

Restoration projects and invasive Japanese Knotweed
(*Fallopia japonica*) along the Bronx River, New York City



Michelle Medina

WCS- AIP

Bronx, NY

December 1, 2014

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History of the Bronx River

The Bronx River is the only freshwater river in New York City (Berger, 2010). The river is 23 miles long, and runs from the Kensico Dam in upper Westchester County, south through the Bronx, ending at the East River and Long Island Sound. The river flows from one of the top five wealthiest counties in New York State, down through the poorest (Tullis, 2007; Data Detectives, 2012).

For over 200 years, the Bronx River has suffered a loss of habitat quality, due to urbanization and a long history of industrial pollution (Bronx River Alliance). This has led to decreased biodiversity. The 1840s saw the area turn into an industrial corridor, with dams appearing, its course straightened, and its banks lined with bulkheads and rock rubble (rip rap) causing the degradation of native vegetation as well as soil and water quality (Young, Graham, & Ruzika, 2008).

The Bronx met with turmoil and fell into a period of urban decay with the construction of the Cross-Bronx Expressway, which fragmented neighborhoods and disrupted communities (Bronx River Alliance). Many residents did not have the luxury to leave their homes and start anew; many were also recent immigrants who did not wish to move again (A. Torres, personal communication, Oct. 23, 2014).

"This neighborhood is targeted over and over again for just the most obscene projects"

— Kellie Terry-Sepulveda, Executive Managing Director of The Point (Tullis, 2007).

In the mid-1970s, community activists renewed efforts to clean-up and restore the Bronx River. Alexie Torres, Founder of Youth Ministries for Peace and Justice, recalled that the community did not begin the restoration for the love of a river, but for the love of their children, families, and community (personal communication, Oct. 23, 2014).



Bronx River Watershed (NYC Dept. of Parks & Recreation, 2012)

Twenty years later saw the creation of the Bronx River Working Group, a collaboration of over 60 community organizations, public agencies and businesses that came together with the goal of improving access to the river (Bronx River Alliance, n.d.). In 2001, the Bronx River Alliance (BxRA) was formed to continue the previous restoration efforts; 140 partners including community-based organizations, the federal government, state and local governments, and schools support them (BxRA, n.d.).

Restoration of a river and a community

In 2012, the Bronx River was designated a National Water Trail by the National Park Service (BxRA, n.d.) and is currently held as a model of urban river restoration.

On October 23, 2014, I attended a symposium "Reclaiming a River: Conservation & Community" hosted by Wildlife Conservation Society (WCS)/Bronx Zoo. At the symposium, I had the opportunity to learn what made the restoration efforts of the Bronx River special when compared to other urban river restoration efforts. Advocates had realized that if social and ecological problems are linked, "the solutions must be linked too" and they were pioneers in connecting environmental issues to "economic issues like job creation and training" (Tullis, 2007, p8).

"Economic degradation begets environmental degradation."

- Majora Carter, Founder and Executive Director of Sustainable South Bronx (Tullis, 2007).

Alexie Torres, recalls four lessons learned during restoration efforts: (1) the community wanted to be directly involved in the work; (2) "We live here, we're experts too!"- learning to be a good partner; (3) the investment in the river is a human investment, and goes beyond the river, what it means as an economic corridor; (4) continue to focus on what it means to leave a lasting legacy (personal communication, October 23, 2014).

Restoration projects have encouraged local stewardship. Volunteers from local environmental and community organizations have directly assisted with restoration projects, meanwhile learning about the river (Young, et al., 2008, p. 182). By these volunteers participating in the improvement of their environment, they have the opportunity to experience the

opposite of an "extinction of experience" (Miller, 2005).

"We live here, we're experts too!"

