

Changes in the spatial and temporal distribution of Gray Catbird (*Dumetella carolinensis*) territories in a riparian corridor of Bronx Park, NYC from 2003 to 2006 amidst floodplain and vegetation restoration

By Jacob Ward

**Introduction**

There are numerous ecological benefits to restoring riparian corridors to their natural state by removing invasive species of vegetation and planting native vegetation, although strict planning, monitoring, and management must be implemented in order to ensure local biodiversity is not disturbed. Birds can be used as environmental indicators to the quality of an area following a restoration project (Bibby 1999).

The population of the Gray Catbird in the study area for this project in northern Bronx Park, New York City declined between 2003 and 2006. In 2003, the species was found to hold the second highest number of territories in the study area behind the American Robin. By 2006, Gray Catbird territories had declined enough to drop the species to seventh on that list (NYCDPR and



**Figure 1.** Gray Catbird (*Dumetella carolinensis*)

NRG 2007). Floodplain restoration along a section of the Bronx River in the north end of the park, which included removal of the invasive shrub species Japanese knotweed, as well as others, and the planting of native flora, began in August 2004 and was completed in Spring 2005. Based on observation and data collection in the field by Principal Research Ecologist Ellen Pehek (New York City Department of Parks and Recreation (NYCDPR), Natural Resources Group (NRG)) and a review of the literature on the subject, it is presumed that the species was making habitat in Japanese knotweed (a Gray Catbird nest was found

in Japanese knotweed in late June 2003) and that its removal was a significant factor in reductions in Gray Catbird territories within the study area.

Research on Gray Catbird (*Dumetella carolinensis*) populations in various locations throughout North America has shown the species to be relatively tolerant of less than natural conditions. A species



**Figure 2.** Invasive Japanese knotweed (right of path).

named for its “meow-like” birdcall, the Gray Catbird is able to adapt to many harsh and changing environments. With a preferred habitat of low, dense shrubs, Gray Catbirds have been found to be tolerant of fragmented and isolated patches, often breeding in urban parks (Dowd 1992, Morgan et al 2007). Gray Catbirds have been found in at least one case to have higher

nesting success in invasive species of vegetation than native (Schlossberg and King 2010). Coupled with their high tolerance to human interaction and habitat alterations (provided shrubby habitat remains present), Gray Catbirds are well suited to breed in city parks, urban forested wetlands, and campgrounds (Dowd 1992).

The research question for this project is:

*Did the removal of Japanese knotweed during a floodplain restoration project completed in 2005 in the study area negatively impact Gray Catbird sub-populations between 2003 and 2006?*

To attempt to answer this question, territory maps were generated for the Gray Catbird in the study area for 2003 and 2006 using ArcGIS 10. The maps were derived from observations recorded in breeding bird surveys using the spot mapping method outlined in Bibby’s *Bird Census Techniques* (1992). Spot mapping involves a data collector recording all bird observations (seen or heard) in a simple survey

map, including relevant attributes to generate territory maps for each species. The territory maps were used to “weight” each observation as being within a confirmed, probable, or possible territory. The weighted observations were then compared to the distribution of Japanese knotweed in the study area to assess changes in the spatial distribution of Gray Catbird territories relative to changes in the spatial distribution of Japanese knotweed. The original hypothesis was that Gray Catbird sub-populations declined in areas where Japanese knotweed was removed. This was found to be true, although further research is needed to determine if other variables were influencing the species, either separate from or in combination with changes in Japanese knotweed distribution.

### Study Area

Bronx Park, owned and maintained by NYCDPR, is located in Bronx County, New York. It is the eighth largest park in New York City, at 718 acres (2.9 km<sup>2</sup>). The Bronx River runs from North White Plains, through the park, and drains into the East River at Soundview Park. The park boasts

