Thain Family Forest Inventory
Updated June 29, 2016

Project Overview

The Thain Family Forest (Forest) at The New York Botanical Garden is the largest remnant of old-growth forest in New York City. Though the forest has remained intact since the last ice age, it has undergone many disturbances both natural and anthropogenic. The descriptive phrase, old growth urban forest is an appropriate designation for this 25 hectare stand (Loeb, 2011).

A long-term study is being conducted in the Forest to observe vegetation change over time (Rudnicky and McDonnell, 1989). When the Garden was first established on its current site in 1895, the Forest was known as the "Hemlock Grove" because the eastern stand, closest to the Bronx River was dominated by the Canadian hemlock (Tsuga canadensis). In 1923, it was observed that the natural regeneration of T. canadensis was less abundant in the Forest when compared to northern forests dominated by T. canadensis (Britton, 1926). This was the first indication that the T. canadensis was declining in the Forest. In 1985, Hurricane Gloria introduced the Hemlock Wooly Adelgid (Adelges tsugae), leading to further decline of hemlock. Today, 120 individuals of T. canadensis remain in the Forest (NYBG, unpublished data 2013).

Hemlock decline is one change in forest composition that has been well documented in the Forest inventory data sets from 1937, 2002, 2006, and 2011. These surveys have observed the dynamics of forest composition over time but have also informed current forest management. By analyzing raw data of 2002 and 2006, Garden staff noticed an increase of invasive plant species, particularly, Amur corktree (Phellodendron amurense), Japanese angelica tree (Aralia elata), and Amur honeysuckle (Lonicera maackii). In 2008, the Garden began actively managing these three species in order to reduce their impacts on the overall ecosystem and to prevent them from becoming the dominant species in the Forest (Schuler and Forrest, 2016).

The goals of this project are (1) to document the change of forest composition; (2) to create a new data set for 2016 and compare with earlier data sets; and (3) to monitor progress of invasive plant species management. The hypotheses of this study are: (1) the decline of T. canadensis will result in a composition shift to native hardwood tree species, (2) the damage caused by Hurricane Sandy has resulted in a decrease in canopy basal area, increased stem density, and an increase in percent cover of coarse woody debris; (3) invasive plant species managed in 2011-2016 (A. elata, L. japonica, H. helix, V. dilatatum) will decline in frequency, density, and percent cover.

This study was established in 2002 to document forest vegetation change over time and the sampling methods were modified from an original inventory study performed in 1985 (Rudnicky and McDonnell, 1989). In 2002 all trees and shrub 5 cm or greater in diameter at breast height, living and dead stems were documented. In 2006,

all living and dead, trees and shrubs 1 cm or greater in diameter at breast height were documents. In 2011, all living and dead stems of trees and shrubs 1 cm or greater in diameter at breast height were documented. Herbaceous line intercept transects were sampled for the four corners for every plot

Protocol

Plot Set Up

1. Locate odd number transect starting points on the western boundary of the Forest using "NYBG Forest Transect Study, 1985" (McDonnell, M.J., 1985) and locator notes from Wayne Cahilly. All starting points are marked with reinforcement bark or survey nail and a metal accession tag documenting the transect number. Replace accession tag or markers as necessary.

   Note that all compass bearings documented in these documents and for setting up the transect plots use true north. All compasses should be set to read true north. In 2016 from Bronx, NY (40° 51' 51" N, 73° 53' 20" W) the declination adjustment according to NOAA National Centers for Environmental Information is 13° 2' W ± 0° 21'.
2. Create new witness tree maps for each starting point using large trees and permanent landmarks. Include DBH and species identification for trees, record compass bearing from tree or landmark to starting point, and record distance between tree or landmark to starting point in meters. At least trees or landmarks should be documented for each starting point. The maps should be filed with the other Forest Inventory Documents and scanned to be stored with data files in pdf form.
3. The transect starting point is the 5m or midpoint on the west side of the first 10m x 10m plot within the transect. Measure 5m to the north and 5 m to south, check alignment of tape with compass and mark plot corners with chain pins and leave the tape level and tight to mark the west plot side.
4. From the two plot corners run two additional tapes 10 meters on a compass bearing due east towards the Bronx River. Mark the plot corners with chain pins and leave the tapes level and tight to mark the plots north and south sides.
5. Finally, run the east tape connecting the 10 meter x 10 meter square plot.
   The plot area is based on horizontal distance not ground plane.
   Measure 10m of the transect due east. Measure the percent slope using a clinometer a the plots midpoint on the west side, measuring west to east.
   Calculate horizontal distance by determining horizontal distance with percent slope and use extrapolate distances to extend plot length on both the North and Soutn sides if there is a plot slope greater than 10%. Record plot slope on Woody

Plant Datasheet.
10% = 10.03m (32.90ft)
20% = 10.12m (33.19ft)
30% = 10.29m (33.75ft)
40% = 10.5m (34.44ft)
50% = 10.85m (35.59ft)
60% = 11.22m (36.80ft)
70% = 11.77m (38.60ft)
80% = 12.36m (40.54ft)

