Stadium Woods
Preliminary Use & Management Plan

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I. Introduction

Stadium Woods is an old-growth forest located on the southeast edge of Virginia Tech’s central campus. The forest canopy as measured by Biohabitats, Inc., includes 13.75 acres. The forest understory, which has more old-growth characteristics, is measured to include 11.8 acres (Biohabitats, Inc., 2012). There are approximately 450 trees per acre over four inches in diameter at breast height and three to five large white oak trees over 250 years old which make up a significant percentage of the over story. In all of Stadium Woods, there are over 58 white oaks over three feet in diameter at breast height (Seiler, 2012).

The Stadium Woods are used by the campus community for academic teaching and research, active and passive recreation, and by the Corps of Cadets for field training and maneuvers. Community members and natural resource organizations also use the Woods for various purposes.

Stadium Woods sparked campus and community debate in January 2011 when plans for constructing a new 2.1 acre indoor athletic practice facility in the north part of the Woods was announced (APFSEC, 2012, p. 1). The facility would remove over 100 trees, including eight or nine older than 300 years. A contentious controversy arose and a social movement to save the Woods spawned more than 10,000 petition signatures and demonstrations. The dispute received widespread coverage in the Roanoke Times, the Washington Post, and CNN; among other media outlets.

On January 19, 2012, Virginia Tech President Charles Steger appointed the Athletic Practice Facility Site Evaluation Committee to study Stadium Woods and the siting of the proposed indoor practice facility. The committee gathered data and held biweekly meetings for four months and on May 5, 2012, offered five recommendations that included:

- Designating Stadium Woods as a reserve and develop a protection, management, and use plan for the Woods.
- Relocating the proposed facility site from the Woods site to the Washington Street tennis court site and develop a site orientation and design that considers cost, aesthetics, mitigation of existing uses, and minimal impact on the Woods.

The committee considered many factors before making the recommendations. Their report notes that the demonstrated social importance of the Stadium Woods became the determining factor in the Committee’s deliberations and this consensus report (APFSEC, 2012, p. 1).

On August 20, 2012, Virginia Tech Vice President Sherwood Wilson issued a memorandum stating his recommendation that the university not locate the practice facility in the originally proposed location. However, regarding the other committee recommendation, he did not recommend designating the area as an old-growth reserve or placing the Woods in a conservation easement (Wilson, 2012).
On November 8, 2012, the ad-hoc Forest Management Committee, facilitated by the Office of University Planning, met for the first time with the charge to develop a management and use plan in response to social pressure to manage the woods and to do so by meeting the vast array of stakeholder needs.

Figure 1 is a map of Stadium Woods with some noteworthy areas illustrated. The Woods are separated into the Woods North and South. The International Peace Garden is noted with green ovals. Trails are lined in yellow and orange and are described later in section V(b) of this report, as are possible locations for signs, which are designated with yellow stars on the map. The Corps of Cadets rappelling tower, designated by a blue circle, is described in section V(c) of this report. Remains of sidewalks from the World War II era are outlined in a light pink dotted rectangle. Proposed infrastructure for football tailgating and student reflection is outlined in a solid dark pink rectangle and is described in section V(a).
a. Figure 1. Map of Stadium Woods
b. Purpose, Rationale, Process

**Purpose:** The purpose of this project is to develop a preliminary use and management plan for the Stadium Woods that portrays and balances the academic, social, recreational, environmental, and use values of the Stadium Woods and its stakeholders by recommending policies to protect those values now and in the future.

**Rationale:** This preliminary use and management plan was prepared as a guide to be used by university committees and others charged with developing the final Stadium Woods use and management plan. Our management recommendations are based on primary and secondary evidence. This plan identifies and defines important campus uses and resource benefits of Stadium Woods and subsequently, presents specific management recommendations for each use or resource area. These recommendations incorporate and balance the needs of stakeholders.

**Process:** The student group of six members charged with developing a preliminary management and use plan included five undergraduate students and one graduate student. The students created this plan in Environmental Planning Studio course UAP 4354/5794 instructed by Dr. John Randolph. The group was asked to, “to develop a preliminary management and use plan for the Stadium Woods. Such a plan must consider the social importance of the Woods, current uses, ecological values and opportunities for improvement, the perceptions of diverse stakeholders, as well as costs and benefits.”

The group met weekly from August through December 2012, researching and gathering information from the APFSE Committee report, an ecological assessment of the woods by independent consultant, Biohabitats, Inc., documents published by Virginia Tech faculty, forest management plans of other universities, and journal articles discussing applicable management practices. The research was analyzed and findings were incorporated into use and resource benefit summaries or successive suggestions for managing and balancing those benefits.

The resource management categories in this plan are: old-growth tree health, tree regeneration, wildlife & habitat, invasive species, and ecological benefits. The use management sections include: significance to community and campus life, recreation and trails, the Corps of Cadets rappelling tower, and prohibited and restricted practices. These sections were selected for inclusion using Arboretum Committee suggestions and secondary research findings. Each management category provides recommendations for management, a discussion of relevant research, and stakeholder comments regarding the topic.

The group solicited input from identified stakeholder groups through an online survey of their use and value perception of the area’s recreation, environment, history, education, and management. 191 individuals responded to the survey. The results were used as a guide to help us incorporate into the plan the perspectives, values, and plan alternatives of those who use and have a stake in the future of the Woods.
II. Management Plan Goal & Objectives

Goal:

Manage Stadium Woods to balance objectives of enhancing user benefits, protecting the old-growth remnant and tree health, ensuring safety, and promoting awareness of their historic and ecological value.

Objectives:

- Enhance the ecological, historical, and use values of Stadium Woods and its benefits to the Virginia Tech and Blacksburg communities
- Protect forest and tree health
- Provide a safe environment for users
- Perpetuate Virginia Tech’s reputation as one of the top green universities in the United States and as a Tree Campus USA
- Promote awareness of the Woods and its rarity and value
- Incorporate and balance important stakeholders’ perceptions and needs
III. Stakeholders and Stadium Woods Values

a. Stakeholders

Because the Stadium Woods are on the campus of Virginia Tech, there are many stakeholder group opinions we must consider. Ideally, stakeholders should be considered from the campus community, the town community, the county community, and the area as a whole. As we tried to decide on what groups would be stakeholders in the future of the Stadium Woods, several groups immediately came to mind. Groups that routinely use the Woods (athletics, corps, recreational users, faculty) were easy to identify. Groups that have advocated for “saving the Woods” (The Environmental Coalition, Friends of Stadium Woods) were also quickly added to the list. It was decided that many groups that may have authority over the Woods or its uses (Virginia Tech Administration, Virginia Tech Arboretum Committee, Town of Blacksburg) should be added as well. The New River Valley Master Naturalists and the New River Valley Bird Club were included because their expertise was sought in the Biohabitats study. Finally, the inclusion of current students and alumni as stakeholders was decided because the Woods is part of the university, and current and former students should have a voice in what occurs at the university.

- Virginia Tech administration
- Virginia Tech Arboretum committee
- Academic colleges and departments (education & research)
- Corps of Cadets & ROTC
- Athletics (players, coaches, staff)
- Recreational users (birdwatchers, bikers, joggers, walkers)
- Town of Blacksburg government and community
- Friends of Stadium Woods
- The Environmental Coalition
- Virginia Tech alumni
- Local wildlife clubs (New River Valley Master Naturalists, New River Valley Bird Club)
- Students
b. Stakeholder Survey Statistical Analysis

We developed and distributed a survey to Stadium Woods stakeholder groups to help us measure and identify important issues and perceptions of various groups. The link to the online survey was distributed by email. To verify accuracy of results, names and VT email addresses were collected from those groups who are part of the university. There were 177 verifiable responses. 14 responses of an original 191 were deleted because no name was provided.

Data was collected from each question using a scale with choices of “strongly agree/very important,” “agree/important,” “neutral/don’t know/no opinion,” “disagree/unimportant,” or “strongly disagree/very unimportant.” It should be noted that neutral values could indicate that the respondent does not have enough information to answer the question.