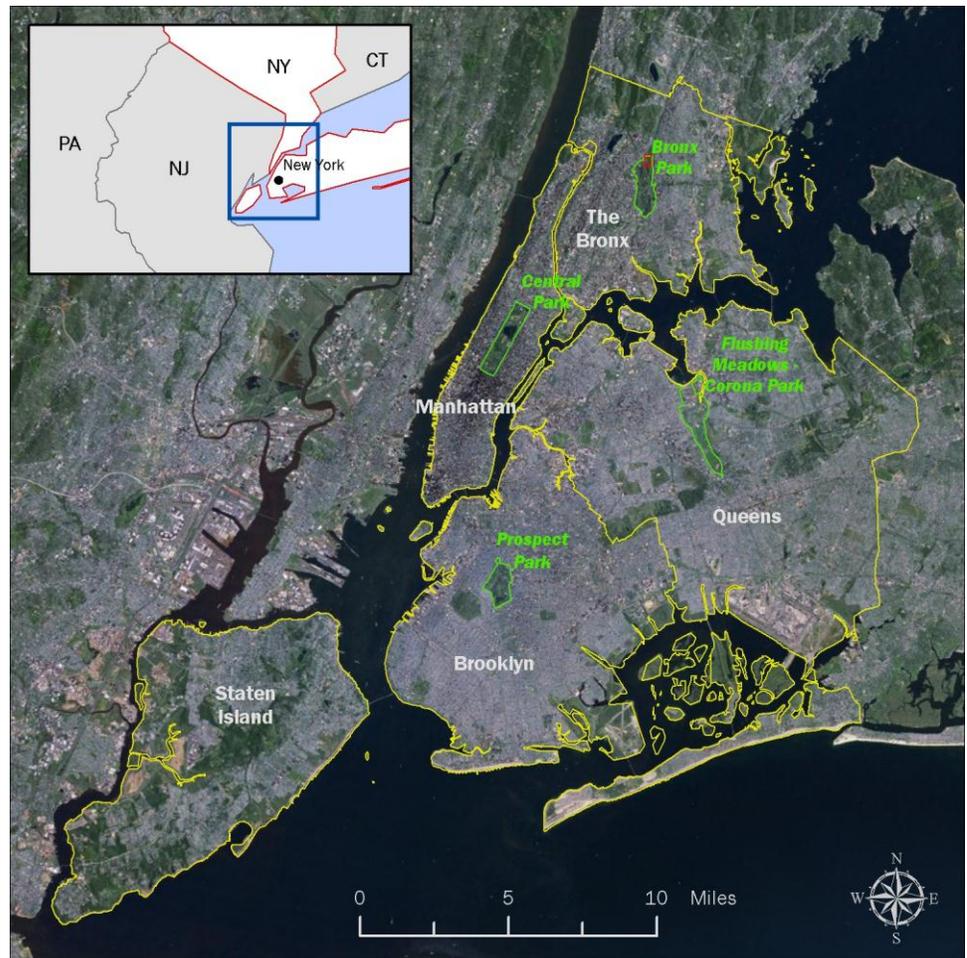
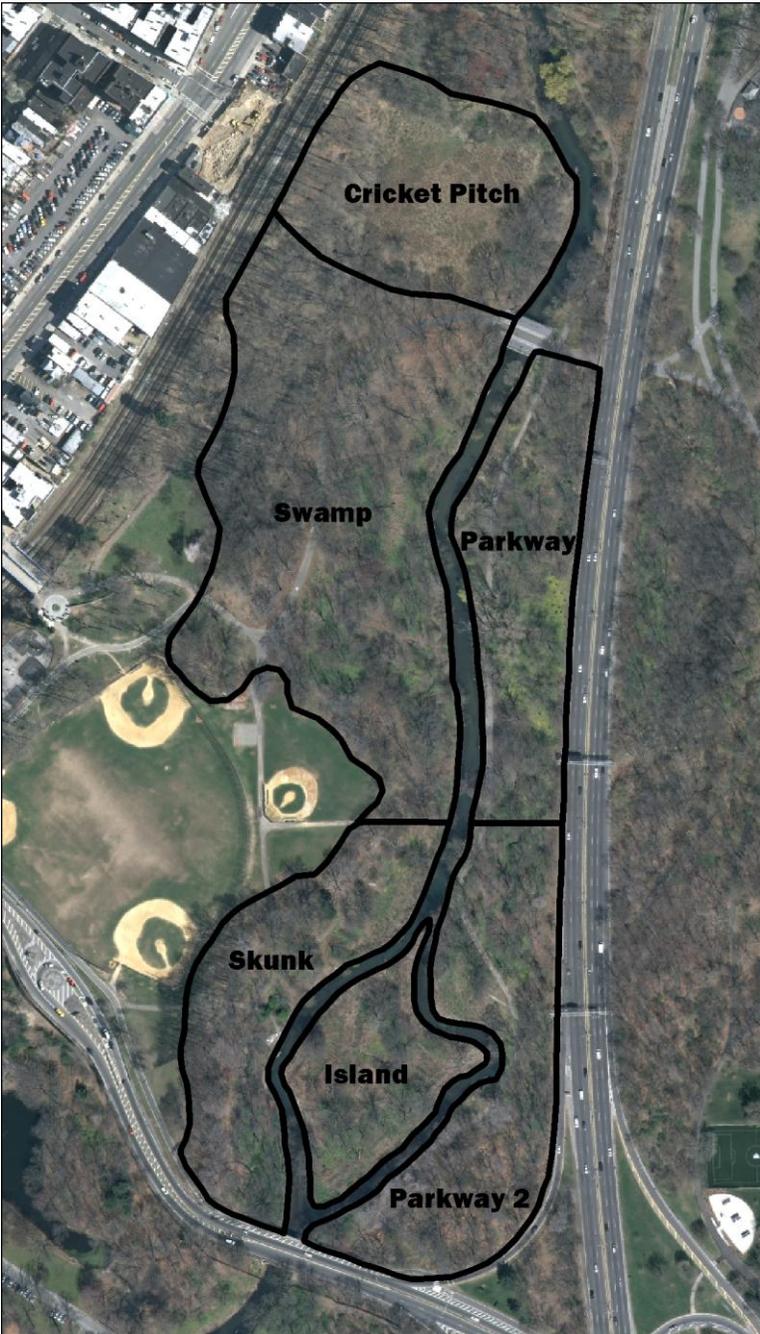


Figure 3. Location of the study area in Bronx Park, New York City.

a myriad of plants and animals that make their habitat along the banks of the 2-mile riparian corridor and in the surrounding forest. Home to the Bronx Zoo and New York Botanical Garden, as well as numerous playgrounds, athletic fields and bicycle paths, the park serves as a recreational area for surrounding residents and visitors (NYCDPR 2011).



