred in sites that have been disturbed in the recent past, such as roadsides, parking lots and areas adjacent to buildings and other structures. A further 30 species were primarily confined to freshwater riparian areas distributed throughout the park.

During the course of the 1994–1998 survey, 53 of the 326 (16.3 %) native herbaceous species (exclusive of planted species) were judged to be rare at PBPK, while 27 native herbaceous species (8.3%) were considered uncommon. For the woody species, 15 of the 116 native species (12.9%) were classified as rare, while 5 (4.8%) were considered uncommon. In all, of the 742 extant native and non-native species of PBPK, 142 (19.1%) have been judged to be rare or un-

common in the park. Another 21 species (5 native; 16 non-native) became extirpated during five years of field work in PBPK. Overall, 26 native species (5.9% of the native flora) of PBPK collected in 1994–98 are considered endangered, threatened or rare in New York State (Mitchell 2000, Young and Weldy 2003). These include 22 herbaceous and four woody species.

As compared to a recent list of the 26 most serious invasive plants in the state (New York State Ad Hoc Invasive Plant Group 2001), PBPK currently has 17 of the species on the list. At least 16 of these have established themselves widely in natural areas of the park, or have formed monodominant stands in disturbed areas. These are: *Acer platanoides*, *Alliaria petiolata*, *Ampelopsis brevipedunculata*, *Berberis thunbergii*, *Celastrus orbiculata*, *Centaurea maculosa*, *Cynanchum louiseae*, *Elaeagnus umbellata*, *Lonicera japonica*, *Lonicera morrowii*, *Lonicera x bella*, *Lythrum salicaria*, *Phragmites australis*, *Rhamnus cathartica*, *Rhamnus frangula*, *Robinia pseudoacacia*, and *Rosa multiflora*. In addition, three other species not on the state list: *Populus alba*, *Viburnum dilatatum* and *Viburnum sieboldii* (for the last of these, see Kunstler 1993), had also established themselves in some of the natural areas of PBPK. These 19 species posed the greatest threat to natural communities in PBPK.

Discussion. The vascular flora of PBPK is composed of 956 species in 471 genera and 123 families. Compared to an unpublished flora of PBPK by H.E. Ahles in 1946–47, there were more total species, genera and families collected in 1994–1998. However, there were fewer native species collected during 1994–1998 than in the Ahles' study (Table 1). In the intervening years, the proportion of native plant species declined from 71.8% in 1946–47 to 55.8% in this study. As the absolute and proportional number of native species declined, the number of non-native species increased from the 187 collected by Ahles, to 300 collected in 1994–98 (Table 1). Overall, according to Table 2, 44.6% of all the native plant species ever collected in Bronx County were collected in 1994–1998 in PBPK. Also, 72.1% of all non-native species ever collected in Bronx County were present in PBPK in 1994–1998. Similarly, almost half (49.1%) of all the non-native species ever collected in New York City were collected in PBPK as part of this study.

The vegetation of Pelham Bay Park from

1994–1998 can be classified into five general plant communities based upon descriptions developed by Reschke (1990): Maritime including intertidal marine, gravelly shores, beach and salt marsh; forest including lowland and upland woods; freshwater riparian areas; meadows/grasslands; and wasteland/disturbed sites. Each of these habitats (except for wasteland/disturbed) contains more non-native than native species compared with the same habitat in 1946–1947 (DeCandido 2004). Four of these habitats are discussed below. By far, most of the species in this study came from two communities: upland forest and grasslands/meadows.

MARITIME PLANT COMMUNITY. Salt marshes flourish where the Long Island Sound and the Hutchinson River estuary border PBPK. The vegetation of the low salt marsh consists primarily of *Spartina alterniflora*, while the high marsh is dominated by *Spartina patens*, *Distichlis spicata* and *Juncus gerardii*. In this marine plant community, four herbaceous species that are disappearing from many other salt marshes in southern New York State can be found: *Aster subulatus*, *Aster tenuifolius*, *Limonium carolinianum* and *Suaeda linearis*. Salt pannes are interspersed throughout the salt marsh. In these poorly drained areas, especially in the high marsh, species such as *Salicornia europaea*, *S. perennis*, *Pluchea odorata*, *Spergularia salina*, and *S. rubra* can be found. Although gravelly shores are fairly common at PBPK, there was no extensive beach plant community typical of the nearby north shore of Long Island as described by Lamont and Stalter (1991). Also, no primary dune system exists at PBPK, such as found in parks on the south shore of Long Island that border the Atlantic Ocean at the Fire Island National Seashore (see Stalter et al. 1986).

Moving landward from the high salt marsh, one encountered a transition zone before the upland forest begins. This area is largely dominated by stands of *Tripsacum dactyloides*. Here also can be found *Hibiscus moscheutos*, *Phragmites australis*, *Polygonum ramosissimum* and *Teucrium canadense*. In other places, especially where the terrain is slightly elevated or the bedrock was exposed, a salt shrub and grass community is found. Species of this drier zone include *Baccharis halimifolia*, *Iva frutescens* ssp. *oraria* and *Myrica pensylvanica*. Typical herbaceous species include *Panicum virgatum*, *Euthamia graminifolia*, *Solidago sempervirens* and rarely, *Spartina pectinata*. In more rocky and

slightly elevated areas, species that can be found are *Amelanchier stolonifera*, *Aronia x prunifolia*, *Lechea mucronata*, *Parthenocissus quinquefolia*, *Quercus stellata*, and *Silene caroliniana* var. *pensylvanica*.

WOODLAND PLANT COMMUNITY. The upland forest community occurs on well-drained acidic soils beginning approximately three meters above sea level. The amount of land classified as forest in one section of the park (Hunter Island) has increased by more than 2.5 times from 1888–1984 (Loeb 1998a). The upland woodland community in PBPK most closely resembles an Appalachian oak-hickory forest of the northeastern United States also described from other parks in New York City (Lefkowitz and Greller 1973, Loeb 1986). Most trees in the canopy are between 15 and 25 meters high though certain individuals (such as specimens of *Liriodendron tulipifera*) are estimated to be up to 45 meters in height. The dominant trees in the two largest patches of mature forest in PBPK (Hunter Island and the Central Woodlands) are *Quercus alba*, *Q. rubra* and *Q. velutina*. Mixed with the oaks but less frequently encountered are *Betula lenta*, *Carya glabra*, *C. tomentosa* and *Fraxinus americana*. Occasional stems of *Castanea dentata* still emerge from stumps of dead trees. In the sub-canopy, species such as *Cornus florida* and *Sassafras albidum* predominate, while *Amelanchier arborea* and *Hammamelis virginiana* occur to a lesser extent. Common low shrubs include *Cornus sericea*, *Gaylussacia baccata*, *Rubus allegheniensis*, *Vaccinium pallidum*, and *Viburnum acerifolium*. The ground layer herbaceous flora is diverse and includes such species as *Alliaria petiolata*, *Aster divaricatus*, *Circaea lutetiana* ssp. *canadensis*, *Geranium maculata*, *Helianthus divaricatus*, *Maianthemum canadense*, *Monotropa uniflora*, *Pedicularis canadensis*, *Solidago bicolor*, *S. caesia* and *S. canadensis* var. *scabra*.