Due to time constraints of the fall semester, we were not able to distribute the survey as widely as would be most preferred. By far, the most responses (nearly 100) were fielded from Virginia Tech students. Recreational users of the woods fielded the next highest amount of responses at 85, and 43 educational users responded. Nearly 50 members of Friends of Stadium Woods responded. Additionally, there were responses from 69 Blacksburg community members, 43 alumni, 36 VT faculty members, 16 wildlife club members, 11 research users, and four Master Naturalists. Only five members of the VT Athletic Department, four VT student athletes, three Cadets or ROTC members, and one member of the VT Grounds Maintenance responded. We would have liked to disseminate the survey to a larger stakeholder population, but were not able to do so. Because of time constraints, results from this survey are not representative of the entire stakeholder population and therefore may not hold substantive weight. However, we do value the feedback we did receive, as illustrated below in several charts depicting responses. In addition, we have included numerous quotes that we feel are important to illustrate stakeholder opinions throughout various sections of this plan.

Overall, we received positive feedback for seeking input from stakeholders by the medium of a survey. We also received several suggestions for the plan, including one to include both short- and long-term objectives, as well as specific plan recommendations such as addressing non-native vegetation, making safety a top priority, and two respondents mentioned prescribed or controlled burns to maintain natural conditions. We have taken into account all suggestions and hope to represent all views from the comments we received in our recommendations for policies.

We received the following stakeholder comment about the plan: “I’m personally thankful that this issue has brought to light the great value that has been ‘hiding’ in Stadium Woods. The woods have lived without specific management for hundreds of years, but it seems that now, with the threatening encroachment of buildings and traffic, a concerted effort to preserve and protect the treasure is greatly needed.”

The stakeholder population distribution can be seen below in Figure 2, Chart 1. Regarding stakeholder identification, we allowed participants to select more than one choice. For example, The Environmental Coalition members are VT students and may also be users of the Woods for education or recreation, and Arboretum Committee members may also be counted under faculty. Due to this format, the distribution of chart 1 is skewed.
Figure 2. Chart 1. Respondent Population

Chart 1. Respondent Population

- VT Student, 98, 18%
- VT Student Athlete, 4, 1%
- Virginia Tech Arboretum Committee, 6, 1%
- User of the Woods for Education, 43, 8%
- Virginia Tech Faculty, 36, 7%
- User of the Woods for Research, 11, 2%
- Corps of Cadets & ROTC, 3, 1%
- Athletic Department, 5, 1%
- Recreational User of the Woods, 85, 16%
- Blacksburg Community Member, 69, 13%
- Friends of Stadium Woods, 48, 9%
- The Environmental Coalition, 57, 11%
- Local Wildlife Club Member, 16, 3%
- Other, 8, 1%
- Master Naturalists, 4, 1%
- VT Grounds / Maintenance, 1, 0%
- VT Alumni, 43, 8%
Chart 2, below, illustrates several general questions that provide a basic overview of perceptions of Stadium Woods. Over two-thirds (71.2 percent) of respondents strongly agree that Stadium Woods enhances campus and community life, and over 85 percent (85.3) strongly agree that it is important for the Woods to be preserved from future development.

Virginia Tech students and alumni overwhelmingly believe that it is very important for Stadium Woods to be preserved from future development. In addition to VT students, faculty and staff, Blacksburg community members, and recreational users believe it is either important or very important for the Woods to be preserved. Two Virginia Tech alumni and current faculty believe that preservation is somewhat unimportant and four people believe that it is unimportant. Among those four, there were two members of the Athletic Department, one VT student, and one Blacksburg community member who is also a VT alum and a local wildlife club member.

Nearly 55 percent (54.8) of respondents strongly agreed and another 25 percent (25.4) agreed that a plan, like this one we have prepared, should be created to meet the valid needs of all stakeholders, even if compromises are required. This shows us that despite potentially controversial issues, our survey respondents believe it is necessary for a Stadium Woods use and management plan that calls for balance of those issues to be prepared. Regarding the plan and compromises, one survey participant said, “I support multiple use and compromise across large areas, but not for so small and unique an area as Stadium Woods. Every small patch can’t, and shouldn’t be expected to, serve all stakeholders. [...] we should prioritize uses that are dependent on old-growth trees, as that is the distinguishing feature of Stadium Woods.” This participant was among 12 respondents, including six Blacksburg community members, several VT students and faculty, and a VT student athlete, who disagreed that a plan should take stakeholder compromises into account. It should be noted that it is difficult to classify respondents because of their multiple affiliations (for example, one Blacksburg community member is also a member of Friends of Stadium Woods, a VT student, and uses the Woods for recreation and education).

Figure 3. Chart 2: Overview
Chart 3 depicts questions asked under recreational values. Of particular interest, respondents agreed that it is important for Stadium Woods to provide a natural area for contemplation and escape for students and for use by Town residents. However, as the questions shifted to ones regarding trails and signs, less respondents strongly agreed and more indicated they were neutral or that they disagreed. Interestingly, a majority was neutral or had no opinion on whether Stadium Woods adds uniqueness to the gameday experience and whether more could be done to enhance that experience. Among this majority were several VT faculty members, Blacksburg community members, many VT students, recreational and educational users of the Woods, one member of Athletics, and a Virginia Master Naturalist.

Figure 4. Chart 3: Recreational Values
Chart 4 graphs various responses regarding educational values, including teaching and outreach, academic research, historical value, and Corps of Cadets and ROTC activities. A majority of respondents agreed that both academic teaching, outreach, and research are important, but an overwhelming majority strongly agreed that the historical value of Stadium Woods is important. This helps to illustrate that the value of the Woods, “is in its natural, rare whole-ness and it should be preserved for all citizens of the Commonwealth.”

In addition, most respondents were neutral or even sometimes disagreed that the Corps of Cadets and ROTC uses of the Woods are important and beneficial. This could possibly be attributed to the low number of responses from Cadets (3), but we do not wish to speculate. One interesting comment we received regarding the Corps’ use of the Woods was to move the rappelling tower from the Woods so that the cleared area around it can regenerate. However, in the past, the Corps has been invaluable in managing the sections of the Woods that they use.

Figure 5. Chart 4: Educational Values
Chart 5 illustrates responses to questions regarding environmental values. Respondents generally agreed that Stadium Woods’ stormwater mitigation, air filtration, carbon sequestration, and other ecological benefits are very important. In addition, survey respondents wholeheartedly agreed that native plants and wildlife should be promoted in Stadium Woods. In regards to invasive species being a problem in the Woods, respondents had opinions mixed between very important, important, and neutral. It seems from the results of that question that not many are aware of the invasive species problems that exist in the Woods, especially in the Woods North.

Figure 6. Chart 5: Ecological Values
Chart 6 graphs questions regarding management values of Stadium Woods. Respondents generally agreed that a use and management plan should be adopted, and an overwhelming majority believes that Stadium Woods should be permanently protected from future development, keeping in line with the recommendations of the APFSEC.

Most respondents also agreed that Stadium Woods’ health and longevity should be carefully managed, and that the Woods should also be managed for nature study, again adding to the highly esteemed educational and environmental values. Surprisingly, a majority of respondents agreed that student and community member safety should be a priority, but did not strongly agree. One notable comment explains, “Regarding safety, not that I think it is unimportant, but that it has been used as an excuse to cut down any trees with dead branches, or to clear underbrush, both of which are undesirable.” Several comments suggested that safety should be a primary concern.

Figure 7. Chart 6: Management Values
c. Summary of Historical & Resource Values

On January 6, 2012, Drs. John Seiler and Jay Sullivan used an increment borer to take cores from three 40-inch diameter trees in Stadium Woods. Tree number 101 was dated back to 1773, when the tree at that time was 12.5 inches in diameter. They estimated it to be 346 years old, meaning that it may have sprouted in the year 1665 (Seiler, 2012). Using Seiler’s methodology, the independent evaluation by Biohabitats, Inc. (2012) estimated tree number 1 to be 450 years old. The Stadium Woods is a living part of our history and it provides a range of ecological, educational, and social benefits.

