Managing the Landscape of Towson University: Becoming a Model

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Dena Bober
Brandi Hale
Michael Hansen
Jennelle Kershaw
Curt Kleinsorg
Ephraim Maduabuchi
Michael Malone
Timothy Marshall
Julie Okronley
Matt Rescott
Erin Shutt
Joseph Vogelpohl
Elizabeth Yarbrough

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Preface

All students completing the Environmental Science and Studies major enroll in ENVS 491, Senior Seminar, during their senior year. In this course, students are presented with an environmental problem and 'charged' with investigating it, analyzing it, and developing solutions/suggestions that are economically sound, logistically feasible and that incorporate stakeholder needs and constraints.

This year the class received its "charge" from Mr. Jack Nye, Director of Planning, Facilities Management. Issues associated with the management of the campus landscape presented an opportunity through which the University could potentially enhance its environmental stewardship. In light of our new Master Plan, the campus landscape will be altered in the not so distant future. The hope was that this group of students could look at the current landscape, get a sense of the future plans, consider how landscape management affects such things as ecological and hydrological processes and develop suggestions for the future landscape of Towson University. What follows is the results of a semester of work on this issue.

The students have worked on this on their own. I provided only limited guidance and help as requested. They deserve the credit for their success.

I. Introduction

The landscape of Towson University is the front door of a complex academic institution. It plays important roles in education, recruitment, recreation, and university and public events. Through all of these activities, Towson University's landscape conveys our common identity to all who pass through the campus. By creating a campus that is not only inviting but also ecologically sound, Towson University and the surrounding community have the chance to allow people to develop and nurture a strong sense of place with relation to our campus.

As we work to sustain, enhance, and beautify our campus, we have an opportunity to become an ecological steward for the 21st century. Ecosystem-based landscape management is valuable not only to Towson University, but also to neighboring counties throughout Maryland. Public recognition of problems such as water pollution, landscape fragmentation, and loss of biodiversity, has resulted in a growing body of Federal, State, and local legislative mandates pertaining to ecosystem-based management. Presently, zoning laws are the primary tools for Government to show recognition of the importance of best management practices throughout Maryland. Each year, it seems that greater areas of green space are being preserved. We must manage our lands accordingly if we are to maintain the health and diversity of the environment.

Sustainable landscaping on Towson University's campus can enhance the student community through education, research, and implementation of ecologically sound management practices. Facilities management currently provides the most ecologically sound practices available. The Towson campus community should view the landscape as a resource for active and passive learning as well as ongoing research. The landscape can

serve as living classrooms for science and liberal arts classes. Development of self-guided tours can serve as outreach to promote the campus as an education and research tool. The campus landscape can be an excellent tool for experiential learning in a broad range of disciplines and courses.

The campus architecture, master plan, and renovation can be adjusted to reflect best management practices (BMPs). Effectively implementing BMPs would result in meeting student and faculty needs. The purpose of our project is to address the specific environmental challenges facing Towson University's campus.

Fully understanding current practices allows for the most effective future landscape management initiatives to be developed. This full understanding begins beneath the surface. As a part of Maryland's Piedmont Plateau, Towson University has a variety of soils, each with a unique profile that can help determine sustainable land use. Of the six different soil series found on campus, most have a moderate to high moisture capacity (USDA, 1976). Ways to decrease storm water runoff and stabilize soil with the appropriate use of plants to create BayScapes, buffers, and rain gardens will be addressed.

Towson University lies within a unique hydrologic area in which storm water runoff from campus enters Towson Run, eventually feeding into the Chesapeake Bay. The volume of storm water runoff is significantly increased by surfaces that inhibit infiltration. By allowing water to flow over more of Towson University's surface, sediment from areas exposed by alternative traffic paths is also incorporated into storm water runoff. Suggestions to reduce such surfaces thereby minimizing runoff and erosion

are presented. In addition, ideas to reduce the impacts of the student population on the landscape will be presented.

As an integral part of the Towson community, Towson University can become a model for other institutions and communities interested in a more ecological approach to landscaping. Several suggestions of how to enhance current practices on campus creating a more ecosystem-based approach will be a focus.

II. History

In order to gain insight into the future of Towson University's landscape, recognition of University history is essential. Towson University, known previously by several different names, did not originate in the town of Towson, Maryland.

Over the past 135 years, Towson University has undergone some major changes, not only educationally, but aesthetically as well. In 1865, the State legislature allocated funds for Maryland's first teacher-training school. In 1866, The State Normal School opened on rented land in Baltimore City. M.A. Newell, the first principal, oversaw 11 students and 3 faculty members (N. Gonce, personal communication, 2003). After occupying two rented sites in Baltimore City between 1866 and 1876, the 10 faculty members and 206 students of the State Normal School moved. The first building constructed specifically for the school was located at the corner of Carrollton and Lafayette Avenues in Baltimore City (N. Gonce, personal communication, 2003).

On April 24, 1904, John and Mary Nelligan purchased 5 plots (72 acres) of land that would eventually be known as Towson University. The 5 plots were bought from Richard S. Albert, Abraham P. Nonemaker, Ray P. Allen, Arthur L. Bosley, and Richard Pleasant, who were trustees of the land at the time of purchase. The true landowner is not known. The Nelligans lived in Glen Esk, which was an original farmhouse. The five plots were combined into one and were known to be partially farmland and summer homes. In 1910, campaigning began for a campus where Maryland's future teachers could live and learn in a more appropriate environment (N. Gonce, personal communication, 2003).

In 1912, the General Assembly passed a $600,000 bond to finance a move. The State purchased 72 acres from John and Mary Nelligan for $83,735.00 (N. Gonce,

personal communication, 2003). The new State Normal School campus, comprising the Administration Building (now Stephens Hall), Newell Hall, and the Power Plant, was dedicated in November 1915. The school's president, Sarah Richmond, moved into Glen Esk, which would serve as the president's residence for more than 50 years (N. Gonce, personal communication, 2003).

The first of three name changes occurred in 1935 during the administration of Principal Lida Lee Tall. The State now required new public school teachers to have baccalaureate degrees instead of 2-year teaching certificates, thus the 80-year-old school revised its curriculum and changed its name to State Teachers College at Towson (N. Gonce, personal communication, 2003). Other changes followed in response to societal and educational demands. In 1963, the State Teachers College expanded with offerings in the arts and sciences as well as graduate programs. Once again, the school changed its name to Towson State College. The baby boom generation began to flock to college campuses in 1964, and during the next decade the college's enrollment increased from 3,537 to 13,399. To accommodate the explosive growth and build additional facilities, the college would purchase more than 200 acres from Sheppard and Enoch Pratt Hospital between 1964 and 1971. Due to an influx of over 10,000 students in a decade, the campus was forced to construct buildings wherever possible. Though the college satisfied the needs of the community, the construction of campus was poorly planned (N. Gonce, personal communication, 2003).

Throughout the 1960s and 1970s, the Center for the Arts, University Union, Resident's Tower, Hawkins Hall, Towson Center, Cook Library, and Minnegan Stadium were added to the campus. Course offerings and programs were also expanded to meet

new demands, and by 1976, the college was renamed Towson State University (N. Gonce, personal communication, 2003).