**Figure 4.** The study area in northern Bronx Park, NYC was split into six subsections to simplify analysis.

The area of interest for this study, encompassing approximately 29 acres along an approximately 550-meter long section of the Bronx River, is located at the northern end of the park (See Figure 3). The study area has been divided into six regions in order to simplify analysis (See Figure 4). The thin strip of forest that sits between the Bronx River to the west and Bronx River Parkway to the east was divided into Parkway 1 (3.8 ac) to the north and Parkway 2 to the south (4.6 ac). The largest region is the Swamp (10.1 ac), a region of swamp forest located west of the river, adjacent to Parkway 1. South

of the Swamp region and west of the river is a strip of mature forest with skunk cabbage, mayapple, and trout lily, dubbed the Skunk region (3.9 ac). The Island region exists between the Skunk and Parkway 2 regions (2.3 ac). The northern end of the study area is capped by the Cricket Pitch (4.3 ac), a region containing an abandoned playing field that New York City's Natural Resources Group (NRG) replanted with wetland vegetation. The Cricket Pitch region was added to the study area for the 2006 bird census (NYCDPR, NRG 2007).

New York City, as well as many other areas in the eastern and northeastern U.S., has very high habitat suitability for Japanese knotweed, a highly invasive perennial weed (Barney et al 2008). Floodplain restoration along the Bronx River in the study area from 2004-2005 included the removal of large areas of Japanese knotweed to make way for the planting of native flora. The invasive species of vegetation was commonly growing in the Bronx Park study area in dense stands over eight feet tall, accelerating the natural accretion of sediment that forms along the river banks, thus limiting access to the river and visibility (NYCDPR, NRG 2007).

## **Literature Review**

Indicators can be used to quantify complex phenomena spatially and temporally to identify trends and patterns. Some basic properties of effective indicators are that they must be quantitative and non-ambiguous, simple, relevant to policy, scientifically credible, responsive to change, easily understood by non-experts, realistic to collect, and able to be analyzed. It is difficult to find indicators that meet all of these properties because they are often conflicting. Birds are considered good environmental indicators because they fulfill many of these properties. Birds are an important component of biodiversity and the preservation of biodiversity is part of environmental quality and sustainability (Bibby 1999). Since the early 1990s, the breeding bird survey has become a powerful tool in collecting information relative to breeding bird censuses, habitats, bird species interactions, and

territories. This method is cost-effective and has the potential to maximize the chances of highlighting trends relative to environmental pressures (Bibby 1999).

In a study conducted by Peak and Thompson (2006) in northeastern Missouri in the 2000-2001 breeding seasons, bird surveys were collected using the spot-mapping method to determine if narrow forested-riparian areas would have a greater density of grassland-shrub nesting species like the Gray Catbird and a lesser density of forest area-sensitive avian species. The study also sought to determine if forested-riparian areas with adjacent grassland-shrub buffer strips would have a greater density of grassland-shrub-nesting species than forested-riparian areas without adjacent grassland-shrub buffer strips (Peak and Thompson III 2006). For the Gray Catbird, a species associated with low-lying, dense, shrubby habitat (Cimprich and Moore 1995), they found that the species density was negatively associated with wide forested-riparian areas and the presence of riparian buffer strips positively affected species density.

Habitat fragmentation can often have negative impacts on the reproductive success of birds and animals. Parks in urban areas such as New York City are representative of fragmented habitats. Morgan et al. (2007) completed a study to analyze the productivity of Gray Catbirds and yellow-breasted Chats in a fragmented riparian system in southern British Columbia during the 2002-2003 breeding season. The habitat fragmentation in the study area is a result of frequent flooding, ephemeral water sources, and mountainous topography (Hejl 1992). They analyzed four large continuous riparian patches of 15-70 hectares in area, as well as five small isolated patches of less than two hectares. Analysis of spot mapping surveys collected for the 2002-2003 breeding season revealed no evidence that fragmentation or isolation of riparian habitats in a western landscape reduced reproductive success of either species. They found nesting dates to be later in the season in isolated patches, although this had no impact on reproductive success. They suggest that although quality may be similar, continuous patches may be

preferable to isolated patches simply due to the availability of more breeding resources (Morgan et al 2007).

In a complex multi-scale analysis of species-environment relationships of breeding birds in pitch pine-scrub oak habitats, Grand and Cushman (2003) found landscape level factors to be the most influential on Gray Catbird populations out of three environmental variables: plot, patch, and landscape. The landscape level variables included six different land cover classes that were abundant in their study area in Plymouth County, MA, as well as fifteen landscape configuration metrics and one class metric (percentage of landscape area held by each land cover class) at five different scales. They suggest that managing for landscape composition and configuration could benefit the Gray Catbird species, keeping in mind that landscape characteristics vary with scale.

In a two-year study conducted at two urban, forested wetlands in Staten Island, New York City, spot mapping censuses from early May to late June for the 1989 and 1990 avian breeding seasons revealed interesting results about the Gray Catbird. Destruction of wetland vegetation from construction, filling, and dumping of septic waste allowed for the introduction and spread of many invasive species of vegetation, to include *Phragmites communis*, Japanese knotweed, *Polygonum cuspidatum*, Japanese honeysuckle, *Lonicera japonica*, poison ivy, *Rhus radicans*, multiflora rose, *Rosa multiflora* and greenbrier, and *Smilax rotundifolia*. The Gray Catbird was found to tolerate nearby residential development as long as dense shrub habitat existed. At Richmond Creek, the Gray Catbird preferred dense vegetation where wetland shrubs mixed with multiflora rose and greenbrier (invasive species). At Latourette Park, the species thrived in areas of dense understory and greenbrier in areas regenerating from storm and fire destruction (Dowd 1992).