By all accounts, this old-growth remnant is unique. It is estimated that only one-half percent of the total forested area in the southeastern United States consists of old-growth forest. The majority of these old-growth forests in the eastern U.S. are in rugged terrain, which made them unreachable to timber harvesting in the past, but also makes them inaccessible to the public in the present. Most descriptions of old-growth forests include the following characteristics, “a large percentage of exceptionally old trees, standing dead trees, coarse woody debris on the forest floor, multilayered canopies, a mix of tree ages, canopy gaps where large trees have fallen, and pits and mounds from the root plates of large trees falling over” (Seiler 2012). Stadium Woods has all of these features. “A woodland caught between an expanding town and university – and overrun by a civil war – yet inexplicably left uncut, is remarkable indeed” (Seiler 2012).

After World War II, veterans and their families were allowed to live in temporary housing in the north end of the Woods as they continued their education. Part of that housing site is now the International Peace Garden. After the tragedy of April 16, 2007, the Corps of Cadets rappelling tower was dedicated to the fallen cadet Matthew La Porte. These Woods are historical, irreplaceable, have existed prior to European settlement, and can be found on a Confederate Civil War map.

In addition to historic value, Stadium Woods has important ecological value. Stadium Woods is located in the Stroubles Creek watershed. That watershed feeds into the New River and houses over 400 different kinds of flora and fauna, 16 of which are endangered, threatened, or species of concern. The Woods contain more than 4,800 trees. Each tree in its lifetime will absorb one ton of carbon dioxide from the atmosphere and serve as valuable carbon storage (Biohabitats, Inc., 2012, 7). The Woods counteract the urban heat island effect by providing air temperature reduction. (EPA 2003). Stadium Woods also plays a role in purifying, treating, and filtering water through the ecosystem. On average, mature trees absorb and filter one-third of the rainfall they encounter, which is about 100,000 gallons of rainfall annually. The Woods reduce erosion, improve stormwater retention, and protect surrounding areas from severe flooding.

VT Climate Action Commitment & Sustainability Plan

On June 1, 2009, the Board of Visitors unanimously approved the Virginia Tech Climate Action Commitment Resolution and endorsed the accompanying Sustainability Plan. The Sustainability Plan was conceived as a means to address climate change and environmental sustainability. Proper management of the Stadium Woods is beneficial to the university attaining its goal of sustainability by providing tree canopy cover, which removes air pollutants and
mitigates stormwater. The CityGreen analysis showed that existing tree canopy removes more than 4,000 pounds of air pollutants with a total dollar benefit of more than $10,000 and absorbs and stores 15 tons of carbon annually (VTCACSP, 2009). By continuing to properly manage the Woods to enhance their health and longevity, we can assist the Energy and Sustainability Committee in a successful Climate Action Commitment and Sustainability Plan.
d. Summary of Use Values

Academic Teaching & Research

Students and faculty regularly use the Woods throughout the school year. Among the many classes and programs that use the Woods are Forest Resources and Environmental Conservation (FOR 2214, 2324, 2414, 2984, 3354, 4454, 5374), Fish and Wildlife Conservation (FIW 2114, 2324), Landscape Architecture, Biology (BIOL 3204, 4404), and the Summer Upward Bound program (APFSEC, 2012, p. 41).

Other academic users are science classes involving collecting samples and observing wildlife, art, and drawing classes, and Appalachian hardwood ecology (APFSEC, 2012, p. 46). The area is used as a teaching forest with experiential learning exercises unique only to Virginia Tech’s campus (APFSEC, 2012, p. 41-46).

In addition to classes, the Woods are also used for graduate and professional level research and forest training. The stakeholders in this usage group include undergraduate students, professors, and high school students in many academic fields across campus. There is much potential to engage and encourage the surrounding high school environmental science, ecology, and natural resource classes to learn about and experience the unique and historic forest.

Survey Responses

We received the following stakeholder comment regarding the Woods’ educational value:

“Stadium Woods is a laboratory for my class, much like a chemistry laboratory. It is a teaching space, that if removed requires me to drive a bus with students to a forest away from campus. Stadium Woods has little ecological value, but a high educational value.”

Passive & Active Recreation

Students, faculty and community members seek the woods for many recreational opportunities. Passive recreation includes personal nature study, individual and group reflection, the seeking of peace and solitude, and observation of birds and trees. Active recreation includes the activities of walking, biking, running, and hiking.

An asphalt path runs along the eastern border of the woods and another asphalt path bisects the forest into northern and southern segments. A rudimentary, informal trail system exists and is used primarily by the students and town residents as a running, hiking, walking or biking path for enjoyment and to get to a destination (Biohabitats, Inc., 2012 p.1).

Corps of Cadets & ROTC Training

According to LTC Charles Payne, a member of the Commandant's Staff that oversees the rappelling tower, the tower in Stadium Woods is a university training facility, built and paid for by VT Facilities. As the primary university user of the facility, the Corps of Cadets is the
university’s executive agent for it, controlling access and use, and ensuring appropriate and necessary maintenance when required.

Rappelling is a component of cadet training that falls under physical fitness and confidence building. The Corps uses the facility throughout the year on an episodic basis. The single largest event occurs during New Cadet Week, when hundreds of cadets train on the tower.

Other university and outside agencies and programs use the tower. The Virginia Tech Army ROTC program uses the tower to a larger degree than does the Corps of Cadets. Local, regional, and state agencies use the tower throughout the year for training, to include the following: VT Police Swat Team, Radford Police, Montgomery County Sheriff’s Department, Blacksburg Rescue Squad, Blacksburg Fire Department, Virginia State Police, and the Southwest Virginia Regional Law Enforcement Academy.

Football Gameday Experience

During home football games, Virginia Tech Hokie football fans migrate through the Woods to Lane Stadium, and to many, this is an important part of their gameday experience. The Woods provide a unique, valued and picturesque football experience for families, students and alumni. The recommendations we make in the plan seek to maximize the sublime feeling of the fall forest during football games and minimize the ecological impact of use.

Survey Responses

We received the following comments regarding the football gameday experience that the Woods’ provides:

“One needs only to go to a Georgia Tech game to see how great the setting of Lane Stadium is. The concrete jungle is terrible and VT is slowly and steadily headed in that direction. Stadium Woods adds greatly to the gameday experience and adds a buffer to the folks in town who do not attend the games.”

“The woods enhance the appearance of the area and the whole experience of football game day……too many buildings around there already!”
IV. Managing Resource Benefits

a. Old-Growth Tree Health

Tree health should be assessed to ensure individual tree health as they contribute to the collective forest as a whole. When a healthcare concern becomes apparent, we recommend that the Arboretum Committee determine an appropriate response. If action is necessary, it will be carried out by Facilities or another appropriate campus entity. Responses may include treatment, removal or no action. The entire forest ecosystem, the visibility and value of the affected tree, and potential effects on neighboring trees should be considered along with the likelihood of treatment success in determining action. Healthcare practices include the following:

1. Integrated Pest Management (IPM). IPM involves the use of a combination of methods to control pests that could potentially harm trees. Methods might include treatment, cultural controls, no action, tree pruning, etc. Monitoring of individual trees and stands for signs of a pest outbreak is important. These methods and an understanding of pest life cycles can help determine the best treatment actions. If treatments are necessary to suppress an insect or disease infestation, biological controls should be favored over pesticides.

2. Soil Additions. If tree health is impacted by the quality and content of its soil, additions to the soil may be considered if they are narrowly tailored so that the addition will improve the tree’s health and can be reasonably expected to not have negative impacts on the surrounding forest. Additions may include fertilization, pH modification, drainage improvement, etc. Soil sampling by the Arboretum Committee or their designee should be performed to determine soil site characteristics and if and what additions are needed.

