The Flora of Stony Brook University's West Campus

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ABSTRACT

Since my very first visit to the State University of New York at Stony Brook, I have been intrigued by the natural history and flora of the campus. During self-guided and escorted walks, I became keenly aware of the many geologic features and living environments that surround us on campus. This paper strives to describe my explorations of the flora and landscapes of West Campus, as well what sustains them.

Each location highlights a different landscape or a specific aspect of a similar landscape. At each site, many of the flora are identified and described briefly. Additionally, at some locations, other environmental issues such as water use and preservation and soil characteristics are discussed.

This paper serves as an example of the types of explorations and investigations that a teacher can conduct with his/her students on school and campus grounds or at local parks and beaches. On Long Island we are surrounded by a variety of habitats that provide us with an excellent reason to get outside the classroom to conduct field studies of our natural environment. The topics for study are virtually limitless and highlight the relevance of studying earth science, the living environment, ecology, and environmental science. We owe students the opportunity to experience science, rather than simply teaching the theory behind it.

INTRODUCTION

The State University of New York at Stony Brook is situated on the Harbor Hill Moraine, formed by the last glacial advance approximately 22,000 years ago (Sirkin, 1996). Since the last glacier's retreat about 20,000 years ago, rainfall and human hands have continued to shape this area into the landscape we observe today. The Stony Brook area was settled by farmers in the early 17th century. Prior to breaking ground for the University in 1959, the land was used as farmland, undeveloped forest, and contained a racetrack near the present day Stony Brook train station.

The West campus includes areas such as the Academic Mall, a formal landscape that contains a variety of ornamental plants and grasses. Most of these plants are not native to this area and the integrity of these plantings is maintained by moderate watering, fertilization, weeding, and pruning.

Wooded areas on West Campus have not been tended in recent years and have become home to plant species that can compete successfully. These woodlands represent second growth forest—a secondary succession where a previous forest has been cut down. Meadows occurring farther from the core campus have developed grasses and weeds which receive little care other than periodic mowing.

The types of existing plant species are dependent upon the local geology, naturally-occurring or introduced soils, water availability, and the amount of human intervention. West Campus includes a range of landscapes from carefully tended areas to areas that have reverted to nature under the influence of the forces that control ecological succession.

