

NEW YORK CITY WILDLIFE EARTHWATCH RESEARCH PROJECT

2008 ANNUAL REPORT

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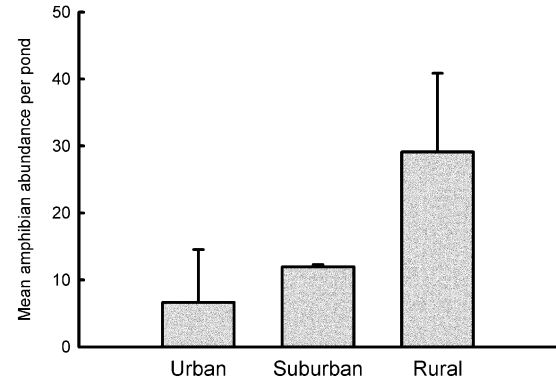
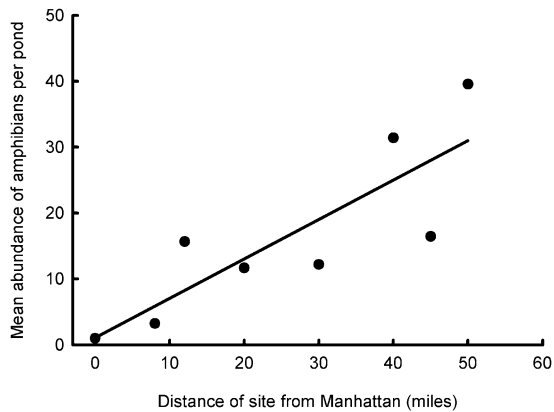
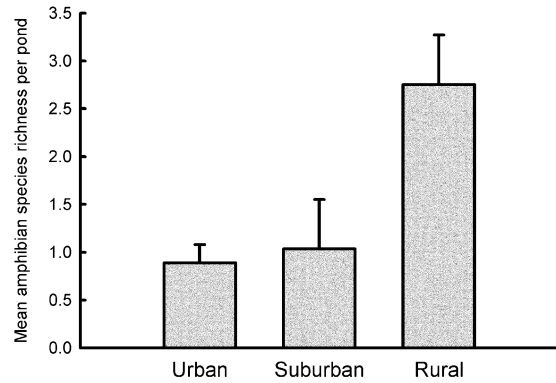
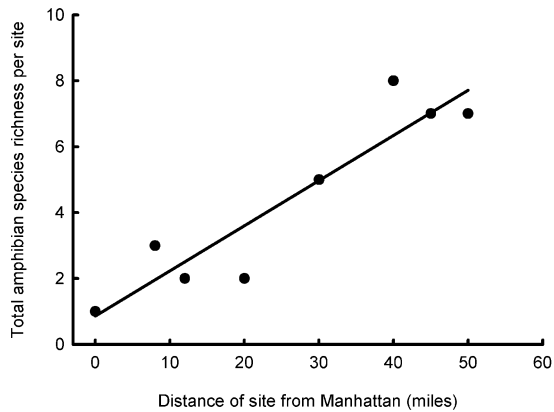
During 2008, the “New York City Wildlife” project, funded by a grant from the Earthwatch Institute to Dr. Catherine Burns was organized and carried out by a diverse team of staff research scientists (8 people), volunteers (30), park managers (8), and student interns (3), with a total of 49 participants during the 2008 field season. Project participants included volunteers and staff from across the continental USA and Alaska, as well as those from other countries, including the United Kingdom, France, Japan, and Hungary. This meant that each of the five research teams was made up of a group of people with diverse interests and experiences, which added immeasurably to the atmosphere and overall team experience.

Our primary research objective during the 2008 field season was to assess the abundance and diversity of amphibians, birds, mammals and plants at a suite of protected areas in the greater New York metropolitan area representing the gradient of urbanization from extremely urban to relatively remote, rural sites. Our research was focused on gathering information to address the following questions:

- 1) What are the human impacts on biodiversity along an urban-suburban-rural gradient?
- 2) Are there thresholds of urbanization and land use change beyond which species of concern cannot exist?
- 3) Do amphibians, birds, mammals and plants respond differently to urbanization?
- 4) Are there land use strategies that facilitate the coexistence of nature and people?
- 5) Are there specific habitat types and other features of protected areas within urban regions that are particularly important for supporting biodiversity?