In richer and moister soils of the forest, species such as *Betula alleghaniensis*, *Carpinus caroliniana* ssp. *virginiana*, *Cornus alternifolia*, *Liquidambar styraciflua*, *Platanus occidentalis*, *Quercus bicolor*, and *Ostrya virginiana* were collected. Beneath this canopy layer, certain shrub species are more abundant, such as *Corylus americana*, *Ilex verticillata* and *Lindera benzoin*. Herbaceous species include *Agrimonia gryposepala*, *Arisaema triphyllum*, *Cardamine coccata*, *Impatiens capensis*, *Osmunda cin-*

namomea, *Phyrma leptostachya*, *Piptochaetium avenaceum*, and *Thalictrum pubescens*.

A unique aspect of the upland forest for New York City Parks is that at PBPK this community extends out in hillocks into the salt marsh in some areas. These hillocks can also occasionally be found as lone islands surrounded by the salt marsh. Typical understory species in this habitat include: *Andropogon gerardii*, *Aralia nudicaulis*, *Aster macrophyllus*, *Aster paternus*, *Aureolaria flava*, *Chimaphila maculata*, *Gaylussacia baccata*, *Helianthus divaricatus*, *Lespedeza hirta*, *L. virginica*, *Lysimachia quadrifolia*, *Pteridium aquilinum* var. *latiusculum*, *Smilax glauca*, *Smilacina racemosa*, *Sorghastrum nutans* and *Tripsacum dactyloides*.

Many herbaceous species that are rare and uncommon within PBPK are confined to forest edges and isolated small gaps within the forest. In the latter case, the canopy gaps are often produced and maintained because of elevated, rocky areas of the forest floor overlain with thin soils. In addition, gaps are formed at PBPK when freshwater collected to form small pools within the forest, above which few trees have grown. Since these areas have been too difficult to maintain by mowing or artificial plantings, isolated havens exist for several species otherwise rare or uncommon in the park. These taxa include: *Agastache nepetoides*, *Ceanothus americana*, *Desmodium canadense*, *Dicentra cucullaria*, *Diervilla lonicera*, *Eupatorium sessilifolium*, *Mimulus alatus*, *Mitchella repens*, *Paronychia canadensis*, *Polypodium virginianum*, *Pyrola americana* and *Viola pubescens*.

GRASSLAND/MEADOW PLANT COMMUNITY. From 1885–1984, land classified as meadow declined by 85%, from 69.7 hectares to 10.5 hectares (Sisinni and Anderson 1993). Compared to habitat descriptions provided by Ahles (Ahles 1947, 1948), there were many more grasslands, meadows and fields in 1946–47 than in 1994–1998 (DeCandido 2001, DeCandido 2004). In the last fifty years, many open areas have become dominated by shrubs and young trees. The only “natural” meadow (the topsoil was removed for fill in the 1930s) with a high diversity of native herbaceous species in PBPK is composed primarily of *Tripsacum dactyloides*. Other important species of this meadow are *Lythrum salicaria*, *Pycnanthemum tenuifolium*, *P. virginianum*, *Solidago speciosa*, *Viburnum dentatum* var. *lucidum* and *V. dentatum* var. *venosum*. Elsewhere, fields and shrub lands were often

dominated by non-native species such as *Ampelopsis brevipedunculata*, *Artemisia vulgaris*, *Bromus* spp., *Centaurea* spp., *Cynanchum louiseae*, *Linaria vulgaris*, *Lonicera japonica*, *Prunus* spp., *Trifolium pratense*, and *Vicia* spp.

WASTELAND/DISTURBED HABITAT. Plants inhabiting frequently disturbed or artificially maintained areas include species that are often non-native in origin. Such species occur primarily in and around buildings, parking lots, golf courses, highways, railways and the abandoned landfill. Typical species of these habitats include *Hieracium* spp., *Mazus pumilus*, *Poa pratensis*, *Taraxacum officinale*, *Veronica* spp., as well as many of the non-native species that may also invade successional old fields and shrub lands. If these disturbed sites were left alone over time, woodlands with a limited number of plant species could develop. These habitats are then frequently dominated by woody species such as *Acer platanoides*, *Acer pseudoplatanus* and *Populus alba*.

RARE PLANTS AND EXTIRPATED SPECIES. Twenty-seven species found during 1994–98 are considered uncommon, rare, threatened or endangered in New York State (Mitchell 2000, Young and Weldy 2003). Eight of these species were at or near the northern limits of their range at PBPK. These were: *Cyperus echinatus*, *Diospyros virginiana*, *Eupatorium hyssopifolium* var. *laciniatum*, *Eupatorium serotinum*, *Lactuca floridana*, *Lechea racemulosa*, *Ptelea trifoliata* and *Viburnum dentatum* var. *venosum*.

Other New York State listed species were indicative of habitats (e.g., salt marshes) that have a limited distribution in the state, or were found in a habitat that has declined in New York City (grasslands). These were: *Asclepias purpurascens*, *Aster subulatus*, *Aster tenuifolius*, *Cenchrus tribuloides*, *Cuscuta pentagona*, *Iris prismatica*, *Juncus brachycarpus*, *Oenothera laciniata*, *Oenothera parviflora* var. *oakesiana*, *Paspalum setaceum* var. *muhlenbergii*, *Suaeda linearis*, and *Tripsacum dactyloides*. Finally there were seven New York State species found in PBPK for which no discernible cause of decline could be determined. These were: *Agastache nepetoides*, *Juglans cinerea*, *Mimulus alatus*, *Polygonum hydropiperoides* var. *opelousanum*, *Ranunculus hispidus* var. *nitidus*, *Silene caroliniana* var. *pensylvanica* and *Veronicastrum virginicum*.

Appendix A also lists 17 plant species collected by H.E. Ahles in 1946–47 that have spe-

cial rarity designations in New York State, and have since become extirpated in PBPK. These are: *Carex bushii*, *Carex buxbaumii*, *Carex polymorpha*, *Carex seorsa*, *Crotolaria sagittalis*, *Cyperus lupulinus*, *Eleocharis halophila*, *Juncus scirpoides*, *Lespedeza violacea*, *Oxalis violacea*, *Panicum scabriusculum*, *Plantago maritima* ssp. *juncoides*, *Polygonum erectum*, *Prunus pumila* var. *depressa*, *Salicornia bigelovii*, *Solidago sempervirens* var. *mexicana* and *Spiranthes vernalis*. With the exception of *P. pumila* var. *depressa* (a small shrub), each of these extirpated plants is an herbaceous species.

There were also two important discoveries of plant species not known from New York State, or believed to have been extirpated in the state. One of these (*Hibiscus laevis*) was first seen in flower in July of 1990 (DeCandido 1991). It was subsequently extirpated due to repeated mowing of the area in the summer of 1992. The second species, *Lactuca floridana*, was found in the same location it was originally discovered in 1954 (see Monachino 1955). This species was previously thought to have been extirpated in New York State.

