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The Central Park Breeding Bird Census, Manhattan, New York City

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Prepared for:

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Central Park, in the midst of Manhattan in New York City, has long been known as an important and high quality birding location. Designed by the renowned architects Frederick Law Olmstead and Calvert Vaux, Central Park was envisioned to be respite from the inner city and heat of summer. Since then it has been referred to as one of the best, if not the best, place in North America to see migrating songbirds during both spring and autumn migration. In addition to migrating songbirds, there is also a fine hawk migration that includes several thousand hawks each autumn, not to mention other birds that appear on a regular basis. The importance of Central Park to birds stems from its large size, its location in the center of a very large metropolitan area, and the fact that it is has large trees covering a large proportion of its area. For these reasons, and its position near the Atlantic Coast where large numbers of migrants concentrate, Central Park is a marvelous resource for migrating birds and for birders wishing to see those birds.

Migrating birds are not the only birds that frequent Central Park. Each year, dozens of species of songbirds and some others nest within the boundaries of this urban expanse of trees, lawns, playgrounds and paths. These habitats may seem incongruous as nesting habitat, but an array of birds including invasive species, non-migrant native species, migrants that fly to the southern United States, and Neotropical migrants that fly to Central and South America. These species are a cross section of the North American avifauna and for them Central Park is home.

Despite the numbers of birders and the long history of birding, comprehensive information is not available regarding what species have territories and, or nest in Central Park. Also lacking is information on their abundance and where they are found within the Park. Despite the fact that no formal studies have been done for the entire park, there is considerable information about these birds that has not been collated or summarized. This information has been gathered by birders over several decades. Most of these birders are members of either the NYCAS or LSNY, or are NYCP&R staff. Many of their records have been published in the forms of lists or sightings in various publications.

As a first attempt to resolve the mystery of which species nest or have territories in Central Park and their abundance and distribution within the Park, the NYCAS conducted seven breeding bird censuses along the west side of the Park in 1994. Under the supervision of David Burg, about one-quarter to one-third of the park was censused in the spring and summer of 1994 using the Cornell Laboratory of Ornithology protocols for conducting breeding bird censuses. Those censuses were subsequently analyzed and collated and provide the first rigorous information on breeding bird presence, abundance, and distribution in the Park.

The information gathered in the 1994 NYCAS study demonstrated that members were very willing and capable of conducting breeding bird censuses in Central Park and that there were some very interesting birds nesting in the Park. In 1998, NYCAS and LSNY pooled their talents and efforts to undertake a complete and thorough breeding bird census of Central Park. This report summarizes that work and draws conclusions regarding the health of the Parks nesting avifauna along with recommendations for maintaining and encouraging the species that currently nest in the Park and species that could nest in the Park in the future.

Acknowledgments

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Norman Stotz, NYCAS, provided invaluable insight on various aspects of the project. Most importantly, he suggested knowledgeable members who volunteered for the project. Special thanks go to Peter Joost who helped in several ways including suggestion of specific volunteers, recruitment of volunteers, and providing significant information on the birds of Central Park. Peter also provided his expertise during the layout phase of this project.

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Finally, and most importantly, members of NYCAS and LSNY provided their time and field expertise in collecting the data that made this report possible. They also brought energy and their concern for the birds, both of which were most appreciated. A list of participants is provided in Appendix I.

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Methods

The overall methods used in the present study were according to the Cornell Laboratory of Ornithology's protocols for doing nesting bird censuses. Some modifications of those protocols were amended slightly to suit the Central Park setting and provide slightly more detailed information so that the study could be used for some other purposes than the standard census data. The modifications do not jeopardize the validity of the results in any way that makes them unacceptable to the Cornell Laboratory standards or data set.

In February of 1998 a design layout of the project was accomplished using a map that showed vegetation from a 1982 survey, in addition to trails, roads, baseball fields, buildings, the reservoir, ponds/lakes, and other structures. A total of twenty survey areas was established (Figure 1, map of park showing block locations). Hereafter referred to as "blocks," similar to but smaller than those used in breeding bird atlasing. Each block averaged about14.6 hectares (36.1 acres), and ranged in size from 7.2 hectares (17.8 acres) to 19.7 hectares (48.7 acres). Up to five volunteers were assigned to each of the blocks with an average of two people (together) visiting a block on a given day. Eight visits were made to each block commencing on 23 May and ending on 17 July 1998. Visits lasted from one hour to more than three hours. In addition to presence of individuals, several types of behaviors and physical attributes were noted: song, number of individuals, presence of a nest, carrying of food, carrying of nesting material, feeding young, young/fledglings present, and a few others. These correspond to systems used for atlasing birds. If a bird was present in the same place for three visits it was considered as a possible nester; present and singing on five visits; carrying nesting material or food, presence of nestlings/fledglings, and presence of nests were confirmation of nesting.