- Alexie Torres, Founder Youth Ministries for Peace and Justice

These volunteers have seen native wildlife return to the Bronx River, an experience the earlier generations never witnessed. Over 0.1 ha of productive intertidal marsh were restored, vital to fish, invertebrates and birds living in the estuary (Young, 2008). Six hundred alewife herring (*Alosa pseudoharengus*) were introduced into the Bronx River (Young, 2008). In 2007, the first beaver was sighted along the Bronx River, 200 years since their last known presence; in 2010, a second beaver was sighted (WCS, 2010). In September 2014, the image of an American Mink was captured on the grounds of the New York Botanical Gardens (NYBG) (J. Schuler, personal communication, Oct.23, 2014).



Construction site of planned community educational facility at Starlight Park, Bronx, NY.

What are the current issues being addressed? What work still needs to occur?

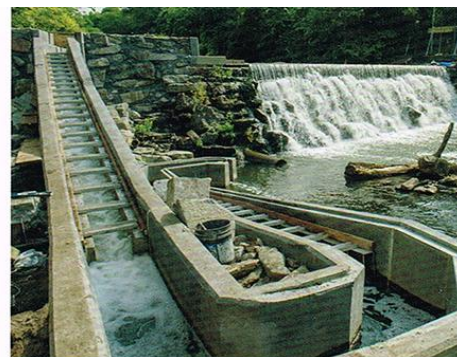
With the stocking of alewife into the Bronx River, the issue of connectivity needed to be addressed. Alewife are anadromous fish, migrating upstream to freshwater to spawn. Remnants of the industrial history of the Bronx River remain as barriers, currently there are three dams. The lowest dam is located just south of the Bronx Zoo, at 180th Street; in preparation for alewife migration, a fish ladder has been constructed. More fish ladders are being planned for dam crossings upstream, along with eel passages for American eel, (*Anguilla rostrata*). American eel are catadromous, born in saltwater they migrate into freshwater as juveniles, grow into adults and migrate back to the sea to spawn (Cooney, 2013).

Populations of American eels along the eastern coast of North America have declined drastically over the last thirty years due to fishing pressures, dams, habitat loss and pollution (Jackman, Larson, & Ruzicka, 2009; WCS, 2013).

A current WCS- New York Seascape project involves characterizing the use of the Bronx River by American eels, as well as assessing the impact of the 180th St dam (M. Camhi, personal communication, Oct. 23, 2014).

Marit Larson, of Natural Resource Group, NYC Parks, discussed objectives, which included increasing native plant cover and diversity on streambeds and floodplains, and improving vegetative structure. Some of these objectives have been met at two parks, Bronx Forest and Shoelace Park. Bronx Forest received expanded floodplain forest and increased floodplain connections. Shoelace Park's vegetative cover is now predominantly native species (personal communication, Oct. 23, 2014). Constant maintenance will be required, which Larson states is difficult to get funding for (personal communication, Oct. 23, 2014).

Linda Cox, Executive Director



Above: Like salmon, alewife live in the sea but migrate up freshwater streams to spawn. In July 2014, NRG and the Bronx River Alliance completed construction of the first of three fish ladders that will enable the fish to move past dams to the river's upstream freshwater reaches. Alewife cannot swim over a dam, but they can jump up small steps in a passage around a dam.

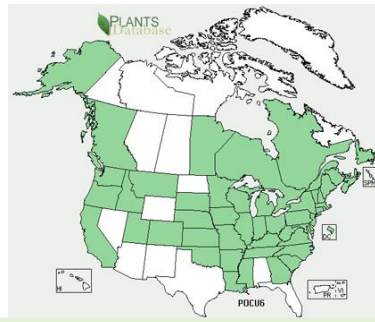
of the BxRA, lists that the Bronx River has become: an ecological and recreational resource, a place for learning, and a model; "what it is not – it's not clean" (personal communication, Oct. 23, 2014). Robin Kriesberg, Ecology Director of the BxRA, adds that combined sewer flow is still a major issue (personal communication, Oct. 23, 2014). In heavy rainfall, New York City's antiquated storm water and sewage pipes dump 558 million gallons into the Bronx River alone; replacing cemented portions of the watershed with greenery would help mitigate the problem by keeping rainwater from entering the sewers (Tullis, 2007).