In 1988, the university became a part of the University System of Maryland. Yet again in 1997, the college was renamed Towson University to reflect the evolution from a State-supported to a State-assisted institution. Towson University has evolved from a small school in downtown Baltimore to Maryland's second largest public institution of higher education. We now have 17,000 undergraduate and graduate students enrolled in 90 educational programs encompassing liberal arts and sciences, as well as applied professional fields (N. Gonce, personal communication, 2003).

III. Current Practices

Towson University's campus has expanded from one piece of rented land to 320 acres of urbanized landscape. Of these 320 acres, the Towson University landscaping crew, headed by Paul Thomas, intensively maintains 200. Towson University's landscaping crew is made up of 17 employees, 12 of whom perform daily tasks. Those 12 individuals make up four 3-man crews, each of which are responsible for approximately 80 acres. When necessary, Mr. Thomas will hire contractors for specific jobs, as needed and within the confines of the budget (P. Thomas, personal communication, 2003).

The current budget for Towson University's landscaping is roughly $800,000, of which $500,000 is devoted annually to salaries and $300,000 is allocated for materials and supplies. Most of the mowing on campus is privately contracted at a cost of $86,000 per year. An average mowing contract consists of 28 mows per year, which equates to $3,800 per single day of mowing. Mowing is contracted because of the costs associated with the acquisition and maintenance of expensive equipment it requires. Paul Thomas saves the University about $40,000 per year by enlisting a contractor for mowing. The money saved has provided funding for other jobs like leaf, tree, and snow removal (P. Thomas, personal communication 2003).

Tree removal and pruning is determined by a safety and age analysis of a tree. If there is a reason that a particular tree be brought down, the landscaping crew ensures that another one be planted elsewhere on campus. Although most tree maintenance is privately contracted, an experienced member of the landscaping crew does small jobs.

Paul Thomas is responsible for both the maintenance and aesthetics of the campus landscape. His crew is an integral part of connecting the institution and its campus to the surrounding community. An improvement of the current practices can only further promote this connection as well as the goals of Towson University.

IV. Impacts of Landscape

Human Aspects

Towson University's landscape can have a significant effect on the faculty, students, and surrounding communities. Knowing how different landscapes affects the mental behavior of the inhabitants is important and can help us develop an effective landscape design.

The appearance of trash on the landscape may have negative affects upon human health. The visual distraction created by trash is found throughout campus from the woods to the classroom. Such distraction causes people to be indirectly affected by their physical environment. A well-maintained landscape with features that increase the aesthetics of the area also influences the way people are likely to treat it. When students begin to value the University's campus, care towards its appearance may become more prevalent. Random littering by the student body may decrease and students throughout the institution may make the effort to help keep campus clean. Such actions will decrease the costs incurred by maintenance and will also provide a more visually appealing campus.

Since the majority of Towson University's population encounters the landscape virtually everyday, it is important to understand how the University affects one's daily mental approach. The stresses associated with urbanized areas, such as noise, crowding, pollution, and traffic, are domineering factors in the mental approach to everyday living (Kuo et al., 1998). While some people may feel comfortable and work well in such environments, others may not. Depending on one's point of view, a rural area or natural landscape may be preferred for its tranquility, beauty, and natural features (Hall IV et al.,

1989). It has been shown in qualitative studies that a pleasant landscape can change or equalize the mood of inhabitants (Shang et al., 2000). While an urban setting offers little stress relief, a natural landscape can enhance one's mental state. Natural settings promote a sense of tranquility and offer some natural healing properties (Staats et al., 2003).

Although most may not know what kind of tree or grass they are looking at, people make instant associations with what they see (Purcell et al., 2001). Some people also feel safer in an urban environment that includes well-placed vegetation. Vegetation cannot be so dense as to limit the ability that one has to observe their surroundings (Herzog et al., 2000). By providing an adequate amount of properly placed vegetation, feelings of safety may be improved. Easing the minds of students and faculty through proper landscape design may be a good way to decrease a fear that some may feel.

Moreover, landscaped areas allow for better recovery from fatigue (Staats et al. 2003). Natural settings can reduce attention fatigue and can be a good tool to enhance positive mental health. Providing an area in which students can recover from the fatigue associated with studying is extremely important. The Glen possesses all of the properties of such an area, however it is too close to the main campus. There is a natural area on the west side of Osler Drive that lies well away from main campus. This area has been of low priority recently but could be developed as an area for student relaxation and recreation. In 1998, several members of the Biology department developed a restoration proposal for the area (Wolfson, personal communication, 2003). The restoration of this area would also enhance its recreational potential, further justifying the implementation of the proposal.

Path choice is also influenced by the present landscape. Pedestrians often choose the shortest and easiest path. Paths that are littered with signs, restrictions, and have a bland appearance are generally avoided (Zacharias, 2001). Path dynamics on Towson University's campus could be influenced by a well thought out landscape design. Providing interesting path options in appropriate directions could eliminate undesirable walking paths. Directing traffic with landscape features is a more visually and psychologically appealing method, rather than placing signs at each intersection showing people where to walk. The public using the campus for outside events, incoming freshmen, and workers called upon for repairs, would all benefit from interesting path choices.

As interesting path choices become a part of the university's landscape further improvements are to follow. Improvements to the landscape of Towson University could alter the entire dynamic of the school. Implementing such changes in an ecologically responsible way can also improve the attitude that people take towards Towson University.

Natural Aspects

There are several components of the natural environment that are important to consider when designing a landscape. Botanical aspects, hydrologic characteristics and climatic conditions are just a few examples of such components. Of these examples, hydrologic characteristics underlay the foundations of the natural environment.

The United States Department of Agriculture defines hydrology as "the study of the properties, distribution, and effects of water on the Earth's surface, soil and

atmosphere" (USDA,1998). Towson University must consider hydrology in the creation of its infrastructure. It is essential that Towson University consciously consider hydrology since actions taken on campus directly affect surrounding communities through its flow off campus.

There are two main streams on campus, South Fork Towson Run and main branch Towson Run. The two streams eventually meet and drain into Lake Roland. The origin of these streams is off campus east of York road. Due to the substantial development of the area, some streams have been completely translated into pipe and put underground. Such is the case with much of the Glen Tributary, a small stream on campus in the Glen, which drains into Towson Run. The first time the water in the Glen encounters daylight is when it enters onto campus in its newly restored channel.

The geology department, under the initiative of Dr. Filer, has begun a small monitoring network of campus hydrology. This network includes 2 stream gauges, a groundwater well, a rain gauge, and 2 sites to sample water quality. It is important to monitor hydrology, as any landscape management plan will have an impact. This network begins to describe the hydrology of campus. An expansion of this network will lead to a better understanding of campus hydrology.

The campus landscape provides unique educational opportunities as the hydrologic characteristics are exploited. Towson University's urban setting creates unique effects on streams. Urban settings induce unnatural flow characteristics in terms of supply to stream channels. Unnatural flow characteristics may range from frequency of flood events to simply an increase in suspended sediment.