During the course of this five-year study, a total of 21 plant species became extirpated (5 native; 16 non-native) from PBPK. The five native species were: *Aster patens*, *Desmodium cuspidatum*, *Hibiscus laevis*, *Oenothera laciniata* and *Spiranthes cernua*. Each of these five species had been reduced to a small population of less than three individuals when initially discovered. It was difficult to determine whether proximate or long-term factors were the decisive causes of particular native plant species extirpations. Overall, 100 of 442 (22.6%) native species identified in this study were considered rare or uncommon at PBPK (Appendix A). The majority of the native species at greatest risk of extirpation were herbaceous plants. Two factors seemed to be at work in the decline of herbaceous species: successional ecological forces and the loss of open habitat such as meadows/grasslands to development (DeCandido 2004).

NON-NATIVE SPECIES. Compared to the 1946–1947 study of the flora of PBPK, there were 135 more non-native species collected in the park in 1994–98. Since the earlier study, significant disturbance events have affected PBPK (see Monachino 1958, Kaltman 1968). These included the placement of a sanitary landfill in the southern region of the park, the expansion of highways in the park and other, small-scale disturbance

events such as construction of buildings or even natural area restoration efforts. In the woodlands, the most pernicious of these non-native species are: *Acer platanoides*, *Alliaria petiolata*, *Celastrus orbiculatus*, *Lonicera japonica*, *Lonicera morrowii*, and *Rhamnus frangula*. The most widespread alien species in open habitats are *Ampelopsis brevipedunculata*, *Artemisia vulgaris*, *Lythrum salicaria*, and *Populus alba*.

The flora of Pelham Bay Park is a rich assemblage of native and non-native species in one of the world's largest cities. Though much of the plant species diversity found by H. E. Ahles in 1946–47 still remains, significant changes have occurred in the last half-century. Establishing a park does not insure the preservation of its native species diversity, and may not even protect its natural areas from development. As we enter a new millennium with open space at a premium in New York City, parks represent low-cost land, where developers and city officials frequently attempt to build recreational facilities, expand highways or place water treatment facilities. At Pelham Bay Park from 1990–2001, there have been proposals for placing an ice-skating rink, bicycle paths, tennis courts, and baseball fields in natural areas. In the 21st century, the future of the natural areas of PBPK depends on those people who believe that biologically significant habitats for plants, wildlife (and humans) must continue to exist in New York City. The degree to which biologists and educators create opportunities for people to appropriately enjoy the remaining natural areas will determine the level of popular support, and in turn, the future of natural areas in PBPK and New York City.

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Appendix A

The following is a checklist of the vascular flora of Pelham Bay Park (PBPk), Bronx County, New York State. Nomenclature follows that of Mitchell and Tucker (1997) with minor revisions by Mitchell (2000). The following symbols have been used throughout the list: an asterisk (*) indicates a species non-native (alien) to northeastern United States. Brackets [] surrounding the scientific name indicate a species planted in the park that is not reproducing to any great degree in any natural area of PBPk. Species preceded by a plus (+) sign were collected only in 1994–1998. Species preceded by a minus (–) sign were collected only by H. E. Ahles in 1946–47. Vascular plants collected in both 1946–47 and 1994–1998 are preceded by no symbol unless the species is non-native (alien).

Immediately following the scientific name, certain plants collected in 1994–98 have been classified as rare or uncommon in Pelham Bay Park (see the Methods section for definitions of these terms). If no mention is made regarding the status of a plant, it should be considered common in the appropriate habitat. Finally, if a species is considered uncommon, rare, threatened or endangered in New York State (NYS), its rarity designation is provided (see Young and Weldy 2003 for exact definitions of these terms for New York State plants).

DIVISION: EQUISETOPHYTAFamily **SELAGINACEAE**

- Selaginella apoda*
- Selaginella rupestris*

Family **EQUISETACEAE**

- Equisetum arvense*

DIVISION POLYPODIOPHYTAFamily **OPHIAGLOSSACEAE**

- Botrychium dissectum*

Family **OSMUNDACEAE**

- Osmunda cinnamomea*
- Osmunda claytoniana*—Rare in PBPk
- Osmunda regalis* var. *spectabilis*

Family **DENNSTAEDTIACEAE**

- Dennstaedtia punctiloba*
- Pteridium aquilinum* var. *latiusculum*

Family **THELYPTERIDACEAE**

- +*Phegopteris hexagonoptera*
- Thelypteris noveboracensis*
- Thelypteris palustris* var. *pubescens*

Family **ASPENIACEAE**

- +*Asplenium platyneuron*—Rare in PBPk

Family **DRYOPTERIDACEAE**

- +*Athyrium filix-femina* var. *asplenioides*
- Dryopteris intermedia*
- Onoclea sensibilis*
- Polystichum acrostichoides*

Family **POLYPODIACEAE**

- +*Polypodium virginianum*—Uncommon in PBPk

DIVISION: PINOPHYTAFamily **GINKGOACEAE**

- [+*Ginkgo biloba*]

Family **TAXACEAE**

- [+*Taxus cuspidata*]

Family **PINACEAE**

- [+*Picea abies*]
- [+*Pinus nigra*]

- [+*Pinus resinosa*]

- [*Pinus strobus*]

- **Pinus sylvestris*

Family **TAXODIACEAE**

- [+*Taxodium distichum*]

Family **CUPRESSACEAE**

- +*Juniperus communis* var. *depressa*—Rare in PBPk
- [*Juniperus virginiana*]

DIVISION: MAGNOLIOPHYTA**CLASS: MAGNOLIOPSIDA**Family **MAGNOLIACEAE**

- Liriodendron tulipifera*

Family **LAURACEAE**

- Lindera benzoin*
- Sassafras albidum*

Family **SAURURACEAE**

- Saururus cernuus*

Family **ARISTOLOCHIACEAE**

- *+*Aristolochia clematidis*—Uncommon in PBPk
- Asarum canadense*—Rare in PBPk

Family **RANUNCULACEAE**

- Actaea pachypoda*
- Anemone quinquefolia*
- Anemone virginiana*—Uncommon in PBPk
- Aquilegia canadensis*
- [*+*Aquilegia vulgaris*]
- Caltha palustris*
- Cimicifuga racemosa*
- *+*Clematis terniflora*
- +*Clematis virginiana*
- Ranunculus abortivus*
- **Ranunculus acris*
- **Ranunculus bulbosus*
- Ranunculus hispidus* var. *nitidus*—NYS Endangered S1
- Ranunculus recurvatus*—Uncommon in PBPk
- **Ranunculus sceleratus*—Uncommon in PBPk
- Thalictrum aquilegifolium*
- Thalictrum dioicum*
- +*Thalictrum pubescens*
- +*Thalictrum revolutum*—Rare in PBPk
- Thalictrum thalictroides*

Family **BERBERIDACEAE**

**Berberis thunbergii*
Podophyllum peltatum

Family **MENISPERMACEAE**

Menispermum canadense

Family **PAPAVERACEAE**

**Chelidonium majus*
 *+*Macleaya cordata*—Uncommon in PBPK
Sanguinaria canadensis—Uncommon in PBPK

Family **FUMARIACEAE**

Dicentra cucullaria

Family **PLATANACEAE**

Platanus occidentalis

Family **HAMAMELIDACEAE**

Hamamelis virginiana
Liquidambar styraciflua

Family **ULMACEAE**

Celtis occidentalis—Uncommon in PBPK
Ulmus americana
 [+*Ulmus minor*]
 [+*Ulmus pumila*]
Ulmus rubra
 [*Zelkova serrata*]