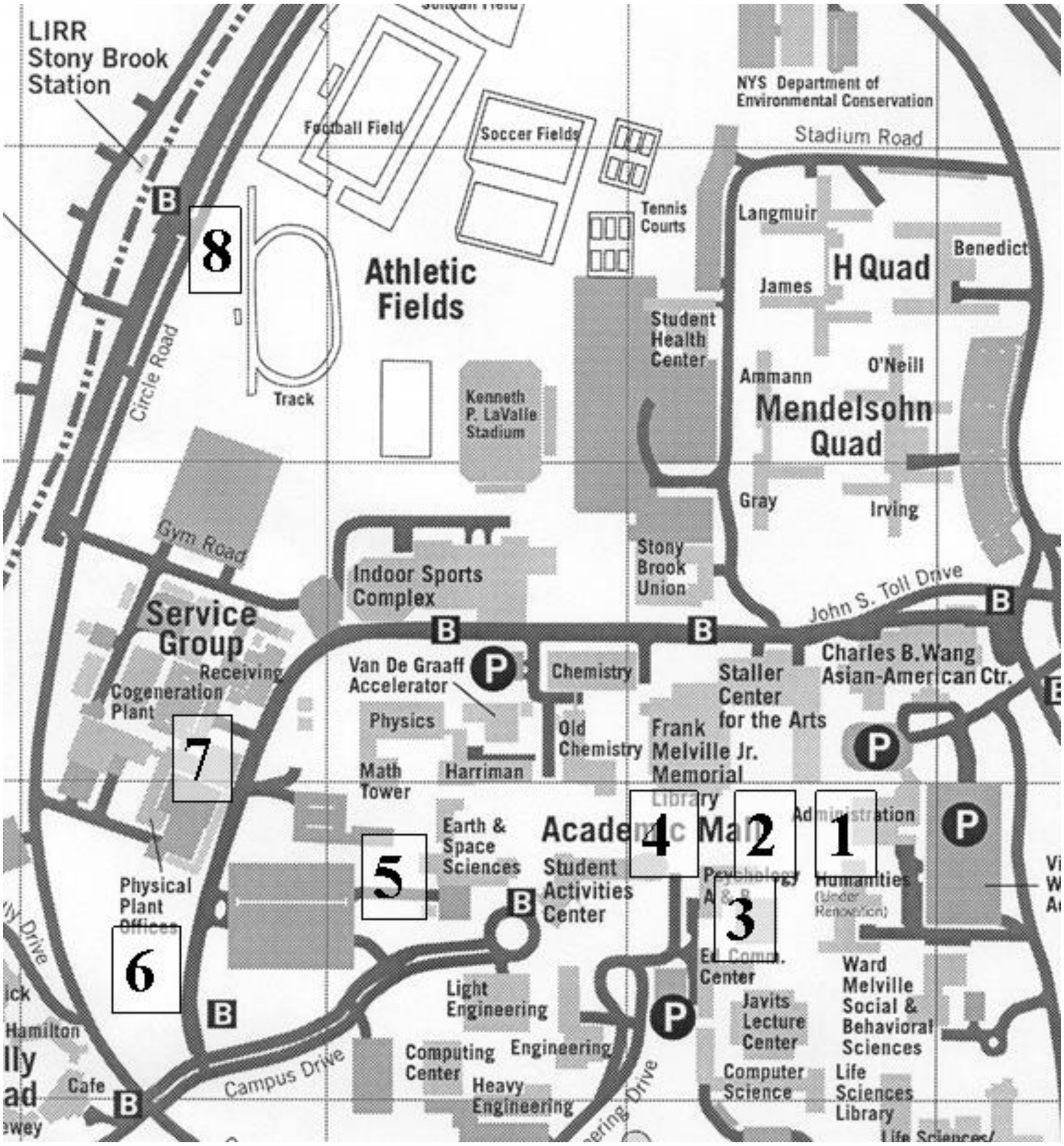

Figure 1 – Stony Brook University's West Campus (SUSB, 2004)

Note: Throughout this paper, common plant names as well as the genus and species (in parenthesis) are used. Common names vary, but the Latin genus and species are consistent and recognized by botanists and gardeners worldwide.

LOCATION 1 - FORMAL GARDENS

Figure 2 – Plantings near Administration Building

I was fascinated by the beautiful formal gardens planted in triangular plots directly in front of Administration. These gardens are dramatic, inviting, and relatively low-maintenance showcases for interesting varieties of plants. The diverse vegetation—the different plant growth (habits), textures, colors, and leaf forms—draws the passerby. In my research using Woods, 1992, *Encyclopedia of Perennials,* I found that the plantings in these formal gardens were perennial. Perennials come back, spread year-after-year, and require only annual trimming. The landscapers placed the plants close together and covered the soil with a mulch layer. This method allows little space and light for weeds to grow, thereby minimizing weeding and creating a low-maintenance garden. The dense plantings also work together to trap valuable moisture, reducing the need for frequent watering.

The formal gardens include a variety of decorative grasses that are native to North America, Europe, and Asia. The Purple Cone Flower (*Echinachea purpurea*) is native to North America and its flowers, stems, and leaves are used as an over-the-counter cold remedy. Joe-pye Weed (*Eupatorium fistulosum*), although usually found in wetlands, is tolerant of a variety of soil conditions and is thriving here. The dark-leafed Coral Bell (*Heuchera micrantha*) is native to the mountains and deciduous woodlands of North America. Autumn Joy (*Sedum* species) is a fleshy, succulent plant that blooms in the fall and grows in the northern temperate regions of the world. The long-leafed Yucca (*Yucca* species) originates in the semi-desert conditions of Mexico. Daylilies (*Hemerocallis* species) are represented in the formal garden. Each Daylily flower lasts for one day, but the many buds on each plant provide a long and beautiful display. The vibrant red Lucifer (*Crocosma masoniorum*) comes to us from Africa.