3. Protection & Preservation. Trees in Stadium Woods should only be removed when the cost to preserve them is too significant to justify the loss of potential future benefits. Therefore, benefits such as aesthetics, energy savings, carbon sequestration and pollutant removal, among others should be closely weighed against the cost of preservation.

   a. All trees should be evaluated for their potential to be preserved when located in an area planned for other use or when they present a safety hazard. Tree removal decisions shall be made by the Arboretum Committee to be carried out by Facilities Management (UIC campus forest, 2011 p.26).

   b. Tree Protection Zones: All sites in the Stadium Woods planned for other uses where trees may be potentially impacted shall establish tree protection zones to ensure proper old-growth tree preservation. We recommend the Arboretum Committee or their designee implement a tree protection zone (TPZ) for sites where tree health and longevity may be potentially impacted by other uses. TPZ shall be established for trees determined to be historically significant, to have a high value in energy savings, carbon sequestration, aesthetics, or pollutant removal, or to contribute significantly to the overall health of the forest. A TPZ protects a tree’s limbs, trunk, and roots from damage. The TPZ shall extend 1...
foot from the trunk for each inch in diameter measured at a height of 4.5 feet. The TPZ shall be designated in an aesthetically pleasing way to protect from damaging uses. If necessary, informational signage shall be placed near the TPZ to clearly state the purpose of the zone, with instructions to keep use activities outside in designated areas.

c. Control landscape debris by removing existing litter and debris to be carried out by concerned campus groups as well as Facilities and a university wide ceasing of all future dumping of debris like pulled landscaping plants and construction waste by all maintenance and construction groups.

d. Limit root compaction by eliminating parking and vehicle travel under tree canopies.

e. Educate students, stakeholders, and university departments of practices that harm trees and encourage uses that do not harm trees through campus organizations and informational materials (UIC campus forest, 2011 p. 26).

Survey Responses

Regarding old-growth tree health, we received the following comments:

“We should prioritize uses that are dependent on old-growth trees, as that is the distinguishing feature of Stadium Woods. Every priority should revolve around optimizing the health of these trees. This seems to me to be common sense. Otherwise every patch of land is reduced to the least common denominator and loses that which makes it special, unique, and of treasured value.”

“Regarding safety, it’s not that I think it is unimportant, but that it has been used as an excuse to cut down any trees with dead branches, or to clear underbrush, both of which are undesirable. I believe that preserving the forest habitat in perpetuity is more important than preserving the health of individual trees.”

“Stadium Woods should be preserved at all costs regardless of use. The ‘plan’ should be to make sure no alternative interest group can kill the forest one tree at a time until there is a threshold event and then someone says ‘Oh well, we've cut down so many, why not cut down the rest.’ Destroying the forest one tree at a time - for some silly, undocumented reason, should be guarded against.”

“I think forest protection (for example against pests, etc.) is important. However a systematic evaluation of each individual tree is mostly inappropriate – they should be managed as a forest fragment, not as a collection of landscape trees.”
b. Tree Regeneration

Tree regeneration is the act of renewing or establishing young trees, be it naturally or artificially, to ensure a variety of different aged trees in a forest. Natural regeneration is established from seeds or sprouts that occupy the land. Artificial regeneration is established from seeds or sprouts that are brought to the site by man for the purpose of re-establishing tree growth (Tree Regeneration, 2012). An overwhelming majority of stakeholders, approximately 94 percent, agree or strongly agree that the Woods need to be carefully managed in order to ensure their health. Through tree regeneration, we can ensure the longevity of the Woods.

There are many factors that need to be accounted for when artificially planting new tree growth such as sunlight, nutrients, moisture, soil and wind.

Artificial regeneration is even less predictable than natural regeneration, and there are two different methods, direct seeding and planting. Direct seeding is most often used with lighter seeds that are sewn into the ground. However, this kind of seeding requires a lot of attention and is very uncertain, for those reasons it is hardly used in Virginia (Tree Regeneration, 2012).

Natural regeneration can occur when there are trees old enough to produce seed, viable seeds, a favorable site for the seed and favorable growing conditions. It allows the flexibility to choose the most suitable species for the forest and soil and is most commonly planted by hand. All artificial regeneration completed in Stadium Woods should be carefully planted to ensure that they thrive (Virginia Polytechnic and State University Campus Design Principles, 2010). Stadium Woods is very unique for tree regeneration because not only is it isolated in an urban environment but also because it suffers from invasive species.

Wind plays a big factor in tree mortality because there is hardly any protection. In the Woods South there is hardly any invasive species and may regenerate at a natural pace. In the Woods North where the invasive constituency is much higher they have a greater problem with the regeneration of old growth trees (Biohabitats, Inc., 2012).

In order for tree regeneration to be as successful as it can, five criteria should be followed when choosing the plant a new seedling:

1. Location: The new seedlings should be planted where they have the maximum benefits of the forests. They should not be planted by anything that could inhibit their growth such as power lines. They should also be planted to guarantee that they can get enough rain and sunlight and are not directly under mature tree canopy. The Stadium Woods is quite isolated and because it is surrounded by extensive urbanization, there is therefore a high degree of vulnerability to wind-related tree failure (Biohabitats, Inc., 2012). It is important to plant these trees where they will have some protection from the wind so they have the opportunity to survive.
2. Source: Trees should be purchased from local sources. This ensures that the seedlings are well suited to the climate, soil conditions and precipitation. This will greatly maximize the chance that they survive (Tree Regeneration, 2012).

3. Species: The tree species should also be chosen to maximize their survival. Native plants should be especially chosen because they are well adept to the local climate and rainfall and therefore will have a better chance of survival. While there is no ‘species list’ for campus planting the Arboretum Committee members should be consulted to recommend species for each specific site (Virginia Tech Campus Tree Care Plan, 2008).
   a. Recommended seedlings to be planted based on their existing abundance are sugar maple, red maple, ornamental cherry, northern red oak, eastern white pine, London plane tree, willow oak, pin oak, service-berry, and ginkgo (Virginia Tech Campus Tree Inventory).
   b. Regeneration consideration of planting blight-resistant hybrid seedlings of the American and Chinese chestnut trees currently under research at Virginia Tech. Establishing seedlings in the Woods would add to the historic integrity by restoring the tree species distribution closer to what it resembled 350 years ago when colonists arrived (The American Chestnut Foundation). Seedlings would also significantly add to possible education and research.

4. Planting: Trees should be planted with care to ensure long-term survival. This often requires them to be planted by hand to the specifications of each individual species (Tree Regeneration, 2012).

5. Removal of Invasive Species: Invasive species need to be removed according to the following Invasive Species Policy, especially in North, to let the younger trees grow.

   There is good hope for Stadium Woods as it has ranked a score of 5 on a scale of 5 on Forest Conditioning Scoring Scale (Biohabitats, Inc., 2012). This means that there is already substantial regeneration taking place, possibly due to a lack of herbivores in the forest. This is essential for the vitality and longevity of the forest.

Survey Responses

“If any hybrids of American Chestnut are available, that would be one choice of a fairly quick growing and long-lived tree to include. Also adding understory small trees and shrubs such as Service-Berry, and maybe some native dogwood species, or Spicebush, or even regionally native ninebark.”
c. Wildlife & Habitat

The Stadium Woods is home to a wide variety of animals and plant life. It provides shelter and food for animals year-round. In the spring may be a valuable nesting site for cavity-dwelling and old-growth dependent species of birds. If the Stadium Woods is further disturbed by encroachment, inappropriate uses, or building, these vulnerable species could be further compromised. Losing valuable habitat for species would reduce the already declining variety of plant and animal life globally.

As an old growth forest, Stadium Woods represent an increasingly unique habitat for wildlife of all kinds. The Virginia Fish and Wildlife Service believe there could be over 400 animal species living in or within three miles of the Woods and/or using the Woods. This number includes 16 possible endangered, vulnerable, or of concern species (Virginia Department of Game and Inland Fisheries). Additionally, there are species that live in the waterways near the forest, and impacts on the forest could cause additional impacts on these species. However, we have found no available studies of animal or plant life done on the Woods thus far.