Modifications of the Cornell Laboratory methods were as follows. For House Sparrows, Rock Doves, and European Starlings, efforts to quantify breeding numbers of individuals were not always made. Instead, field observers noted their presence but focused on other species. To accurately assess the numbers of breeding individuals of these three invasive species would have required far too much time and effort, which would have detracted from efforts to quantify more "important" species such as the Neotropical migrants and species that are rare in the metropolitan New York area.

Results

A total of 31 species were confirmed to nest within Central Park, including 28 native species, and three aliens (House Finch was considered to be native, Table 1). One Red-tailed Hawk nest, located on a building across Fifth Avenue from the Park, was included as confirmed because most of its territory is within the Park. Another five species were noted to be possible nesters. Gadwall, Red-eyed Vireo, and White-breasted Nuthatch are three of the five that could reasonably nest, whereas Alder Flycatcher and Eastern Wood-Pewee are unlikely to nest. The habitat appears to be unsuitable for the latter species. Several species were not confirmed or listed as possible breeders that could be expected to breed, based on available habitat, their presence in other urban parks, and the fact that they were noted as visitors on several occasions. These include Barn Swallow, Black-capped Chickadee, and Brown-headed Cowbird. The last species is a nest parasite and does not occupy regular nesting territories, so it could have been overlooked. We estimate that a minimum of 34 species nest in the Park, although the total may be 40 or more. Not all of these may nest successfully or in the same years.

House Sparrows and European Starlings were without a doubt the most numerous, and Rock Doves were also very abundant. These species are alien to North America. Absolute numbers of nesting territories for these species was not determined because of the vastness of that task. In some areas, these species nested almost continuously as was the case along portions of Fifth Avenue.

American Robins were the most numerous (confirmed nestings) and widespread of native species with more than 200 nesting territories confirmed (Table 1). It was recorded in all blocks. Common Grackle was the second most numerous with 19 pairs being recorded. The next five most numerous were, in descending order, Baltimore Oriole (17 territories, 50% of all blocks), Northern Cardinal (13 (50% of all blocks), Blue Jay (13), Northern Flicker (10), and Red-bellied Woodpecker (9).

The number of species (not including House Sparrows, European Starlings, and Rock Doves) varied greatly among the 20 blocks (Table 2). For confirmed species the range was between one and 11 species. Adding probable and possible nesters the range increased to between three and 16 species . The blocks with the greatest number of species (confirmed, probable, and possible combined) included those in the most forested portions of the park, especially those in the far north and along the west side (Figure 2). The forest that includes blocks 9 through a portion of 12 ranged from nine to 14 species. Another diversity locus includes blocks 3, 4, 19, 20, and a portion of block 5. These blocks hosted between 10 and 16 species and include the Ramble and adjoining areas. Block 18 had twelve species, a high number that is explained by the Hallett Sanctuary (isolated and relatively undisturbed forest) and the pond.

Blocks with the least species were situated along the east side of the Park from block 17 through block 8 (Table 2). The reason so few species were found in these blocks is the presence of high human use facilities (buildings, ball fields, etc.).

Native Species Accounts. Accounts of the abundance and occurrence of breeding birds. The following species were assigned status as follows: Very Abundant – always can be found in fairly large numbers; Common – always can be found in some numbers; Uncommon – usually can be found in small numbers or, at least, an individual can be located; Occasional – individuals can be located, but not on all trips to the Park – species may also be restricted to small portions of the Park; Rare – may nest at such low numbers as to be virtually undetectable as nester, but individuals can be found; and Very Rare – only one found during the breeding bird census. Not all of the species are confirmed as nesting in the Park. These are considered occasional or rare and are indicated by a question mark in parentheses. Status for species listed below is for the nesting season only. Also noted are species migratory tendency: Neotropical – if they fly to Central or South America, migrant if they migrate but do not leave the continental United States, and resident if they are nonmigratory. All Neotropical migrants were noted as long distance migrants and others were noted as middle distance if they fly into the southeastern United States and, or short distance if they do not fly into the southeastern United States.