Japanese knotweed

A 25 year review of floristic surveys of plants of the Bronx River Parkway Reservation in Westchester (north of the Bronx), from 1973-1988, revealed that 35.5% were non-native, with 10.6% being invasive species that were negatively affecting the ecosystem (Frankel, 1999).

Japanese knotweed (*Fallopia japonica*) is considered a noxious, highly invasive weed in North America (Weston, Barney, & DiTommaso, 2005). In the 1870s, Japanese knotweed was introduced in the Northeast as an estate planting, and can now be found in 42 states, and eight Canadian Provinces (Weston, et al., 2005; Cornell University, 2014). Japanese knotweed can reach heights of 5m, with rhizomes (underground stems) extending 15-20m in length and a depth of 2m (Weston, et al., 2005), and clones spread outward at a rate of about 50cm/year (Maerz, Blossey, & Nuzzo, 2005).

Japanese knotweed easily invades disturbed areas such as roadsides, and along riparian corridors (Weston, et al., 2005) such as the Bronx River. Once established, stands form solid



US Distribution of Japanese Knotweed.
Map: USDA NRCS PLANTS Database

homogenous colonies that displaces native vegetation, alters hydrological processes along streams and rivers, and negatively affects wildlife (Skinner, van der Grinten, and Gover, 2012).

Researchers have compared the foraging success of Green frogs (*Rana clamitans*) in fields dominated by native species versus fields with established Japanese knotweed; the results showed that none of the frogs foraging in the field with Japanese knotweed gained mass (Maerz, et al., 2005). Researchers studying invertebrate

abundance and assemblages in European riparian habitats revealed that habitats invaded by Japanese knotweed yielded half of the invertebrate biomass compared to native habitats (Gerber et al., 2008).

Therefore, in areas where Japanese knotweed has invaded, invertebrate prey species are not present for higher trophic feeders. To further the problem there are no native herbivores in North America that consume Japanese knotweed (Maerz, et al., 2005). This combination results in significant decrease in biodiversity.

Japanese knotweed is now widely distributed along the banks of the Bronx River, making its management a high priority to the “preservation of the limited remaining natural riparian habitats along the Bronx River” (Haight et al., in personal communication, November 2014).