While fully answering each of these questions requires at a minimum several years of data collection, we made significant progress during the 2008 field season (the project’s first season). We surveyed plants and animals at eight study sites along a 50 mile urbanization gradient stretching generally north from central Manhattan, including (with increasing distance from Manhattan): Central Park, New York Botanical Garden, Pelham Bay Park, Marshlands Conservancy, Great Swamp N.W.R., Harriman S.P., Ward Pound Ridge, and Black Rock Forest. Below I provide summary information for each of the taxonomic groups surveyed by the Earthwatch expeditions in 2008, and a preliminary assessment of the trends in the data collected this year. Following data collection in 2009 & 2010, more detailed analyses of these data will allow us to more comprehensively address the questions above.

Amphibians: Amphibian surveys were conducted at eight sites (at a total of 44 ponds) by the 2008 Earthwatch team. For all sites combined, a total of 13 species different amphibian species were identified, and nearly 900 larval and adult individuals were captured and released. The number of different species (species richness) and the number of individuals of each species (abundance) varied substantially from one site to the next, with both richness and abundance tending to increase as the distance of the site from Manhattan increased. In other words, amphibians showed a very strong negative response to increasing urbanization, as indicated in the graphs below. The amphibian species detected by our surveys ranged from fairly common species found at most sites (e.g. wood frogs,



spring peepers) to uncommon species like the blue spotted salamander which was only found at Harriman State Park. The species found during surveys of each site, and the number of larval and adult individuals, are shown in the tables below.

The addition of data from new sites in 2009 and 2010 will allow us to examine more refined relationships between the extent of urbanization (including variables like human population density, the size of a protected area, and landscape connectivity) and amphibian abundance, richness, diversity and species composition. In the future, we will also test for thresholds of urbanization beyond which amphibian species are highly impacted, and will examine whether patterns that we observed in amphibian responses to urbanization are mirrored by other taxonomic groups such as birds.

Amphibian species recorded at each site during 2008 Earthwatch surveys. An "x" indicates presence of a given species.

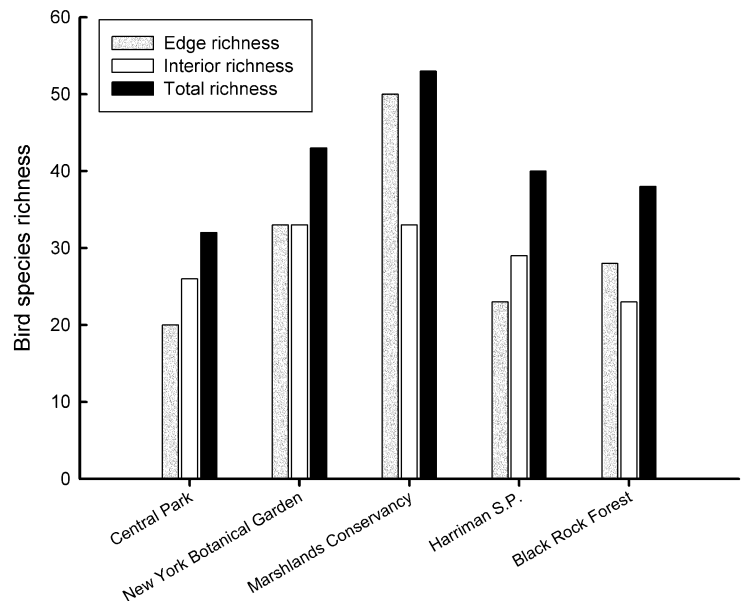
Common name	Scientific name	Central Park	New York Botanical Garden	Pelham Bay Park	Marshlands Conservancy	Great Swamp NWR	Harriman State Park	Ward Pound Ridge	Black Rock Forest
Wood frog	<i>Rana sylvatica</i>			x		x	x	x	x
Green frog	<i>Rana clamitans</i>		x		x	x		x	x
American bullfrog	<i>Rana catesbeiana</i>	x							
Pickereel frog	<i>Rana palustris</i>							x	
Spring peeper	<i>Pseudacris crucifer</i>			x		x	x	x	x
American toad	<i>Bufo americanus</i>						x		
Red spotted newt	<i>Notophthalmus viridescens</i>					x	x	x	x
Marbled salamander	<i>Ambystoma opacum</i>						x	x	x
Spotted salamander	<i>Ambystoma maculatum</i>					x	x	x	x
Blue spotted salamander	<i>Ambystoma laterale</i>						x		
Red/lead-backed salamander	<i>Plethodon cinereus</i>		x		x				x
Four-toed salamander	<i>Hemidactylium scutatum</i>						x		
Two-lined salamander	<i>Eurycea bislineata</i>		x						