Alder Flycatcher – Very Rare (?). Listed as a possible nesting species in area 10, the Loch, this flycatcher should not be nesting in Central Park. It is a long-distance, Neotropical migrant that normally nests in swamp forests to the north and west of New York City. This individual sang regularly in a small area of the Loch, in a manner that indicated territorial advertisement or defense. The location should be visited in subsequent years to determine if the individual returns or if the species is actually nesting there.

American Crow – Uncommon. This short to middle distance migrant was confirmed in three blocks and was probably breeding in another. It was also present and possibly breeding in three other survey areas. It was also noted in other blocks and is a widespread species in the Park.

American Robin – Very Abundant. This short to middle distance migrant is the most abundant species (other than the three invasives) in the park. It nests in virtually all portions of the park. More than 200 pairs of this species were confirmed to be breeding. Nesting was confirmed in all but one block (#2), but evidence suggests that the species was possibly breeding there. In a few blocks (# 19 and 20) more than 35 territories were confirmed.

Baltimore Oriole – Uncommon. One of the few, long distance, Neotropical migrants in the park, this species is rather uncommon, although widely distributed in the Park. A total of 16 nesting pairs was confirmed in 8 blocks (40%), with possible nests in three other blocks. They prefer the more wooded habitats with smaller cleared areas.

Barn Swallow – Occasional-Rare (?). This long distance Neotropical migrant primarily forages over the Park, it was not confirmed or probable as a nester. It was observed as a visitor in five blocks. The absence of structures (buildings) may be the reason for lack of nesting. However, if those conducting the surveys did not scrutinize buildings, the species nests could be overlooked.

Black-billed Cuckoo – Rare (?). This Neotropical migrant was observed as a visitor in three blocks and is not likely a nesting species.

Black-capped Chickadee – Rare (?). Only one record of this resident, non-migrant was reported, from the southwestern corner of the Park. It was reported as a visitor and it is surprising that this species is not nesting in the Park.

Belted Kingfisher – Rare (?). A nest site was suspected on the southern edge of the Hallett Sanctuary in block 18 at the southeastern corner of the Park, but was never confirmed. Kingfishers are short-middle distance migrants that are apparently finding adequate food in the Parks ponds and lakes.

Brown-headed Cowbird – Rare. This short-middle distance migrant is a nest parasite that is credited, in part, with the decline of several species of songbirds. Very few individuals were seen, although it was possibly breeding in block 18. The species is more difficult to confirm as a nester because it does not build nests and roams until it finds a suitable host to parasitize. Based on what is known about cowbirds and their preference for lawns and open areas, Central Park was believed to host more of this species. However, the seeming absence of this species, provides a modicum of optimism for species such as Wood Thrush and others that are plagued by cowbird parasitism.

Blue Jay – Common. An edge species that is a short distance migrant or a resident, Blue Jays were confirmed in 50% of the blocks in the Park, with an average of about one pair per block.

Brown Thrasher – Rare. Only one Brown Thrasher nest was confirmed, in block 19 of the Ramble, and a second was suspected in block 19. This middle distance migrant nests in thick brush patches, so it is surprising that only one pair was found.

Cedar Waxwing – Rare. This largely frugivorous species was confirmed only in block 10, although it possibly was nesting in block 5.

Chimney Swift – Rare (?). This long distance, Neotropical migrant was not confirmed or suspected to breed, although it was seen as a visitor in several blocks. It could be nesting in buildings near the Park and use the Park as its foraging habitat. Insects are probably most numerous over the Park as opposed to over buildings.

Common Grackle – Common. Nineteen territories of this species were confirmed in nine of the 20 blocks. It was also probably nesting in one other block and possibly nesting in seven other blocks. Thus, it may be nesting in 17 of 20 (85%) blocks in the Park.

Common Yellowthroat – Occasional. Although there would seem to be enough habitat in the Park to support several or a dozen pairs of this middle distance migrant, only one territory was confirmed (block 19). It is probably nesting in block 14. It was seen as a "visitor" in eight other

blocks. As with the Brown Thrasher and some other species, the forest understory and brush areas of the Park are not extensive enough.

Downy Woodpecker – Common. Confirmed in four blocks (six pairs), this resident species is observed throughout the Park. It is probably nesting in two other blocks and possibly nesting in another three areas. At least six territories were confirmed. Competition with other cavity nesters may be the reason why so few of this species were seen.