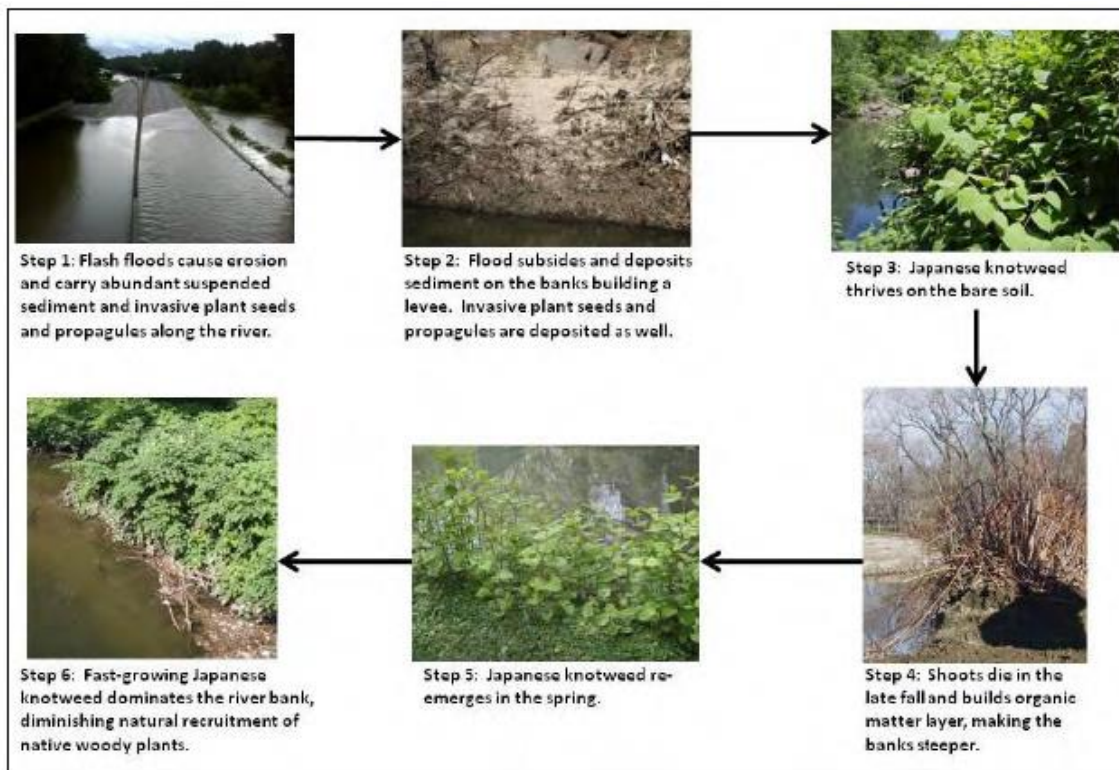


Figure 1. The Bronx River is an urban river system characterized by disturbed hydrology. Frequent flash floods carry invasive seeds and propagules from upstream to downstream, resulting in conditions that favor the establishment of invasive plants, most notably Japanese knotweed. Diagram from Yao et al., 2012

Japanese knotweed, the Bronx River and zookeepers

Jessica Schuler, Director of the Thain Family Forest in the New York Botanical Garden (NYBG), and others have been testing and comparing different methods of Japanese knotweed management at the NYBG (J. Schuler, personal communication, October 23, 2014). She plans to continue the Japanese knotweed management project south into the grounds of the Bronx Zoo, and has expressed interest in my proposed idea of recruiting zookeepers to participate and assist in the project on zoo grounds (personal communication, Nov. 2014). I plan to propose a volunteer program to the Bronx Zoo's General Director to invite and organize zookeepers from the Bronx Zoo animal departments, and potentially WCS staff, to participate and assist in the project. For my mapping project, I located stands of Japanese knotweed in an area I believe will be conducive to a project for zookeeper teambuilding. I also constructed a compilation of restoration projects along the river, which I intend to share with Bronx Zoo keepers to educate them on what has been taking place in their backyard, and for the purpose of volunteer recruitment.

Mapping: Bronx Zoo: Japanese knotweed along Mitsubishi River Walk

The first stage of my mapping project was to identify areas invaded by Japanese knotweed along the along the banks of the Bronx River, on Bronx Zoo grounds. On November 3, 2014, I identified a suitable potential site just south of the New York Botanical Garden, in the northern area of the Bronx Zoo, along the Mitsubishi River Walk. The Mitsubishi River Walk trail displays the restoration work performed along the river, as well as educational graphics for native vegetation and wildlife. It includes a display showcasing an earlier, successful project removing another highly invasive plant, Purple Loosestrife (*Lythrum salicaria*). I did not have to walk far before I encountered large stands of Japanese knotweed. Considering the ease of accessing this area, I think this would be the ideal location for my keeper involvement project.

I employed the tablet application, “US Topo Maps Free”, version 2.6.1, from ATLOGIS Geoinformatics (<http://atlogis.com>), to map stands of Japanese knotwood, via use of waypoints recorded and saved onto the mapping application. I selected and used the “Orthoimagery USGS EDC HRO” maps as my baselayer.