1. An animal and bird count should be done annually by wildlife science classes to monitor how wildlife is using the Woods, at such a time that transient species can be noted such as spring and fall migrations. Reports should be compiled in a data base and given to the Arboretum Committee.

2. Depending on the species found, further policies should be implemented so that use of the Woods does not negatively impact these species, using the Virginia Wildlife Action Plan for proper management (Game and Inland Fisheries 2005)
   a. These policies should consider how usage impacts animals at their most vulnerable states, such as during nesting and hibernation
   b. Cooper’s Hawks are known to prefer old-growth forest for nesting, and their usage of the forest should be documented as soon as feasible, such as spring 2013 (Biohabitats, Inc., 2012)
   c. Areas to encourage important wildlife habitat should be managed for wildlife and could be designated with signs to reduce disturbing wildlife living patterns

3. If endangered, vulnerable, or “of concern” species are confirmed in the Woods, further policies must be enacted to ensure their continued safety.

4. Signage and maintenance
   a. Encourage people not to feed wildlife
   b. Signs may also include common species found in the Woods, so that visitors may correctly identify the animals they see, fostering a sense of pride of place.
   c. Trash should be collected regularly so that garbage cans do not attract common scavengers such as raccoons and squirrels ("Respect Virginia's wildlife!" 2012)

5. Allow brush piles and natural accumulation of plant species to provide proper habitats for wildlife such as small mammals and reptiles. Brush piles will also aid birds in building nests ("Respect Virginia's wildlife!" 2012)
Survey Responses

Stakeholder opinions of Woods management fall in line with the following policy recommendations. Stakeholders are especially concerned with invasive species removal, and the replacement of invasive species with native species. 95 percent of respondents to the stakeholder survey believe that it is important or very important to promote native plants and wildlife in the Woods. Stakeholders also expressed concern with maintaining the understory of the Woods so that wildlife could best use it for food and shelter.
In any forest, invasive species are a threat to the ecological stability of the woods. The Woods North has significant invasive species present. Privet, Japanese honeysuckle and multiflora rose are the main issues. Although the Woods South has less invasive species present, Japanese honeysuckle and others still remain.

According to the Biohabitats study, the following are the main invasive species found in the Stadium Woods, and should be considered the biggest threats:

- Japanese honeysuckle (Lonicera japonica)
- English ivy (Hedera helix)
- Multiflora rose (Rosa multiflora) (pictured above in figure 8)
- Bush honeysuckle (Lonicera maackii)
- Japanese privet (Ligustrum sp.)
- Oriental bittersweet (Celastrus orbiculatus)
- Burning bush (Euonymus alatus)
- Japanese barberry (Berberis thunbergii)

Other invasive species could be present in the future and special care should be taken with non-native plants used in landscaping areas adjacent to Woods. The Committee should maintain contact with those responsible for landscaping the university, especially in areas near the Stadium Woods to ensure that only native plants are used.
1. Invasive species should be removed at least once a year; however, optimally invasive species will be removed several times each semester for increased tree health (Biohabitats 2012).
   a. The New River Valley Master Naturalists has been primarily responsible for invasive species removal and does so themselves and sometimes by enlisting help from campus groups like the Environmental Coalition and the Society of American Foresters.
   b. The Arboretum Committee, the New River Valley Master Naturalists, or other appropriate groups should be contacted before any group wishes to remove species. Those wanting to remove invasive species should be educated in proper removal techniques and plant identification.
   c. Groups removing invasives should be familiar with species listed above and VT Weed Identification Guide to ensure only invasives are removed (Hagood, n.d.).
   d. Removal of invasive species should be considered when assigning community service projects to Virginia Tech students for infractions.

2. Controlled burning with the VT Wildland Fire Crew should be considered, especially in the North Woods, in order to effectively remove the maximum amount of invasive species in the least amount of time. Using the VT Wildland Fire Crew would also provide educational benefits to the university and the staff.
e. Ecological Benefits

Air Temperature Reduction

There are many benefits that, as an urban forest, the Stadium Woods provides regarding air temperature reduction. Large white oaks and other trees provide shade and lower temperatures in urban areas. A reduction in temperature comes with improvements in air quality, decreases in energy use and reduced ozone formation.

Project Evergreen explains, “Large shade trees can reduce local temperature 5-10°F, that maximum mid-day temperature reductions due to trees range from 0.072°F to 0.36°F per each one percentage increase in canopy cover.” Not only do trees shade surfaces and reflect sunlight to reduce temperatures, but the physiological processes of trees also help cool the air. When trees transpire water through leaf stomata, the evaporating water absorbs energy. The energy is removed from the leaf and its environment, then lowering local air temperatures. The shade of trees reduces heat storage by buildings, roads, and other infrastructure (EPA 2003).

The Stadium Woods could reduce attic temperatures as much as 40 degrees. With respect to those who use the Woods for recreation, the temperature of the asphalt is directly affected, enhancing the quality of those who regularly use it. (EPA 2003).

Stormwater Mitigation & Water Purification

According to the Urban Forestry Network, research suggests that trees intercept 100,000 gallons of rainfall every year, and that five percent added tree cover could reduce runoff in a city by two percent. Evergreen trees are especially adept at retaining water. Magnolias, pines and other evergreens can intercept as much as 4,000 gallons per year. Deciduous trees are somewhat efficient, but not to the same degree, as they absorb about 500 to 700 gallons per year. A mature oak tree can absorb 50 gallons of water in a day. On average, a mature tree can absorb 36 percent of the rainfall it comes in contact with, translating into reduced runoff and soil erosion. It is estimated that the urban forest can reduce annual runoff by two to seven percent. This reduction can be converted into dollar savings due to the use of smaller drainage and artificial retention systems. Through the collective action of leaves and the anchoring and absorbing effects of roots, trees also contribute to soil stabilization, cleaner water, and the recharge of groundwater that serves as the drinking supply for over half the nation’s population. The role of trees in stormwater retention and its resulting benefits to public health and municipal budgets deserves greater appreciation. This is one more reason why the planting and care of trees in our communities is of critical importance.

Seiler stated that, “Storm water retention was then discussed briefly. It was pointed out that moving from a land use of mature forest (Stadium Woods) to an impervious surface (new building) is a worst-case scenario for storm water planning. The Washington Street location is already a largely impervious surface requiring minimal mitigation. The claim was made that existing infrastructure located near Stadium Woods can handle the storm water and that no further land would be used for new stormwater retention ponds (Biohabitats, Inc., 2012, 7).”
Although stormwater retention was not a focal point, the report discussed the challenges that the University would face regarding stormwater. Stormwater retention poses many challenges, especially that impervious surfaces do not allow rain to infiltrate into the ground. There are no water sources in the Stadium Woods, so little runoff is generated in the Woods because the soil and trees absorb the water. The stormwater that does not soak into the ground from surrounding areas elevated near the woods becomes surface runoff to be mitigated by the absorptive vegetation. There are no natural or manmade surface drainage features on site and the site is above flood elevations of any near streams. Two major concerns are the volume and the timing of the runoff water and also any potential contaminants that the water is carrying.

Air Filtration & Carbon Sequestration

Urban vegetation not only removes air pollutants from its surroundings, but it produces oxygen as well. On average, a single tree can produce nearly 260 pounds of oxygen in one year. That is enough for almost two people (Clean Air and Water, 2012).

