



Gama Grass photographed in Pelham Bay Park in the Bronx.

Searching for *Green* in Gotham

The Big Apple affords wonderful opportunities to study changes in biodiversity through time.

By Robert DeCandido, PhD | Photos by author

New York City is my laboratory. When spring peepers begin chorusing in March, I am transformed from sleepy bookworm into mad scientist, keen to identify every plant and animal I find in my travels through Gotham. On starry summer nights, I creep through Central Park, in search of owls that flit from tree to tree in the shadow of skyscrapers. In autumn, I spend hours with my neck craned to the skyline, watching hawks heading south in migration. During winter, I keep warm in science libraries, thumbing through vivid accounts of wild New York written by early naturalists in whose footsteps I now follow. I am on a mission to determine what plants and animals inhabited my city in the past, and which ones live here still. Why have some species disappeared, while others flourished? Is there any rhyme or reason to these local extinctions? By answering such questions, it might be possible to develop strategies to protect our remaining biodiversity.

I know, I know. To some, New York City is regarded as the land of rats, roaches and other nasty things. Worse, many scientists don't take urban ecology studies seriously. I am often teased by those who do "serious" research in the rainforests of faraway Shangri-las. Compared to them, I feel like an outsider to real science. However, important biological information that has relevance to "wild" places can be discovered in urban areas if you know where to look. Cities like New York afford wonderful opportunities to study changes in biodiversity through time. There is often a history of investigation for particular urban locations made by naturalists dating back as far as the early 19th century, recorded in scientific papers, museum specimens and field notes. This historical record can then be compared to what still exists today in order to understand how and why changes have occurred.

Does the study of New York City's urban ecology have any relevance to other places? Absolutely. Today, most people in North America, South America, Europe and Australia live in cities. By 2025, almost two-thirds of the world's people will live in urban areas. Understanding the effects of rapid development will help conservation biologists decide what kinds of species and habitats to monitor in the coming years as urban sprawl affects natural areas throughout the world. Rather than a strange place to study nature, New York City might be the perfect laboratory to study a habitat that people, plants and wildlife share together. Understanding changes in diversity in New York City through time can shed light on the future of biodiversity everywhere.

Here in Gotham, my favorite species are wildflowers and other plants that grow in our parks. No special skills are needed to find them, and they won't run or fly

away when you do. Plants define natural areas in the five boroughs: from the meadows and woodlands of the Bronx to the ponds and forests of Staten Island, to the sandy ocean beaches and salt marshes of Brooklyn and Queens—and even to the baseball fields of Manhattan's Central Park. Native plants (those found here before Europeans arrived) tell us about what New York City was like in the past and our connection to other places near and far. For example, a native tree such as the sweetgum (*Liquidambar styraciflua*) commonly grows in moist woodlands in all five boroughs and ranges south to Guatemala. Another native species found here, skunk cabbage (*Symplocarpus foetidus*), is also native to eastern China. American chestnut (*Castanea dentata*) trees still exist in New York City and so do native orchids. We have at least one globally endangered plant, Torrey's mountain mint (*Pycnanthemum torrei*), found in fewer than 20 other locations in North America.

New York City also has many non-native plants such as dandelions, hawkweeds and bittersweet. To the casual observer, these invasive plants make natural areas in New York City look vibrant. But looks can be deceiving. These non-native plants tell a tale of disturbance and development, extinction and invasion.

Non-native plants such as purple loosestrife, Asiatic dayflower, garlic mustard and porcelainberry can outcompete native plants creating a landscape of sameness that can adversely affect birds and insects.

Some of these non-native European species are so aggressive they can sprout through the



Salt marsh in the Bronx



Asiatic dayflower

asphalt in parking lots. Alien plants such as porcelainberry (*Ampelopsis brevipedunculata*), mugwort (*Artemisia vulgaris*) and Asiatic dayflower (*Commelina communis*) have run rampant in meadows throughout the city, making it virtually impossible for native species to keep a toe-hold. We have little idea how others such as purple loosestrife (*Lythrum salicaria*) affect the diversity of our native insects and birds. Overall, in the last 50 years many of our natural areas have become dominated by a handful of non-native generalist species, creating a landscape of sameness.