Family **CANNABACEAE**

[+*Cannabis sativa*]—no specimen collected
 *—*Humulus japonicus*
 *—*Humulus lupulus*

Family **MORACEAE**

**Broussonetia papyrifera*
 *+*Maclura pomifera*—Uncommon in PBPK
 **Morus alba*
Morus rubra—Rare in PBPK

Family **URTICACEAE**

Boehmeria cylindrica
 –*Laportea canadensis*
Pilea pumila
 *+*Urtica dioica*

Family **JUGLANDACEAE**

Carya cordiformis
 +*Carya glabra*
Carya ovata
Carya tomentosa
 +*Juglans cinerea*—Rare in PBPK; NYS Uncommon
 S4
Juglans nigra

Family **MYRICACEAE**

–*Comptonia peregrina*
Myrica pensylvanica

Family **FAGACEAE**

Castanea dentata
Fagus grandifolia
 [+*Fagus sylvatica*]

Quercus alba

Quercus bicolor—Uncommon in PBPK
Quercus coccinea
 [+*Quercus macrocarpa*]
Quercus montana
Quercus palustris
 [+*Quercus robur*]
Quercus rubra
Quercus stellata
Quercus velutina

Family **BETULACEAE**

**Alnus glutinosa*
 +*Alnus incana* ssp. *rugosa*—Rare in PBPK
Betula alleghaniensis—Rare in PBPK
Betula lenta
Betula populifolia
Carpinus caroliniana ssp. *virginiana*
Corylus americana
 [+*Corylus avellana*]
Ostrya virginiana—Rare in PBPK

Family **PHYTOLACCACEAE**

Phytolacca americana

Family **NYCTAGINACEAE**

**Mirabilis nyctaginea*

Family **CACTACEAE**

+*Opuntia humifusa*—Rare in PBPK

Family **CHENOPODIACEAE**

Atriplex patula
 *+*Atriplex prostrata*
 *+*Bassia scoparia*
 **Chenopodium album*
 **Chenopodium ambrosioides*
 *+*Chenopodium glaucum*—Uncommon in PBPK
 +*Chenopodium simplex*
 *+*Cycloloma atriplicifolium*—Rare in PBPK
 –*Salicornia bigelovii*—NYS Threatened S2-S3
Salicornia europaea
Salicornia perennis
 **Salsola kali*
Suaeda calceoliformis
Suaeda linearis—NYS Endangered S1
 –*Suaeda maritima*

Family **AMARANTHACEAE**

**Amaranthus albus*—Uncommon in PBPK
 *+*Amaranthus blitum*—Uncommon in PBPK
 *+*Amaranthus cruentus*
 *+*Amaranthus hybridus*
 *+*Amaranthus retroflexus*

Family **PORTULACACEAE**

Claytonia virginica
 **Portulaca oleracea*

Family **MOLLUGINACEAE**

**Mollugo verticillata*

Family **CARYOPHYLLACEAE**

*+*Agrostemma githago*—Rare in PBPK
 **Arenaria serpyllifolia*

**Cerastium fontanum*
 **Cerastium glomeratum*
 *+*Cerastium semidecandrum*
 **Dianthus armeria*
 [+*Lychnis coronaria*]
 +*Paronychia canadensis*—Rare in PBPK
 *+*Sagina japonica*
 **Sagina procumbens*
 **Saponaria officinalis*
 **Scleranthus annuus*
Silene antirrhina—Uncommon in PBPK
Silene caroliniana var. *pensylvanica*—NYS Vulnerable S3
 **Silene latifolia*
Silene stellata
 **Silene vulgaris*—Rare in PBPK
 *+*Spergularia rubra*
 *+*Spergularia salina*
 **Stellaria graminea*
 –*Stellaria longifolia*
 **Stellaria media*

Family POLYGONACEAE

*+*Polygonum arenastrum*
Polygonum arifolium
 **Polygonum aviculare*
 *+*Polygonum bellardii*
 **Polygonum cespitosum* var. *longisetum*
 *–*Polygonum convolvulus*
 *+*Polygonum cuspidatum*
 –*Polygonum erectum*—NYS: Extirpated
 **Polygonum hydropiper*
Polygonum hydropiperoides
 **Polygonum lapathifolium*
Polygonum pensylvanicum
 *+*Polygonum persicaria*
Polygonum punctatum var. *confertiflorum*—Uncommon in PBPK
Polygonum ramosissimum—Rare in PBPK
Polygonum sagittatum
 **Polygonum scandens*
Polygonum virginianum
 **Rumex acetosella*
 **Rumex crispus*
 **Rumex obtusifolius*
 **Rumex patientia*
 **Rumex salicifolius* var. *mexicanus*

Family PLUMBAGINACEAE

Limonium carolinianum

Family CLUSIACEAE

–*Hypericum boreale*
Hypericum gentianoides—Rare in PBPK
 +*Hypericum mutilum*
 **Hypericum perforatum*
Hypericum punctatum

Family TILIACEAE

Tilia americana
 [+*Tilia cordata*]

Family MALVACEAE

**Abutilon theophrasti*
 [+*Alcea rosea*]
 **Althaea officinalis*

+*Hibiscus laevis*—Extirpated in PBPK
Hibiscus moscheutos
 [+*Hibiscus syriacus*]
 *+*Malva moschata*—Extirpated in PBPK
 *+*Malva neglecta*

Family CISTACEAE

–*Helianthemum canadense*
 +*Lechea mucronata*—Uncommon in PBPK
 –*Lechea pulchella*
 +*Lechea racemulosa*—NYS Rare S3

Family VIOLACEAE

–*Viola affinis*
 –*Viola conspersa*
 –*Viola cucullata*
 **Viola odorata*
 –*Viola palmata*
 [+*Viola pedata*]
 –*Viola x porteriana*
Viola pubescens—Rare in PBPK
Viola sororia

Family CUCURBITACEAE

*+*Citrullus colocynthis*
 +*Echinocystis lobata*—Rare in PBPK
Sicyos angulatus

Family SALICACEAE

**Populus alba*
 +*Populus deltoides*
Populus grandidentata
Populus tremuloides
 [+*Salix alba*]
 [+*Salix babylonica*]
Salix discolor
 [+*Salix fragilis*]
 [+*Salix lucida*]
 +*Salix nigra*—Rare in PBPK
 +*Salix sericea*—Rare in PBPK

Family CAPPARIDACEAE

[+*Cleome hassleriana*]—Extirpated in PBPK

Family BRASSICACEAE

**Alliaria petiolata*
 *–*Allysum alyssoides*
 **Arabidopsis thaliana*
 *+*Armoracia rusticana*—Extirpated in PBPK
 **Barbarea vulgaris*
 *–*Brassica nigra*
 *+*Brassica rapa*
Cakile edentula
 **Capsella bursa-pastoris*
Cardamine bulbosa
Cardamine concatenata
Cardamine diphylla—Rare in PBPK
 *+*Cardamine hirsuta*
 –*Cardamine x maxima*
 +*Cardamine parviflora* var. *arenicola*
Cardamine pensylvanica
 +*Cardamine pratensis*—Rare in PBPK
 *+*Cardaria draba*
 *+*Diplotaxis muralis*
 *+*Diplotaxis tenuifolia*
 *+*Draba verna*