Eastern Kingbird – Uncommon. This long distance, Neotropical migrant was confirmed in four blocks (four territories) and was possibly nesting in another block (block 12).

Eastern Wood-Pewee – Very Rare (?). Reported as possibly nesting in block 10, this long distance Neotropical migrant prefers larger forests. Some observations may have been of migrants, but the individual that established a territory in block 10 may have been aberrant. As with the Alder Flycatcher, this portion of block 10 should be checked for this species in the 1999 nesting season.

European Starling - Very Abundant. This alien species is resident or undertakes short migrations. It nests in all blocks of the Park and competes with species such as Northern Flicker and Red-bellied Woodpecker, among others, for nesting cavities.

Field Sparrow – Very Rare. Seen only one time in block 16, this short to middle distance migrant was not confirmed as having a territory within the Park. Habitat seems to be available that would be suitable to the species.

Fish Crow – Occasional. Only one territory of this short distance migrant species was confirmed (block 1), although visitors were reported from three other blocks.

Gadwall – Occasional. This short-middle distance migrant may have nested in block four, although it was also seen as a visitor to blocks three and nine. Searches earlier in the season than this breeding bird census are needed to confirm whether this species nests in the Park. It is a relatively common nester within the City.

Great Crested Flycatcher – Rare. A maximum of two nests may exist and only one was territory was confirmed for this long distance, Neotropical migrant. Confirmation was in block 10, although the possible nesters in block 11 were probably nesting. Individuals were also noted in blocks 9 and 3. Most sightings were in the far north end of the Park where the forests are most contiguous.

Gray Catbird – Common. Eight territories of this species were confirmed in six blocks of the Park and was probably breeding in three others. Possible breeding was noted in seven other blocks, so it is widespread in the Park. It was most numerous (three nests) in block 19.

Hairy Woodpecker – Rare. This resident species was found as a visitor in only two blocks and is probably not nesting.

House Finch – Uncommon. Fewer nesting House Finches were detected than suspected at the outset of the project. This resident species (that is suspected of making some short distance migrations) was confirmed in five blocks and also possibly nested in four other blocks. Only six nests were confirmed. It was noted as a visitor in several other locations in the Park. It may nest in larger numbers than confirmed by this study. Observations commencing earlier in the spring may answer this question.

House Sparrow - Very Abundant. This alien does not migrate and nests in every block of the Park.

House Wren - Uncommon. Seven territories of this small, brush-loving species were confirmed in four blocks. It was also suspected to breed in block 13. All confirmed nestings were from the northernmost forested portions of the Park (blocks nine, 10, 11, and 12). It is a short-middle distance migrant that was found mostly at the north end of the Park, and surprisingly absent from the Ramble.

Killdeer – Rare (?). Killdeer were seen in block seven, but nesting is not suspected. It might nest if there were areas that were not subject to mowing or if there were gravel areas that were not subject to extreme disturbance from vehicles, people, dogs, rats, etc.

Mallard – Common. Confirmed nesting of this species was recorded in four blocks and it was probably nesting in another (block 4). It is a very common suburban nester that can survive practically any conditions.

Mourning Dove – Common. Eight territories of this resident species were confirmed in five blocks. In another seven blocks it is a possible nester. Overall, it is widely distributed in the Park and may be more common than the numbers reported.

Mute Swan – Rare. This resident species nested successfully in the Ramble, in block 19. Individuals were also seen visiting blocks 2 and 20 (the same individuals as in block 19).

Northern Cardinal – Common. Cardinals were confirmed to be nesting in eight of the twenty blocks surveyed (40%). A total of 10 nests were confirmed for this resident species. It is also a possible nester in nine other blocks, which means that it nests throughout most of the Park.

Northern Flicker – Uncommon. Confirmation of breeding for this short-middle distance migrant occurred in seven blocks (35%), in which ten nestings were confirmed. It was also probably nesting in one other area (block 4), and possibly nesting in three other blocks. It is widely spread in the Park in small numbers.

Northern Mockingbird – Occasional. This resident species is usually common in suburban settings in the Metropolitan area, but it is not confirmed as a nesting species in the Park. It was seen as a visitor in six blocks. It is surprising that this suburban species is not nesting. Winter food supply may not be sufficient for this nonmigrant.

Red-bellied Woodpecker – Uncommon. This mainly resident species was confirmed in five (25%) of the blocks in the Park. Four territorial confirmations were from block 20 in the Ramble. It was also possibly nesting in three other blocks (4, 5, and 9).