An understanding of the current properties of the water in streams must be applied

before actions are taken to improve it. Concurrently with stage and discharge measurements, Dr. Filer has also made water quality (QW) measurements. These measurements are made at the same places where stage is measured, in the Glen and by Towsontown garage. There are five parameters measured when a QW sample is taken, they are: pH, total dissolved solids (TDS), conductivity, dissolved oxygen, and phosphate. Sediment loads in streams can be estimated using TDS measurements. The degree to which urbanization has affected a stream can be gauged using sediment load data. Streams with high sediment loads usually produce altered stream channels and significant hydrologic changes. This should concern the University as our streams already exhibit these signs.

Trends for pH have also been established and show little difference between measurements for precipitation and stream water. Acidic precipitation is normally buffered by local geology before entering streams. Since stream water measures slightly acidic, it has not encountered area geology. It can be concluded that stream water may have originated from storm sewers and the impervious surfaces they serve (J. Filer, personal communication, 2003).

Sediment load and pH are only two of many water quality aspects, which could be described. With Towson Run being highly urbanized and a major tributary to Lake Roland, development of water quality trends would benefit the institution educationally in its program. Students could actively get involved in the study of urbanized streams. Towson could set an example for other institutions by holding itself accountable for the quality of water that passes through campus. Water quality trends and analysis could provide evidence that improvements in campus landscaping practices are working.

Faculty and students could implement and maintain an impressive hydrologic monitoring network. Stations for stage and discharge of streams could be expanded to include other parts of campus and further understand the journey of water. Groundwater wells could be used to monitor changes in water quality and illustrate effects of topography on water levels. Automatic samplers could be placed to gather water quality data during storm events. With the right funding, real time stations could be installed for use during classes. An extensive monitoring network might attract the interest of outside researchers who are seeking data on urbanized streams. Towson University could serve as model for other universities, which may want to develop such a network but may not know how.

Another important component of the natural environment is plants. The plants that we now find on our campus are either native or non-native. Non-native or exotic plants are those that have been introduced from a foreign environment. Therefore, they do not have natural enemies that limit propagation, allowing them to become invasive. Invasive species are difficult to control once they become established in a new environment. However, not all exotics are invasive (Westbrooks, 1998). Many times exotic species thrive in a new environment and are able to co-exist in conjunction with native plants.

Environmentally destructive invasive plants are extremely costly to control. While invasives may seem to be appealing they are detrimental to neighboring plant life cycles. Some of the prevalent invasives on the university's campus include: Norway Maple, Tree of Heaven, and English Ivy (Refer to appendix A for more information on these invasives and ways to control them). Most of the invasives on campus are located on the edges of lower priority areas.

Control of invasive species, which occupy areas between different land uses, should occur. Filling these areas with native natural landscape elements could do this. Wildflower beds and buffer plants are excellent in this role. By using such natural methods, stewardship for the landscape by its users will increase.

V. Landscape Stewardship

Several methods can be used to facilitate environmental stewardship, which are well-developed innovative solutions. Modification of our landscape to include such installations will illustrate to others Towson University's commitment to the environment.

Rain Gardens

A need exists for innovative methods to control storm water runoff during and after rain events. Pollutants and nutrients build up on a variety of surfaces, including sidewalks, parking lots, and rooftops. During a storm event, rain washes pollutants and nutrients into the nearest water body. One solution becoming popular today is the idea of rain gardens.

Bioretention, a key word used by Prince Georges County Department of Environmental Resources (PGDER), is the delay and absorption of nutrients, pollutants, and water by plants and soils (Keyser, 2003; PGDER, 2003). The ideal location for a rain garden is at the source of runoff. Sources of runoff can be the corner of a parking lot, a gutter carrying water off the top of a building, and pitched sidewalks. Each of these locations represent places where bioretention can occur if proper plantings are installed. As rain gardens become increasingly popular, assistance as well as guidance, about their construction will become more available.

Constructing a rain garden involves the arrangement of physical and plant material in order to create an efficient runoff suppressor. Typically native plants found in riparian zones are used (Keyser, 2003). These plants are tolerant of dynamic water levels. Shade trees compliment short dense shrubs in the garden. These shrubs are highly

effective at reducing the energy associated with runoff. Low areas that allow water to pool can be lined with grass, mulch or gravel.

Rain gardens require little maintenance upon completion especially when compared to lawns. Like all gardens, rain gardens require routine upkeep to continue maximum benefit. Their bioretention properties, and simple maintenance needs ensure an ecological storm water control tool.

Riparian Buffer Zones

Riparian zones are commonly defined as vegetative corridors adjacent to stream channels. Flooding, erosion, pollution and habitat degradation are all problems associated with the waterways on campus. Increasing the width of the vegetated riparian zones can significantly affect such occurrences by providing a barrier, slowing runoff and filtering water prior to discharge into the stream.

The size of the buffer needed depends on the size of the stream or frequency of flooding. Essentially the larger the width of the buffer the greater the volume it can filter runoff. Well-maintained riparian zones are at least 100 feet on each side of the stream channel (CRJC, 1999).

Native plants with extensive root systems should be primarily chosen to occupy the buffer. Plants with extensive root systems provide soil stability as well as habitats for aquatic fauna. There are plants native to Maryland that would be perfect for such a location (see Appendix B and D for listings of plants that could be used.)

Impervious vs. Pervious Surfaces

Impervious surfaces do not allow water to infiltrate. Asphalt and concrete are good examples of impervious surfaces; the fine grain particles used to make these

materials do not allow water to seep through them into the ground. These materials present an impenetrable layer between the Earth's surface and precipitation. The amount of land covered and the location of impervious surfaces can lead to excessive runoff. Water accumulated on these surfaces must be diverted to storm sewers eventually discharging into local streams.

Considering how storm water will exit a surface is necessary when designing new landscape for Towson University. As Towson University implements our new master plan, 76 acres of impervious surface will decrease to 56 acres (J. Nye, personal communication 2003). The remaining 56 acres of planned impervious surfaces could perhaps be characterized by semi-pervious surfaces. Semi-pervious surfaces provide many benefits stemming from increased filtration rates to decreased dissolved chemicals in community water. In addition to the quality and quantity of impervious surfaces, the actual dimensions of particular surfaces and their arrangement can greatly impact the flow of water. The width of the sidewalk, for example, should be in direct proportion to the estimated number of users. For example, for two people walking side-by-side the sidewalk should be 7.5 feet wide (NEMO, 2003). Also, it is recommended that where possible, roadways and sidewalks be separated by buffer zones.

A number of new materials exist that are designed to increase surface infiltration. These alternative porous surfaces include grid pavers, block pavers and soil pavement. Grid pavers are constructed from plastic grids made from recycled material. The grid is secured into the ground and can be filled with materials such as grass or crushed stone. Block pavers are small concrete blocks placed in cement that is made from coarse grains to allow for drainage (NEMO, 2003). Soil pavement allows the natural soil to be sprayed

with an environmentally safe solution that hardens the soil. Though the soil becomes a hardened surface, pores still remain allowing for infiltration. As these innovative surfaces increase across campus, surface temperatures during the day will show a slight decrease. That decrease is the direct result of a change in surface color. Lighter surface colors reflect solar radiation and therefore discourage heat absorption. Shading from trees will also contribute to lower surface temperatures (NEMO, 2003).