As a result, we are losing the diversity that is characteristic of New York City. In order to help combat this invasion and preserve native plant species, we urban scientists needed some weapons of our own: an inventory of what plants once lived here but are now gone (extirpated), and a comprehensive list of what remains (extant). In the past two decades, my colleagues and I have

compiled a list of more than 2,100 New York City plant species, 1,369 (65%) native plants and 739 (35%) non-native. New York City is home to about 60% of the native species ever recorded in New York State—an area 150 times larger. Pockets of native plants still thrive in New York City because some of the finest natural areas were set aside as parkland



Great Lobelia

beginning in the mid 19th century, including Central Park in Manhattan and Prospect Park in Brooklyn. Most of the Bronx parks were established in 1888 as part of New York City's first environmental movement, whose motto was "More Parks Now!" By the late 19th century, clubs and organizations with strong interests in plants and wildlife had been established. These included the Torrey Botanical Club (1867), the American Museum of Natural History (1869), the Linnaean Society of New York (1878), the Staten Island Institute of Arts and Sciences (1881), the New York Botanical Garden (1891) and the Wildlife Conservation Society (1895). Today, we have a good idea of what plants and animals were previously found in each borough because of the collections, notes and writings made by members of these organizations.

Since the first comprehensive studies began, native herbaceous plants such as wildflowers, sedges and grasses have been most abun-



Helleborine orchid

dant. Approximately 30% of our botanical diversity comes from just three families of plants whose members generally prefer much sunshine. These include asters and goldenrod species (Asteraceae), grasses (Poaceae), and sedges (Cyperaceae). The abundance of species in these and similar sun-loving plant families indicates that from the 19th to mid 20th century, most of New York City's natural areas were composed of open fields and meadows. Closed canopy forests were rare. Since the Second World War, we have lost nearly half of our native herbaceous species. By comparison, only about a fifth of woody shrubs and trees have become extinct in New York City. Certain groups of our native plants have been particularly prone to extinction. Gone are the majority of our native ferns, violets, sedges, grasses, and pondweeds. We have lost 24 of the 30 species of native orchids ever found here. All 21 of the native orchids once found on Manhattan

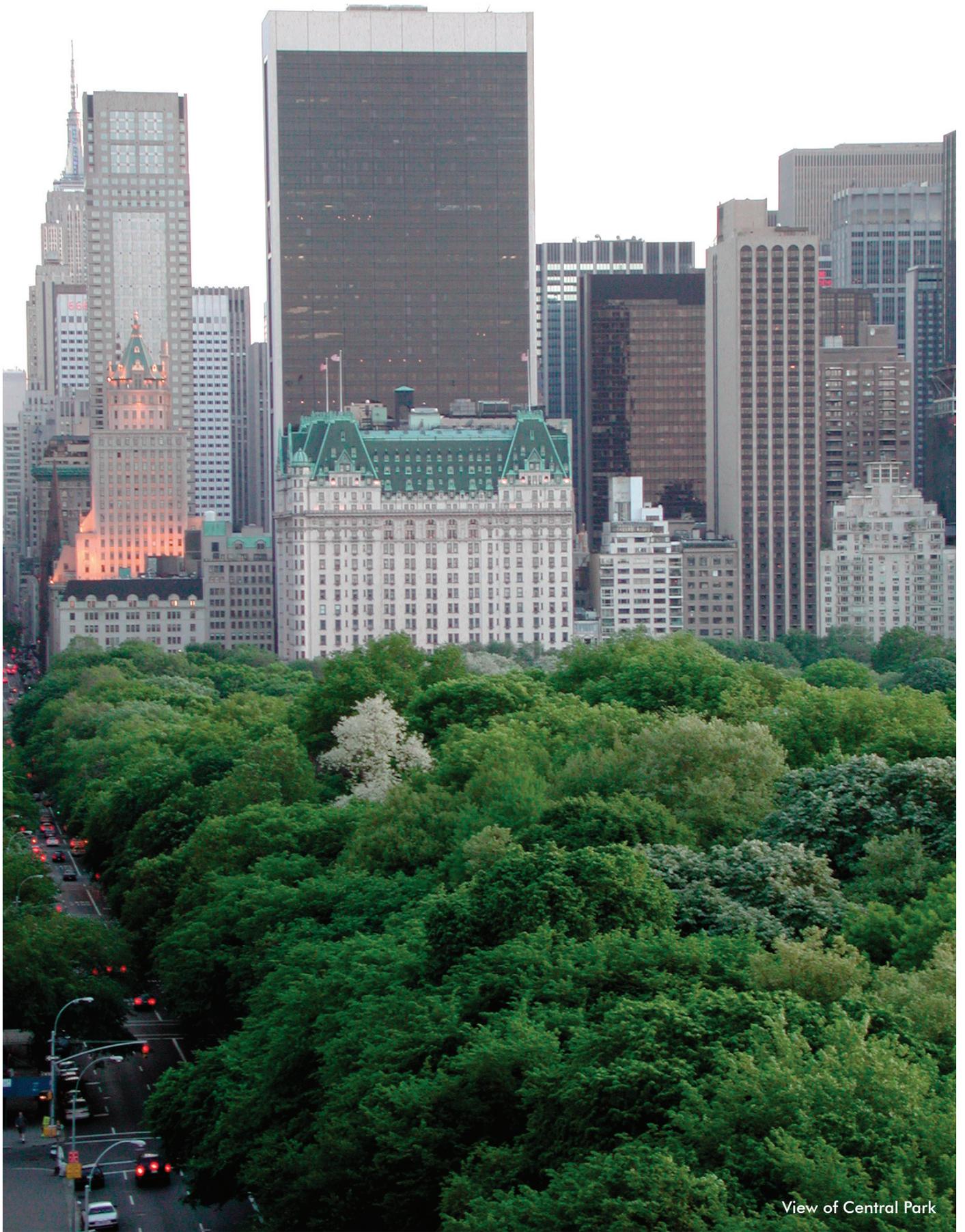
Island have been eliminated. Nine entire plant families (all composed of herbaceous species) have been extirpated from New York City. Sadly, here in the Big Apple, native herbaceous plants, especially wildflowers, appear to have a dim future for a variety of reasons.