- *–*Erysimum repandum*
- **Hesperis matronalis*
- **Lepidium campestre*
- *+*Lepidium ruderalis*
- Lepidium virginicum*
- **Raphanus raphanistrum*
- **Rorippa nasturtium-aquaticum*
- **Rorippa palustris*
- **Rorippa sylvestris*
- *+*Sinapis alba*—Extirpated in PBPK
- *–*Sisymbrium altissimum*
- **Sisymbrium officinale*
- **Thlaspi arvense*—Rare in PBPK

Family **CLETHRACEAE**

Clethra alnifolia

Family **ERICACEAE**

- +*Chimaphila maculata*
- Gaylussacia baccata*
- +*Kalmia latifolia*
- Lyonia ligustrina*—Rare in PBPK
- Monotropa uniflora*
- +*Pyrola americana*—Rare in PBPK
- [+*Rhododendron maximum*]
- Rhododendron periclymenoides*
- Rhododendron viscosum*—Rare in PBPK
- Vaccinium corymbosum*
- Vaccinium pallidum*

Family **EBENACEAE**

Diospyros virginiana—Rare in PBPK; NYS Threatened S2

Family **PRIMULACEAE**

- *+*Anagallis arvensis*—Extirpated in PBPK
- +*Lysimachia ciliata*
- **Lysimachia nummularia*
- Lysimachia quadrifolia*
- Lysimachia terrestris*
- Samolus valerandi* ssp. *parviflorus*—Rare in PBPK

Family **HYDRANGEACEAE**

- *+*Philadelphus coronarius*

Family **GROSSULARIACEAE**

- **Ribes rubrum*

Family **CRASSULACEAE**

- +*Penthorum sedoides*—Uncommon in PBPK
- **Sedum album*—Rare in PBPK
- **Sedum sarmentosum*
- **Sedum telephium*

Family **SAXIFRAGACEAE**

- Chrysosplenium americanum*
- Heuchera americana*
- Saxifraga virginiana*

Family **ROSACEAE**

- Agrimonia gryposepala*
- +*Agrimonia pubescens*—Uncommon in PBPK
- +*Amelanchier arborea*
- +*Amelanchier canadensis*—Rare in PBPK
- [+*Amelanchier laevis*]

- Amelanchier stolonifera* *Aronia x prunifolia*
- *+ *Aruncus dioicus* var. *acuminatus*
- [*Crataegeus monogyna*]
- **Duchesnea indica*
- Fragaria virginiana*
- Geum canadense*
- **Malus pumila*
- *+*Potentilla argentea*
- Potentilla canadensis*
- Potentilla norvegica* ssp. *monspeliensis*
- *+*Potentilla recta*
- Potentilla simplex*
- Prunus americana*
- **Prunus avium*
- +*Prunus maritima*—Rare in PBPK
- +*Prunus persica*
- Prunus pumila* var. *depressa*—NYS Endangered S1
- Prunus serotina*
- [+*Prunus serrulata*]
- [+*Pyrus calleryana* ‘Bradford’]
- [+*Pyrus communis*]
- **Rhodotypos scandens*
- Rosa carolina*
- *+*Rosa multiflora*
- +*Rosa palustris*
- **Rosa rugosa*
- Rosa setigera*—Uncommon in PBPK
- Rosa virginiana*
- Rubus allegheniensis*
- Rubus flagellaris*
- **Rubus laciniatus*—Rare in PBPK
- Rubus occidentalis*
- **Rubus phoenicolasius*
- Rubus setosus*
- +*Spiraea alba* var. *latifolia*—Rare in PBPK
- Spiraea tomentosa*

Family **FABACEAE**

- *+*Albizia julibrissin*—Rare in PBPK
- *+*Amorpha fruticosa*—Rare in PBPK
- Amphicarpea bracteata*—Uncommon in PBPK
- Apios americana*
- Baptisia tinctoria*
- [+*Cercis canadensis*]
- Chamaecrista fasciculata*
- *+*Coronilla varia*
- Crotalaria sagittalis*—NYS Endangered S1
- Desmodium canadense*—Rare in PBPK
- +*Desmodium cuspidatum*—Extirpated in PBPK
- Desmodium humifusum*—NYS: Extirpated
- Desmodium paniculatum*
- *+*Genista tinctoria*
- [+*Gleditsia triacanthos*]
- [+*Gymnocladus dioica*]
- Lathyrus japonicus* var. *maritimus*
- [+*Lathyrus latifolius*]
- Lespedeza capitata*
- Lespedeza hirta*
- +*Lespedeza intermedia*—Rare in PBPK
- +*Lespedeza procumbens*—Uncommon in PBPK
- Lespedeza violacea*—NYS Rare S3
- Lespedeza virginica*
- **Lotus corniculata*
- **Medicago lupulina*
- **Medicago sativa*
- **Melilotus alba*
- **Melilotus officinalis*

Phaseolus polystachios—Rare in PBPK

*+*Puereria lobata*

**Robinia pseudo-acacia*

+*Strophostyles helvula*

**Trifolium arvense*—Uncommon in PBPK

*–*Trifolium aureum*

*+*Trifolium campestre*

**Trifolium hybridum*

**Trifolium pratense*

**Trifolium repens*

**Vicia cracca* ssp. *tenuifolia*

**Vicia sativa* ssp. *nigra*

*–*Vicia tetrasperma*

*–*Vicia villosa*

**Vicia tetrasperma*—Rare in PBPK

*+*Wisteria sinensis*

Family ELAEAGNACEAE

[+*Elaeagnus angustifolia*]—Extirpated in PBPK

**Elaeagnus umbellata*

Family LYTHRACEAE

+*Lythrum alatum*—Rare in PBPK

**Lythrum salicaria*

Family ONAGRACEAE

Circaea lutetiana ssp. *canadensis*

Epilobium coloratum

**Epilobium hirsutum*—Rare in PBPK

+*Ludwigia alternifolia* +

Ludwigia palustris *Oenothera biennis*

+ *Oenothera laciniata*—Extirpated; NYS Endangered S1

+*Oenothera parviflora* var. *oakesiana*—Rare; NYS Threatened S2

Oenothera perennis

Family NYSSACEAE

Nyssa sylvatica

Family CORNACEAE

+*Cornus alternifolia*—Rare in PBPK

Cornus amomum

Cornus florida

Cornus foemina ssp. *racemosa*

[+*Cornus mas*]

[+*Cornus sericea*]

Family SANTALACEAE

–*Comandra umbellata*

Family CELASTRACEAE

*+*Celastrus orbiculata*

Celastrus scandens—Rare in PBPK

[+*Euonymus alata*]

[**Euonymus europaeus*]

[+*Euonymus fortunei* var. *radicans*]

Family AQUIFOLIACEAE

[+*Ilex opaca*]

+*Ilex verticillata*

Family BUXACEAE

[+*Buxus sempervirens*]