While the absorption of heat is of concern to the campus community, so is the performance of a surface in colder conditions. Snow is particularly difficult to handle when working with alternative surfaces. Research suggests that more porous surfaces are able to thaw at a faster rate. With a rubber blade placed on the plow, snow removal is no longer a problem (NEMO, 2003).

As Towson's campus continues to grow, it is important to approach developmental issues with landscape stewardship in mind. By increasing the amount of permeable surfaces, the quantity and strength of storm water runoff produced on campus will decrease. Taking new initiatives to improve infiltration will increase the water quality of local streams and provide greater protection against soil erosion. Undisturbed soil is needed to store moisture and nutrients in order to sustain healthy vegetation.

BayScapes

BayScaping is a new and innovative way to landscape that was developed to prevent further harm to the Chesapeake Bay. BayScapes are environmentally sound and have many benefits for wildlife and people. Less mowing and fertilizer applications are required in areas in which they have been installed. These landscapes are colorful and help protect water quality. BayScapes also provide habitats for songbirds, small

mammals, butterflies, and a plethora of other organisms. BayScaping is being promoted throughout the Chesapeake Bay watershed and people are encouraged to visit representative site (ACB 2003).

BayScaping on Towson University's Campus could greatly improve Towson University's image within the community. Adopting this type of landscape, Towson University shows its awareness of problems facing the Bay. Towson University would become a role model for other universities in the Chesapeake Bay watershed (ACB 2003).

Cow Paths

Foot traffic has increased as the campus has expanded. This increase has led to the evident problem of eroded footpaths, known as "cow paths." Looking at the location of these paths on campus, it is easy to see how they follow the shortest distance between two points. The problem here is that traffic on these paths continually kills grass blades and roots. Killing the roots of the grass degrades the stability of the soil, which allows for erosion. During storm events, paths on flat land form puddles. People attempt to avoid the puddles and cause the path to further widen (LDNPA, 2003). Unless some method is implemented to prevent traffic on these paths, they could continually become larger and deeper. This problem escalates more rapidly when the path is located on a hillside.

Originally, the hillside would be covered with grasses; the grass roots holding the soil firmly in place. As a path begins, the soil becomes compacted and does not permit water to percolate into the soil. Instead, rainfall will move along the pathway, further incising it. As continued trampling occurs, the path gets deeper and wider. Subsequent

storm events expose underlying rock. Conditions on the path worsen and cause it to become an undesirable place to walk. Pedestrians will now choose to walk along the sides of the path because it is flatter and easier to navigate. This, in turn, kills more grass and the path is continually widened (DNP, 2003).

As noted earlier, creating attractive features that draw pedestrian traffic can be a good way to influence path choice. Additionally, roping off specific areas or planting obstacles, such as trees and shrubs, can decrease traffic on these paths. These barriers also help to protect the integrity and structure of the soil and root systems, and are much more aesthetically pleasing than rocky, dirt paths through the middle of a grassy area.

VI. Towson University as a Model

By adopting environmental stewardship as a long-term goal, and implementing programs to attain this goal, Towson has the potential to expand its role as an institution of learning. As environmental awareness continues to build within our culture, it is important that institutions of all kinds step forward to set an example for others to follow. A model is an example or a demonstration of a concept or idea. As a model we could serve to illustrate the ideas of environmental stewardship to those who want to see what can be done. A model can be applied to multiple cases and specialized to fit certain situations. By initiating environmental stewardship in its landscape and education program, Towson University becomes a mechanism by which other people and organizations could increase their environmental responsibility. If Towson were to become a model institution, the university stands to benefit in several ways.

The current campus landscape, potential initiatives that could be implemented, and some technical information have all been addressed thus far. While this is important, it is equally important to address the reasons why such actions should be taken. As we implement programs to make our landscape more environmentally responsible and friendly, we assume the role of a model. Since the level of ecological awareness we would be demonstrating is not prevalent, the university becomes the exception rather than the norm. There are two important groups of people for whom the university will serve as a model, residents of the surrounding community, and other institutions. Towson is situated in a unique niche where it can serve as a model for both.

The University has indicated it plans to become more involved in the surrounding community in the next few years and the campus landscape is an ideal place to start.

Primarily because of its visibility, the campus landscape provides an arena in which the university can show community constituents the innovative changes as they are implemented on campus. Residents who see these changes might want to adapt those ideas to the landscapes in which they reside or at the institutions at which they work. Our involvement doesn't have to stop with change to our landscape. Rather the university can go out into the community to share what is has been doing with those who may not be familiar with the campus. Towson University can take a proactive approach to its involvement in the community. One means might be to become further involved in the Jones Fall Watershed association which is our local watershed (Towson Run flows into Jones Falls). Another option might be to start a watershed association specifically for Towson Run. In this venue, Towson University can demonstrate how the parts of its landscape management program benefits the stream. Watershed associations are popular in the Baltimore region with the development of three major organizations and smaller spin offs in local areas. For example the Bear Creek Watershed Association in Dundalk is a spin off of the Herring Run Watershed Association.

Realizing the value of becoming a model campus, several universities already have management plans that will make them environmentally sustainable. Many Ivy League schools make a reference to environmental stewardship in their Master Plan and statement of university mission. For example, Brown University's "Brown is Green" Website proudly shows their environmental program. "The University adopted a Brown Is Green initiative in 1990 to facilitate the conservation of resources, waste reduction strategies, and increased awareness of environmental issues on campus" (Brown University, 2003). Cornell University has also made its environmental mission well

known. The head of the Center for the Environment represents a group of alumni that sponsors programs for discussion and networking between students, faculty and Council members actively addressing environmental issues (Cornell University, 2003). Not only Ivy League schools are declaring their intentions regarding environmental responsibility.

Many schools are adopting a "green" attitude that attracts environmentally conscious students to their institutions. Implementation of our new master plan provides a golden opportunity to actively deploy and advertise our environmental stewardship. If Towson University were to join the growing list of colleges that are known for taking care of the environment, we will improve our reputation at both the national and local levels.

VII. New Initiatives

There are many actions Towson University can take to further environmental stewardship by developing campus landscape into an educational arena. Suggestions are made for doing such.

Dr. James Hull and George Krause were responsible for the development of a walking tour book designed to teach participants about the trees on campus. Similar guidebooks could be developed for the history of the campus buildings, special plantings, or the new Glen stream restoration. Different departments could incorporate a "living classroom" component into their curriculum by using such tours. Incoming freshman and parents can learn more about the campus in an environmental way when they come for tours or orientation events.

Placing plaques on specimen trees and special plantings that name the species and give a brief explanation of its ecological value and its noteworthy characteristics could also evoke student and public interest toward Towson University's landscape. Teachers can use the information as part of information gathering activities as well as ecological recognition.