Pockets of native plants still thrive in New York City because of its magnificent parks. Half of all the plants ever catalogued in New York State, are found in the city.

In our parks in the last 75 years, development for landfills, highway expansion, baseball fields, buildings and water treatment facilities has caused a net loss of open space for living things. Native herbaceous plants are forced to

exist on ever smaller parcels of land. Many sun-loving native plant species are being shaded out as the forest around them has matured. In the few remaining meadows and fields, our native species are losing the war of competition with aggressive non-native plants.

Increased use of city parks has had a negative effect too, especially on erodible slopes and sensitive wetlands. Perhaps the most important lesson to be learned from New York City is that the designation of an area as a park is not sufficient to ensure the preservation of its native plants, or to prevent the invasion of non-native species. This is most evident in Pelham Bay Park in the Bronx, the second largest park in New York City. Since 1947, at least 145 native plant species have been extirpated, while 136 non-native species became established during this same time frame. Every habitat in that park has a greater percentage of non-native species than just a half-century ago.



View of Central Park

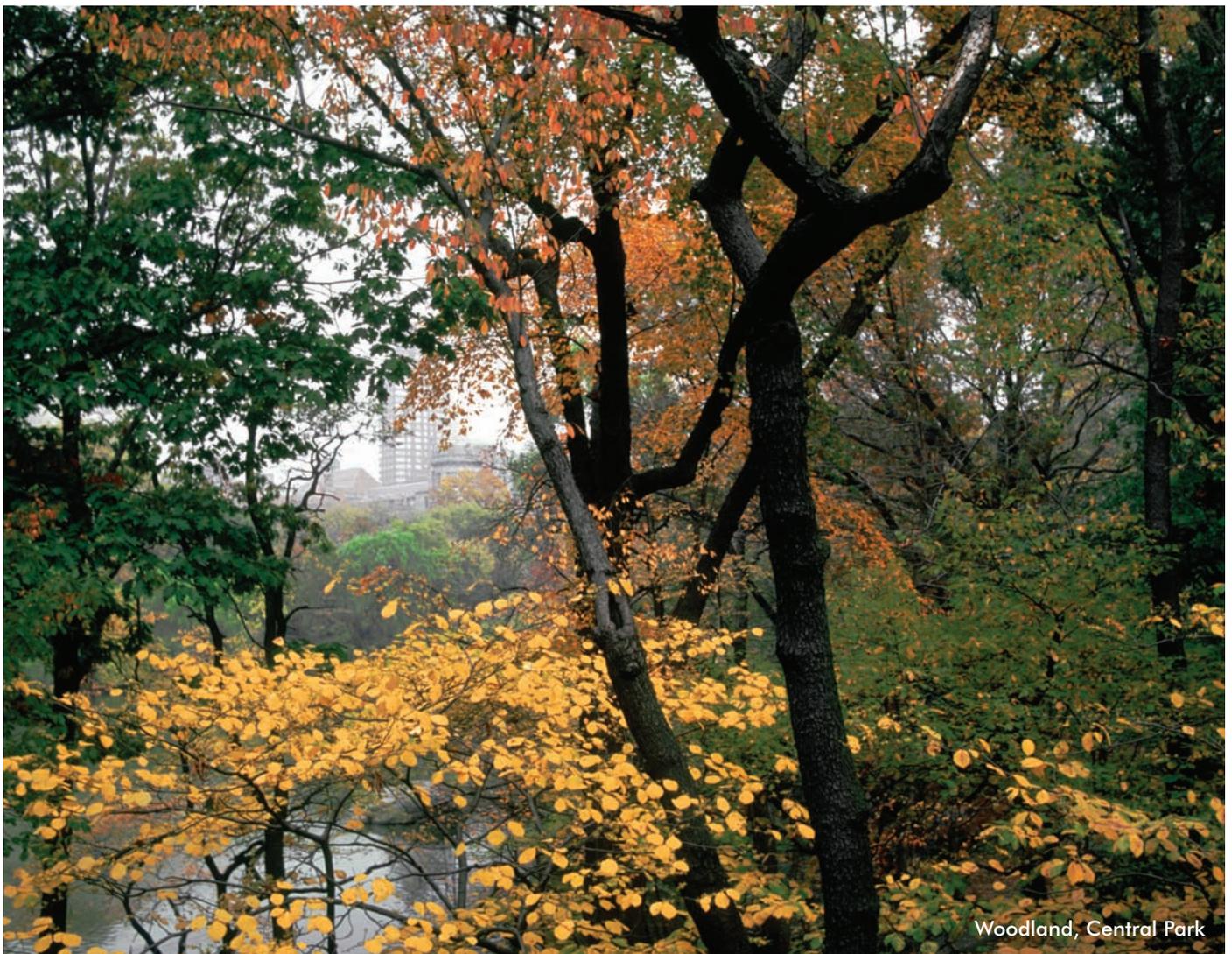
In each New York City borough, a wave of extinction threatens our native flora. Not surprisingly, Manhattan and Brooklyn, the two boroughs that developed the fastest in the 19th century, have been affected most. They have the least amount of parkland and have lost approximately 70% of their native species. Even Queens, where most parks were established from the 1920s through the 1960s, lost roughly 62% of its native flora. An alarming trend is clearly evident: in every borough except Staten Island, more native species have been eliminated than still exist. If other boroughs are any indication, the same trend is going to happen to native plant species diversity on Staten Island in the coming years.

Being a true-blue scientist with

ear pressed to the ground, I am always listening for solid ideas to help save New York City's remaining plant diversity and prevent further degradation of our natural areas.