Many bird species prefer invasive plants over native plants for nesting (Hecksher 2004). In a recent study conducted by Schlossberg and King (2010) in western Massachusetts in 2004 and 2005,

they found that Gray Catbirds had higher nesting success in invasive plants than in natives. Although nesting cover was not quantified, the authors suggest that due to Catbirds having larger nests than other species in their sample, the Catbirds may have benefited from the increased cover that invasive species offer (Baicich and Harrison 1997).



for most surveys. Data were collected for 2-3 hours just after sunrise between 5:40 AM and 9:55 AM for all dates in order to make observations during times of heightened bird detectability (Shields 1977). To minimize disturbance and equally weight all regions of the study area at all times, survey routes were

rotated for each visit date within a season. Figure 5 above shows a sample breeding bird survey used in this study.

#### Data Entry and Preparation

All scanned breeding bird surveys were geo-referenced in ArcGIS 10 to the NAD83 Long Island, New York (FIPS 3104) State Plane coordinate system in US survey feet. The most current (2008) high-resolution (2-ft) orthoimagery available for the study area was used as the reference image. The imagery was downloaded from the United States Geological Survey (USGS) website using their Seamless Server. Although the



**Figure 6.** Gray Catbird observations in 2003 and 2006 in Bronx Park, New York City. Data source: New York City Department of Parks and Recreation.

breeding bird surveys contained all species observed, point features were digitized only for the Gray Catbird. Attributes recorded for the points included gender, behavior (singing, calling, flying, fighting, etc.), juvenile/adult, feeding/fledgling, weather and temperature, and start and finish times of the survey. Figure 6 above depicts the raw observations of Gray Catbird for both years in the study.

### Analysis

The first objective in this analysis was to validate the data points collected by the surveyors in 2006. NYCDPR research ecologists Ellen Pehek and Susan Stanley surveyed the study area together in 2006, but filled out their own breeding bird surveys, so both of their surveys were used to validate observations. Points found in the same general region (within 30 feet) on a given date by both observers were considered the same observation. Observations that were clearly unique (outside the 30-ft threshold) were kept in the dataset.

The second objective was to create species maps delineating possible, probable, and confirmed Gray Catbird territories in the study area for both years using the methods outlined in Chapter 3 of *Bird Census Techniques* (Bibby 1992). The basic guidelines for generating the territories are as follows:

- For a territory to be classified as *confirmed*, at least one of the following situations must have been observed:
  - Singing bird in the area on at least three consecutive visits
  - An active nest
  - Bird carrying fecal sac
  - Bird carrying food
  - Unfledged or recently fledged young
  - Distraction display or injury-feigning
- For a territory to be classified as *probable*, at least one of the following situations must have been observed:
  - Singing bird in the area on more than one visit (not necessarily consecutive)
  - Pair in suitable breeding habitat
  - Chasing of conspecifics, agitated behavior, or anxiety calls
  - Bird carrying nesting material or excavation of a nesting hole
  - Courtship and display

- For a territory to be classified as *possible*, at least one of the following situations must have been observed:
  - A singing bird within a suitable habitat on at least one site visit (NYCDPR, NRG 2007)

Tabular results exist for possible, probable, and confirmed breeding territories for the Gray Catbird for 2003, 2005, and 2006 (NYCDPR, NRG 2007). They are presented in Table 1 below.

**Table 1:** Gray Catbird territories in the Bronx River Park study area from 2003-2006

	Swamp			Parkway 1			Parkway 2			Island			Skunk		
Year	<i>Ps</i>	<i>Pr</i>	<i>Cf</i>												
<b>2003</b>	2	7	3	0	1	1	0	2	2	0	1	0	0	5	1
<b>2005</b>	2	4	0	2	3	0	0	1	1	1	1	0	1	2	2
<b>2006</b>	1	0	4	2	2	0	0	1	2	1	1	0	0	1	1

	Totals					
Year	<i>Ps</i>	<i>Pr</i>	<i>Cf</i>	<i>All</i>	<i>Pr/Cf</i>	<i>Ps = Possible</i>
<b>2003</b>	2	16	7	25	23	<i>Pr = Probable</i>
<b>2005</b>	6	11	3	20	14	<i>Cf = Confirmed</i>
<b>2006</b>	4	5	7	16	12	

Data Source: Bronx River Forest and Floodplain Restoration – Bond Act Project: Year 2 Monitoring Report. New York City Department of Parks and Recreation, Natural Resources Group. July 2007.

