

September 1, 2010

Environmental Studies Report

Mitzi Harrington

Forest Internship at the New York Botanical Gardens

This summer I interned for the months of June and July at the New York Botanical Gardens (NYBG) in the Bronx. Within the NYBG's 250 acres is about 50 acres of old-growth forest. This is one of the oldest remaining forests in the New York City area. Therefore the Forest is an important ecosystem with life at many different levels of the forest canopy. Moreover, the Bronx river flows through it and provides yet another habitat, boosting the Forest's biotic diversity. The Forest is home to many animals including turkeys, owls, turtles and muskrats. However, within an urban environment, the Forest has faced some harsh conditions and has changed rapidly in recent years though it has demonstrated resilience. This forest provided a wonderful place for me to study forest ecosystems and forest management practices.

Jessica Schuler is the forest manager and each day she gives instructions to the forest gardeners, Anthony and Chris. This summer I joined their team. The four of us managed the Forest for the safety and enjoyment of the Garden's visitors and for the health of the Forest ecosystem. For the visitors' safety, we ensured that branches and trees hanging over trails were promptly removed. We closed the Forest off to visitors one week at the end of July when drought threatened a forest fire. In addition we maintained trails which included installing water bars. These bars, installed across the trails, prevent loose soil and mulch from flowing down slope and collecting at the bottom during a rain storm. We made the bars from honey locust (*Robinia pseudoacacia*) trees that we gathered from the forest. Honey locust, which is particularly rot resistant, will last longer before it needs to be replaced.

In order to preserve the integrity of the Forest, the forest team protects it from the influences of urbanization. Animals and plants in forest ecosystems are threatened by pollution, invasive species and global warming among other things. Urban forests face these influences to a greater extreme, and the NYBG is an island in the middle of New York City.

Pollution such as acid rain, storm runoff from streets, and garbage that floats down the river are hazardous to the forest. At the Garden I helped collect garbage from along the river twice a week. The Bronx River winds through suburbs, picking up garbage before it enters

the Garden. Garbage lands on the banks within the Forest where wood ducks, great herons, muskrats, and turtles find a home. Most of the garbage was intentionally disposed of by being tossed into the river, including bottles, plastic bags, and cans. The Bronx River is not just polluted by garbage but by chemicals that enter the river as runoff from roads and fields, such as oil and fertilizer. Though the NYBG can do nothing about what enters the river upstream, it has made efforts to control what enters the river as it runs through the Garden. They just recently began to build a catch basin that will collect storm water from the road and parking lot and will filter and clean the water before it flows into the river.

Invasive species also threaten the health of forest ecosystems. Invasive species are animals or plants that reproduce rapidly and displace other organisms. Usually they are exotic and push out native species either by preying upon them or by using up their resources. These species spread rapidly when they arrive in the United States because the predators that keep their populations under control in their native country are not present here. The native plants within the Forest have suffered from both invasive pests and plants. The hemlock wooly adelgid swept through the Garden in the 1980s. This adelgid feeds upon the sap of eastern hemlocks (*Tsuga canadensis*). Slowly these trees have died throughout the Garden and the snags and fallen trees are haunting reminders of the epidemic. Before the wooly adelgid, a fungus wiped out the American Chestnuts in the Forest. The American Chestnut blight and the hemlock wooly adelgid decimated two very important tree species of northeastern forests. As these trees fell, gaps were created in the canopy that allowed light through to the forest floor and the soil around the fallen trees was rich with nutrients from the decaying wood, creating favorable condition for new growth. This is an example of forest succession: young trees replacing older trees over time. When canopy trees die, they create opportunities for new trees to grow into the site. Often the site of an old hemlock or American Chestnut tree was replaced by invasive plant species. These species are usually prolific reproducers, fast growing and often they tolerate harsh conditions better than native plants so that in the face of drought, shallow soil, or low nutrient levels, they are still able to thrive. Therefore these plants quickly occupy any available site. Some invasive plants have accidentally arrived to the United States, for example if their seeds were carried over on a ship. However, many species were intentionally planted here as ornamentals, including some that were planted in the New York Botanical Garden's collections. For example, the corktree (*Phellodendron amurense*) was planted in the Garden and it is one of the most

problematic invasive plants in the Forest. It reproduces prolifically from root sprouts, and grows quickly into a tree that is difficult to uproot. Ironically, though this tree costs the Garden to control it, the trees that were originally planted there remain as large, old trees that continue to produce an abundance of seeds. As long as these old trees remain standing, corktree will remain problematic in the Forest.