Stadium Woods contains about 4,800 trees, according to the Virginia Tech Campus Tree Inventory, providing 624,000 pounds of oxygen a year or enough oxygen for 520 families of four (Virginia Tech Campus Tree Inventory). According to National Oceanic and Atmospheric Administration, “Over its lifetime, a single tree will absorb 1 ton of carbon dioxide from the atmosphere.” With a 4,800 tree count in Stadium Woods, that would be 4,800 tons of carbon dioxide absorbed from the atmosphere (NOAA, 2012). The CityGreen analysis showed that existing tree canopy on the Virginia Tech campus removes more than 4,000 pounds of air pollutants with a total dollar benefit of more than $10,000 and absorbs and stores 15 tons of carbon annually (VTCACSP, 2009). 86 percent of stakeholders believe that the Woods have the important or very important ability to filter air pollutants. 95 percent of stakeholders also believe that in general all of the ecological benefits that the Woods provide are important.

Trees and other vegetation are effective at trapping and absorbing many pollutant particles (Beckett, 1997). It is estimated that among cities in the United States the average annual air pollution removal performed by trees is approximately 711,000 metric tons of pollution. Urban trees, including Stadium Woods, can help to lower volatile organic compounds and reduce the amount of urban ground ozone levels (Nowak, 2000). Urban trees can also lower a number of other pollutants such as nitrogen dioxide, sulfur dioxide, volatile organic compounds, carbon monoxide, ozone, and particulate matter less than 10 microns in size (Biohabitats, 2012). A study by Impens and Delcarte showed that the interception of particles by vegetation such as trees were greater for trees located in urban areas because of their close proximity to road traffic. In a way, the trees created dust filters in cities and towns and helped to decrease the amount of particulate matter in the air. When one is exposed to particulate matter, it affects the cardiovascular and respiratory systems and poses a dangerous threat to the at risk population; the young, the old and the ill (Impens, 1997). The i-Tree method was used to calculate the amount of volatile organic compounds removed from the air it is estimated that the Woods removes approximately one ton of pollutants a year, a benefit estimated to be worth roughly $5,190 (Biohabitats, 2012).
Trees remove gaseous air pollution primarily through uptake in their leaf stomata and absorbed by water films to create acids in the inner leaf surface. Trees also physically intercept airborne particles on their bark and leaf surfaces (Nowak, 2006).

This is a broad topic to be addressed in a multitude of ways. However, it is vital that these policies strive to find a balance between forest uses and ecological benefits. We must address both human activities, as well as the naturally occurring processes. Most of these goals will be achieved through the utilization of best management practices. Some of the suggested practices include:

1. Limiting human activities that compact the soil (driving/parking) in order to maintain forest floor water filtration, decrease soil erosion, and increase the benefit of natural vegetation (Main Forest Service, 2006).
   a. The encouraged source of transportation in the Woods should be walking.

2. Arboretum Committee to determine:
   a. When a tree presents a hazard and should be cut down – as few trees as possible should be cut down.
   b. An appropriate level of pruning and tree maintenance.

3. Pest management: elimination and identification of invasive species that may pose a threat to tree health.


Survey Responses

Regarding ecological benefits, we received the following comment, “To suggest that there are some desired management practices to help preserve the woods is beneficial. However, in my opinion those practices would be best achieved by dealing with the best of the old growth area (the south portion) exclusively. It seems to me very unlikely the entire area would ever be restricted from development. So preserve the best piece and concentrate on that as an objective.”

The question in the survey dealing with stormwater asked how important is the Woods’ ability to mitigate stormwater. The responses indicated that just over 80 percent (81.4) of survey participants believe that Stadium Woods’ stormwater mitigation is important or very important. Nearly 15 percent (14.7%) responded either neutral, don’t know, or no opinion. This is a good indicator of how important stormwater mitigation is in the Stadium Woods and our stakeholders seem to agree.
V. Managing Use Benefits

a. Significance to Campus & Community Life

The Stadium Woods are a resource truly unique to the Virginia Tech campus. Having an old growth forest on campus not only stimulates use value, but also promotes a strong sense of intrinsic value. As the Hokie Nation, we should be proud of the unique opportunities afforded by this forest, and completely incorporate them into our campus and community life. As a land grant university, it is extremely important that Virginia Tech cherish the educational value added to our curriculum through the use of this old growth forest. The great commonwealth of Virginia gave this land to the university: for the people, to be used by the people, for education to benefit the people. As reflected in our stakeholder survey, 74 percent of survey participants strongly agree that the Woods enhances both campus and community life. Therefore, this resource should not only be appreciated by our campus, but also by surrounding communities.

Figure 9. This picture reflects the current various uses that surround the Woods.

Since this forest is estimated to be over 350 years old, it should also function as a historic site for many to appreciate. It is a remnant; it is what uncut forests in Virginia would have looked like when colonists arrived from Europe in the 1600s. Stakeholder survey feedback strongly supported this ideal; eighty percent of surveyed individuals considered the historical value of the woods to be “very important”. It is vital that the history of the woods is preserved. For example, there are still sidewalks located in the north section of the woods from WWII. Veterans originally used these sidewalks, as they walked to trailers that were being utilized. The Stadium Woods are full of hundreds of years of history, and it is important that this history is both cherished and shared.

For the past four years, Virginia Tech has been honored to be named Tree Campus USA by the Arbor Day Foundation. As a Tree Campus USA member, it should be made a priority to
develop a sense of connectivity between the campus and surrounding communities. This linkage will ultimately result in an overall healthier forest. Virginia Tech must embrace the Stadium woods resource, while striving to engage multiple stakeholders and community members.

Campus and community policy should work to engage all members and stakeholders, while creating a sense of mutual respect with the Woods. It will work to foster a sense of attachment between members of the community and the Stadium Woods. It is important that campus and community members are able to fully take advantage of the unique resource that is the Stadium Woods. Part of this process will involve education, helping individuals to understand the benefits of having these Woods on campus. Additionally, individuals will be encouraged to treat the Woods in an ecologically sustainable manner. Several policies that work to achieve these goals include:

1. Incorporation of Stadium Woods into the freshman orientation process. This will create a sense of attachment and stewardship with students at an early stage.

2. Possibility of showing the Woods during campus tours with Hokie Ambassadors.

3. Classroom involvement. In addition to the traditional class users of the words such as forestry, other classes in a variety of subjects should be encouraged to take advantage of the relevant wide-ranging learning aspects offered by the forest.

4. Engaging campus groups in forest processes by asking for specific help in identified management areas such as removing invasive species, cleaning up litter, tree regeneration planting efforts, among others. Student groups requiring community service should be considered in addition to forestry, natural resources, environmental, and other topic related organizations.

5. Designating specific areas suitable for gameday tailgating, while also designating areas as cut-through routes to Lane Stadium.

6. Explore the option of creating a deck overlook (including stairs) for football gameday tailgating and student reflection. This deck would be located on the elevated western side of the Woods North (as seen in Figure 8 below) and should be constructed to complement practices to lessen soil erosion in that area. The view-shed of this proposed deck is shown in Figure 9. There are various use options for this deck:
   a. Gameday VIP tailgating.
   b. Gathering spot for students, serving as an area to study, read, think, etc.
   c. An area for classroom activities.
Figure 10. Elevated area on the western side of the Woods North overlooking the football practice field and Lane Stadium

![Elevated area on the western side of the Woods North overlooking the football practice field and Lane Stadium](image)

Figure 11. A hypothetical view from the potential tailgating deck

![A hypothetical view from the potential tailgating deck](image)

**Survey Responses**

Regarding campus and community life, we received the following comments from:

“*Stadium Woods is a unique campus amenity for Tech students, Blacksburg residents, and campus visitors; and it should be preserved so that future generations may enjoy its benefits.*”

“Virginia Tech should work to set an example of preserving woods in an urban setting as they have influence around the world in a time that the earth's environment is stressed.”

“I think that Stadium Woods is currently being underutilized by both University and community educators. Learning can be enhanced in every subject (from computer science to bioinformatics) by both directed and undirected study in nature. Stadium Woods can be enhanced so that its preservation is a feather in the cap of this great University. It can be shared such that athletes, football fans, nature lovers, the student body, the Blacksburg community, and the ecosystem all benefit. Let's not give up before we make that happen!”
b. Recreation & Trails

The Stadium Woods is a sanctuary of recreation for Blacksburg and Virginia Tech. This could encompass biking, walking, running, sitting, bird watching, pet walking and much more. The capacity to provide an admired recreational experience should be designed through designating appropriate recreation areas thereby minimizing disturbing the ecosystem integrity.