Summary of amphibian data: Earthwatch 2008

Numbers indicate total numbers of adult and larval amphibians detected during timed surveys (egg masses not included)

Common name	Central Park	New York Botanical Garden	Pelham Bay Park	Marshlands Conservancy	Great Swamp N.W.R.	Black Rock Forest	Ward Pound Ridge	Harriman S.P.	ALL SITES
Wood frog	0	0	3	0	92	248	38	44	425
Green frog	0	5	0	17	2	1	12	0	37
Bull frog	1	0	0	0	0	0	0	0	1
Pickereel frog	0	0	0	0	0	0	2	0	2
Spring peeper	0	0	44	0	14	23	2	33	116
American toad	0	0	0	0	0	0	0	13	13
Red spotted newt	0	0	0	0	3	8	7	3	21
Marbled salamander	0	0	0	0	0	6	46	2	54
Spotted salamander	0	0	0	0	11	69	41	58	179
Blue spotted salamander	0	0	0	0	0	0	0	2	2
Four-toed salamander	0	0	0	0	0	0	0	2	2
Red/lead backed salamander	0	6	0	18	0	1	0	0	25
Two-lined salamander	0	2	0	0	0	0	0	0	2
# ponds sampled	1	4	3	3	10	9	9	5	44
Total richness (all ponds)	1	3	2	2	5	7	7	8	13
Mean richness per pond	1.00	1.00	0.67	0.67	1.40	2.33	3.33	2.60	NA
Total abundance (all ponds)	1	13	47	35	122	356	148	157	879
Mean abundance per pond	1.00	3.25	15.67	11.67	12.20	39.56	16.44	31.40	NA

Birds: Avian communities were surveyed using visual and auditory point-counts at each of five study sites in 2008. At each study site, 10 points were surveyed that were classified as “interior” points (those more than 150 m from park boundaries) and 10 points that were classified as exterior, or “edge” points (those less than 150 m from a park boundary). The bird team identified a total of 86 species of birds during these surveys (see attached chart). The bird species detected ranged from very common species, such as the American Robin, American Goldfinch and Blue Jay, to rarer species only detected at one site (e.g. Black-throated Blue Warbler and Cerulean Warbler, both only observed at Black Rock Forest, our most rural site). Species richness was lowest at Central Park (32 species), intermediate at Black Rock Forest (38), Harriman S.P. (40) and the New York Botanical Garden (43), and was highest at Marshlands Conservancy (53). Avian richness was not strikingly different for edge vs. interior points, with the exception of Marshlands Conservancy (see graph at right). At this site, the richness of birds at edge points was much higher than that at interior points, primarily due to shorebird species found only along the coastal park boundaries. In-depth analysis of the impacts of urbanization on the avian community will require the addition of data from sites in the coming years, but the data collected during 2008 represents the critical first steps towards accomplishing our project goals.



Bird species recorded at each site during 2008 Earthwatch surveys. An "x" indicates presence of a given species.