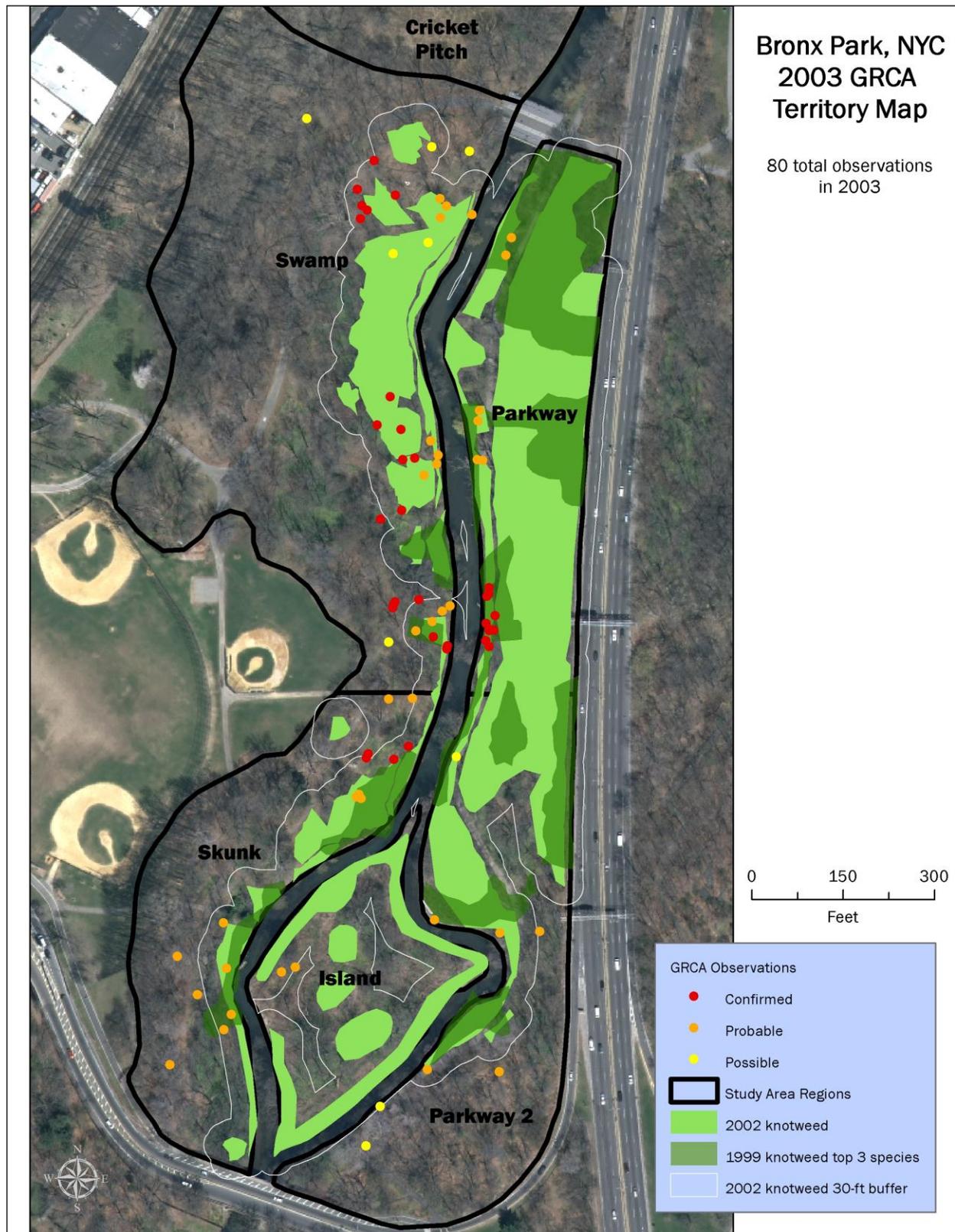
The species maps were validated using the tabular data generated in the 2007 monitoring report (See Table 1 above). Territory numbers closely matched, although were not perfect due to subjectivity of some qualitative judgments in deciding how many points to include in each territory cluster (Appendix A contains the worksheets used to delineate the Gray Catbird territories for each year). After validation, each point contained within a territory type was given a unique attribute to classify it as being within a specific territory type (i.e. confirmed territory observation).

Maps that delineate areas of Japanese knotweed for 1999 (pre-invasive species control and restoration) and 2005 (post-restoration) obtained from the Bronx River Alliance Ecological Restoration and Management Plan (2006) were then geo-referenced and digitized for use in the GIS analysis. The

