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The Value of Native Plants[1]

What is a 'Native' Plant? What is Biodiversity?

If one asks five different people "What is a native plant?", one is likely to get five different answers. Defining "native" in geographic terms is complicated and not necessarily suited to protecting indigenous flora. Since the 1970s with the creation of the Federal Endangered Species Act, the United States has attempted to save native flora, with mixed success. The standard approach has been to use geographic or political boundaries to conserve native plants; for example: New York State Environmental Conservation Law Section 9-1503.

New York City's Local Laws 10 and 11 of 2013 represent an evolving approach to protect our native plants by focusing on biodiversity, rather than individual plant species, and reflects an increased understanding of plant conservation. A focus on biology is a better way to understand what is native and how best to protect native populations. Seen through this lens, the protection of native plants is linked with the protection and sustainability of ecosystems.

Biological diversity, or biodiversity, is the richness of species, both animal and plant, that occupy a given ecosystem. Taken out of the context of the ecosystem, biodiversity has little biological meaning. This is recognized both in the present law, and in the commonly accepted definition of native species from Federal Executive Order 13112: "....."**native species' shall mean, with respect to a particular ecosystem, a species that, other than as the result of introduction, historically occurred or currently occurs in that ecosystem.**"

The more intact an ecosystem the more species richness there is, and the greater its resiliency - its ability to recover from the minor and major perturbations of weather, biological invasion, and other disturbances. As species and their assemblages are lost, the ecosystem begins to unravel, and the ability of the ecosystem to endure and recover from disturbance is lessened. Unmitigated, the systems collapse, and even if the ecosystems appear superficially unchanged, their functionality - their ability to deliver ecological services, whether carbon sequestration, food and shelter for wildlife, retention and cleaning of stormwater, or lowering of the heat island effect - is compromised.

Seeking to increase the biodiversity, and thus resiliency of an ecosystem, is the primary and most effective means of protecting native plants. Conversely, biodiversity cannot be increased by randomly planting additional species of plants or introducing new animals into the ecosystems. Ecosystems are groupings of species that have evolved over time, often millennia. As the eminent biologist E.O. Wilson states in his defense of biodiversity:

"…diversity, the property that makes resilience possible, is vulnerable to blows that are greater than natural perturbations. It can be eroded away fragment by fragment, and irreversibly so if the abnormal stress is unrelieved. This vulnerability stems from *life's composition as swarms of species of limited geographical distribution. Every habitat, from*

[1] This document originally appeared in the 2nd edition of the Native Species Planting Guide

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Brazilian rain forest to Antarctic bay to thermal vent, harbors a unique combination of plants and animals. Each kind of plant and animal living there is linked in the food web to only a small part of the other species. Eliminate one species, and another increases in number to take its place. Eliminate a great many species, and the local ecosystem starts to decay visibly." (Wilson, E.O., *The Diversity of Life, 1985.*) [Emphasis added]

New York City Local laws 10 and 11 of 2013 serve the important purpose of requiring Parks to maximize its efforts to increase the biodiversity of functioning ecosystems in New York City. While planting native species outside of well-functioning ecosystems will not increase biodiversity it does not mean that those species cannot still provide habitat for bird, animal, and insect species as well as aesthetic value throughout the urban environment. Furthermore, it is the philosophy of Parks to enhance the proportion of native species throughout the built city when appropriate.

Natural New York

Understanding the current state of biodiversity in New York City's ecosystems requires an understanding of the historical natural forces that shaped these ecosystems and the effect that development of the built city has had on these ecosystems. With this knowledge we can formulate the best plans to save and increase species richness in our surviving ecosystems.

New York City is a coastal city, at the edge of a continent, and at temperate latitudes. These geographic and climatic conditions have been uninterrupted for thousands of years and have yielded a landscape of primarily forested ecosystems which give way at the continent's edge to coastal grasslands and salt marshes.

The last glacial ice age ended between ten to twenty thousand years ago. Before the retreat, however, glaciers had wiped clean the slate of local vegetation and forced plant species to retreat southward where they survived until the climate warmed. As the glaciers retreated and the climate warmed, plant species expanded their range northwards again, re-assembling into the ecosystems of the present day. We know that some species were still rebounding into modern times, expanding their ranges in an inexorable, slow, and methodical process.

The withdrawal of the glaciers left its physical mark on the future city as well. Chief among these events was the creation of ridges - terminal end moraines which formed high ground through portions of Queens, Brooklyn, and Staten Island. These moraines have characteristic soils that support specific ecosystems, remnants of which still exist in these boroughs. Similarly, to the east of these moraines, large glacial outwash plains formed, consisting to various degrees of gravels or sands, which also came to shape the natural city.

