Battle Park: A Summary of Vegetation and Seasonal Changes
For the NC Botanical Garden

<u>Photos from Plot 16 over time as an example of seasonal changes throughout Battle Park</u>

2/15/06   3/16/06

4/10/06   5/3/06 12:45 PM

    <u>Summary of Seasonal Tree Growth</u>: At the time of the first photo (2/15/06), the beeches in Plot 16 had visible buds. By 3/16/06 (Seasonal Stage 1), all beeches throughout the park have budded, and all red maples except those in Plot 7. By 4/10/06 (Seasonal Stage 2), the hickories in plots 8 and 11 have all budded but not the ones in plot 3; the tulip poplars throughout the park almost all now have their leaves. By 5/3/06, the leaves of all trees and saplings have fully grown, filling in the forest with greenery.

Tree Diversity: The sixteen 10x10 meter plots in Battle Park shown below each have an α-diversity of 3-9 tree species. However, the species composition differs substantially between plots, with some combination of 27 total tree species throughout the park that are listed at right (γ-diversity).

The β-diversity (species turnover) was calculated between 3 pairs of plots (color-coded below) to give an example of species turnover throughout Battle Park. The lowest turnover is between plots 11 and 16, both north-facing and at roughly the same elevation. The highest turnovers are for plots at varying distances from the stream, or that are separated by the stream.
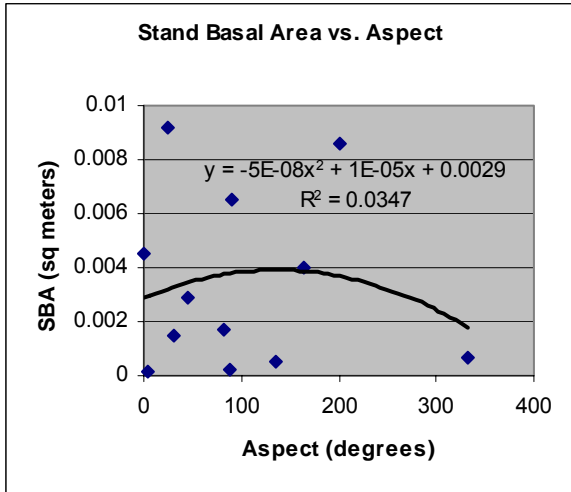
Pair of plots:	3-9	11-16	2-7
β-diversity:	5	3	6

Tree Species in Battle Park

| Scientific Name	Common Name
Liriodendron tulipifera	Tulip poplar, yellow poplar
Fagus grandifolia	Beech
Liquidambar styraciflua	Sweetgum
Carya ovata	Shagbark hickory
Acer negundo	Boxelder
Acer rubrum	Red maple
Quercus rubra	Red oak
Cornus florida	Dogwood
Oxydendrum arboreum	Sourwood
Quercus alba	White oak
Ulmus americana	Elm
Acer saccharinum	Sugar maple
Juniperus virginiana	Eastern red cedar
Viburnum obovatum	Viburnum
Magnolia tripetala	Umbrella magnolia
Nyssa sylvatica	Black gum
Paulownia tomentosa	Princess tree
Ligustrum sinense	Chinese Privet Bush
Ilex opaca	Holly
Carpinus caroliniana	Ironwood, American Hornbeam
Rosa multiflora	Multiflora Rose
Prunus sp.	Cherry Tree
Viburnum prunifolium	Blackhaw
Acer barbatum	Florida Maple
Carya tomentosa	Mockernut Hickory
Quercus falcata	Southern Red Oak
Quercus durandii	Durand Oak
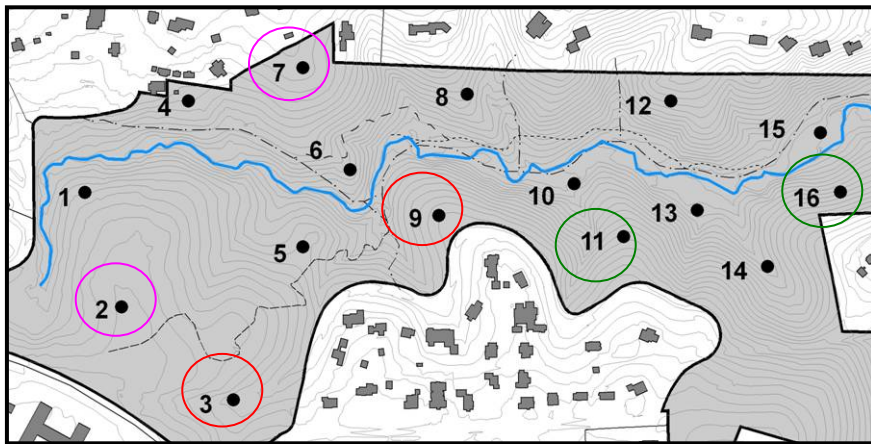
Dominant Community Types: The majority of Battle Park's trees are hardwoods, with holly and eastern red cedar as the only evergreen species. The dominant community type is beech-tulip poplar, which always occur together and also often occurs with red maple. The importance values for beech, tulip poplar, and red maple were 35.5, 24.4, and 22.0, respectively. Variations from the beech-tulip poplar community type were Plot 7 and Plot 8, which were made up almost entirely of red maple and mockernut hickory; these two plots were south-facing, high in elevation, far from the stream, and close to a residential area. Plot 11 had more dogwoods than any other plot, as well as the most red and white oaks of all the plots.
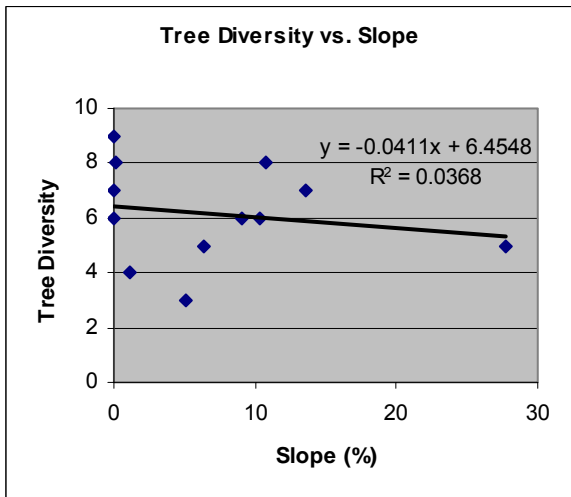
Relationships Between Tree Properties and Physical Parameters: We collected data on DBH, aspect, slope, and α-diversity to determine whether there might be any relationships between these. In each case both a linear and quadratic curve was fit, with the best of the two curves shown below. For the most part, there was a lot of scatter in the data coming from the 12 plots (4 of the 16 plots on the above map either were not sampled, or some data was missing). The only interesting trend appears to be with tree diversity vs. aspect.