Red-eyed Vireo – Rare (?). Long distance Neotropical migrants like this species are generally rare nesters in urban Parks. A possible nesting occurred in block four, but was unconfirmed. With the presence of so many migrants in early to mid-June, these sightings should be regarded carefully. They do nest adjacent to houses and lawns in some areas.

Red-tailed Hawk – Rare. The only hawk nest that was confirmed was the Red-tailed Hawk nest situated on a building across Fifth Avenue from the Park. A short-middle distance migrant, this species has nested for several years on the same building and its offspring or that of others can be expected to nest, or attempt to nest, in the Park or on other nearby buildings in the future. Although the nest was not in the Park, most of the territory for this nest is within Central Park, as is the foraging area.

Ring-necked Pheasant – Rare (?). This resident species is known to nest around the edges of urban environments, where people are scarce. Individuals (perhaps one bird) were observed in three blocks during the study and breeding was not confirmed.

Red-winged Blackbird – Uncommon. Five blocks were confirmed to host nesting red-wings. It was also probably nesting in blocks 2, 9, and 20, and possibly nesting in three others.

Rock Dove – Very Abundant. This alien resident species is found throughout the Park and breeds in many localities. Nesting locations for this species were recorded in only a few blocks, but it is obviously nesting in all suitable habitat.

Rough-winged Swallow – Rare. Swallows were less abundant than expected. Rough-winged Swallow nesting was confirmed in block 12 (the Meer) and the species was only seen in that block and block 4.

Song Sparrow – Occasional. Why so few of these short-middle distance migrants were confirmed is a mystery, although it may be related to an scarcity of brushy habitat. Only one nesting was confirmed (block 12) for only one nest. The species was also probably breeding in block 4.

Tufted Titmouse – Occasional. This resident species was confirmed only in one location, block 11 (the Blockhouse) where the forest is relatively large. It was also recorded as a possible nester in blocks 9 and 18. Visitors were seen far and wide in the park.

Warbling Vireo – Rare. A maximum of two nestings of this Neotropical migrant were recorded. In block 2 nesting was confirmed and in block 19 it was possible. Only one other individual was recorded.

White-breasted Nuthatch – Rare (?). Possible nesting of this resident species was noted in block 1. Another individual was noted in block 9.

Wood Thrush – Rare. Normally considered a forest interior nester, this long-distance Neotropical migrant, seems to be reproducing in small numbers in Central Park. Nesting was confirmed in block 20 (the Ramble) and another nest was possible in the Ramble. It was also recorded in four other blocks, including the adjacent block in the Ramble and another close by.

Discussion

The 1998 Breeding Bird Census for Central Park marks the completion of the largest census of breeding birds ever done. The 20 contiguous blocks cover about 341 hectares (834 acres). That it was done in an urban environment is also noteworthy. The results show that urban environments can be productive and important avian breeding areas and that with proper management and care, the long-term health of this avifauna can be insured.

Central Park hosts a diverse array of nesting birds including waterfowl (two or three species), woodpeckers (three species), songbirds, and even one diurnal raptor species. It is likely that virtually all species that nest in the park were observed, although not all were confirmed or probable nesters. In addition to the 34 species that we consider to be confirmed nesters and several others that potentially nested, there may be other species that were not detected. These latter species may not nest every year and their nests may not be successful. It should also be remembered that species that nest elsewhere in the city come to Central Park to forage and rest. These species include the harbor herons, gulls, swallows, swifts, and some others. Thus, the Park is also important to species that nest near the Park or even several miles from the Park.

Nesting species in Central Park are primarily short to middle distance migrants or residents that utilize forest edge and suburban habitats. Only a few of the species are Neotropical migrants and none of the abundant species are Neotropical migrants. Only one species, the Wood Thrush, considered to be a forest interior bird was confirmed as nesting in the Park, although Great-crested Flycatcher depends, to some degree, on forest (as do some of the other species). The fact that the American Robin, an edge species, is so common reinforces the contention that the Park is primarily a lawn, fragmented by forest patches.

Forest patches that are largest, such as those in the northwest and north central portion of the Park (Blockhouse and Loch), as well as the Ramble, host the most forest dependent species. These include Wood Thrush, Great-crested Flycatcher, and some others. These areas are also important to species such as Northern Flicker, Red-bellied Woodpecker, House Wren, and Tufted Titmouse. The Black-capped Chickadee and Tufted Titmouse, as well as the White-breasted Nuthatch are also dependent on larger trees and forest patches, but were found in numbers lower than expected based on the "look" of the habitat.