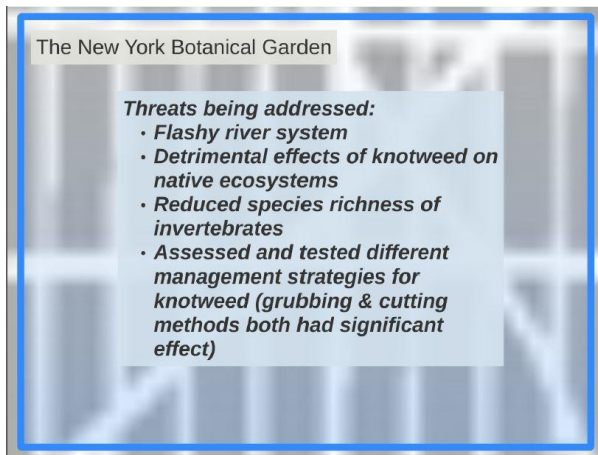
Print capture of Orthoimagery USGS EDC HRO map displaying locations of Japanese Knotweed stands, blue markers, along Mitsubish Riverwalk, Bronx Zoo, November 3, 2014.

Mapping: Restoration Projects along the Bronx River



Restoration projects along the Bronx River

Images from Prezi- Restoration projects along the Bronx River



[Link to my Prezi of Bronx River Restoration Projects](#)

I created another map to display some of the restoration work occurring on the Bronx River. I was not satisfied with any of the web-based mapping software, and ultimately experimented with Prezi to create a presentation, sequentially displaying information pertaining to restoration projects, travelling south along the Bronx River. I used maps as base layers, and included information and images of the parks and projects.

On September 13, 2014, I participated in a guided canoe trip by Bronx River Alliance, and travelled from Shoelace Park at the northern reaches of the river in the Bronx, south through Bronx Forest, Thain Family Forest in the New York Botanical Garden, and disembarking at Mitsubishi River Walk, on Bronx Zoo grounds. I then visited Mitsubishi River Walk again on November 3, 2014. On November 9, 2014, I visited five sites Shoelace Park, River Park, Starlight Park, Concrete Plant Park, and HuntsPoint Riverside Park, and photographed the sites, which I incorporated into my Prezi compilation.



Shoelace Park, looking south on Bronx River. November 9, 2014

Discussion

The Wildlife Conservation Society (WCS) manages the Bronx Zoo. Unfortunately, the Bronx Zoo Mammal Department, with over 70 keepers, has suffered from poor morale for over 15 years. In a recent WCS-wide employee survey the mammal department ranked last in employee satisfaction (C. McCann, personal communication, Sept.2014). When reading about the decline of social capitalism (Putnam, 1995) and the use of environmental education to foster a “sense of place” (Kudryavtsev, Stedman, & Krasny, 2012) I reflected back to the issues of poor morale at my workplace. I identified this as an important social issue with my work community. From personal observation, I believe that many keepers in my department, as well as some visitors, seem to look down upon the Bronx. Many, just as myself before this semester, are not aware of the historical restoration efforts that have occurred and continue to occur in our own backyard. Restoration efforts that, as I learned at the Reclaiming a River: Conservation & Community symposium hosted by the Bronx Zoo, Bronxites should be very proud of.

As a possible method to assist in the improvement of keeper morale I plan to propose a volunteer program for keepers to participate and assist in a project removing Japanese knotweed along the Bronx River on Bronx Zoo grounds. I believe that participating and completing a project such as this can offer the keepers a sense of accomplishment and behave as a teambuilding exercise. It can offer the opportunity for keepers that normally do not work together, the opportunity to do so in a different environment. Kudryavtsev, et al. discuss the primary mechanisms and factors influencing a “sense of place” being an “experiential” approach, with direct positive experiences with a place, and “instructional” approach through indirect sources (2012). In September 2014, I participated in a BxRA organized “Upper River Run” guided canoe trip and enjoyed seeing things from a very different perspective, I truly believe that keepers would enjoy the experience just as much as I did. Linda Cox, Executive Director of BxRA, suggested an after work canoe trip for keepers with the BxRA for teambuilding.