Species name	Central Park	New York Botanical Garden	Marshlands Conservancy	Harriman State Park	Black Rock Forest
Acadian Flycatcher		x			x
American Crow	x	x	x	x	x
American Goldfinch	x	x	x	x	x
American Redstart			x		x
American Robin	x	x	x	x	x
Baltimore Oriole	x	x	x		
Barn Swallow			x		
Black-and-white Warbler				x	x
Black-capped Chickadee			x	x	x
Black-crowned Night Heron	x		x		
Black-throated Blue Warbler					x
Blue-headed Vireo				x	x
Blue-winged Warbler				x	
Blue Jay	x	x	x	x	x
Blue-gray Gnatcatcher			x	x	
Broad-winged Hawk					x
Brown-headed Cowbird		x	x		x
Canada Goose	x			x	
Canada Warbler				x	
Carolina Wren			x		
Cedar Waxwing	x	x		x	x
Cerulean Warbler					x
Chimney Swift	x	x			
Chipping Sparrow		x		x	x
Clapper Rail			x		
Common Grackle	x	x	x		
Common Yellowthroat		x	x		x
Double-crested Cormorant	x	x	x		
Downy Woodpecker	x	x	x	x	x
Eastern Kingbird		x			
Eastern Phoebe		x		x	x
Eastern Towhee		x	x	x	x
Eastern Wood-pewee	x	x	x	x	x
European Starling	x	x	x		
Fish Crow			x		
Gadwall	x				
Gray Catbird	x	x	x	x	x
Great Crested Flycatcher	x	x		x	x
Great Egret	x		x		
Great Black-backed Gull	x				
Hairy Woodpecker		x	x		x
Herring Gull	x	x	x		
Hooded Warbler				x	
House Finch		x			
House Sparrow	x	x			
House Wren	x		x		
Indigo Bunting			x	x	
Killdeer			x		
Louisiana Waterthrush				x	x
Magnolia Warbler				x	
Mallard	x	x	x		
Marsh Wren			x		
Mockingbird		x	x		
Mourning Dove	x	x	x	x	
Northern Cardinal	x	x	x		
Northern Flicker	x	x	x	x	
Northern Parula				x	x
Northern Waterthrush				x	
Osprey			x		
Ovenbird				x	x
Pine Warbler		x		x	
Prairie Warbler				x	
Red-bellied Woodpecker	x	x	x	x	
Rose-breasted Grosbeak					x
Red-eyed Vireo		x	x	x	x
Red-tailed Hawk	x	x	x	x	
Red-winged Blackbird		x	x		
Rock Pigeon	x	x	x		
Rough-winged Swallow			x		
Ruby-throated Hummingbird			x		
Scarlet Tanager				x	x
Snowy Egret			x		
Song Sparrow	x	x	x		x
Tree Swallow		x	x		x
Tufted Titmouse	x	x	x	x	x
Turkey Vulture				x	
Veery					x
Warbling Vireo		x	x		
White-breasted Nuthatch		x	x	x	x
Wild Turkey			x		
Wood Duck		x			
Wood Thrush	x	x	x	x	x
Worm-eating Warbler				x	x
Ring-necked Pheasant			x		
Yellow-throated Vireo			x	x	x
Yellow Warbler			x		x
TOTAL SPECIES: 86	32	43	53	40	38

Mammals: Mammals were surveyed at each of eight sites using two different methods during 2008, camera-trapping for medium to large-bodied mammals, and track-tubing for small mammals. Five camera traps were set up at each site for 48 hours (240 total camera-trap hours per site), with the exception of Central Park, where sampling was limited to 3 cameras due to concerns of park staff regarding possible vandalism. Camera trapping images documented the presence of 10 different mammal species, ranging in size from eastern chipmunks and gray squirrels to black bears (see attached photos). Several species were detected at all eight study sites, such as the ubiquitous gray squirrel and raccoon, and other rarer species were only found at a small subset of sites (e.g. black bears at Black Rock Forest, red foxes at Great Swamp N.W.R. and Ward Pound Ridge). Not surprisingly, the larger, rarer species tended to be limited in distribution primarily to the most remote of our study sites (see table below). Domestic cats were detected at several of the more urban sites, as were non-native rats.

Mammal species recorded at each site during 2008 Earthwatch surveys. An "x" indicates presence of a given species.