Stand Basal Area vs. Aspect

$$y = -5E-08x^2 + 1E-05x + 0.0029$$
$$R^2 = 0.0347$$

SBA (sq meters) vs. Aspect (degrees)

Stem Density vs. Slope

$$y = -0.0023x + 0.1667$$
$$R^2 = 0.0602$$

Stem Density vs. Slope (%)

There is no trend between SBA and aspect, judging from the low R^2 in both plots - these look like fairly uniform scatter plots. Zero degrees above is the same as 360 degrees, and in between there doesn't seem to be any trend to the data.
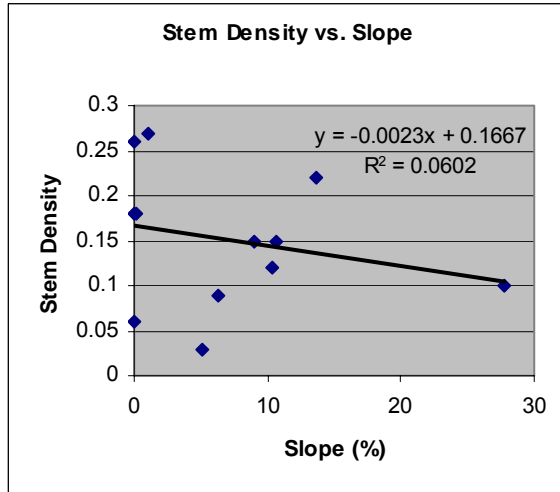
There isn't much of a trend here either, though it looks like higher stem densities may be found on plots with shallower slopes.

Tree Diversity vs. Slope

$$y = -0.0411x + 6.4548$$
$$R^2 = 0.0368$$

Tree Diversity vs. Slope (%)

Tree Diversity vs. Aspect

$$y = 9E-05x^2 - 0.0226x + 6.7096$$
$$R^2 = 0.4097$$

Tree Diversity vs. Aspect (degrees)

Discarding the one outlier to the right, all plots had roughly the same range of slope (0-15%) and an alpha diversity range of 3-9 species.
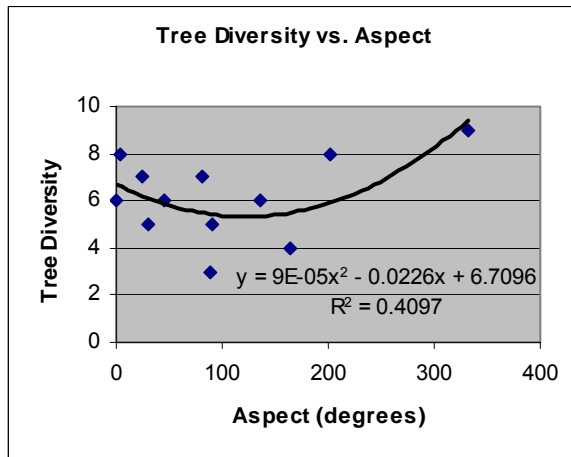
Regardless of the aspect, tree diversity was consistently between 3-9 species for all plots. There does seem to be support in the data for a decline in tree diversity with aspects near 180 degrees (south-facing slopes), and an increase where aspects are closer to 0 degrees.