By developing projects for classes such as plant ecology and general ecology, components of Towson University's landscape could be used for research. For example, students in a class or a club might accept a challenge to remove invasive species in different locations using various techniques. Classes could then monitor areas, from which invasives have been removed, to assess success and determine what happens to the plant community after the invasive plants are removed. Conversely, some areas of invasives could be left and controlled to exhibit the effects of invasives on the

environment. Hydrology and geology classes could monitor any changes in the soils and water surrounding buffer zones. Installed rain gardens might also be monitored for ecological benefit.

Another opportunity to enhance student ownership of Towson University's campus would be to involve the ever-increasing number of student groups with environmental activities. Students could use exotic species removal or trash clean up as part of "servfest" (a volunteer competition between student groups) or designate parts of campus to Fraternities or Sororities to maintain and keep trash free. Once students have invested personal time working throughout the campus, they will feel more connected to campus. Student organizations will feel that maintaining the campus and promoting environmentally healthy living is a priority. Such activities will broaden the minds of some students that may not have already been aware of the landscape. The "place" that they have created on campus will encourage students to feel connected to campus in a new way.

With increased awareness among the students and faculty, the outside community will be eager to find out Towson University's secret. Local schools may want to use our campus as a "living classroom" learning tool. The College of Education could make lesson plans incorporating information pertaining to different species of plants on campus, local plant communities, as well as differences between invasive and native plants as they fit into the environment. Using the campus and its landscape as a learning tool for the University and the surrounding community will increase the connection between the two.

The area west of Osler Drive could be developed as a recreation and relaxation area. A restoration proposal developed by Dr. Hull and colleagues in the Biology Department presents a plan for the use of this area (Wolfson, personal communication, 2003). This area can be incorporated into several classes. Ecology, limnology, and herpetology classes could benefit from the use of the proposed ponds and wetland. Restoration of this area could result in an extraordinary facility on campus.

VIII. Conclusion

Our project required that we, the students, possessed a clear understanding of several concepts and ideas. These concepts and ideas are what form the basis for our suggestions to campus planners. The following is our sense of what some terms mean. Landscape elements combine to form landscapes. A landscape is a mosaic, or a cluster of interacting ecosystems that is repeated throughout a specific location, no bigger than about 10,000km^2 (Huggett, 2000). Ecosystems are a web of intricately complicated life forms each relying on the other for survival. The purpose of this entire project has been to inform and educate those who read it. It has been our intent to convey our sense of urgency to other universities, communities, organizations, etc. We hope to initiate a chain reaction started from our example. We hope that information we provide about the potential for the future of campus results in implementation of some of our suggestions.

If we consider the Towson University campus landscape as just one puzzle piece in the big picture, then by enriching our environmental stewardship, we complete our portion of the puzzle and contribute to regional environmental improvement.

Our intentions have been to: (1) address the specific environmental challenges facing Towson University's campus, (2) discuss possible solutions to improve hydrologic responsibility, (3) address the value of creating a more diverse landscape, (4) provide ideas to reduce or alter impervious surfaces, which can help minimize runoff, erosion, and problems with flooding, (5) make several suggestions of how to modify the current practices to create a more ecosystem-based approach, (6) enhance the noticeable aspects of a well-designed landscape that improve ecological health and (7) consider ways in which the campus can expand its educational activities to include the landscape.

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Appendices

Appendix A – Invasive Plants Found on Towson University's Campus with Recommendations for Control and Replacement.

Brandi Hale and Jennelle Kershaw
(Information presented below obtained from Westbrooks, 1998)

Norway Maple *Acer platanoides*

This tree has large, five-point leaves similar to sugar maple. When the leaf or stalk is broken a drop of white sap will show. The fall foliage is yellow. This tree has allelopathic properties preventing the growth of grass, garden plants, and forest understory beneath it. The seeds travel in the wind and can grow in deep shade. Without control the Norway maple could take over an entire forest. To control this tree, seedlings can be pulled by hand and large trees can be cut down. Herbicides can also be used to control the Norway maple but is not highly recommended. Some native alternatives include: American beech, Red maple, and Willow Oak.

Tree of Heaven *Ailanthus altissma*

This tree has long, compound leaves, with 11-25 lance-shaped leaflets that smell like peanut butter or burnt coffee when crushed. It is incredibly virulent and can grow under very poor conditions. It is a major threat because it produces a huge number of wind-borne seeds. It also grows very quickly and has allelopathic properties that kill surrounding plants. To control this invasive tree, seedlings can be pulled up but one should make certain to remove the entire plant and all of its root structure, if not the tree will grow back. Large female trees can also be targeted to control spread by seed. Herbicides, such as glyphosate and triclopyr, can also be used on the Tree of Heaven but should be done in moderation. Some native alternatives include: Box Elder, Black walnut, and Fringetree.

English Ivy *Hedera helix*

This perennial vine covers the ground and grows up trees eventually pulling them down. It spreads along the ground and sometimes spreads by fruit. To control English ivy, all vines on the ground can be pulled by hand and vines on trees can be cut to destroy the plant. The parts of the vines that remain rooted in the ground can be treated with a herbicide, such as triclopyr . This process will need to be repeated until all remains are gone. Some native alternatives include: Virginia creeper and Crossvine, native vines that support native wildlife.

Ground Ivy, Gill-Over-Ground, Creeping Charlie *Glechoma hederacea*

This non-vining perennial groundcover has leaves that look like Garlic Mustard only smaller with square stems and a minty smell when crushed. It spreads by wind-borne seeds and runners. To control this invasive repeated pulling is necessary for small infestations. Herbicides, such as glyphosate may be necessary for larger groupings.

Garlic Mustard *Alliaria petiolata, A. officinalis*

This non-native weed has rough, scalloped leaves that smell like garlic when crushed. It grows in clusters of erect plants unlike the Ground Ivy. To control this invasive, hand removal of the entire plant, including the root, is necessary. Cutting plants low to the ground in the spring months will help prevent seed

production. Herbicides is also an effective control but not highly recommended. Some native alternatives include: Wild ginger, Lady fern, and Creeping Phlox.

Mile-A-Minute Vine, Devil's Tail Tearthumb *Polygonum perfoliatum*

This annual non-native weed has triangular leaves, barbed stems, and turquoise berries. It rapidly grows on slopes covering and shading out surrounding plants. Controlling this vine involves pulling seedlings and vines out by hands before seed set. Herbicides are also an effective means to controlling Mile-A-Minute.

Appendix B - Plants Suitable for Towson University's Campus

Brandi Hale and Jennelle Kershaw
(Information obtained from Hawthorne, 1999 and Smittle, 2002)

Shade Tolerant Plants:

Bleeding Heart (*Dicentra spectabilis*)

This plant is a native to the area and is low-maintenance as well. It can stand three feet tall and equally wide and bear one-inch pink/white blossoms that look like hearts torn apart. It thrives in the shade and emerges in mid spring with blossoms lasting until late summer. The plant is long-lived with little maintenance except for dividing overgrown clumps. It has a strong resistance to insects and diseases. Bleeding Heart goes well with solomon's seal, trillium, hosta, and ferns.