The gravel path that bisects the forest creates a substantial break in the understory, which warrants the designation of the Woods North and South. The maintenance performed around the Corps of Cadets rappelling tower and mowing that occurs along the asphalt path corridors creates a variety of habitat types within the forests themselves. Community types contain variability within the stand and the boundaries shown are intended to demonstrate that there are tangible differences between these units that can impact management decisions (Biohabitats, Inc., 2012).

The current state of the Woods and the primary management approach has been minimal. An additional asphalt path runs along the eastern border. A rudimentary, informal trail system exists for recreational uses. Pre-sampling reconnaissance of the forest, along with analysis of the sampling results, indicates that there are two different vegetation stands within the Woods (Biohabitats, Inc., 2012)

Figure 12. A view of an unpaved trail in Stadium Woods.

1. This plan proposes a use-centered approach to the management of trails in the Woods for recreation and increased safety. Dirt trails should only be wide enough for biking and walking and should be managed to be free of debris. Forest floors are highly sought by runners as they reduce injuries that occur from running on pavement and hard surfaces.

2. Clearly identify and mark with small, unobtrusive trail signs for running or walking. These signs will encourage and focus recreational use in designated areas.
3. Add strategically placed benches along the trails to provide a place to sit, bird watch, relax, read, or reflect.

4. Place trashcans and recycling bins in areas with litter (between five to eight total) as well as pet waste disposals. These will keep the Woods visually pleasing and encourage responsible disposing of waste from recreational uses and gameday migration.

Figure 13. An existing sign in Stadium Woods that can be used as a template for additional signs.

5. Make more informational signs like the above photo. To promote the values important to the campus community, signs could be placed next to significant trees and vegetative areas to explain species, historical significance, and other relevant information in an area. It would be fairly inexpensive to produce these signs. To make these signs, Facilities must be consulted to determine the expenses as well as their environmental impact. The significance of these signs would educate the public, show the importance and historical significance of the trees, and list the species that live in the Woods. This plan proposes to put signs at the entrances of each path (two large signs). We aim to help educate the users of the Woods and others by teaching them about the trees and the species that live there, thus encouraging campus community members and recreational users to help protect the health of the Woods.

6. Paths can be more prominent for recreational activities to encourage use of this area. Along with dirt paths, there could also be pathways with mulch on them as a longer-term goal when funding becomes available. We recommend using mulch because it spreads out foot compaction of the soil. Mulch could even be non-biodegradable mulch if it was deemed for safe for the ecosystem, to be determined by the Arboretum Committee, so that mulching would have to be done less frequently (normal wood chip mulch decomposes over time and must be reapplied more often). The first trail that should be mulched the one that bisects the Woods South (see page 5 map orange trail label “A”). Migration through the Woods takes place on this trail before football.
games as fans enter Lane Stadium, so mulching would enhance the gameday experience. If more funding was available, mulching should be considered for additional paths in the Woods.

7. Currently, there is lighting along both paths lining sides of the Woods South. The west side, running parallel to Lane Stadium has uniform Virginia Tech lights (see below photo and page 5 map yellow trail label “C”). The east side has minimal ununiformed lighting placed a few yards from the trail (see photo below and page 5 map yellow trail label “D”). This plan recommends the consideration of installing uniform Virginia Tech lights on trail “D”. These would enhance the aesthetic value of the space presently and football gameday experience by providing safe and pleasing recreational use.

Figure 14. Trail C winding parallel to Lane Stadium lined with standard Virginia Tech lights.  Figure 15. Ununiformed lighting along Trail D.

8. This recommendation for consideration could enhance the recreational, travel-through, and gameday experience of Virginia Tech students and alumni using and the Woods. This long-term recommendation could self-generate funds for implementation. This is done by brick laying, with each brick inscribed with a donor name, over the gravel trail that bisects the Woods North from the Woods South (see photo below and page 5 map orange trail label “B”). The path is also frequently used to get to football games. This would be an alumni landmark in the middle of the Stadium Woods, possibly enhancing the historic and social values.
Figure 16. Trail B, which bisects the Woods North and South.

Figure 17. Potential sign design for additional signs.
Survey Responses

After reviewing the results, it was unanimous that recreational use of the Woods is very important and people felt strongly about preserving the Woods and looking for improvements. Over 90 percent (90.9) of survey participants agreed or strongly agreed that students should have a natural area in which they can escape to. In regards to Blacksburg community members having that same luxury, over 85 percent (85.3) agreed or strongly agreed. Regarding paving of the trails, the distribution of responses was scattered, with over 28 percent (28.8) disagreeing or strongly disagreeing that there should be both paved and non-paved trails. A majority (62.1 percent) of respondents either agreed or strongly agreed that signs are important to designate walking or biking trails in the Woods.

Nearly 53 percent (52.5) of respondents were neutral or had no opinion on whether there is currently too much debris on trails. Over 54 percent (54.8) of respondents feel that the Woods adds uniqueness to the football gameday experience, while an equal proportion of respondents agreed or were neutral (40 and 38 percent, respectively) on whether more can be done to enhance that experience.

“Clearly marked foot trails with signs would be very beneficial to the community. It needs to be more of a landmark on campus. Virginia Tech should be proud of Stadium Woods because it truly is a unique thing.”

“Stadium woods should remain a woods. I would not like to see it paved and filled with lights, because it takes away from the integrity of the forest.”

“No paved paths but continue to maintain the unpaved paths.”

“[…] Some trails should be adapted for those with disabilities but that does not always mean paving.”

“I think some paved paths are important for the disabled and keeping the game day fans safe from ankle rolls/preventing erosion, but they should be built with a minimalist approach and NOT 10 feet wide…a 5 foot wide path should suffice.”

“I think the preservation of Stadium Woods is very important for present and future generations. I like to go on runs and walks through Stadium Woods, both to escape and to enjoy the scenery.”
c. Corps of Cadets Rappelling Tower

The Corps of Cadets uses a rappelling tower constructed in the woods for maneuvers and combat simulation. According to LTC Charles Payne, a member of the Commandant's Staff that oversees the rappelling tower, the rappelling tower in Stadium Woods is a university training facility, built and paid for by university facilities. As the primary university user of the facility, the Corps of Cadets is the university’s executive agent for it, controlling access and use, and ensuring appropriate and necessary maintenance when required.

Rappelling training is a component of cadet training that falls under physical fitness and confidence building. The Corps uses the facility throughout the year on an episodic basis. The largest single event occurs during New Cadet Week, when hundreds of cadets train on the facility.

Other university and outside agencies and programs also use the tower. The Virginia Tech Army ROTC program uses the tower to a larger degree than does the Corps of Cadets. Local, regional, and state agencies use the tower throughout the year for training, to include the following: VT Police Swat Team, Radford Police, Montgomery County Sheriff’s Department, Blacksburg Rescue Squad, Blacksburg Fire Department, Virginia State Police, and the Southwest Virginia Regional Law Enforcement Academy.

Currently the area around the rappelling tower is maintained free of underbrush and herbaceous plants (Biohabitats, Inc., 2012). The maintenance performed around the rappelling tower and mowing that occurs along the asphalt path corridors creates a variety of habitat types within the forests themselves. The understory within the Woods North was given a scale of 3 out of 5 on the Vertical Structural Diversity score due to a lack of understory limiting the habitat and diminishing the ecosystem services that can be provided by that section of the Woods (Biohabitats, Inc., 2012).

To increase the amount of understory in the Woods North while still allowing the Woods to be used for training purposes it is necessary that the ROTC:

1. Limit the maintenance to areas around the rappelling tower to the area that undeniably needs to be cleared.

2. Ensure that the Woods are left as is, without any trash or items that do not belong.
d. Prohibited & Restricted Practices

Certain practices are known to be detrimental to individual trees and the ecological integrity of the campus forest and may interfere with proper management of the campus forest.