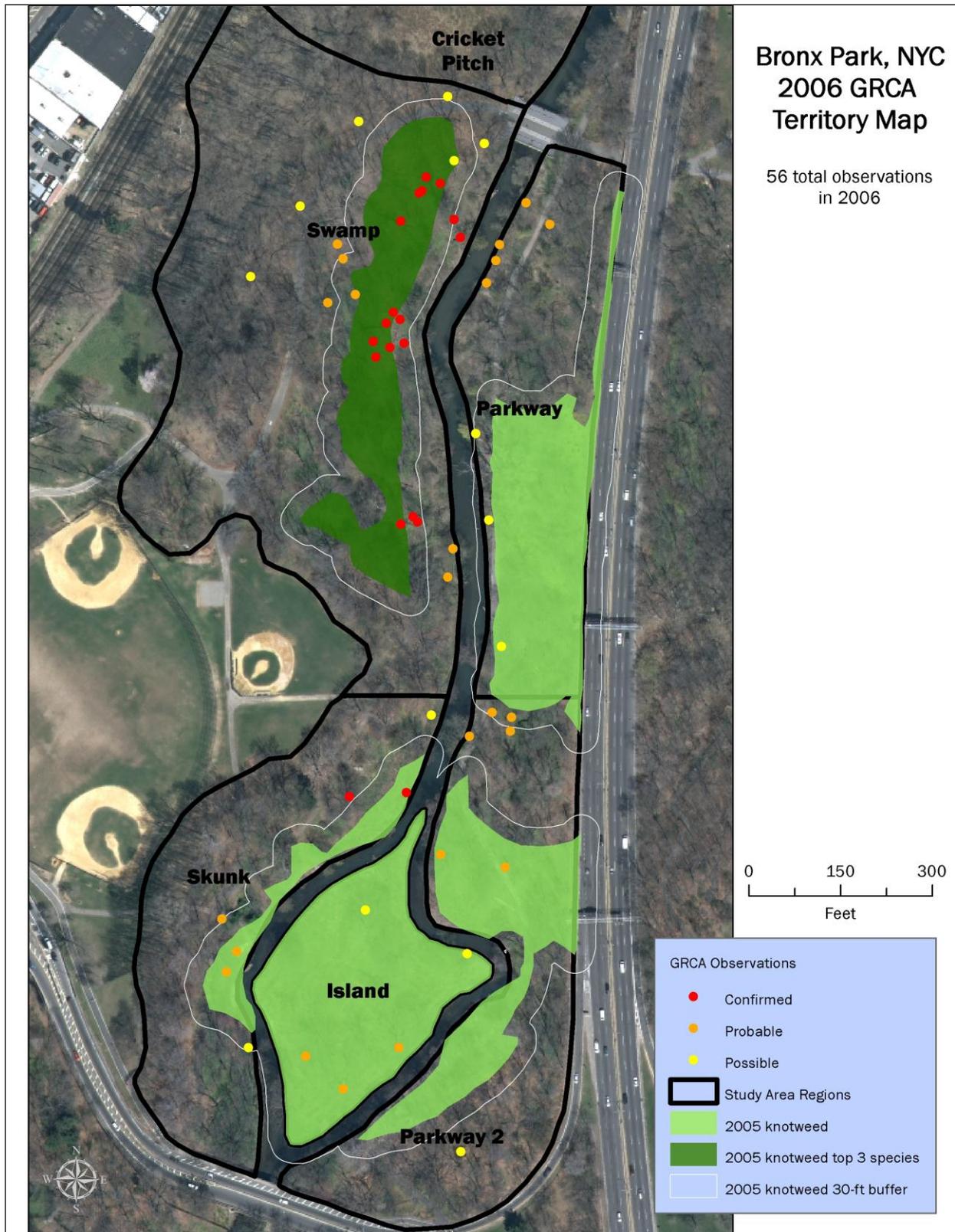
knotweed data for 2005 contained areas where knotweed was present, as well as areas where knotweed was one of the top three species of vegetation. The 2005 data were used to represent knotweed distribution in 2006 assuming similar post-restoration conditions existed for both years (NYCDPR provided a shapefile delineating areas where knotweed was present in 2002 to be used as representative of knotweed distribution in 2003, although the shapefile did not contain areas where knotweed was one of the top three species of vegetation). The 1999 knotweed data derived from the Bronx River Alliance report (2006) contained areas where knotweed was one of the top three species of vegetation. These data were used to represent composition in 2002 under the assumption that distribution of knotweed had not declined from 1999-2003.

The Gray Catbird observations classified by territory type were related to the spatial distribution of Japanese knotweed in the study area for each year using simple spatial analysis techniques in ArcGIS 10. First, 30-ft **buffers** were generated around the knotweed areas assuming some distance error exists from the process of spot-mapping to digitization. Gray Catbird observations by territory type (confirmed, probable, and, possible) were then identified within the knotweed buffer zones using the **select by location** tool. This was done for all territory types in both years for areas where knotweed was present, as well as areas where knotweed was known to be one of the top three vegetation species. The results of this analysis are presented below.

## Results



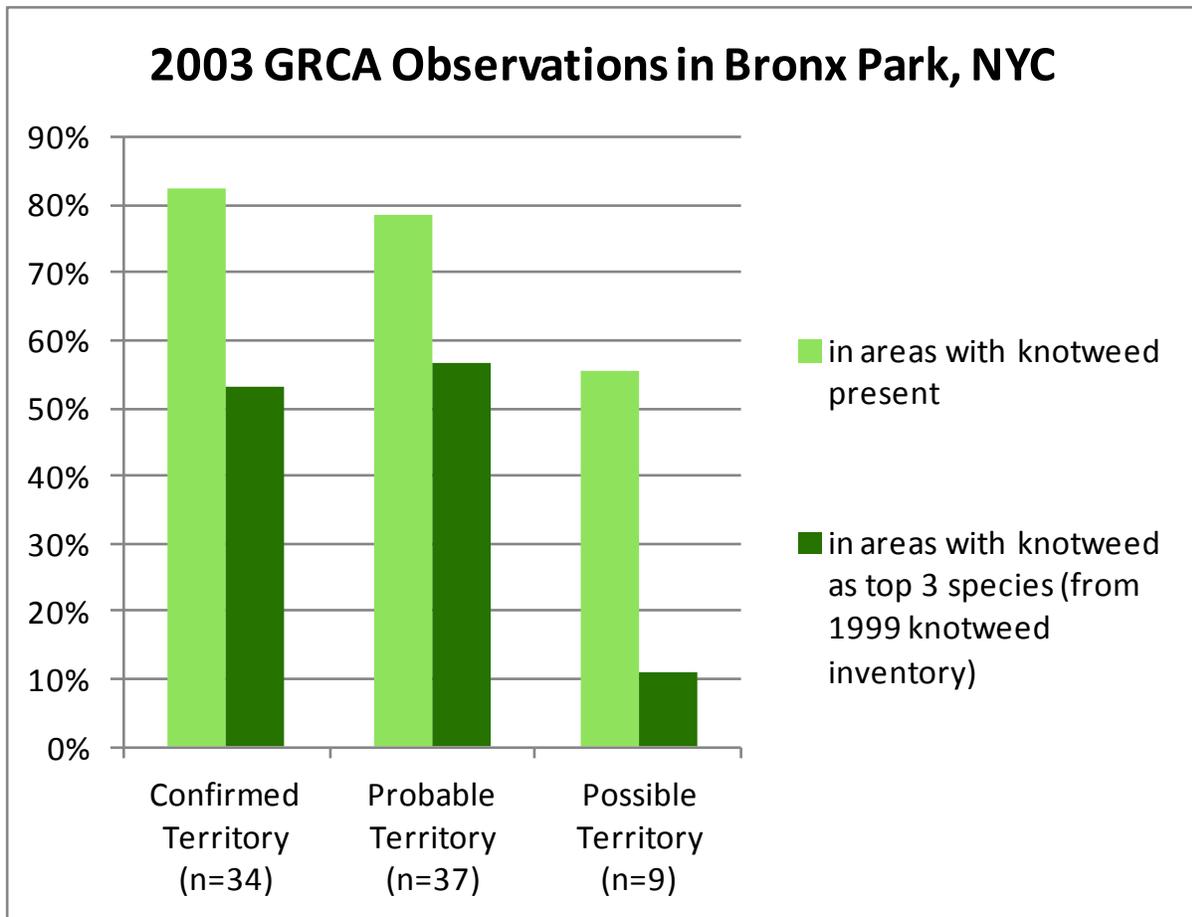
**Figure 7.** Confirmed, probable, and possible Gray Catbird (GRCA) territories in the study area in 2003 relative to distribution of Japanese knotweed. Data courtesy of the New York City Department of Parks and Recreation and the Bronx River Alliance.