Goatsbeard (*Arunsu dioicus*)

This plant is a native species growing up to five feet tall, is a great plant for growing in masses as a backdrop for smaller plants. The plant produces plumes of creamy white flowers that are present from spring to fall. It is a shade lover and when grown there it can tolerate dry conditions as well as moist. Deals well with root competition from trees. The plant does particularly well in erosion prone areas due to it extensive root system. Goatsbeard lives many years and dividing crowded clumps is done on an as needed basis. The plant goes well with cohosh, hydrangea (shrub), and ferns.

Solomon's Seal (*Polygonatum biflorum*)

This plant is one of the most graceful plants for the shade standing two feet tall with arching stems and attractive leaves. It is also tough and can withstand total neglect and tolerates both heat and cold. In the spring the plant has a brief flowering with bell shaped white blossoms dangling from the stems. It lives many years with almost no maintenance and the only potential problem would be snails and slugs attraction to the plant. Solomon's Seal goes well with hosta and fern.

Trillium (*Trillium erectum*)

This plant is another tough native, which has clusters of three leaves and three-petaled ruby red flowers that bloom in early spring and become dormant by midsummer. The plant is most happy in moist, shady, woodland conditions and once planted should not be moved because it looks most attractive when in a cluster. The plant is almost completely resistant to insects and diseases but can be nibbled by slugs and snails. The plant lives many years with no maintenance and never needs rejuvenating. Trillium goes well with solomon's seal and ferns.

Cohosh (*Cimicifuga racemosa*)

This plant is a low maintenance native plant with several common names, including bugbane and snakeroot. The plant is two to four feet tall with clumps of lacy foliage and creamy white flowers lasting from spring to fall. It lives for decades, doesn't need renewing and has an excellent resistance to insects and diseases. A notable feature of the plant is that it is the larval host for the rare Appalachian Blue Butterfly. Cohosh goes well with hydrangeas (shrub) and ferns.

Wild Pink Azalea, Pinksters (*Rhododendron periclymenoides*)

This shrub is a signature shrub distinguished by their smaller, oval leaves, tubular pink flowers and usually short, twiggy stature. The native species is easy to grow and can last for decades. The plant grows best in open woodland settings and also does well on steep, rocky slopes helping with erosion. This azalea goes well with hosta and ferns.

Hydrangea (*Hydrangea macrophylla*)

This shrub is an adaptable and long-lived native with deep green leaves and large clusters of pink flowers blooming from early summer to fall. The plant stands three to ten feet and some pruning may be needed at times. Hydrangea works well with azalea, mountain laurel, and rhododendron.

Mountain Laurel (*Kalmia latifolia*)

This shrub is one of the most beautiful native shrubs. The plant blooms in late spring/early summer with clusters of white, pink, cup-shaped blossoms and has year-round dark green, shiny foliage. It lives many years and pruning is rarely needed. The plant is very important for erosion control due to its ability to form large colonies on the steepest of slopes. Something to note about the plant is to always buy the species and not cultivars that will skew the gene pool. Mountain Laurel goes well with azalea, hydrangea, and rhododendron.

Rhododendron (*Rhododendron maximum*)

This shrub is a strong native species, has thick leathery leaves on woody branches that form tiers. It blooms in late spring to summer with large tubular flowers in a variety of colors. The plants need to be sited carefully so that their brittle limbs will not grow into a high-traffic area. It lives for decades and pruning is only needed to remove dead or damaged wood. Rhododendron works well with azalea, mountain laurel, and hydrangea.

Witch Hazel (*Hamamelis virginiana*)

This shrub is a unique native shrub due to the fact that the plant blooms, clusters of crinkled yellow or coppery red blossoms, are produced in winter. The leaves of the shrub also turn yellow, orange and red in the fall. The shrub should be placed where its vibrant colors can be appreciated. It also does well next to streams and also on steep slopes, decreasing erosion. The shrub is essentially problem free and needs very little maintenance. A notable feature of the shrub is that it is the only nectar source for the night-flying mouth, which pollinates it in the fall. Witch Hazel goes well with azalea and rhododendron.

Sun Loving Plants:

Butterfly Weed (*Asclepias tuberose*)

This plant is a native species that produces bright orange flowers in the summer. It can tolerate full sun to light shade in dry to moist soils. It can tolerate sandy soils, drought, and extreme heat. It will live many years and can grow back from its deep roots. It is very attractive to Monarch butterflies.

New England Aster (*Aster novae-angliae*)

This plant is a native species that produces large plants that grow to 3-5 feet tall. The flowers, in shades of red and purple, bloom for 2-3 months in late summer and fall. It prefers full sun and moist soil. It is successful along riverbanks, wetlands, sunny slopes and edges.

Joe-Pye Weed (*Eupatorium dubium*)

This plant is a native species that produces huge clusters of mauve flowers. It can grow up to 8 feet tall. It prefers partial to full sun in soil that is moist to wet. It is successful along riverbanks and wetlands, and also on sunny slopes and meadows. It is very attractive to butterflies.

Cardinal Flower (*Lobelia cardinalis*)

This plant is a native species that produces bright red, white or pink flowers. It grows 3-4 feet tall. It prefers partial to full sun in soil that is moist to wet. This plant is successful along riverbanks and wetlands. It is attractive to hummingbirds.

Black-eyed Susan (*Rudbeckia hirta*)

This plant is a native species that provides color in areas that may normally be difficult for plants to grow in. The flower color ranges from bright yellow to orange or red. It can grow up to 3 feet tall. It prefers full sun and dry soil. This plant is successful on dry, sunny slopes or open meadows.

Pasture Rose (*Rosa carolina*)

This shrub is a native species that produces single pink flowers, usually solitary, sometimes in small clusters. The mature height can range from 1 foot to 20 feet. It prefers partial to full sun in moist soil. This plant is successful on dry ridgetops and sunny sites.

American Elderberry (*Sambucus canadensis*)

This shrub is a native species of shrub that produces huge cymes of white flowers in June. It can grow as tall as 10 to 15 feet. It prefers full sun in moist to wet soil. This shrub is successful along riverbanks and wetlands.

Smooth Arrowwood (*Viburnum recognitum*)

This shrub is a native shrub species that produces a variety of colors of flowers. The flowers bloom from April to June while the shrub can grow up to 12 feet. It prefers full to partial sun in well-drained soil. The soil can be sandy or rocky, however.

Spicebush (*Lindera benzoin*)

This shrub is a native species that produces yellow flowers from April to June. This shrub is especially useful in erosion control. It can grow in partial to full sun in sandy soil. It can be successful in a variety of landscapes and requires little maintenance. This shrub can also provide shelter for small animals and birds. It could add color to erosion-prone hills throughout campus.

Appendix C – Suitable Grass Types for the Towson University Campus

Curt Kliensorg
(Information below was obtained from Seedland, 2003)

Tall fescue

This is a variety of grass that performs exceptionally well within the designated growing region that Towson is a part of. However, it performs optimally when planted as 70% or more of a mixture. It is a hardy variety that requires very little, if any, additional irrigation above natural rainfall. This variety should be mowed, on average, once a week to a height of three inches or slightly higher, this allows for dry weeks during the summer to be skipped. There is also a dwarfing growth habit that characterizes the variety, which allows the grass itself to grow to full size, however, in slower fashion so as to reduce the amount of clippings produced after each mow. Tall fescue is a flush green grass that maintains full color well into winter months as well as dry months in the summer. It is particularly well suited for campus since it is disease tolerant as well as tolerant to high traffic. Tall Fescue also has a very good establishment speed. The time required between germination and full coverage is relatively short. Disease and insect resistance is also relatively high for the variety.