Although the diversity or richness of species found in the 20 blocks by the volunteers seems to be very accurate, there may be some bias with respect to numbers of individuals present in the blocks. The number of individuals or territories is a measure of the abundance of a species. The bias that may be present is with respect to some of the most abundant species including American Robin. Not all volunteers were as diligent or as efficient with respect to recording/reporting this species. Instead they focused on the more uncommon species, thereby missing some abundant species. The accuracy of abundance estimates provided in this report for all species except robins, House Sparrows, Rock Doves, and European Starlings, seems to be very accurate.

Recommendations

Although this study found Central Park to possess a rich and diverse array of breeding birds, the Park does not seem to be realizing its true potential as avian habitat. The fact that Central Park encompasses such a large area and that there are already relatively large tracts of suitable habitat for birds poses a marvelous opportunity for the City of New York with respect to encouraging and enhancing the nesting avifauna. Development and implementation of an avian conservation plan could increase the number of breeding species in the Park and increase the numbers of nesting pairs/territories of these species. Both would enhance the quality of birding experiences in the Park, as well as improve the park ecosystem.

The most important tool for increasing the diversity and abundance of nesting species in Central Park is habitat management/restoration. The nesting of some species that already nest in Central Park could be enhanced or encouraged In addition, some of the recommendations for these species could encourage species that are not known to nest in the Park. The recommendations are as follows.

1. Creation of a Species Watch List. Because there are several species that nest in very small numbers in the Park, a Watch List should be created. This Watch List would include Brown Thrasher, Common Yellowthroat, Great Crested Flycatcher, Northern Flicker, Song Sparrow, and Wood Thrush, although other species might also be included. These species nest in small numbers and, or require habitats that are very limited within the Park (habitats that are sensitive to change through inappropriate management). It is recommended that NYCAS, LSNY, and New York City Parks biologists form a committee to establish such a list.

2. Habitat Enhancement/Restoration and Management. Perhaps the single most important recommendation for enhancing bird habitat in Central Park is to establish a habitat enhancement and management plan that specifically focuses on the needs of nesting birds. Many of the elements of such a plan will also benefit migrants that are known to use the Park in large numbers each spring and autumn. The key elements of an enhancement/restoration and management plan are:

(1) Encourage and enhance forest understory. Much of the forested area in the park has either no understory or one that is severely damaged or dominated by plants (often alien) that do not provide habitat to brush loving birds. The elements of such a plan, if implemented would and should establishing or encouraging the growth of a forest understory. The presence of Brown Thrasher, Gray Catbird, Northern Mockingbird, Great Crested Flycatcher, House Wren, Song Sparrow, Northern Cardinal, and, perhaps, Wood Thrush, show that these species probably nest successfully in the Park and that parks such as Central Park are not completely unsuited to their reproductive endeavors. However, the paucity of brushy areas may explain why these species are present in such small numbers. By encouraging the enlargement and, or enhancement of existing brush patches, and, or the establishment of new ones where there is now grass, these species might breed in larger numbers.

(2) Increase the size and improve the quality of forests by planting a diversity of native trees and shrubs. Tree plantings around the edges of existing forests will increase the size of forest patches and provide larger areas for nesting and foraging. Shrub and tree plantings should also include species that provide fruit (hackberry, viburnums, rubus species, etc.) for year-round residents as well as migrants.

(3) Establish forested (canopy and shrub layers) corridors between habitat islands. One of the constraints for birds living in Central Park is the lack of brushy or canopy corridors that can be used to move (to forage, disperse, etc.) among forested areas. Planting trees and shrubs in strategic locations will permit movement of individuals among patches, thereby increasing the habitat available to them.

(4) Remove a few species of non-native trees (not all individuals) and replace them with native trees. Species such as Norway maple and a few other alien species are utterly worthless as anything but shade trees. They can be replaced by natives (or even alien species) that will be less injurious to the forest and more friendly to the birds (and other animals and plants) of the forest.

(5) Provide more and denser patches of coniferous trees. Larger and denser stands of evergreens such as spruces or pines will increase the availability of nesting habitat for several species, as well as provide winter and migration roosting areas for other species. Eastern red cedar, pitch pine, white pine, among others will provide greenery for winter as well as habitat for birds.