The following is a list of practices recommended to be considered for prohibition:

1. **Planting.** In order to prevent planting of undesirable species and to allow those managing the Woods to be aware of the current status of all trees on campus, no tree shall be planted without the approval of the Arboretum Committee and Facilities.

2. **Maintenance.** No tree maintenance, such as pruning or removal, shall be conducted without the approval of the Arboretum Committee or Facilities. This is simply to prevent maintenance detrimental to the health and integrity of the forest.

3. **Vandalism.** Vandalizing any tree is prohibited. This includes the attachment of any sign, bicycle, or other object to a tree in such a way that may be harmful to the tree.

4. **Tree topping.** Tree topping involves the improper pruning or removal of limbs without regard for the structure or growth pattern of the tree. This can lead to a reduction in the tree healing potential, a creation of improper crown balance, and weak growth of new branches, which are key to tree structural and safety (UIC campus forest, 2011 p. 31).

5. **Mowing.** The Arboretum Committee should determine whether to mow large or small areas under trees. Mowing compacts soil and eliminates the forest’s natural ability to ensure organic matter decay for overall ecosystem health. A prohibition on mowing an area of the Woods to protect tree health and ecological integrity should be weighed against the uses of the area mowing would enhance. Areas determined to allow mowing should be narrowly approved only to enhance a compelling and serious community use interest and impact forest health no more than necessary than to meet the needs of the compelling and serious community use.

6. **Vehicles.** Driving or parking is prohibited on tree protection zone (TPZ). Some areas may be deemed suitable for game day football parking however, TPZ shall be placed around priority trees and vehicles are prohibited from parking there.

7. **Parking.** Since parking in the Woods has emerged as one of the more contentious issues in developing the management plan, we elaborate on the issue below.

Parking football players prior to games have sparked campus and community discussion, protests, and press coverage. This management plan seeks to resolve this issue by balancing the need to protect the health of Stadium Woods and the need for convenient football parking. This section presents the needs of current users, the ecological effects of soil compaction, stakeholder opinions, and our logical recommendations for resolution.
There is a need for a convenient and safe parking location for the VT football team. Roughly 70 players use the east portion of the woods to park before and during football games.

According to an article published in the Journal of Arboriculture, “Compaction of soil is a detrimental result of heavy human use of a site. The destruction of the associated vegetation is an accompanying feature. Soil compaction commonly causes reduced water infiltration, loss of pore space, increased soil density, decreased waterholding capacity, and reduced aeration. These soil characterizes impede root growth resulting with decreases in nutrient uptake, and reductions in soil microorganism activity. Amelioration of soil compaction under existing vegetative cover, especially trees, is difficult without some injury to the root systems (Craul, 1994).”

The Arboretum Committee explained in their position statement regarding parking in Stadium Woods that they do not, “condone driving on turf and parking near trees anywhere on campus. We understand that this is sometimes necessary for building maintenance, grounds maintenance, construction, and special events; however, tree protection guidelines developed by the Arboretum Committee should be followed during these events to prevent soil and tree damage. When driving and parking on turf is unavoidable, driving and parking under tree driplines (the perimeter of the crown) should be avoided always. The extent of the dripline is a rough indicator of the extent of the root system. Encroaching on this space compacts the soil, leading to the decline and death of tree roots that reside there (Seiler, 2012).”

There is no empirical research that proves parking on tree roots compacts soil enough to kill the trees, especially relevant to this case where parking occurs only a few times a year. However, it can be reasonably accepted that soil compaction negatively affects tree health, eventually leading to tree death. Compaction of soil and compression of roots from parking is a detrimental practice. As a result, arborists generally recommend that parking on roots of valuable trees be avoided wherever possible.

This plan recommends that the appointed Forest Management Committee consider two viable options for addressing parking in the east portion of Stadium Woods.

1. No parking shall be allowed in the Stadium Woods and the appointed FMC should determine an alternative, convenient, and safe location for football parking. We believe this is the best solution that would satisfy the needs of all stakeholders involved and uphold the important value of protecting the old growth trees in Stadium Woods.

2. Some areas may be deemed suitable for game day football parking however, TPZ shall be indicated around priority trees, following the above guidelines, to protect critical root zones. Vehicles should be prohibited from parking in these areas. Similarly, places where vehicles can park could be clearly marked, if it is more reasonable to provide designations in this way. Overall, this suggestion could be a suitable compromise if the appointed FMC cannot determine an alternative, convenient, and safe location for football parking.
Case Study: Michigan State University

Michigan State University has prohibited all parking, including gameday cars, near its campus trees since 2001. A 2001 press release from the university titled "New Parking Rules Help Save Campus Trees," begins, "Soil compaction. It's a problem that is slowly killing some of the largest, oldest and most beautiful trees on the Michigan State University campus."

"What happens is that the soil becomes so tightly packed around a tree's roots that the roots can't take up air and water from the soil," says forestry professor James Kielbaso. "Sometimes roots can be crushed and killed immediately by one instance of heavy weight. More often, compaction is created over time by repeated smaller loads. The tree suffers a slow, starving death."
"It can take five to 10 years of steady decline before the tree finally dies," Swartz says. "Soil compaction is very difficult, if not impossible, to reverse, so it's very important to prevent it from occurring whenever possible."

Some of the areas to be protected have been popular tailgating sites in the past. A number of new parking options south of the river will accommodate vehicles displaced from north of the river.

"We think that once people understand why we are asking them not to park on grassy areas near trees, they will cooperate with us," said Lt. John McCandless. "Everyone appreciates the natural beauty of our campus and no one wants to do anything that might damage it."

Trees with widespread roots are most vulnerable to the problem, Kielbaso says. "The root systems of some of our oldest trees spread out horizontally up to three times the height of the tree, and most roots lie within the upper 12 to 24 inches of soil," he says. "If we want these beautiful trees around for future generations, we must take care of them now" ("New parking rules," 2001).

Survey Responses

Regarding parking, we received the following comments from stakeholders:

"Given the unique qualities of Stadium Woods, it seems like all desires/needs for this space should NOT be equally valid especially when some of the needs are matters of convenience which can be met by various options (parking, for example)."

"I think continuing to mow areas of the woods would provide space for more unique gameday experiences, but using these areas as a parking lot for football games should be prohibited."

"First of all, there should not be ANY parking in Stadium Woods. The woods are not a place to tailgate, drink or have wild parties, and that seems to be the norm for the 'football game-day experience.' The true value of the woods is the ecological value."
VI. Future Work

1. Determine which groups on campus can contribute to these policy recommendations to ensure the plan implementation is a success.
   a. Engaging various stakeholders will ensure that the plan lives on if each plays a management role.

2. Although our survey provided valuable information, more careful consideration should be given to all stakeholder groups so they are more equally researched and represented in the final plan.

3. Engage a student class, group or research project to complete annual wildlife counts. Understand more specifically what survives in the Woods and what needs should be taken into consideration when determining specific management policies.

4. For recreational management recommendations, short-term and long-term objectives might be devised for the university to understand what is possible immediately and in the future depending on available funding.

5. Longer-term plan sections for tree regeneration efforts should carefully consider continuing the native structure of the Woods as removal of invasive species is successfully undertaken.

6. Incorporate balancing the value of campus and community safety as applicable to Virginia Tech Police Department.

7. The first recommendation of the APFSEC committee stated, “Designate the Stadium Woods Old Growth Reserve for permanent protection and develop a use and management program to enhance its ecological value and benefits to the campus community.” The report explained, “The recent outpouring of public sentiment about the value of the Woods provides an opportunity to raise funds for this designation and management effort. (APFSEC, 2012, p. 10).” Therefore, the implementation of some form of permanent protection should be considered in the long-term that is suitable to the university and stakeholders involved.
VII. Bibliography


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