Perennial Ryegrass

Perennial Ryegrass is a valuable addition to a mixture of grass. Ryegrass is particularly beneficial in the early spring months, since it grows quite well during the cooler months of late winter. It produces a full brilliant green leaf that grows rather fast while the fescue is still coming out of dormancy. It is not the best variety however to make up the bulk of a mixture. Once the weather begins to stay warm, ryegrass discontinues growing, and is taken over by the tall fescue. Ryegrass does not require any additional irrigation since it primarily functions when the soil is already relatively moist. Additional fertilizer is not necessary since the variety begins to decrease in growth after the spring months. Areas requiring this 'early greening' probably need a light over seeding once every other year.

Kentucky Bluegrass

Kentucky bluegrass is a dense patterning grass that performs well when coupled with Tall Fescue and Ryegrass. Bluegrass is sufficient for filling any spots in a lawn and giving a lawn the green carpet look. However, it is not particularly tread resistant, nor is it easily maintained. When used as the prominent variety, bluegrass requires a significant amount of mowing and irrigation along with subsequent fertilizer application. It does, however, perform well when mixed with the aforementioned varieties. Bluegrass grows at a relatively moderate speed, and particular varieties are disease and insect resistant.

Appendix D – Trees Suitable for the Towson University Campus

Joe Vogelpohl
(Information below obtained from Dirr, 1983; DNR, 2003; NPS, 2001, 2002; Petrides & Wher, 1998; and Thompson, 1999)

Trees are listed according to their preference of soil moisture and height.

Red Maple (*Acer rubrum*)

The Red Maple is probably the most adaptable tree you can plant. It grows well in wetland areas including streams but also can be planted in the upland areas. Do not plant it near any sidewalks or anywhere its roots can push up causing problems. The tree has very strong wood and nice fall colors. Typically the tree will grow between 40-60' but it can grow up to 120'. Its spread is just a bit smaller than its height. It also has a high to moderate growth rate of around 2' per year. The plant prefers and will do best in moist acid soil. Although it grows well on campus, it does not do well in heavily polluted areas.

Pin Oak (*Quercus palustrus*)

The Pin Oak is a good tree to plant near streams or other wet areas. The tree can get large growing up to 100' but is typically between 60-70'. This tree has fast growth at 2 or more feet a year. This tree tolerates flooding and city conditions as well as high soil pH and full sun (does not need full sun, but prefers a good amount). The tree has a very shallow fibrous root system that could be put to good use at controlling erosion.

Sycamore (*Platanus occidentalis*)

The Sycamore does very well in deep moist soil around rivers streams and bodies of fresh water. The tree is typically between 75-100' tall but can get much taller with a spread equal to or greater then its height. This tree grows very fast at over two feet per year. Roots are shallow so it would be good for erosion control but not around side walks. The bark gets a nice color of white with brown. The wood is very hard and would not break easily.

Box Elder (*Acer negundo*)

The Box Elder does best in wet soils around lakes, ponds, and streams but can tolerate dryer, even poor soils. The tree can grow up to 70' but is typically between 30-50'. This tree will attain a spread that is equal or greater than its height. The plant does well in cold conditions although it can have some ice and wind damage (falling limbs) due to its weak wood. In addition it tolerates a wide range of pH conditions. The tree is a strong competitor, therefore it is important to check, every few years, to make sure the tree is not taking over.

Persimmon (*Diospyros virginiana*)

The Persimmon enjoys living where water is readily available. The tree grows usually between 35-60' but can reach the heights of 90' with a spread that is approx. two-thirds its height. It has a slow to medium growth rate between 1-2' per year. The tree is very adaptable although it likes moist, well-drained sandy soil. The tree can tolerate a wide range of pH conditions, full sun, low fertility, and dry soils. It also does well in cities and has very strong wood. This tree is quite resistant and has very few problems with diseases and or insects. It has somewhat large yellow to pale orange fruit that measures 1-1 ½" long which many animals enjoy.

Green Ash (*Fraxinus pennsylvanica*)

The Green Ash does best around bottomlands and along streams where it usually grows between 50-60' but can grow as high as 80', with a spread about a half of its height. The tree grows relatively fast about 2 – 3' per year. This tree does require a lot of sun but it tolerates high soil pH, and salt pollution.

Black or Sour Gum (*Nyssa sylvatica*)

The Black or Sour Gum does best when planted around streams or other areas with moist soil. The tree is typically between 30-50' but can get up to 100', its spread gets to be about two-thirds its height. This tree is quite resistant and has very few problems with diseases and or insects. The tree need an acidic soil and it can grow in sun or semi shade but it does not like heavy polluted areas. It has a large taproot so does not contribute to erosion control. The tree does have small half an inch black fruit (berry) that is eaten by many birds. The berries can cause stains so is not suggested for where people would be walking.

Willow Oak (*Quercus phellos*)

The Willow Oak is a good tree to plant in wet to very wet soil. The Oak is typically between 40 and 60' tall but can get up to 100' with a spread on average of about two-thirds its height. This is the only tree that likes poorly drained loamy or clay, acid soils. Also likes full sun.

Black Willow (*Salix nigra*)

The Black Willow grow best around riverbanks, lakes and other fresh bodies of water with poorly drained soils. The tree typically grows between 60-80' and has an irregular spread. The tree has moderate growth rate of under a foot and a half a year. The wood is weak and might require some maintenance.

Pawpaw (*Asimina triloba*)

The Pawpaw grows best around riverbanks and or moist fertile soils. The tree is typically between 15-20' tall but can get up to 40' with a spread that is the same as the height. The tree is slow growing with less then a foot a year. The Pawpaw is quite resistant and has very few problems with diseases and or insects. The Tree prefers fertile, deep, and slightly acid soils. It does well in full sun but it can tolerate and even grow in deep shade. The tree has large purplish flowers from April - May. Also produces a large fruit that is loved by many animals.

Ironwood (*Carpinus caroliniana*)

The Ironwood grows best in moist soils. The tree is typically between 20 – 30' tall but can get up to 50' with a spread of about equal size. Ironwoods are slow growers with a little less then a foot a year. The tree has relatively few problems with diseases and or insects. It prefers deep rich and acidic soils around rivers or streams, but it can tolerate drier sites. The tree can also tolerate heavy shade and periodic flooding. The tree has a handsome bark that has a strong muscular appearance. This tree also produces fruit that is cherished by many animals. Also known as Blue Beech.

Hackberry (*Celtis occidentalis*)

This tree prefers moist soils but it will do just fine on dry more upland sites. The tree typically grows between 40 – 60' but can get as tall as 100' with an almost equal spread as its height. The rate of growth is high to moderate at about two feet a year. The tree tolerates most any soils and can withstand a wide range of pHs. This tree can also withstand high winds and full sun and grows well in cities. The tree does have a fruit, which is about a half inch long; it is reddish orange and is also loved by many animals. The rare hackberry butterfly also uses the tree.