*+*Pachysandra terminalis*

Family EUPHORBIACEAE

–*Acalypha gracilens*

Acalypha virginica var. *rhomboidea*

Chamaesyce maculata

+*Chamaesyce polygonifolia*—Rare in PBPK

**Euphorbia cyparissias*

Family RHAMNACEAE

Ceanothus americanus—Rare in PBPK

*+*Rhamnus cathartica*

**Rhamnus frangula*

Family VITACEAE

*+*Ampelopsis brevipedunculata*

Parthenocissus quinquefolia

*+*Parthenocissus tricuspidata*—Rare in PBPK

+*Vitis aestivalis*

Vitis labrusca

Family LINACEAE

*+*Linum usitatissimum*—Extirpated in PBPK

–*Linum virginianum*

Family POLYGALACEAE

–*Polygala sanguinea*

–*Polygala verticillata* var. *ambigua*

Polygala verticillata var. *isocycla*

Family SAPINDACEAE

[+*Koeleruteria paniculata*]

Family HIPPOCASTANACEAE

[+*Aesculus flava*]—Rare in PBPK

[+*Aesculus hippocastanum*]

Family ACERACEAE

*+*Acer campestre*

*+*Acer ginnala*

*+*Acer negundo*

**Acer platanoides*

**Acer pseudoplatanus*

Acer rubrum

Acer saccharinum

[+*Acer saccharum*]

Family ANACARDIACEAE

Rhus copallinum

Rhus glabra

Rhus hirta—Rare in PBPK

Toxicodendron radicans

–*Toxicodendron vernix*

Family SIMAROUBACEAE

*+*Ailanthus altissima*

Family RUTACEAE

Ptelea trifoliata—Rare in PBPK; NYS Endangered S1-S2

Family OXALIDACEAE

Oxalis stricta

–*Oxalis violacea*—NYS Threatened S2-S3

Family GERANIACEAE

*+*Erodium cicutarium*

Geranium carolinianum—Rare in PBPK
Geranium maculatum

Family **BALSAMINACEAE**

Impatiens capensis

Family **ARALIACEAE**

Aralia nudicaulis
 –*Aralia racemosa*
 *+*Aralia elata*
 *+*Hedera helix*
 –*Panax trifolius*

Family **APIACEAE**

*+*Aegopodium podagraria*
 *+*Aethusa cynapium*
Angelica venenosa—Rare in PBPK
Cicuta maculata
 *+*Conium maculatum*—Rare in PBPK
Cryptotaenia canadensis
 **Daucus carota*
Heracleum maximum
Osmorhiza longistylis
 **Pastinaca sativa*
Sanicula odorata
Sanicula marilandica
 –*Zizia aptera*
 –*Zizia aurea*

Family **GENTIANACEAE**

–*Bartonia virginica*

Family **APOCYNACEAE**

Apocynum androsaemifolium
Apocynum cannabinum var. *cannabinum*
 **Vinca minor*

Family **ASCLEPIADACEAE**

Asclepias incarnata var. *pulchra*
Asclepias purpurascens—Rare in PBPK; NYS Un-
 common S2-S3
Asclepias syriaca
Asclepias tuberosa var. *interior*—Rare in PBPK
 **Cynanchum louiseae*

Family **SOLANACEAE**

+*Datura stramonium*
 **Lycium barbarum*
 *+*Lycopersicon esculentum*
 –*Physalis heterophylla*
Solanum carolinense
 **Solanum dulcamara*
Solanum ptycanthum

Family **CONVOLVULACEAE**

**Calystegia sepium*
 **Convolvulus arvensis*
 *+*Ipomoea nil*—Extirpated in PBPK
 *+*Ipomoea purpurea*

Family **CUSCUTACEAE**

–*Cuscuta gronovii*
Cuscuta pentagona—NYS Uncommon S-3

Family **POLEMONIACEAE**

**Phlox paniculata*

Family **HYDROPHYLLACEAE**

Hydrophyllum virginianum

Family **BORAGINACEAE**

*+*Echium vulgare*—Extirpated in PBPK
 [+*Mertensia virginica*]—Extirpated in PBPK
 +*Myosotis laxa*
 +*Myosotis verna*—Rare in PBPK
 *+*Pulmonaria saccharata*—Rare in PBPK
 *+*Symphytum officinale*—Rare in PBPK

Family **VERBENACEAE**

+*Phryma leptostachya*—Rare in PBPK
Verbena hastata—Uncommon in PBPK
Verbena urticifolia

Family **LAMIACEAE**

Agastache nepetoides—Rare in PBPK; NYS Threat-
 ened S2-S3
Collinsonia canadensis
 **Glechoma hederacea*
Hedeoma pulegioides—Rare in PBPK
 *+*Lamium purpureum*
 **Leonurus cardiaca*
Lycopus americanus
Lycopus uniflorus
 +*Lycopus virginicus*
 *–*Mentha arvensis*
 –*Monarda fistulosa*
 *–*Nepeta cataria*
 –*Physostegia virginiana*
 **Prunella vulgaris*
Pycnanthemum tenuifolium
Pycnanthemum virginianum
Scutellaria lateriflora
Teucrium canadense
Trichostema dichotomum

Family **PLANTAGINACEAE**

**Plantago lanceolata*
 **Plantago major*
 –*Plantago maritima* ssp. *juncoides*—NYS Threatened
 S2-S3
Plantago rugelii
 –*Plantago virginica*

Family **OLEACEAE**

[+*Chionanthus virginicus*]—Extirpated in PBPK
 [+*Forsythia viridissima*]
Fraxinus americana
 [+*Fraxinus nigra*]
Fraxinus pennsylvanica
 **Ligustrum vulgare*
 *+*Syringa vulgaris*

Family **SCROPHULARIACEAE**

–*Agalinis maritima*
 –*Agalinis purpurea*
 –*Agalinis tenuifolia*
Aureolaria flava
 –*Aureolaria virginica*
 *+*Chaenorrhinum minus*—Rare in PBPK
Chelone glabra—Uncommon in PBPK
Gratiola neglecta
Linaria canadensis

**Linaria vulgaris*
 –*Lindernia dubia*
 *+*Mazus pumilus*
 +*Mimulus alatus*—Uncommon in PBPK; NYS Rare S-3
 +*Mimulus ringens*
Pedicularis canadensis
 *+*Penstemon digitalis*—Uncommon in PBPK
Scrophularia lanceolata
 +*Scrophularia marilandica*
 **Verbascum blatteria*
 **Verbascum thapsus*
 **Veronica arvensis*
 *+*Veronica chamaedrys*
 *+*Veronica hederifolia*
 **Veronica officinalis*
Veronica peregrina
 *+*Veronica persica*
 **Veronica serpyllifolia*
Veronicastrum virginicum—NYS Threatened S-2

Family **OROBANCHACEAE**

–*Epifagus virginiana*
Orobanche uniflora

Family **BIGNONIACEAE**

**Campsis radicans*—Rare in PBPK
 *+*Catalpa speciosa*—Rare in PBPK
 **Paulownia tomentosa*

Family **CAMPANULACEAE**

*+*Campanula rapunculoides*—Extirpated in PBPK
Lobelia inflata
 –*Lobelia spicata*
 +*Lobelia siphilitica*
 *+*Triodanis perfoliata* var. *biflora*—Rare in PBPK
Triodanis perfoliata var. *perfoliata*