Climate has also played a significant role in shaping local plant populations. Many southern species find their present day northern limit here in New York City. Similarly, some species with northern distributions find their southern limit here as well. In New York City there are many examples of species at the edges of their range.

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New York City is a city of islands: Queens and Brooklyn (being the western extent of Long Island), Staten Island, and Manhattan (being virtually an island, although technically a peninsula). Only the Bronx is contiguous with the continental United States. Islands have a significant effect on biodiversity or species richness, both through physical isolation and by virtue of the island's size.

All of these factors, and more, have come together over evolutionary time to create the present day ecosystems that constitute New York City. However, development has left virtually all of these ecosystems as isolated remnants, far smaller than their original size. Utilizing *The Ecological Communities of New York State* by Carol Reschke, Parks' Greenbelt Native Plant Center (GNPC) staff has identified 28 natural ecosystems still distinguishable within New York City's borders. Many are fragmented and compromised, and only recognizable to trained botanists, but many others are intact.

Historical and Present Plant Surveys

New York City has always been a center of botanical exploration and expertise. Many of the 19th and 20th Century's leading botanists were either born or worked here and as a result we have detailed records of the species and overall numbers of species that once occurred here and good approximations of the present numbers. Many of these species were collected and preserved as dried specimens in herbaria at the New York Botanical Garden, Brooklyn Botanic Garden, and elsewhere. Based on these and other historic records we estimate that approximately 1,500 to 2,000 species likely occurred in the five boroughs of New York at the time of European colonization.

Since the early 1990s, the Brooklyn Botanic Garden, through its Metro Flora Project, has been systematically resurveying the flora of New York City and the surrounding region. Their work has revealed that there are approximately 750 species still present within our boundaries.

Utilizing historic and present day records it is possible to frame the question of what degree of biodiversity is still possible for the surviving ecosystems of our city. Does the current number represent a maximum or can we hope to manage our ecosystems better and possibly restore some of the lost species, thus increasing their biodiversity as the law instructs us to do?

What is Biodiversity? How Biodiverse Can New York City Hope to Be?

As stated previously, biological diversity, or biodiversity, is the richness of species, both animal and plant, that occupy a given ecosystem. To know what is possible we need to be aware of the theoretical boundaries to species diversity that have been established by scientists. Much of the science that reveals the extent of local biodiversity comes from studying islands.

A few key principals of island biogeography are important to consider understanding the level of biodiversity possible for New York, our 'City of Islands'. The degree of biological diversity is limited by the size of an island -- the larger the island, the more species diversity is possible. All things being equal, and with some species always being lost and new species being recruited, a dynamic equilibrium is obtained in which the overall number of species is constant for a given island of a given size.

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By the 1970s the world was awakening to the dramatic loss of habitat. These losses have turned vast tracts of ecosystems into small isolated islands of vegetation. It wasn't very long before the theories of island biogeography were seen to be of practical use in designing and setting aside bioreserves. Questions were being raised as to the optimal size for a reserve to sustainably maintain its biodiversity prior to fragmentation and isolation.

There are parallels to the bioreserve questions that are relevant to the management and sustainability of urban ecosystems. New York City ecosystems have become severely fragmented, reduced in size and biologically isolated by the development of the city. The number of species that can be contained in most of our parks is severely limited, and we cannot increase the number of species and hence the biodiversity of our ecosystems simply by cramming more species into New York City's parkland, even if those species once occurred there. Many of the ecosystems within the 5 boroughs, with good management, can move towards a new, lower dynamic equilibrium reflective of their present reduced size and isolation.

There are many critical factors promoting biodiversity that can be exploited through proper and well funded management of New York City's parkland, such as control of invasive plants and insect pests, eliminating or at least minimizing and mitigating further fragmentation of our ecosystems, protecting hydrologic regimes, and supporting healthy plant populations through sound management practices. Critical to this last point is the management of the genetic health of these remnant plant populations. Without the ability to exchange their genes between large numbers of individuals within their local population and to receive and transmit occasional novel genes with outside populations, evolution cannot proceed and much like a handful of surviving tigers managed in zoos, we will be confined to practicing sophisticated horticulture in elaborate "native" gardens, rather than land management of functioning natural ecosystems.

Parks can work in concert to manage the genetic health of New York City's remnant ecosystems by instituting a program to increase plant population size by planting additional individuals into the population. These plants must be carefully sourced to protect the genetics of the remnant population. In addition, Parks can seek to exchange and reintroduce genes from neighboring, now isolated populations. If population size can be optimized, genetic diversity increased, and ecosystem health reversed, it may be possible to reintroduce lost species to our ecosystems with a reasonable expectation that they will integrate, survive, and sustain themselves.

To paraphrase E.O. Wilson, every species is dynamically linked to a handful of other species. No species can be reintroduced without considering the complex interactions it has with other species.