Method	Common name	Scientific name	Central Park	New York Botanical Garden	Pelham Bay Park	Marshlands Conservancy	Great Swamp NWR	Harriman State Park	Ward Pound Ridge	Black Rock Forest
Camera-trapping	Eastern chipmunk	<i>Tamias striatus</i>		x						
	Gray squirrel	<i>Sciurus carolinensis</i>	x	x	x	x	x	x	x	x
	Norway/black rat	<i>Rattus sp.</i>		x	x					
	Virginia opossum	<i>Didelphis virginiana</i>					x	x	x	
	Red fox	<i>Vulpes vulpes</i>					x		x	
	Raccoon	<i>Procyon lotor</i>	x	x	x	x	x	x	x	x
	White-tailed deer	<i>Odocoileus virginianus</i>				x		x		x
	Black bear	<i>Ursus americanus</i>								x
	Domestic cat	<i>Felis catus</i>	x		x	x				
	Domestic dog	<i>Canis lupus familiaris</i>								x
Track-tubing	White-footed mouse*	<i>Peromyscus leucopus</i>	x	x	x	x	x	x	x	x
	Eastern chipmunk	<i>Tamias striatus</i>	x	x	x	x	x	x	x	x
	Northern short-tailed shrew	<i>Blarina brevicauda</i>			x		x	x		
	Gray squirrel	<i>Sciurus carolinensis</i>	x	x	x	x	x	x	x	
	Raccoon	<i>Procyon lotor</i>	x	x	x	x	x	x	x	x
	Domestic cat	<i>Felis catus</i>			x					

*Due to track similarities, it is possible that a minority of those tracks attributed to white-footed mice may have been made by red-backed voles (*Clethrionomys gapperi*). Final track assignments will be made during winter 2008.

Track-tubing surveys, targeting smaller-bodied mammals, were conducted along 10 transects (5 interior and 5 edge transects) within each of the eight study sites for 2008. A track-tube was set every 15 m along each 150 m long transect (for a total of 100 tubes per site). Track-tubing records positively identified at least six mammal species. The majority of tracks recorded were those of white-footed mice and gray squirrels, with an intermediate frequency of eastern chipmunk and raccoon tracks detected, and rare tracks indicating the presence of northern short-tailed shrews and domestic cats (see table below). Due to the similarity in tracks between red-backed voles (*Clethrionomys gapperi*) and white-footed mice, we cannot at this stage rule out the possibility that a few of the tracks attributed to white-footed mice were made by voles. A closer inspection of these tracks is necessary for final determination, and will be conducted this winter. To be conservative (and based on earlier live-trapping records from this region), at this point we are assuming that all tracks of

The relative abundance and diversity of small mammal species' tracks detected during track-tube surveys in 2008. Values of relative abundance range from 0 to 1, with higher values indicating a greater abundance of that species.

Site	White-footed mouse	Gray squirrel	Raccoon	Eastern chipmunk	Northern short-tailed shrew	Domestic cat	Diversity (H')
Central Park	0.27	0.34	0.20	0.18	0.00	0.00	1.36
New York Botanical Garden	0.88	0.04	0.01	0.07	0.00	0.00	0.49
Pelham Bay Park	0.68	0.11	0.09	0.10	0.01	0.01	1.06
Marshlands Conservancy	0.24	0.52	0.09	0.15	0.00	0.00	1.19
Great Swamp N.W.R.	0.90	0.03	0.05	0.01	0.01	0.00	0.46
Harriman State Park	0.67	0.14	0.14	0.02	0.02	0.00	0.98
Ward Pound Ridge	0.78	0.07	0.11	0.04	0.00	0.00	0.76
Black Rock Forest	0.93	0.00	0.04	0.04	0.00	0.00	0.31

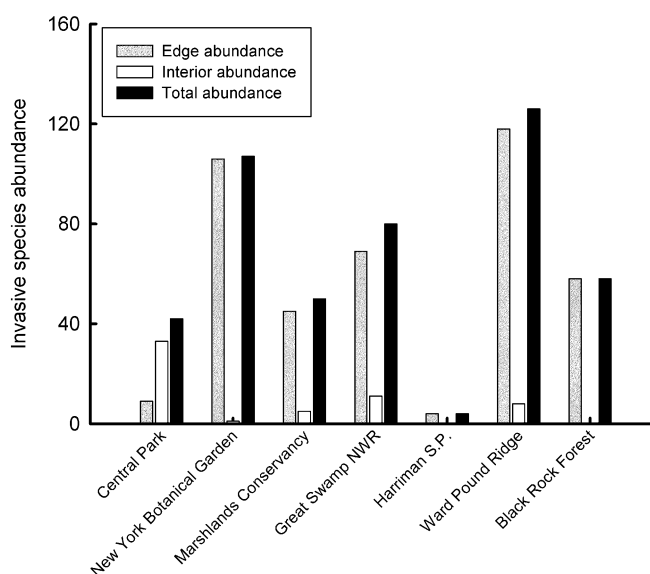
this type were made by white-footed mice.