Family **RUBIACEAE**

Cephalanthus occidentalis—Rare in PBPK
Galium aparine
 +*Galium circaezans*—Uncommon in PBPK
 **Galium mollugo*
 +*Galium palustre*—Rare in PBPK
 –*Galium tinctorum*
 +*Galium triflorum*
 +*Mitchella repens*—Rare in PBPK

Family **CAPRIFOLIACEAE**

+*Diervilla lonicera*—Rare in PBPK
 [+*Lonicera fragrantissima*]
 **Lonicera japonica*
 *+*Lonicera morrowii*
 *+*Lonicera x bella*
Lonicera sempervirens—Rare in PBPK
Sambucus canadensis
 [+*Symphoricarpos albus* var. *laevigatus*]—Extirpated in PBPK
Triosteum perfoliatum
Viburnum acerifolium
Viburnum dentatum var. *lucidum*
Viburnum dentatum var. *venosum*—Uncommon in PBPK; NYS Threatened S2
 **Viburnum dilatatum*
Viburnum lentago
 *+*Viburnum opulus*—Uncommon in PBPK

Viburnum prunifolium
 *+*Viburnum sieboldii*

Family **ASTERACEAE**

**Achillea millefolium* var. *lanulosa*
Ambrosia artemisiifolia
Ambrosia trifida
 –*Anaphalis margaritacea*
Antennaria plantaginifolia
 *+*Anthemis arvensis*—Rare in PBPK
 +*Anthemis cotula*
 **Arctium minus*
 *+*Artemisia annua*
 **Artemisia vulgaris*
Aster cordifolius
Aster divaricatus
Aster ericoides
Aster laevis
 +*Aster lanceolatus* var. *simplex*
Aster lateriflorus
 +*Aster lowrieanus*
Aster macrophyllus
Aster novae-angliae
Aster patens—Extirpated in PBPK
Aster paternus
 +*Aster pilosus*
 +*Aster schreberi*
 –*Aster puniceus*
Aster subulatus—Uncommon in PBPK; NYS Threatened S2
Aster tenuifolius—NYS Uncommon S3
Aster umbellatus—Rare in PBPK
 –*Aster undulatus*
Baccharis halimifolia
Bidens bipinnata—Rare in PBPK
Bidens frondosa
 *+*Bidens polylepis*—Rare in PBPK
 +*Bidens vulgata*
 *+*Carduus nutans*—Rare in PBPK
 *+*Centaurea jacea*
 *+*Centaurea maculosa*
 –*Centaurea nigra*
 **Centaurea nigrescens*
 **Cichorium intybus*
 **Cirsium arvense*
Cirsium discolor
 **Cirsium horridulum*—Uncommon in PBPK
 **Cirsium vulgare*
Conyza canadensis
 **Coreopsis lanceolata*—Extirpated in PBPK
 [+*Echinacea purpurea*]—Extirpated in PBPK
Erechtites hieracifolia
Erigeron annuus
Erigeron philadelphicus
 –*Erigeron pulchellus*
 +*Erigeron strigosus*
 +*Eupatorium dubium*
 +*Eupatorium fistulosum*
 +*Eupatorium hyssopifolium* var. *laciniatum*—Uncommon in PBPK; NYS Threatened S2
 –*Eupatorium maculatum*
Eupatorium perfoliatum
 –*Eupatorium pilosum*
Eupatorium purpureum
Eupatorium rugosum
 +*Eupatorium serotinum*—NYS Endangered S1
Eupatorium sessilifolium—Rare in PBPK

Euthamia graminifolia
 +*Euthamia tenuifolia*
 *+*Gaillardia aristata*—Extirpated in PBPK
 **Galinsoga parviflora*
 **Galinsoga quadriradiata*
Gnaphalium obtusifolium
 *+*Gnaphalium uliginosum*—Rare in PBPK
 –*Helenium flexuosum*
 *+*Helianthus annuus*—Rare in PBPK
Helianthus divaricatus
Helianthus giganteus
 –*Helianthus strumosus*
 **Helianthus tuberosus*
 –*Heliopsis helianthoides*
 *+*Heterotheca subaxillaris*—Uncommon in PBPK
 **Hieracium aurantiacum*—Extirpated in PBPK
 **Hieracium caespitosum*
 *+*Hieracium floribundum*—Rare in PBPK
 +*Hieracium kalmii*
 *+*Hieracium piloselloides*
 –*Hieracium scabrum*
Hieracium venosum
 **Hypochaeris radicata*
Iva frutescens ssp. *oraria*
 –*Krigia biflora*
Krigia virginica
Lactuca biennis
Lactuca canadensis
 +*Lactuca floridana*—Rare in PBPK; NYS Endangered S1
 **Lactuca serriola*
 *+*Lapsana communis*—Uncommon in PBPK
 **Leucanthemum vulgare*
 **Matricaria discoidea*
Mikania scandens
Pluchea odorata var. *succulenta*
Prenanthes trifoliolata—Uncommon in PBPK
 **Rudbeckia hirta* var. *pulcherrima*
 –*Rudbeckia laciniata*
 *+*Senecio vulgaris*
Solidago bicolor
Solidago caesia
Solidago canadensis var. *scabra*
Solidago juncea
 –*Solidago nemoralis*
Solidago odora
Solidago rugosa
 –*Solidago sempervirens* var. *mexicana*—NYS Endangered S1
 +*Solidago sempervirens* var. *sempervirens*
Solidago speciosa
 –*Solidago ulmifolia*
 *–*Sonchus arvensis*
 **Sonchus oleraceus*
 [+*Tagetes patula*]
 **Tanacetum vulgare*
 **Taraxacum officinale*
 **Tragopogon pratensis*
 **Tussilago farfara*
Vernonia noveboracensis
Xanthium strumarium var. *canadense*

CLASS: LILIOPSIDAFamily **ALISMATACEAE**

Alisma subcordatum
Sagittaria latifolia—Rare in PBPK

Family **ARACEAE**

Acorus americanus—Rare in PBPK
Arisaema triphyllum
Symplocarpus foetidus

Family **LEMNACEAE**

Lemna minor

Family **COMMELINACEAE**

**Commelina communis* var. *ludens*
 *+*Tradescantia virginiana*—Rare in PBPK

Family **JUNCACEAE**

Juncus acuminatus
 –*Juncus articulatus*
 +*Juncus brachycarpus*
 –*Juncus bufonius*
 –*Juncus dudleyi*
Juncus effusus var. *pylaei*
Juncus gerardii
 –*Juncus scirpoides*—NYS Endangered S1
Juncus tenuis
Luzula campestris var. *multiflora*