**Figure 8.** Confirmed, probable, and possible Gray Catbird (GRCA) territories in the study area in 2006 relative to distribution of Japanese knotweed. Data courtesy of the New York City Department of Parks and Recreation and the Bronx River Alliance

**Table 2.** Percentages of 2003 GRCA observations found within 30 feet of Japanese knotweed (by territory classification).

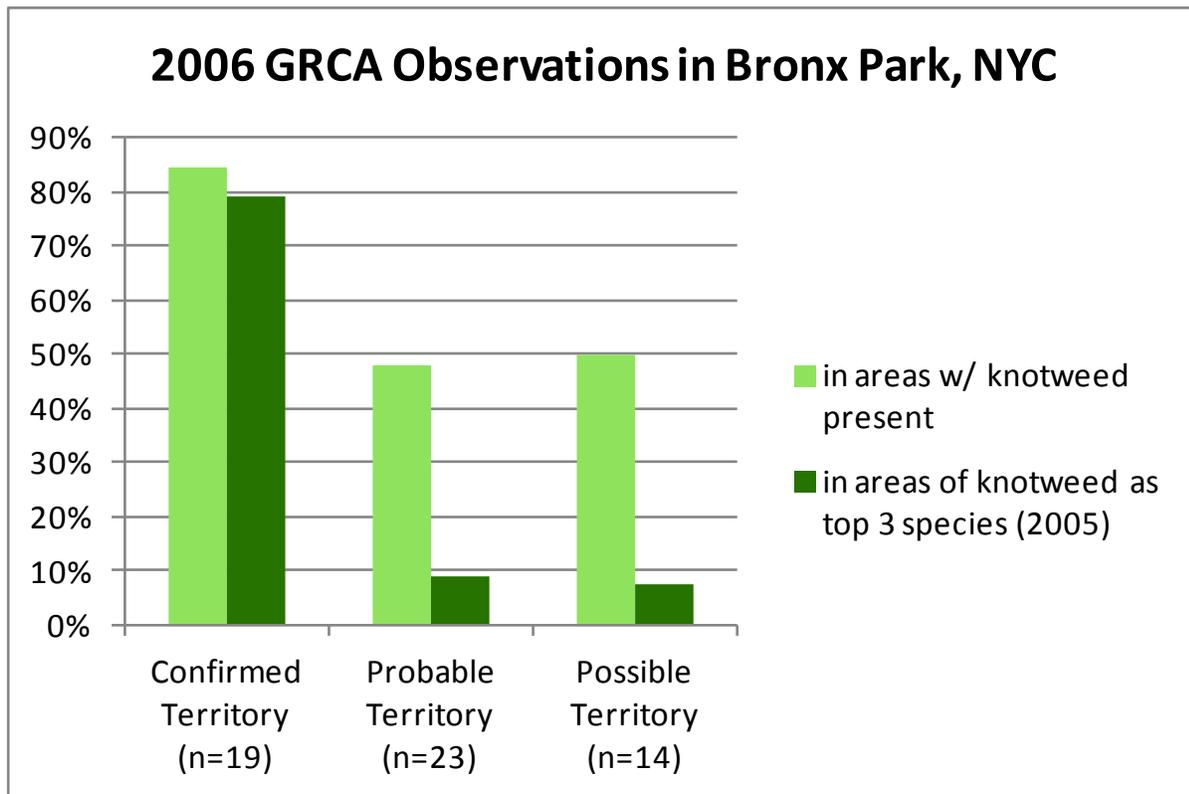
2003 GRCA Observations (n=80)	Knotweed Present (Top 3 species)	in areas with knotweed present	in areas with knotweed as top 3 species (from 1999 knotweed inventory)
<b>Confirmed Territory (n=34)</b>	28 (18)	82.4%	52.9%
<b>Probable Territory (n=37)</b>	29 (21)	78.4%	56.8%
<b>Possible Territory (n=9)</b>	5 (1)	55.6%	11.1%
<b>Total</b>	62 (40)	77.5%	50.0%



**Figure 9.** Graphed percentages of 2003 GRCA observations found within 30 feet of Japanese knotweed (by territory classification).