In combination, these two survey methods allowed us to document the presence of at least 12 species of mammals at our eight 2008 study sites. These surveys showed that even the most urban sites supported mammal populations of several common species, and that larger and rarer species of mammals could be found at a number of our suburban and rural sites, including foxes within 30 miles of Manhattan and black bears within 50 miles. Assessment of additional sites during 2009 and 2010 will provide further information for more detailed, quantitative analysis.

Plants: Native and non-native understory plant species were surveyed using two methods along four transects within each of seven study sites during 2008. First, the abundance of three invasive species: Japanese barberry, Oriental bitterweet, and multiflora rose was assessed along the length of four 150 m transects within each study site (sampling a total area of 600 m² per site). Two transects were located within the park interior and two along the park edge. The abundance of invasive species ranged from a total of 4 individuals at Harriman State Park to over 100 individuals at the New York Botanical Garden and Ward Pound Ridge (see table below). Different invasive species dominated different sites, with Japanese barberry in high abundance at Ward Pound Ridge and Black Rock Forest, and absent from the more urban sites, and the opposite pattern observed for multiflora rose.

Site	Total Invasive Species Abundance	Edge Transect Invasive Abundance	Interior Transect Invasive Abundance	Japanese Barberry Abundance	Bittersweet Abundance	Multiflora Rose Abundance
Central Park	42	9	33	0	27	15
New York Botanical Garden	107	106	1	0	70	37
Marshlands Conservancy	50	45	5	1	7	42
Great Swamp	80	69	11	8	1	71
Harriman State Park	4	4	0	4	0	0
Ward Pound Ridge	126	118	8	111	15	0
Black Rock Forest	58	58	0	26	32	0

The abundance of invasive plant species did not appear to vary significantly by degree of urbanization, or distance from Manhattan, but was strongly influenced by whether transects were in edge or interior locations. For all sites but Central Park, the abundance of these three target invasive species was high along park edges, whereas these species were nearly absent from interior transects (see graph at right). This information provides a compelling indication that invasive plants are likely to be a much bigger problem in general for parks with greater edge area relative to interior (i.e. small parks, or those that are long and narrow).