Fringetree (*Chionanthus virginicus*)

The Fringetree likes deep moist fertile soil but can grow on dryer upland sites. This tree grows normally between 25-30' but can be smaller with its spread that is about equal to its height. The Fringetrees growth rate is slow just about under a foot a year. The tree prefers an acidic soil of 6.0 to 6.5. It likes full sun on stream banks and grows well in clusters. Also it does very well in cities and has a high tolerance to air pollution. The tree has a half to two thirds an inch dark blue drupes (fruit), which birds love. This tree also produces large clusters of aromatic white flowers in late spring.

White Oak (*Quercus alba*)

The White Oak grows best in moist woodland sites that are well drained. This tree is typically between 60-80' but can get much taller past 100' with a spread of about two thirds or more. This tree has a slow to moderate growth rate of just over a foot a year. The tree is susceptible to many diseases like most oaks but still seems to live a long life nevertheless. This tree prefers acid soils and full sun. White Oaks can tolerate dry soils. Many animals and insects eat the acorns of this tree.

Southern Red Oak (*Quercus falcata*)

The Southern Red Oak in most respects is the same as the White Oak except it generally only grows 70-80'.

Northern Red Oak (*Quercus ruba*)

The Northern Red Oak does best in moist, well drained, soil in the upland. The tree usually grows between 60-75' with a spread of about two thirds of its height but can grow over 100'. The Northern Red Oaks growth rate is faster then most oaks with up to two feet per year. It is susceptible to typical 'oak' diseases although it does well. This tree prefers sandy loam soils that are well drained and somewhat acidic with full sun. This tree also does well in cities and tolerates higher air pollution. Does have a small tap root so "might" be able to grow a little closer to sidewalks without as much problems.

Black Oak (*Quercus velutina*)

The Black Oak does best in well-drained soils of the uplands. This tree is typically between 60-70' with varying spreads. Black Oaks will tolerate poor, dry, sandy or heavy clay hillsides. This tree has a large taproot, could be a little better near sidewalks.

American beech (*Fagus grandifola*)

The American Beech prefers well-drained acidic soils in upland. The tree usually grows between 50-70' with a spread equal or slightly smaller then its height but the tree can grow over 120'. The rate of growth for this tree is very slow, less then a foot a year. The tree likes full sun but will tolerate shade. This tree does not tolerate wet or compact soil. This tree produces nuts that many animals enjoy. American Beeches have shallow roots and would be good for controlling erosion but grass does not grow well under this tree. This is a nice tree although many people write on its smooth bark.

American Holly (*Ilex opaca*)

The American Holly can be planted in moist upland sites. This tree can grow up to 50' but is usually smaller. The spread of this tree varies but is smaller then the height of the tree, with the spread being widest at the bottom. Its rate of growth is about average of a foot and a half a year but will slow down with age. It has many diseases but still seems to do well. This tree can grow in partial shade or full sun. It

cannot tolerate poorly drained soil, or particularly dry soil, and the tree can get uprooted if winds are severe. The American Holly can tolerate higher air pollution and high soil pH. This tree is an evergreen that produces small red fruits. Also called a Christmas holly.

Black Cherry (*Prunus serotina*)

The Black Cherry prefers deep moist fertile soils but can grow in dry gravelly or sandy soils in upland areas. This tree grows usually between 50-60'. It is usually fairly tolerant of many conditions. This tree has small, less then a half an inch, red fruit that later turns black. Birds love this fruit. Black Cherries also have small showy flowers that many insects visit. One potential problem is that they tend to give off a lot of pollen, which could affect many students.

Sassafras (*Sassafras albidum*)

The sassafras will grow well in moist loamy soil but will also grow in dryer and rockier sites in the upland. This tree grows between 30-60' with about two thirds of that spread. The trees growth rate is moderate with just under two feet a year. This tree does particularly well as far as diseases and insects are concerned. This tree prefers full sun or light shade. Sassafrases are more difficult to establish because of its deep taproot. Tree has half an inch drupes that are dark blue and attract many animals. The leaves turn a brilliant orange in fall.

Dogwood (*Cornus florida*)

The Dogwood does well in upland areas that can be moist or dry. This tree grows to about 20' although it can grow taller, its spread is of equal height or larger. The rate of growth is usually slow or under a foot a year. This is an attractive tree that is widely planted even though it is susceptible to some diseases. The tree does not do well in poorly drained or wet soils. The tree likes to grow in partial shade but it can grow in full sun. If the tree is grown in sunny somewhat dryer sites it could help it survive the anthracnose disease. This tree is not good at dealing with pollution. The dogwoods have wonderful looking flowers (white or pink) and produces small red berries in clusters which many birds eat. Also called flowering dogwood.

Redbud (*Cercis canadensis*)

The Redbud does best in moist well-drained soils but will do well in most any soil except permanently wet ones. This tree grows between 25-30' and usually has an equal or greater spread. The rate of growth is moderate at a little less then a foot and a half a year. The tree is only moderately resistant to pests. The plant is pH adaptable and can take full sun or light shade. This tree has long two to three inches seed pods which are produced in October that could be a problem around sidewalks. Redbuds produce exquisite small blossoms that cover the bark in the spring. These flower attract many butterflies.

Black Haw (*Viburnum prunifolium*)

The Black Haw does best in moist soils but can do very well in dryer upland sites. This tree height is usually around 12-15' but can get larger the spread is about two thirds of its height. Its growth rate is relatively slow, less then a foot a year. This tree is adaptable to many different soil types and does well in sun or shade. Also this tree is quite resistant and has very few problems with diseases and or insects. The Black Haw produces fruit that is pinkish in color and is about a half an inch in length. The flowers are quite large at two to four inches in width and are white in color. The bark is scaly light brown and provides something to look at in the winter.

Chestnut Oak (*Quercus prinus*)

This tree does best in well-drained soils and does well in rocky dry and poor upland sites. This tree is a dominant tree around here. The normal size is from 60 – 70' with an irregular spread but can grow over 100'. The rate of growth is moderate with just under a foot and a half a year.

Pignut Hickory (*Carya glabra*)

The Pignut Hickory will grow on very rocky dryer soil. It grows between 80-90' with a spread almost half its height, it can grow to over 100'. The Pignut Hickory has very large round nuts over an inch that could cause problems in clean up, damage to cars, and could cause a student quite a lot of pain. Do not suggest planning this tree in areas where it could cause these problems.

Scarlet Oak (*Quercus coccinea*)

The Scarlet Oak is similar to the other Oaks but it likes dry sandy to rocky soil. The tree grows between 70-75' and a spread of about two thirds that. Scarlet Oaks growth rate is moderate to fast at one and a half to two feet a year.

Post Oak (*Quercus stellata*)

The Post Oak is similar to other Oaks; it likes rocky ridges and silty loams but can grow in dry gravelly or sandy soils. This is a smaller Oak which grows typically between 40-50'.