Family **CYPERACEAE**

Bulbostylis capillaris
 –*Carex alata*
 –*Carex amphibola* var. *turgida*
Carex annectens
 –*Carex aquatilis*
 –*Carex bebbii*
Carex blanda
 –*Carex bushii*—NYS Uncommon S3
 –*Carex buxbaumii*—NYS Threatened S2
Carex cephalophora
 –*Carex conoidea*
Carex crinita
 –*Carex digitalis*
Carex festucacea
 –*Carex granularis*
 –*Carex gynandra*
 –*Carex hirtifolia*
 +*Carex intumescens*
 +*Carex laxiflora*
Carex lurida
 –*Carex normalis*
 –*Carex pallescens*
Carex pellita
Carex pensylvanica
 –*Carex polymorpha*—NYS: Extirpated
 –*Carex projecta*
 –*Carex rosea*
 –*Carex scoparia*
 –*Carex seorsa*—NYS Threatened S3
Carex squarrosa
Carex stipata
Carex stricta
Carex swanii
Carex tribuloides
 –*Carex trisperma*
Carex vulpinoidea
 +*Cyperus diandrus*
Cyperus echinatus—Rare in PBPK; NYS Endangered S1
 *+*Cyperus esculentus* var. *macrostachyus*

- Cyperus lupulinus* ssp. *lupulinus*—NYS Threatened S2
Cyperus lupulinus ssp. *macilentus*
Cyperus strigosus
–*Eleocharis elliptica* var. *elliptica*
Eleocharis elliptica var. *pseudoptera*
–*Eleocharis halophila* - NYS Threatened S2
Eleocharis obtusa
–*Fimbristylis autumnalis*
Scirpus atrovirens
Scirpus cyperinus
+*Scirpus pendulus*
Scirpus pungens
Scirpus robustus
- Family POACEAE**
**Agrostis gigantea*
Agrostis hyemalis
+*Agrostis perennans*
*+*Aira caryophylla*
*+*Aira praecox*
*+*Alopecurus pratensis*
Andropogon gerardii
Andropogon virginicus
Anthoxanthum nitens
**Anthoxanthum odoratum*
Aristida dichotoma—Rare in PBPK
+*Aristida longespica*
**Aristida oligantha*
**Arrhenatherum elatius*
*+*Avena fatua* ssp. *sativa*
**Bromus commutatus*
*+*Bromus hordeaceus*
**Bromus inermis*
*+*Bromus sterilis*
**Bromus tectorum*
Calamagrostis canadensis
–*Calamagrostis cinnoides*
+*Cenchrus tribuloides*—Rare in PBPK; NYS Threatened S2
Cinna arundinacea
–*Cinna latifolia*
**Dactylis glomerata*
+*Danthonia compressa*
+*Danthonia spicata*
+*Deschampsia flexuosa*
**Digitaria ischaemum*
**Digitaria sanguinalis*
Distichlis spicata
**Echinochloa crusgalli*
+*Echinochloa muricata* var. *microstachya*
–*Echinochloa muricata* var. *muricata*
**Eleusine indica*
–*Elymus canadensis*
–*Elymus villosus* var. *arkansanus*
Elymus virginicus
*+*Elytrigia repens*
–*Eragrostis capillaris*
**Eragrostis cilianensis*
*+*Eragrostis minor*
Eragrostis pectinacea
Eragrostis spectabilis
**Festuca rubra*
*–*Festuca trachyphylla*
Glyceria striata
**Holcus lanatus*
*+*Hordeum jubatum*
- *+*Hordeum murinum* ssp. *leporinum*
*+*Hordeum pusillum*
Leersia oryzoides
Leersia virginica
**Lolium perenne* var. *aristatum*
**Lolium perenne* var. *perenne*
**Lolium pratense*
–*Muhlenbergia mexicana*
Muhlenbergia schreberi
–*Panicum acuminatum*
–*Panicum boscii*
Panicum capillare
Panicum clandestinum
Panicum dichotomiflorum
Panicum dichotomum
–*Panicum latifolium*
–*Panicum oligisanthes* var. *scribnerianum*
Panicum rigidulum var. *pubescens*
–*Panicum sabulorum* var. *thinum*
–*Panicum scabriusculum*—NYS Endangered S1
Panicum sphaerocarpon
–*Panicum verrucosum*
Panicum virgatum var. *spissum*
–*Panicum virgatum* var. *virgatum*
Paspalum setaceum var. *muhlenbergii*
Paspalum setaceum var. *setaceum*—NYS Threatened S2
+*Phalaris arundinacea*—
**Phleum pratense*
Phragmites australis
Piptochaetium avenaceum—Rare in PBPK
**Poa annua*
*+*Poa bulbosa*
**Poa compressa*
*+*Poa nemoralis*
**Poa pratensis*
**Poa trivialis*
*+*Puccinellia distans*
Schizachyrium scoparium ssp. *scoparium*
*+*Secale cereale*
*+*Setaria faberi*
*–*Setaria italica*
+*Setaria parviflora*—Rare in PBPK
**Setaria pumila*
**Setaria viridis*
Sorghastrum nutans
+*Spartina alterniflora*
Spartina cynosuroides—Rare in PBPK
Spartina patens
Spartina pectinata—Rare in PBPK
Sporobolus asper—Rare in PBPK
Tridens flavus
Tripsacum dactyloides—NYS Threatened S2
**Triticum aestivum*—Rare in PBPK
–*Vulpia octoflora*
*+*Vulpia myuros*
[+*Zea mays*]
- Family SPARGANIACEAE**
–*Sparganium americanum*
Sparganium eurycarpum—Rare in PBPK
- Family TYPHACEAE**
Typha angustifolia
Typha latifolia

Family **LILIACEAE**

Allium canadense
 *–*Allium schoenoprasum*
 **Allium vineale*
 **Asparagus officinalis*
 *+*Convallaria majalis*
 *+*Chionodoxa luciliae*
Erythronium americanum
 *+*Galanthus nivalis*
 **Hemerocallis fulva*
 **Hosta ventricosa*
 *+*Hyacinthoides nonscripta*
Hypoxis hirsuta
Lilium canadense—Rare in PBPK
Lilium superbum—Rare in PBPK
Maianthemum canadense
Maianthemum racemosum
 –*Medeola virginiana*
 **Muscari botryoides*
 *+*Narcissus pseudo-narcissus*
 *+*Ornithogalum umbellatum*
Polygonatum biflorum
Polygonatum commutatum—Uncommon in PBPK
 *+*Scilla siberica*
 [+*Trillium grandiflorum*]—Extirpated in PBPK
 [+*Trillium cernuum*]
Uvularia perfoliata—Rare in PBPK
Uvularia sessilifolia
Veratrum viride

Family **IRIDACEAE**

*+*Crocus* sp.
Iris prismatica—Uncommon in PBPK; NYS Threatened S2
 *+*Iris pseudacorus*
Iris versicolor—Uncommon in PBPK
Sisyrinchium angustifolium
 –*Sisyrinchium atlanticum*
 +*Sisyrinchium montanum*

Family **AGAVACEAE**

*+*Yucca filamentosa*

Family **SMILACACEAE**

Smilax glauca
Smilax herbacea
Smilax rotundifolia

Family **DIOSCOREACEAE**

Dioscorea villosa—Rare in PBPK

Family **ORCHIDACEAE**

*+*Epipactis helleborine*
 –*Plantanthera lacera*
Spiranthes cernua—No specimen collected; Extirpated in PBPK
 –*Spiranthes vernalis* - NYS Endangered S1