Figure 3 – Russian Sage **Figure 4 – Purple Coneflower**

The woody plants in this landscape include: purplish-blue flowering Russian Sage (*Perovskia* species), native to Iran and northwest India; red-leafed Japanese Maple (*Acer palmatum*); Kousa Dogwood (*Cornus kousa*), another Japanese native that bears beautiful white flowers in the spring and red fruit in the fall; Barberry (*Berberis thunbergii*), a red and green-leafed bush; and Mugo Pine (*Pinus mugo*), a low-growing pine that is particularly well-suited to a xeriscape, or dry garden (Woods, 1992).

During the course of the day, plants give off moisture through pores in their leaves and stems by a process called transpiration. Transpiration is greatest on hot, dry, windy days. Plants that are adapted to dry conditions have rounded, folded, fleshy, or needle-like leaves with a thick waxy coating or small hairs. I found it interesting to consider which moisture conservation technique was being employed by each particular plant. For instance, Mugo Pine (*Pinus mugo*) conserves water with needle-like leaves that provide little surface area for transpiration; while Autumn Joy (*Sedum* species) employs a waxy coating on its rounded, fleshy leaves; and the Coral Bell (*Heuchera micrantha*) holds onto droplets of moisture with the fine hairs on the undersides of its leaves and stems.

Having identified the flora, I found that, in general, these perennial plants and shrubs were tolerant of dry conditions and full sun. In an attempt to conserve water resources, there is a trend toward planting xeriscape gardens and lawns. Xeriscape plants require *little or no watering once they are established*, a process that can take one to two years. Nonxeriscape plants need about one inch of water per week (Papernik, 2003). It is reassuring that, in its choice of plantings for newly landscaped areas, the University is making an effort to conserve valuable water resources.

The United States Environmental Protection Agency (USEPA) has designated Long Island's water supply as a sole source aquifer system (Dunn, 2000). In other words, the rainwater that permeates our ground is the only source of drinking water (other than bottled water) that we have available to us (Koppelman, 1996). An aquifer is geologic formation that contains water and can supply wells or springs. A lens of fresh water, surrounded by salt water, lies beneath Long

Island. Excessive pumping of fresh water causes salt water to seep (intrude) into the aquifer to replace the fresh water. Some areas--such as parts of Nassau County, the North and South Forks, and Shelter Island--are already experiencing salt water intrusion.

The Suffolk County Water Authority, which provides service to approximately 80% of Suffolk County residences, estimates that 30% of the water they produce is used for garden and lawn irrigation. Approximately 10% is used for drinking consumption, while the balance is used for showering, bathing, dishwashing, toilets, washing machines, etc. Other municipal water systems servicing the remainder of the County probably experience similar usage. Farms have their own wells and irrigation systems and are not considered in these estimates of groundwater use (Stevenson, 2003).

LOCATION 2 – TURF LAWN

Turf is a mat of grass laid down over prepared soil that establishes an "instant" lawn. I recall the preparation and planting of these lawns in the Academic Mall, when a team of workers arrived, spread topsoil over the construction-rutted soil, then fitted the carpet-like mats of grass to the area. These lawns have been carefully maintained--watered, fertilized, and fenced-off--since their planting.

I observed the turf grass to be of one variety--one stalk the same as the next. Recently, I noticed increasingly more weeds growing among the turf grass. A weed is any undesirable plant. Unless treated with herbicides that discourage the growth of weeds, lawns become home to plant species other than the cultivated grass. Maintaining a lawn of this type requires regular application of fertilizers, herbicides, and pesticides.