A Role for Our Native Species in the Built Environment

Planting native plants outside of New York City's natural ecosystems cannot contribute to the biodiversity of these ecosystems, and is therefore not required by this manual. Indeed, outside of the Forever Wild and natural areas identified in the next chapter, emphasis will be placed on increasing the proportion of native plants used in Park plantings. We can seek to restore or increase ecosystem health and attempt to restore

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and expand ecosystems on their edges, but there is no scientific proof that planting out into the built city will benefit adjoining ecosystems.

However, it does not mean that native species cannot serve an important role in infrastructure improvements. A good example is the current experiment between Columbia University and Parks to establish green roof plantings utilizing regionally native plant species. Two regional ecosystems, Hempstead Plains and Rocky Summit ecosystems, were chosen for this experiment because they closely mimicked the conditions encountered on rooftops -- hot, well drained, and drought-prone. The project is not seeking to create extensions of Hempstead Plains and Rocky Summit ecosystems onto the roofs of New York City; it is impossible to successfully transplant the totality of these ecosystems in all their biological complexity. Rather, the project sought to exploit existing knowledge of these species as they function in their natural ecosystems to create beauty and ecosystem services on rooftops.

Parks will continue to increase its use of native species in ornamental plantings designs and in right-of-way areas as appropriate. Native species have evolved to local environmental and edaphic conditions, and many have utilitarian and aesthetic qualities that can be of service to those responsible for designing and maintaining the public landscape as well as to individual property owners who seek to enhance their own backyards or street tree pits.

Parks is fortunate to have at its disposal a facility dedicated to the propagation and production of the flora of New York City's native ecosystems – Parks Greenbelt Native Plant Center. This facility exists primarily in support of efforts to conserve, manage and restore the City's ecosystems. Furthermore, it produces plants only from locally sourced, genetically rich plant populations, which contributes significantly to maintaining the genetic integrity of New York City's surviving ecosystems- a critical factor in maintaining biodiversity. Over the twenty years of its existence, GNPC has learned to grow roughly two thirds of the species still to be found in New York City's ecosystems.

The GNPC welcomes the opportunity to make these species both better known and more available to meet the challenges we collectively face to build a sustainable and resilient city. This guide will be an excellent tool in advancing these goals.

Introduced and Naturalized Plant Species

Plant introductions have been conducted since the earliest period of Western colonization and Native American populations introduced edible and useful plants from other regions along their trade routes. However, these introductions were made into agricultural systems, or were introduced as garden ornamentals. While some introductions have reproduced aggressively and can be considered invasive, many others have adapted to local conditions and have naturalized. Ecosystems are not static, but evolving and as mentioned earlier, ecosystems lose and gain species through evolutionary time. The issue for biodiversity and sustainability of ecosystems arises from the degree to which introductions disrupt functioning ecosystems. To again quote E. O. Wilson: "Eliminate one species, and another increases in number to take its place. Eliminate a great many species, and the local ecosystem starts to decay visibly."

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Naturalized species perform valuable functions as ornamentals, provide habitat, shelter, and food for some bird, animal, and insect species.They have, however, decreased the overall diversity of the ecosystems they have colonized by displacing other species. Although they provide some ecological services, they will not function to the same degree as the species they displaced in intact ecosystems that have evolved over evolutionary time. In addition, if they have displaced specialist species that, for instance could only be pollinated by a particular bee species, then that loss will have cascaded through the ecosystem, with the potential loss of many other plant and animal species.

In highly disturbed sites, even within remnant ecosystems, introduced plants may prove better adapted to soil and hydrological conditions and this very well may merit their use, even though this is contrary to the goal of increasing the use of native plants in the city. Intelligent and informed planting design recognizes a number of complex characteristics that can't be confined to a narrow discussion of native vs. non-native origins.

Conclusion

Opportunities to increase biodiversity of New York City's existing ecosystems through planting practices will be carefully managed by New York City's land management professionals and landscape architects, and indeed we are now instructed to take concrete steps to do so. We can best meet this challenge by preserving the best of the remaining open space ecosystems that are as yet unprotected and through sound management and restoration of our surviving ecosystems.

Landscape architects and horticultural professionals exercise judgement in the specification of ornamental and native species to achieve a multitude of environmental and design goals. This guide, by presenting a selection of historically present native species, will further enhance the existing plant palette and serve to increase species diversity and the greater use of native species in various green spaces throughout the five boroughs.

"Biological diversity is the key to the maintenance of the world as we know it. Life in a local site struck down by a passing storm springs back quickly because enough diversity still exists. ……..This is the assemblage of life that took a billion years to evolve. It has eaten the storms – folded them into its genes – and created the world that created us. It holds the world steady." (Wilson, E.O., 1985)