(6) Use of the Woodland Advisory Committee and professional ecologists should be an integral part of any management or restoration plan.

2. Nest Boxes and Structures. Perhaps the best means of attracting new nesting species and enhancing habitat for those species currently nesting is the establishment of a nest box system. Species that could benefit from nestboxes include: Black-capped Chickadees, Great-crested Flycatcher, House Wren, Northern Flicker, and other woodpeckers. With such structures, less desirable species may become a problem. Nest boxes should be checked and cleaned regularly for them to be successful. In addition, unwanted nests of House Sparrows and starlings should be removed immediately upon their discovery.

Erection of structures of various sorts might entice species like Barn Swallows, Rough-winged Swallows, and others to nest. These two species adapt readily to human types of structures. Providing overhangs at the Meer and the Loch, or in the Ramble could provide nesting substrate for Barn Swallows. Even the placement of plastic or mud nests (built by humans or elsewhere by Barn Swallows) could serve as encouragement. For Rough-winged Swallows, pipes or other types of cavities near water might work. The low abundance of these species and absence of numerous nesting individuals may also be governed by scarcity of insect forage.

The regular presence of Black-crowned Night-Herons and other long-legged waders in some portions of the Park could provide an opportunity to encourage these species to nest within the Park's boundaries. Construction of stick nests in isolated locations near water might provide the impetus for some individuals. Such nest structures could be provided in the Ramble and

elsewhere. Nest structures such as these, if placed in the forest of the Loch or Ramble, might also encourage Red-tailed Hawks to breed.

The erection/creation of nesting structures is a wonderful means of providing an activity for volunteers. From construction to maintenance and monitoring, volunteers can virtually run such a program, once established. Corporate sponsorship is also a means of providing the funding for construction and plantings.

3. Plan for a Second Breeding Bird Census. A second complete breeding bird census should be conducted in about five years. In the interim, efforts should be made to locate and confirm new species, as well as mapping there nesting territories. These efforts can be done somewhat informally, although the records should be centralized and kept on some sort of data form. Such a form would simply include dates of observation, the species, what was observed (nest, copulation, feeding young, fledglings, etc.), and location on a map. It is suggested that New York City Audubon Society create a filing system that permits confirmation (via the system used in this project) of new species and that the system be kept in a single safe location. The information from this file should be used in upcoming censuses.

4. Breeding Bird Censuses in Other New York City Parks. Using the Central Park Breeding Bird Census as a template, other city parks may be censused. Parks to focus on might include Van Cortlandt Park, Pelham Bay Park, Inwood Park, Alley Pond Park, Forest Park, and Prospect Park. (Brooklyn Bird Club has conducted informal censuses in Prospect Park for several years.) Some of these parks are too large to census completely, but critical portions of them can be the focus of breeding bird censuses. In 1998, Mariners Marsh Park in Staten Island conducted a breeding bird census using the same methodology as used in Central Park. By censusing this park and the others, a more complete overview of the nesting avifauna of city parks will be gained. In addition, the censuses will be comparable. Censuses will also provide a means of evaluating the quality of habitat of each park so that management plans are based in scientific fact and so that the results of management or restoration can be monitored in the future.

Table 1. Summary of species for which territories were located and, or nesting confirmed for Central Park, Manhattan, New York City (given in alphabetical order rather than AOU Checklist order). Numbers refer to block numbers for which bird was found in that category and numbers in parentheses refer to the number of confirmed territories. When parentheses do not appear, only one nesting (confirmed, probable, or possible) was involved.

Species	Nesting Confirmed (#Territories)	Probable	Possible	Percentage of Blocks
Alder Flycatcher			10	5
American Crow	1,3,10 (3)	5	6,9,18	35
American Robin	all but #2 (206)			100
Baltimore Oriole	4,5,10,12,13,15,19,20 (16)		6,9	50
Barn Swallow	present but unconfirmed			
Black-billed Cuckoo	present but unconfirmed			
Black-capped Chickadee	present but unconfirmed			
Belted Kingfisher			18	5
Brown-headed Cowbird	present but unconfirmed			
Blue Jay	1,3,4,5,11,14,16,17,18,20 (13)	7,9	6,8,10,15	80
Brown Thrasher	19 (1)			5
Cedar Waxwing	10 (1)		5	
Chimney Swift	present but unconfirmed			
Common Grackle	1,2,3,4,5,12,13,18,19 (19)	6	9,10,11,16,17	75
Common Yellowthroat	19 (1)	14		10
Downy Woodpecker	7,9,11,20 (6)	3	18	30
Eastern Kingbird	3,4,7,12 (4)	19	12	30
Eastern Wood-Pewee			10	5
Fish Crow	1 (1)			5
Gadwall			4	5
Great Crested Flycatcher	10 (1)	11		10
Gray Catbird	3,4,9,13,18,19 (8)	2,20	6,10,14,16	60
Hairy Woodpecker	present			
House Finch	1,5,13,18,19 (6)		4,9,15	40
House Wren	9,10,11,12 (7)		13	25
Killdeer	present but unconfirmed			