Fig. 5 Turf Grass

There is concern about the use of these chemicals in gardens and lawns due to Long Island's coarse sandy soils, high water table, and acidic (low pH) groundwater, which all contribute to horticultural chemicals' leaching ability. Leaching occurs when water carries a dissolved chemical through soil. Some contaminants that are of concern on Long Island are nitrates and pesticides. Nitrates come from fertilizers and sewage. A pesticide is defined as "any compound or element utilized as an insecticide, herbicide, nematicide or fungicide, and any metabolite of these chemicals" (Suffolk County Department of Health Services, 1999).

Due to Long Island's geohydrology, nitrates easily become mobile in our soil. In the 1999 Suffolk County Department of Health Service's (SCDHS) *The Water Quality Monitoring Program to Detect Pesticide Contamination in Groundwaters of Nassau and Suffolk Counties, NY*, it was found that 12.7% of the private wells in Suffolk's agricultural areas exceeded the 10 parts per million (ppm) maximum contaminant level (MCL) for nitrate. Over 22% of public wells in Suffolk showed marginal (above 6 ppm) nitrate contamination and a number of public wells periodically exceed the nitrate drinking water standard of 10 ppm. When this occurs, water companies switch to an alternate well field. Excessive nitrate in drinking water is particularly dangerous to pregnant women, where an association has been made between high nitrate levels and first trimester miscarriages *and* to infants, where it can lead to methemoglobinemia or blue baby syndrome (Suffolk County Department of Health Services, 1999).

For the purpose of the SCDHS's 1999 report, 2,306 water samples were collected from areas with known or suspected pesticide contamination in Nassau and Suffolk counties. Of the 498 public wells tested, 6.4% had detectable levels of pesticide and 1.6% exceeded drinking water maximum contaminant levels (MCLs). The detection level of pesticides in private wells (located in Suffolk only) was 38.5%, with 12.9% of the private wells tested exceeding one or more MCLs. Public supply wells that exceed MCLs are removed from service or amended with a granular activated carbon filters to reduce contaminant levels. Due to "concerns of potential adverse health effects and [the] ability to leach into groundwater" six of the ten pesticides exceeding MCLs are currently banned on Long Island (Suffolk County Department of Health Services, 1999).

With increased pollution, more water treatment is needed and deeper wells must be drilled—all at greater expense to the consumer. Alternatives to high maintenance lawns must therefore be considered for the future preservation of our groundwater resources—both in terms of contamination and overuse.

LOCATION 3 – BIRCH GARDEN

Tucked between Psychology A and B, stands the beautiful, shady courtyard garden designed, donated, and planted by Professor Ashley Schiff in 1967. University planners intended to preserve a maximum of the natural woodland areas on campus (Vorhees, et al., 1948). However, much to the dismay of many, these natural landscapes were destroyed during construction. Dr.

Schiff, a conservationist and professor of political science, strove to beautify the Stony Brook Campus, where major construction was still in progress (Shannon, 2003).

Figure 6 –Birch Garden

With the help of students, the original, low-maintenance garden was planted with European White Birch (*Betula pendula*), pink and white Azaleas (*Rhododendron* species), and English Ivy (*Hedera helix*). The garden now also includes perennials at its entrance and River Birch (*Betula nigra*) as well as several varieties of Hosta (*Liliaceae* species) throughout the garden. The River Birch was introduced to replace some of the original White European Birch, which suffered serious damage during ice storms (O'Leary, 2003).

Figure 7 --Stone Blocks

The plants in the Birch Garden are watered by a sprinkler system, while horticultural cloth and mulch cover the ground to retain moisture and discourage weeds. The pathway of abutting stone blocks provides a durable surface with spaces in-between that allow rain to enter the ground over a majority of this garden. Maximum rainwater infiltration is especially important here on Long Island because the groundwater that eventually accumulates in the aquifers is our sole source of drinking water. Paved surfaces prevent infiltration and increase runoff. Long Island's average rainfall amounts to 44 inches/year. Where the ground is unpaved, 50% of this rainwater infiltrates the ground, 45% evapo-transpirates, and 5% runs off (Koppelman, 1996). A typical, 10,000 square foot, unpaved backyard in our area can infiltrate approximately 160,000 gallons annually (Hanson, 2003)!