Besides the corktree, other major invasive plants in the Forest, that I helped to control were oriental bittersweet (*Celastrus orbiculatus*), Japanese honeysuckle (*Lonicera japonica*) bush honeysuckle (*Lonicera maackii*), Japanese knotweed (*Polygonum cuspidatum*), aralia (*Aralia elata*), and garlic mustard (*Alliaria petiolata*) among many others. The Garden avoids using chemical control because the chemicals can spread and harm surrounding native plants and animals. However, this summer they began to use herbicide sprays on some plants in the forest, but never along the river which is particularly sensitive to chemicals. Herbicide pellets were also injected in the base of large trees and appeared to effectively kill the trees. I did not participate in either of these applications. Most control of invasive plants at the Garden was manual. With our hands, or tools such as a Maddox, and a weed wrench, we pulled up invasive plants, aiming to remove most of the root. We concentrated our efforts along the river and trails which are particularly lined with invasive plants, because they serve as a path along which the propagules are carried and spread, and also provide a level of disturbance that is welcoming to new growth. The eastern end of the river was lined with a wide band of Japanese knotweed. The Garden is currently experimenting with methods of controlling it; they are comparing grubbing with cutting. Cutting is much quicker, however, if grubbing is much more effective, it may be worth the effort.

When invasive plants are removed it is important to replace them with native plants. If they are not replaced, the newly available site will be open to further colonization of invasive species. The native replacements are grown in the Garden's large greenhouse. I helped collect some seeds of black gum (*Nyssa sylvatica*) to be sown in the greenhouse and then planted in the forest. We strung up tarps beneath the canopy of two mature black gum trees. At the end of July when the fruit was ripe, the small, dark blue fruit dropped into the tarp. The foresters try to collect most of their seeds from the Garden because native replacements will grow best in the Forest if the seeds were collected locally. I also assisted in sewing some of these seeds in little trays, watering them and watching them grow into small seedlings which we then transplanted into the understory.

As my senior project at Sewanee, I researched invasive plant control and participated in writing an invasive plant management guide for the Domain. I studied different control methods and the pros and cons of each. But it wasn't until this summer that I put it to practical use and had the opportunity to apply what I learned. I was able to witness the aggressiveness of invasive plants, and how difficult it is to eliminate them. I would like to see how successful the control was, and I hope to return to the Garden next summer to visit the areas of the Forest where we removed invasive plants and planted natives. I am curious to see whether the native replacements will grow into healthy plants or if more invasive species will fill back in. I also was able to learn about new invasive plants that are not a problem on the Domain. It was interesting to compare which invasive plants are present at the different latitudes. For example, Chinese privet is one of the most abundant invasive plants at Sewanee but I saw only a couple in the Garden.

The composition and structure of the Forest has changed over time. The existing plants, the dominant species, and the diversity of the Forest is impacted by urbanization. Before the woolly adelgid swept through the forest, the eastern hemlock was a dominant tree species. Today only a few small hemlocks remain. The loss of the hemlock has allowed other trees to dominant the Forest. To monitor these types of changes, 20m by 20m permanent plots were set up in the forest in the 1980s, and the species growing in them were recorded periodically. For some years these plots were forgotten. However, the Garden's current forest manager, Jessica Schuler, began to collect data from them again last year, and laid out a some additional plots in areas of forest management in order to evaluate the effectiveness of management practices. This summer I helped collect data in the plots. We used a method created by a PhD student at Rutgers University who is comparing various urban forests in New York City. This method involved identifying herbaceous species along transects, shrubs (under 1in dbh and over 1m tall) in randomly selected subplots, and all of the trees (over 2.54in dbh and 1m tall) in the plot. We also collected soil samples and measured soil compaction with a penetrometer at each site. The soil samples will reveal what minerals and chemicals are present in the soil, and the soil compaction measurement will reveal how much the Forest has been used by people in the past.

Because I received funding for this internship, the NYBG did not pay me and I got the perks of a volunteer. I took two classes at their school of professional horticulture: *Soils* / and *Native Flora in Summer*. I also went on weekly plant walks and on occasional field trips.

During the plant walks I learned to identify plants in NYBG collections outside of the forest, such as in the vegetable and rose gardens. Among the field trips I attended was a visit to Eagle Street Rooftop Farm in Brooklyn, New York, which grows organic vegetables, makes honey, and raises chickens.

Thanks to the Environmental Studies Internship Fund I was able to have this wonderful experience as a forest intern at the New York Botanical Gardens. I thoroughly enjoyed my time meeting great people who were willing to share their knowledge with me. They helped me identify plants and learn about forest health and forest management. After this experience I know that I am interested in the field of forest restoration and environmental protection as a future career.