I spoke with Jessica Schuler about my idea of keeper involvement with a project, and she has informed me that she and her team will be extending their Japanese knotweed removal project currently in NYBG, southward on to Bronx Zoo grounds, and would welcome keeper involvement. I plan to share my map of locations of Japanese knotweed stands along Mitsubishi River Walk with her as well as with keepers when explaining the potential project for recruitment purposes. I plan to use my Prezi map presentation of restoration projects on the Bronx River as an “instructional” approach, educating keepers about the activities occurring on the Bronx River, to stir interest. The project as well as the canoe trip will be first hand encounters, falling under “experiential”. I hope that the opportunity to learn more about their backyard, and engage in its restoration will help improve morale among keepers and in the department, and foster a “sense of place” for keepers at the Bronx Zoo.

Bronx Zoo keepers increasingly spend part of their day educating visitors about conservation and WCS projects across the globe. With so few aware of projects in our own backyard, this potential project could better help get the conservation message across to visitors. Hands on, direct involvement in urban conservation projects can be one of the methods of getting conservation messages across (Klein, 1996). When referring to work on the Bronx River, Dr. Eric Sanderson, Senior WCS Conservation Ecologist, stated “if we can make it work here, we can make it work anywhere” (personal communication, Oct. 23, 2014) and since urban conservation is such a challenge, that it offers the opportunity to learn solutions that may work outside of urban areas (Sanderson, 2011).

Camera trapping

Last winter Bronx Zoo employees witnessed coyotes on zoo grounds. When speaking with Jessica Schuler, she told me of researchers using camera traps to monitor the coyotes on NYBG grounds. I am now in contact with researchers from the American Museum of Natural History, under the “the Gotham Coyote Project”. I have been interested in setting up camera traps on zoo grounds along the river to monitor wildlife using the river as a corridor. I have spoken to the assistant curator of my department and he believes this is a very possible project for me. It would be interesting to map the usage of native wildlife along the river corridor, and possibly use it to correlate new native species traveling down the corridor with levels of habitat restoration.

This entire course and project fostered an interest in what has been going on in my own “back yard”, things I knew nothing about, and as a Bronx resident, I should be proud of. When speaking with different people at the symposium, I spoke with Jerry Willis who currently works with the National Park Service. He worked on the restoration of the Bronx River decades ago, he stated that “what happened here was special”, further stating that he has never seen the same happen anywhere else, as far as how engaged and involved the community was in the river’s restoration. I hope I can use my Prezi map to spread the message.

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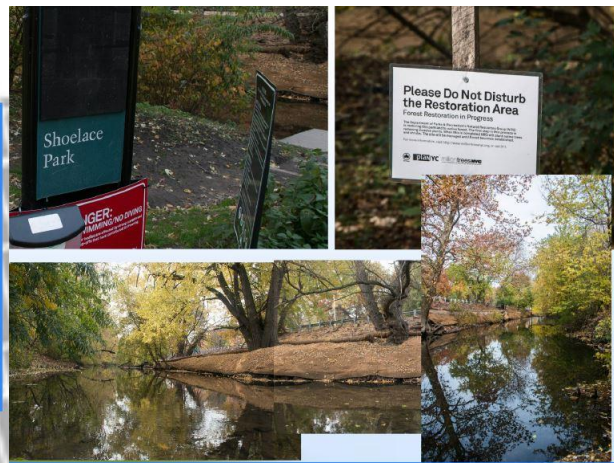
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Appendix A

The following are slides taken from the Prezi: Restoration Projects along the Bronx River:



- Shoelace Park has been the site of both native species plantings and invasive species removal.
- It also offers canoe access.