LOCATION 4 – GROUNDCOVER PLANTINGS

As an alternative to grass, groundcovers were planted beneath the trees and within some of the walkway dividers of the Academic Mall. The visually-appealing dark green leaves of Periwinkle (V*inca minor*), the red and green leaves of the low-growing Barberry bush (*Berberis thungergii*), and the striped light and dark green leaves of Lilyturf (*Liriope muscari*) represent low-maintenance, perennial groundcovers. These plantings require only annual trimming and no mowing, require little water once established, remain green for most of the year, provide natural mulch, and choke out weeds. This treatment represents an effective, efficient, and attractive alternative to the traditional lawn. Groundcovers reduce the need for fertilization, watering, and maintenance (Arthurs, 1979).

Figure 8 – Periwinkle, Barberry, and Lilyturf Groundcovers

Figure 9 – Drip Irrigation

During the landscaping of the Administrative Mall, I observed the installation of a micro- (or drip) irrigation system. Typically inexpensive to install, the tubing is laid down on the surface of the soil and covered by mulch. This type of low-pressure irrigation delivers water a little at a time, directly to the roots. Therefore, 80% of the water reaches the roots versus 20% from a sprinkler (Hodgson, 1998). Since water is applied at soil level, much less of it is lost to evaporation.

Sprinklers deliver a high volume of water in a short period of time, in a process described as a "drench-and-let dry cycle." Often, the spray is misdirected or drains away unused because the soil and plants cannot absorb it so quickly. Micro-irrigation keeps the roots evenly moist consistently, but does not waterlog the soil. This system applies small amounts of water, more frequently, over longer periods of time. The water spreads laterally and the tubing (emitters) is closely spaced to allow coverage zones to meet (Hodgson, 1998). The net result is that micro-irrigation emitters dispense one-half to two gallons per hour versus the 8 gallons per minute of sprinklers (Hanson, 2003).

The added benefit of micro-irrigation is that the surface of the soil remains dry, discouraging the germination of weed seeds. Additionally, since the leaves are not moist, plant diseases are less likely to develop. Conventional watering and sprinkler irrigation spread soil-borne disease when drops of water bounce up from the soil (Hodgson, 1998).

LOCATION 5 – WOODLAND

Here, behind the Earth and Space Sciences building and flanked by two parking lots, stands a small, fairly typical North Shore deciduous woodland community. Deciduous trees have large flat leaves that provide maximum surface area for photosynthesis during the spring and summer, shed their leaves in fall, and lie dormant during the winter months. This site represents the effort of University planners to retain wooded landscapes adjacent to paved areas.

Figure 10 -- Woodland

Moist woodlands such as this show us the full range of strata—a canopy of tall trees, an understory of shorter trees, a shrub layer of low bushes, an herb layer of short plants, and a litter layer of decomposing leaves on the ground. Decaying leaves create leaf soil or humus that acts as insulation, holds water, and allows air to circulate. They also provide a home to thousands of earthworms, insects, and microorganisms per square foot.

This woodland is characterized by a canopy of White and Red Oak (*Quercus alba* and *rubra*, respectively), Red Maple (*Acer rubrum*), and Black Locust (*Robinia pseudoacacia*). The understory is populated by Mountain Laurel (*Kalmia latifolia*), Sassafras (*Sassafras albidum*), and blight-challenged American Chestnut (*Castanea dentate*) shoots. The shrub layer consists of Mapleleaf Viburnum (*Viburnum acerifolium*) and Lowbush Blueberries (*Vaccinium augustifolium*). A variety of plants and wild flowers make up the herb layer of this community. Poison Ivy (*Toxicondendron vernix*) and Fox Grape (*Vitus labrusca*) vines grow among the other plants (Springer-Rushia and Stewart, 1996). Decomposing leaves resting on the soil make up the litter layer of this woodland.