Perhaps collecting seeds of native plants for propagation and translocation, or removing acres of non-native plants that carpet our parks could stop the loss of native species. Such endeavors are part of the solution, but we can't forget to preserve one of our most important habitats: the classroom. Growing there now are young New Yorkers in whose eyes I can read two fundamental questions: Why should we care if our native species go extinct? Why is preserving our diversity important?

These are good questions, and ones that people throughout the world are trying to answer. In the last decade, urban naturalists from as far as Italy and Russia have documented the remaining plant species of their cities, found rare native plants and published scientific papers about changes in local biodiversity. Closer to home, the "Chicago Wilderness" movement has sparked public support and fueled a wave of enthusiasm to save or restore pockets of native plants and animals in the urban environment. In more than one California city, people are working to transform abandoned landfills into meadows, wetlands and forests. Perhaps a new perspective is needed, too: besides restoring parks at street level, green space can



Garlic mustard



be created for native species atop buildings, especially in industrial areas. In New York City, just such an idea is taking root. Almost 600 acres of warehouse roofs are being planted with hardy, drought-resistant grasses and wildflowers for climate control. These and similar solutions, especially if they involve young people, are music to my ears.

Right now in New York City, a renewed environmental movement is afoot to preserve our remaining wild plants and places. Naturalist foot soldiers are combing our parks, continuing to note species new to the city. Graduate students from city universities are conducting ecological studies of urban oases. Reporters from the *Village Voice* and even the *New York Times* are reminding everyone that good

things can still be found in our town. However, the future of New York City's remaining biodiversity depends on more than the efforts of naturalists, scientists and

concerned citizens. We need to ignite the imagination of all New Yorkers, from school kids to taxi drivers to the Mayor.

Who cares about the 2,100 plant species that compose New York's parks, yards and city streets? Why is biodiversity important? I don't know, but I can hear the flowers thinking.

Urban ecologist **Dr. Robert DeCandido** was born and raised in the Bronx. He has studied bird migration, night hunting peregrine falcons, Gotham's nesting owls and American kestrels, and flora of the Big Apple.



Cardinal flower