Parkland Section

Bronx River Forest

- Site of the only remaining floodplain forest in the lower Bronx River watershed
- Expanded floodplain forest, floodplain connections and access
- Removal of invasive species, planting of native species, bank stabilization and the addition of in-stream habitat structures.



wetlands restoration of this area

The Thain Family Forest in the New York Botanical Garden

- The largest remaining tract of old-growth forest in New York City
- NYBG studied methods for controlling Japanese knotweed, an invasive species that dominates the riverbank, as well as the impacts of management on restoration saplings
- NYBG restored a stream that runs through the forest and into the Bronx River
- School groups and citizen scientist volunteers monitored diversity and abundance of bottom-dwelling insects, crustaceans, and other creatures in the stream and the Bronx River

The New York Botanical Garden

Threats being addressed:

- Flashy river system
- Detrimental effects of knotweed on native ecosystems
- Reduced species richness of invertebrates
- Assessed and tested different management strategies for knotweed (grubbing & cutting methods both had significant effect)

"If we build it, will they come?"

• Jessica Schuler, Director of the Thain Family Forest, NYBG



"Jose" in 2007, the first

gotham coyote project: www.gothamcoyote.org

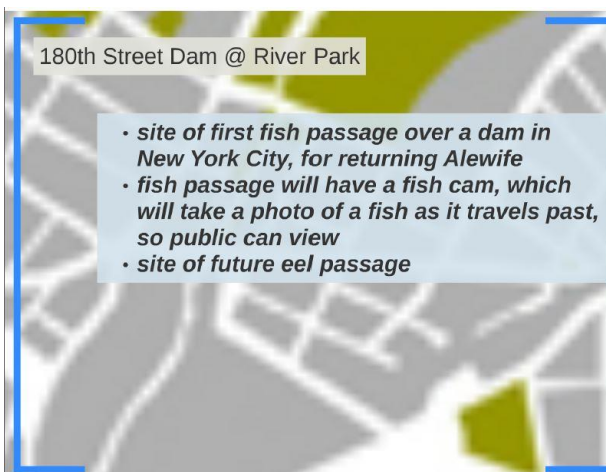
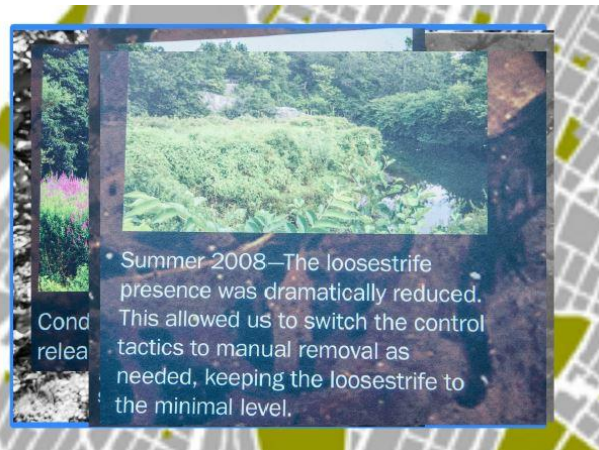
The New York Botanical Garden

- Creation of a canoe portage trail and canoe launch around the dam and Snuff Mill in the Garden that allows passage from the northern Bronx River to the estuary, and has included invasive plant maintenance
- Maintenance of storm water catch basins at the facilities connected to discharge points to the river. Catch basin maintenance programs are effective measures to prevent sediment and other pollutants from reaching water bodies

Bronx Zoo

- Restoration of riverside forest
- Creation of Mitsubishi River Walk to educate public about the river
- Monitored number of eels and alewife herring in the river and studied health of river's reptiles and amphibians
- Mitigation of Purple loosestrife with use of beetles
- Improved stormwater runoff management throughout the exhibits to prevent polluted discharge to the Bronx River
- site of the anadromous fish (Alewife herring) reintroduction project

Prezi slides continued



Appendix B

- Link to Prezi- Restoration Projects along the Bronx River
http://prezi.com/an-5fv-usqvl/?utm_campaign=share&utm_medium=copy
- New York Natural Heritage Program (n.d.) iMapInvasives Retrieved from <http://www.nyimainvasives.org/>

While researching I came across this app, for desktop and mobile use, for members of the public that I wanted to share, it encourages citizen scientists to report observational data for reporting and mapping invasive species in New York.