Light is the important factor that supports plant life from the top canopy to the bottom herb layer of this woodland. Several years ago, for some unknown reason, the shrub and herb layers were removed from this area, but have recovered somewhat. The more aggressive pioneer species like Mapleleaf Viburnum, Sassafras, and Poison Ivy have taken advantage of the lack of competition within the lower strata and have moved in with a vengeance. Removal of shrub and herb layers disturbs the ecosystem and habitat of the creatures that live within them.

LOCATION 6 – WOODLAND

Figure 11 – Mountain Laurel

This more secluded woodland community, located adjacent to the Physical Plants, has been disturbed less than Location 5. The flora here are similar to the previous location, but are more diverse. White and Red Oak, Red Maple, and American Beech (*Fagus grandifolia*) make up the canopy. In addition to the Mountain Laurel, Sassafras, and American Chestnut understory growing at the previous site, this woodland consists of Black Cherry (*Prunus serotina*) and Flowering Dogwood (*Cornis florida*). The shrub layer is home to Mapleleaf Viburnum, Lowbush Blueberries (*Vaccinium augustifolium*) and Wild Raspberry (*Rubus* species). The herb layer consists of Common Nightshade (*Solanum nigrum*), Christmas Fern (*Polystichum acrostichoides*), Solomon's Seal (*Polygonatum biflorum*), and a variety of other wild flowers. Along with Poison Ivy and Fox Grape, Catbrier (*Smilax rotundifoilia*) vines grow here as well.

Figure 12 – Leaf Litter

Plants carry on photosynthesis by drawing energy from the sun, and water and nutrients from the soil. The roots of plants absorb minerals from the soil, which go into the leaves. These nutrients return to the soil at the end of a growing season, when the leaves fall and break down as they decay.

I was very interested to examine the soil horizons of this area by using an auger to remove a soil core measuring one meter in length. An auger is a corkscrew-tipped tool that removes a short plug of soil with each twist of the handle. Choosing an undisturbed area away from the path that was free of Poison Ivy, I gently brushed aside the thin topmost layer of dry leaves and acorn bits, the more decomposed older leaves, the humus (rotted leaves and twigs), and finally exposed the mineral soil.

To prepare for collecting a soil horizon, I laid a large black garbage bag on the ground. After several twists of the auger I carefully removed the excavated core and placed it at the end of the plastic that represented the top of the profile. I measured the depth of the hole and by compressing the soil sample with my hands, adjusted its length to match the depth of the hole. At this location I was not able to auger down more than 16 cm without encountering a layer of till, where the cobbles prevented proceeding any farther. After four attempts, I settled on examining and characterizing the soil I had removed from the last hole. (In areas where till might be a problem, using a shovel or garden trowel to dig down approximately 10 cm is more practical than using an auger.)

The soil's upper horizon, which measured 5 cm, was fairly dark and full of roots. This soil was structureless because it was difficult to pick out a single ped (an individual unit of soil structure), and the structure fell apart when handled. The horizon below the upper one measured 10 cm and was lighter in color and contained fewer roots and more pebbles. The soil structure of the latter was granular and its consistence was friable because the peds broke when a small amount of pressure was applied. With both soil horizons, I took a sample around the size of a golf ball and moistened it with water. I worked the water into the soil with my fingers and began to squeeze it between my thumb and forefinger in a snapping motion to try to form a ribbon of soil. Both soils were soft, smooth, easy to squeeze and felt very smooth (with no sandy grittiness), so I characterized them as silt loam according to a soil textural triangle diagram. Since there was no bubbling when I tested the soils with several drops of vinegar, I determined that they contained no carbonates (GLOBE, 1997).