**Table 3.** Percentages of 2006 GRCA observations found within 30 feet of Japanese knotweed (by territory classification).

2006 GRCA Observations (n=56)	Knotweed Present (Top 3 species)	in areas with knotweed present	in areas with knotweed as top 3 species (2005)
Confirmed Territory (n=19)	16 (15)	84.2%	78.9%
Probable Territory (n=23)	11 (2)	47.8%	8.7%
Possible Territory (n=14)	7 (1)	50.0%	7.1%
<b>Total</b>	<b>34 (18)</b>	<b>60.7%</b>	<b>32.1%</b>



**Figure 10.** Graphed percentages of 2006 GRCA observations found within 30 feet of Japanese knotweed (by territory classification).

The results of the territory mapping revealed Gray Catbird (GRCA) confirmed and probable territories to be widespread throughout the Swamp region relatively close to the river in 2003. The Parkway region contained a substantial grouping of confirmed territory observations at the southern

end very close to the bank. There were two concentrated areas of probable territory within the Parkway region. The northern Skunk region contained confirmed GRCA territory, as well as probable territory distributed throughout. The Island and Parkway 2 regions contained no confirmed territories, but did contain some sparsely distributed probable territories (See Figure 7).

Confirmed and probable GRCA territories in 2003 exhibited a similar relationship to Japanese knotweed distribution in the area, both for areas with knotweed present and areas with knotweed as one of the top three vegetation species. Approximately 80% of confirmed and probable territory GRCA observations were found within 30 feet of areas where knotweed was present. 50-60% of those observations were found within 30 feet of areas where knotweed was one of the top three vegetation species. Possible territories were less associated with proximity to knotweed, especially in areas of knotweed as one of the top three species (11.1 % of possible territory GRCA observations) (See Table 2 and Figure 9).

In 2006, the Swamp region contained three substantial areas of confirmed territory GRCA observations, with one area of probable territory in the north, and possible territory observations distributed throughout the northern end of the region. The Skunk region was the only other region containing confirmed territory, located at the northern end of the region, with one probable territory near the center. The Parkway, Parkway 2, and Island regions contained few and sparsely distributed probable and possible territories. A noteworthy result of the territory analysis was that the substantial confirmed territory in the Parkway region in 2003 was absent in 2006.

Confirmed territory GRCA observations were highly associated with the distribution of Japanese knotweed in 2006. Nearly 85% of all confirmed territory observations were located within 30 feet of areas where knotweed was present and almost 80% of all confirmed territory observations were located within 30 feet of areas where knotweed was one of the top three vegetation species. Probable territory

GRCA observations were less associated with the distribution of knotweed in the study area than in 2003. Probable territory observations were much less associated with knotweed distribution than in 2003, and possible territory observations were slightly less associated (See Table 3 and Figure 10).

## **Discussion**

It was important to establish confirmed, probable, and possible Gray Catbird territories in order to more accurately identify the areas where the species was breeding in both years. The territory delineation analysis allowed for the “weighting” of separate observations in the quantitative analysis of the relationship between Gray Catbird observations and the distribution of Japanese knotweed.

It was very interesting to find that confirmed Gray Catbird territories were highly associated with the distribution of knotweed in both years. The most noteworthy results indicating this association were the increases in number of confirmed territory observations found in areas where knotweed was present, but especially in areas of knotweed in the top three species of vegetation. A corridor of knotweed *present* in 2003 in the Swamp region became an area of knotweed as the top three species of vegetation in 2006. All confirmed territories located within that corridor remained intact. A confirmed territory in the southern area of the Swamp region in 2003 located in an area of knotweed as a top three species of vegetation was absent in 2006 after the knotweed was removed. Also noteworthy is the finding that the confirmed territory in the Parkway region in 2003 (located in an area of knotweed as one of the top three species of vegetation) was absent in 2006 after the area of knotweed was downgraded to knotweed *present* after the completion of the restoration project. It is interesting that the probable and possible territories were less associated with the distribution of knotweed than confirmed territories in 2006. Gray Catbirds may have been breeding in other types of vegetation in the area in both years, but prefer the invasive knotweed.

## **Conclusion and Avenues for Further Research**

It was expected to find that Gray Catbird territories declined from 2003 to 2006 in areas where Japanese knotweed was removed based on field observation and a review of the literature. The results of this analysis provided enough evidence to conclude that the removal of Japanese knotweed was a significant factor in the population and territory decline of the Gray Catbird. More extensive research would be required to analyze the distribution of native shrub species that existed in the area before restoration and the native shrub species that were planted as part of the restoration efforts. It could then be determined what other suitable habitat existed in the area for the Gray Catbird.

It would be beneficial to look at the change in total area of native shrub vegetation in combination with the invasive species over the time period to establish if overall shrub density impacted the species. According to the Floodplain Restoration Year 2 Monitoring Report (NYCDPR, NRG 2007), the number of territories held by other bird species increased significantly, particularly for the red-winged blackbird and warbling vireo. New bird species were also found in 2006 that were not found in 2003. It would be beneficial to determine if increases in the territories of other birds and new bird species attracted to the area worked against successful breeding of Gray Catbirds (Zavaleta et al 2001).

It is yet another curiosity if the decrease of Gray Catbird population and territories had a negative impact on the environmental quality of the study area, or if the decrease in these territories was a move to be more in balance with other bird species in the area. A reduction in Gray Catbird territories may not have been a negative occurrence if biodiversity increased as a result of the floodplain restoration.

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