Species	Nesting Confirmed (#Territories)	Probable	Possible	Percentage of Blocks
Mallard	2,9,12,18 (5)	4		25
Mourning Dove	4,5,12,19,20 (8)		1,2,6,10,13,16	55
Mute Swan	19 (1)			5
Northern Cardinal	9,11,12,13,14,15,17,19,20 (12)	3,4,8,18,20	2,6,10	85
Northern Flicker	1,3,5,7,9,10,20 (10)	4	6,16	50
Northern Mockingbird	present but not confirmed			
Red-bellied Woodpecker	3,11,18,19,20 (9)		4,5,9	40
Red-eyed Vireo			4	5
Red-tailed Hawk	?? (1)			
Red-winged Blackbird	3,4,12,18,19 (9)	2,9,20		40
Ring-necked Pheasant	present but not confirmed			
Rough-winged Swallow	12 (1)			5
Song Sparrow	12 (1)	4		10
Tufted Titmouse	11 (1)		9,18	15
Warbling Vireo	2 (1)		19	10
White-breasted Nuthatch			1	5
Wood Thrush	20 (1)			5

European Starling, House Sparrow, and Rock Dove are not included in this list. The former two species were confirmed in all twenty areas, whereas Rock Dove probably breeds in most of the park census areas.

Table 2. Summary of numbers of nesting species in each block of Central Park, New York City, 1998. Does not include House Sparrow, European Starling, or Rock Dove.

Block in Park	Confirmed Species	Probable Species	Possible Species	Total Species
1	7	0	2	9
2	3	2	3	8
3	9	2	2	13
4	8	4	4	16
5	7	1	2	10
6	1	1	7	9
7	4	1	1	6
8	1	1	1	3
9	7	2	6	15
10	7	0	7	14
11	7	0	2	9
12	11	0	0	11
13	6	0	0	6
14	3	1	1	5
15	2	0	2	4
16	2	0	3	5
17	3	0	1	4
18	8	1	3	12
19	10	1	1	12
20	8	2	0	10

Figure 1. Map of Central Park, New York City showing the 20 blocks where breeding bird censuses were conducted, 23 May – 17 July 1998. Nesting territories are noted as four letter abbreviations for species centered on where their territories or nests were. Species that were confirmed have no asterisks, species that were probable nesters are indicated with one asterisk, and species that were possible nesters are indicated with two asterisks.

Figure 2. Map of 20 censusing blocks in Central Park including block number and number of species found in each block (not including House Sparrows, European Starlings, and Rock Doves).

Appendix I. List of participants who undertook the individual breeding bird censuses in Central Park, New York City, 23 May-17 July 1998.

Otto Adamec, Lorie Alcaide, Deborah Allen, Regina Alvarez, Karen Asakawa, Regina Barneso, Melinda and Peter Beuf, Karen Bland, Shale Brownstein, Evan Caravelli, James Cleary, Rebekah Creshkoff, Kathy Crisci, John Day, Bob DeCandido, Boker Doyle, Sarah Elliott, Tom Fiore, Marcia Fowle, Adele Gotlib, Peter Joost, Clark Judge, Jr., Jane Kashlak, Charles Kennedy, Paul Kerlinger, Ellen Kornhauser, Mary Anne McNulty, Harrison Maas, Teresa Marrero, Allen Messer, Renee Miller, Mary and Roger Morrison, Lenore and Peter Mott, Vincent Muehter, Bill Nagel, Geoffrey Nulle, Wendy Paulson, Jonathan Perez, Dorothy Poole, Hector Prud'homme, Toni Randolph, Lynn Rappaport, Sandra Reynolds, Evelyn Sanford, Roberta Schaper, Peter Shen, Kristen Stram, Pavel Sova, Corneilius Walsh, Marie Winn, Ted Zinn