According to the *Soil Survey of Suffolk County, New York*, West Campus contains mostly Riverhead and Haven soils--Haven loam is found behind the Earth and Space Sciences building, and Riverhead Sandy loam is found at the site of the forest near the train station. It should be noted that the soils on campus have been disturbed during the construction process. Suffolk County soils formed from materials deposited during the period of the last glaciation. The materials that make up our soils are: glacial outwash made up of sorted soil and gravel, unsorted glacial till, and small amount of glacial lake silt and clay. With the retreat of the glacier, the till and outwash were covered by water or wind-deposited silt, clay, and fine to very fine sand. The native vegetation has affected the character of the soil by adding organic acids when the leaves fall from the trees. Earthworms and other burrowing animals create soils that are more permeable to air and water, aggregate soil particles, and fertilize the soil with their waste. Bacteria and fungi break down organic materials and return nutrients to the soil. Man has dramatically altered the soil with his farming and construction practices (United States Soil Conservation Service, 1975).

LOCATION 7 – MEADOW

Figure 13 – Broad-Leafed Plantain

A variety of grasses and weeds coexist in this field adjacent to the Physical Plants. Crabgrass, White Clover (*Trifolium repens*), narrow-leafed Plantain (*Plantago lanceolata*), and broad-leafed Plantain (*Plantago major*) are some of the plants that grow here. Native Americans dubbed broad-leafed Plantain "White Man's Foot" because this weed appeared in North America where Europeans settled. The Shoshone applied wet dressings of *Plantago major* to wounds and venomous insect and reptile bites. They used the seeds as a worming treatment. Plantain is also a folk remedy for treating poison ivy's itch (Spencer, 1968).

Broad-leafed plants such as those found in this meadow require little water and fertilizer, are relatively slow growing, but have a low tolerance for traffic (Arthurs, 1979). The diversity that exists in a meadow such as this provides a variety of food for wildlife and is not impacted as dramatically by the pests that can ruin a homogeneous lawn.

LOCATION 8 – WOODLAND

Figure 14 – Norway Maple

I was intrigued by the dense stand of predominantly Norway Maple (*Acer platanoides*) and several Black Locust (*Robinia pseudoacacia*) across from the train station. This woodland was not typical of others I had observed around campus. There was no stratification within this woodland--only an overwhelming canopy of interlocking Norway Maple leaves and the occasional Black Locust.

Norway Maple is considered a fast-growing “weed” of the tree world. Although a native of Eurasia, the Norway Maple was introduced to Philadelphia in the 18th century as an ornamental shade tree. Today, it is the most planted city tree in the United States. This maple is tolerant of shade and efficient in its use of water and nutrients and thus outcompetes native Sugar Maples (*Acer saccharum*). The dense canopy created by the Norway Maple discourages the growth of the understory, shrub, and herb layers, further reducing plant diversity. The appearance of the woodland confirmed the growth habit of the Norway Maple. It is no wonder that conservationists are urging communities to ban and remove this tree. Black Locust thrives in disturbed areas and grows quickly. This characteristic has apparently insured the Black Locust’s survival in this particular woodland (Randall and Marinelli, 1996).

CONCLUSION

This research paper shows the type of science we can experience by simply looking around us, here in our immediate neighborhood. Suffolk County, Long Island, particularly, offers us a wide breadth of locales that can be tapped for their natural beauty and educational benefits. The questions students can ask themselves are: why does this area look the way it does; why do certain plants (and not others) grow here; how has human intervention changed the environment around us; what can we do to maintain an environment that is beneficial to plant, animal, and human life in our community?

With an observant eye and some simple tools, science can be conducted right outside our doors. Attaining the knowledge and understanding of our environment can help us make informed decisions about: how we landscape, how much water we use, how we fertilize, or how we protect our gardens from pests… The campus at the State University of New York at Stony Brook offers a wonderful opportunity to observe a variety of landscapes in a readily accessible area. Experience it!

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