Data Collection

1. Using a tablet and field data sheet writing in ball point pen. Completely fill out data sheet including: date, observers, transect number, and plot number. Record all species names in botanical latin, no acronyms.
2. Start with the ground layer sampling. Extend a 5m line transect from each plot corner toward plot center. Use a compass to confirm a 45° and tape alignment. Secure end of tape with a chain pin. Meter 0-1 is closest to the plot center. Note which plot corner you are working in on the datasheet: NE, NW, SE, SW. Record the number of centimeters occupied by all herbaceou plants and nonliving features (e.g. leaf litter, rock, bare soil), and woody plants that are <1m tall within each meter along the 5m transect. When a species/ feature are not present within a meter draw a diagonal line across the box on the data sheet and enter a "0" value on the tablet spreadsheet. Coarse woody debris is measured for pieces greater than or equal to a half of an inch. These herbaceous layer transects are measured in layers under 1m in height, there is often overlap (i.e. frequently leaf litter is observed as a 100cm in any given meter) and the total centimeters collected in any 1 m segment can be greater than 100. The goal is to collect a representative sample to allow for the extrapolation of percent cover, you are not recording percent in the field that will be calculated during the data analysis. If there are small gaps between features or plants on a line that are less than 5cm or approximately three finger put together, than the gaps are ignored and this is recorded as a continuous patch.
3. Collect Herbarium specimens from any unknowns abundant in the plot, when possible make a specimen from a fertile sample to help with identification. Label the specimen with the corresponding transect number-plot number and letter identifier starting with "A" for each plot (i.e. the first specimen collecting in the first transect plot one would be labelled, 1-1A). Document that an herbarium specimen was collected and write/type the corresponding specimen number in the notes section of the data form/sheet. Take a picture of the unknown and store in the data form to the Google Drive with the plant ID and Herbarium number

ID using the tablet.

4. Record the plot number, tree location North (N)/South(S) in plot, tree number starting with "1" for each plot, diameter at breast height (DBH; 1.32 meters height) in centimeters. A tree or woody plant is considered in the plot when greater than or equal to 50% is in the plot. DBH is measured for all woody stems greater than or equal to 1 cm, measured from mid-slope. Calipers are used on stems smaller than 5 cm. Multiple stems are measured individually and recorded individually but, noted as stem number in the stem column. For example, if a Viburnum dentatum shrub has 7 stems that are greater than or equal to 1cm in DBH the stem measurements are recorded individually and the number 7 is recorded 7 times in the stem column. Tree vigor on a scale of 1-4 is recorded.
   1 = plant is in good health, actively growing, no evidence of decline.
   2 = plant in minor decline but, not life-threatening. Notable pathological, structural or physical damage.
   3 = plant in major declince, the problem is life-threatening, and the expectation is that the plant will be dead within 1 to 2 years.
   4 = plant is dead.

   Crown class for the canopy tree layer is also recorded as Codominant, Dominant or Suppressed.
   C = a tree whose crown helps to form the general level of the main canopy in even-aged stands or, in uneven-aged stands, the main canopy of the tree's immediate neighbors, receiving full light from above and comparatively little from the sides
   D = a tree whose crown extends above the general level of the main canopy of even-aged stands or, in uneven-aged stands, above the crowns of the tree's immediate neighbors and receiving full light from above and partial light from the sides
   S = a tree whose crown is completely overtopped by the crowns of one or more neighboring trees —note the vigor of overtopped (suppressed) trees varies from high to low depending on individual circumstances
   U = a tree or shrub whose crown is clearly underneath the canopy layer.

5. Lastly, survey the plot after all data has been collected and list any species that were missed in the sample. Spend no more than 10 minutes recording additional species.
6. Upload observations of invasive plant species to iMapInvasives.
7. Clean up measuring tapes and set up next plot. Repeat steps #1-5.

References:

Loeb, R.E. 2011. Old Growth Urban Forests. Springer.

Rudnicky, J.L. and M.J. McDonnell. 1989. Forty-Eight Years of Canopy Change in a Hardwood Hemlock Forest in New York City. Torreya 116(1):52-64.

Schuler, J.A. and Forrest, T. A. 2016. Thain Family Forest Program 2008-2025. The New York Botanical Garden.

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In 2002 each transect had the correspond # of plots. At total of 247 plots.
#1 = 4
#3 = 16
#5 = 17
#7 = 19
#9 = 20
#11 = 26
#13 = 31
#15 = 28
#17 = 27
#19 = 20
#21 = 13
#23 = 12
#25 = 8
#27 = 6

In 2006 each transect had the corresponding # of plots. A total of 245 plots.
#1 = 3
#3 = 15
#5 = 17
#7 = 19
#9 = 20
#11 = 26
#13 = 31
#15 = 28
#17 = 27
#19 = 20
#21 = 13
#23 =12
#25 = 8
#27 = 6

In 2011 each transect had the corresponding # of plots. A total of 248 plots.
#1 = 3
#3 = 15
#5 = 15
#7 = 17
#9 = 19
#11 = 26
#13 = 30
#15 = 28
#17 = 30
#19 = 22
#21 = 17
#23 = 13
#25 = 7
#27 = 6

Materials
3 compasses
1 clinometer
10 chain pins (candy canes)
1 large caliper
1 small caliper
2 dbh tapes
2 100m tape
2 50m tape
3 30m tapes
3 clipboards
2 mifi hotspots
2 tablets
2 DBH tapes metric
Newcomb's Wildflower Guide
Grimm's Trees and Shrubs
The Manual, Gleason and Cronquist
Mistaken Identity

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