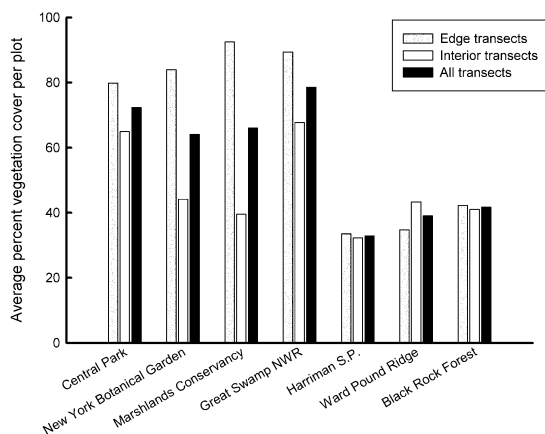
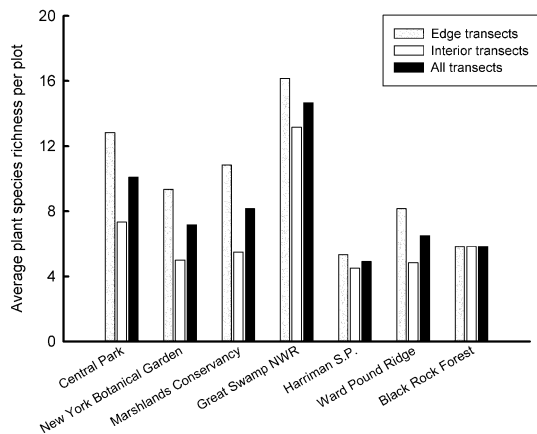
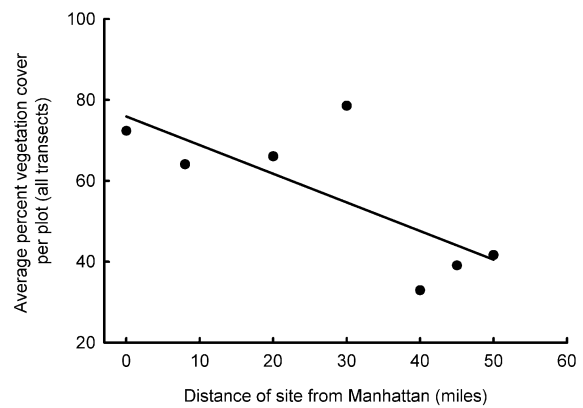
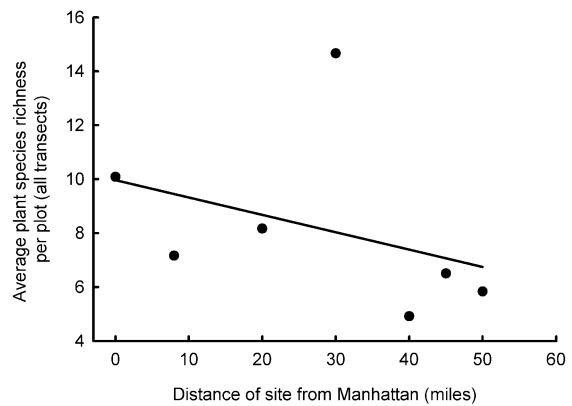


Native and non-native plants were also surveyed comprehensively within 2 x 2 m plots stationed at three points along each of the four plant transects described above (for a total of 12 plots sampled per site). Within each plot, every plant species was identified and the percent cover of each was recorded. When species could not be identified in the field, a voucher specimen was taken for preservation and later analysis at the New York Botanical Garden. Although these “unknown” species are still being identified, and hence the final species lists for these sites are still being fine-tuned, our data indicates that the 2008 plant

team identified approximately 300 different plant species. Once all unknown plants are identified (winter 2008), final species lists will be provided to all 2008 study sites as well as to interested project participants.

In general, these 2008 plant surveys indicate that overall plant species richness decreases with increasing distance from Manhattan (see graphs at right). In other words, increasing urbanization appears to have a positive impact on the number of different plant species found in an area (likely due to enhanced numbers of non-native species). The percent cover of vegetation observed in a plot, a measure of how dense the understory is, also appears to decrease as the degree of urbanization declines. Additional data from the upcoming 2009 & 2010 field seasons will help us to determine whether these are generalize-able patterns, and to investigate what may be causing them.

When we assess overall patterns of plant community species richness and percent vegetation cover for plots along edge versus interior transects, a clear pattern emerges that mirrors that found for the targeted invasive species surveys. Both species richness and vegetation cover are higher on edges than in interior sections of nearly all



parks surveyed in 2008. This is particularly striking for the urban and suburban sites, and less so for the rural sites, where the “edges” do not mark such strong transitions between natural and man-made habitats (see graphs at left). Again, this identifies potentially important differences in plant communities in parks dominated by “edge” areas, and those with larger, intact interior regions. We will investigate these intriguing ideas further in upcoming years.

Summary: During our first field season, we made substantial progress towards achieving our project goals. For most taxonomic groups that we studied, we found intriguing evidence of the impacts of urbanization, and we are eager to investigate these emerging patterns and their root causes further in the upcoming years. Although any conclusions that we draw from this first year of investigation are preliminary, and await confirmation and further exploration based on data from additional study sites, the information gathered during

2008 gives us an exciting platform from which to start our 2009 investigations.

Acknowledgements

Many thanks to the fantastic 2008 volunteers, field staff, and Earthwatch support staff who all worked hard to make the first year of the project incredibly successful. Also, thanks to the staff at each of the sites that we worked at this year, without whose support the project would not have happened.

Camera-trap photos 2008: Black bear at Black Rock Forest and raccoon at Central Park.

