

Indigenous Flora on Campus: A Feasibility Study

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Abstract

Students at Dalhousie University Studley campus poorly identified indigenous plants of Nova Scotia. We propose that students are unable to identify native species because much of the Studley campus landscape consists of exotic Nova Scotian plant species. The environmental, social, and economic benefits of having indigenous species on Studley campus are discussed. Interviews with ecology and biology professors identified many of these benefits, including maintaining the ecological integrity of the campus. These interviews also identified current landscaping practices and possible future projects involving indigenous landscaping (i.e. rooftop gardens). Possible methods of implementing new indigenous areas are also discussed, including methods such as soil grafting.

Facilities Management provided information on university operations, funding sources (i.e. graduate societies) and contact information for their current landscape architect. Results of a group administered questionnaire to students on Studley campus show that the length of time a student has lived in Nova Scotia and the level of education they have obtained are positively correlated with their ability to identify indigenous plant species of Nova Scotia. We discovered that 61% of students feel that there are benefits to having more indigenous species on campus and over 50% were able to name benefits of including native species in the landscape (i.e. educational and conservation benefits). A cost analysis determined that using volunteer work would be the most cost effective way to implement the project. We recommend that future students focus on an inventory of current species on campus, open communication with Facilities Management, research pertaining to the maintenance of exotic versus indigenous species, and the costs associated with their maintenance.

1. Introduction

1.1 Definitions

Whenever considering the implementation or analysis of a project/experiment, the researcher must adequately define the terms surrounding their project. Literature research was used to define the following terms: urbanization, horticultural practices, weeds, non-native species and native species. Urbanization is the conversion of rural to urban areas due to large numbers of migrating people in a geographic area and because of economic opportunities created by industrialization (Nebel *et al.*, 1998, CancerWEB's On-line Medical Dictionary, and Wordnet). The development of major infrastructures and buildings resulted in the conversion of natural ecosystems into anthropogenic ecosystems (i.e. lawns) which resulted in the establishment of alien (non-native or invasive) plant species that replaced native species (Freedman, 2004; Goldstein *et. al.*, 1982; Kowarick, 1990; Zerbe *et al.*, 2004).

Horticultural practices are used to maintain urban vegetation for aesthetic reasons such as gardens that have foreign ornamental trees, shrubs and herbaceous plants (Jenkins, 1994). These practices require a lot of chemicals and water to achieve the neat and tidy monoculture lawns to keep away weedy plants and pests (McDonald, online 2004).

A weed is referred to as any plant which grows where it is not wanted and possesses undesirable qualities such as rapid maturation prolific seed production, long distance dispersal, and unaesthetic growth forms (Paratley, 2000). From an ecologist's perspective, a plant is considered a weed when it shows the capacity to colonize and exploit open disturbed habitats (Paratley, 2000). Weeds can be either native or non-native but the definition for these terms are very confusing since their quality of being native varies in spatial and temporal scales so these labels are of uncertain value when planning restoration projects (Kitchen and McArthur, 2001). A non-native plant is one that occurs

in a region outside of its historical geographic range, usually taken to be its post Ice Age (Holocene) range (Paratley, 2000).

Non-native (alien, introduced or non-indigenous) plants in urban areas have most often been introduced by people. Some say that non-native plants can do better than native plants in man-made areas needing management. They are said to have become “naturalized” but are not indigenous plants (Kitchen and McArthur, 2001; Schwartz, 1997, Paratley, 2000). The introduction of non-native plants are recognized to enhance biodiversity – especially in man-made systems and in open areas (Zerbe *et al.*, 2004). Non-native plants do not seed out and establish viable populations beyond the area in which they are planted but spread out occasionally less than 10% (Paratley, 2000). Some non-native (invasive) species are able to seed out beyond their viable populations, establish themselves in great distances away at an explosive rates which drastically alters the composition of the plant community, exclude native species, and alters an ecosystems function (Korwarick, 1995).

In the context of Americas, a plant is considered native (or indigenous) when they have been identified as being present in an ecoregion during pre-Columbian times (circa 1500) with the arrival of many Europeans. The greater the geographic distance between the seed source and planting sites, the less a plant is considered to be native (Kitchen and McArthur, 2001). Native species are often, but not always, well adapted to the altered environments and in wildland communities (Kitchen and McArthur, 2001). We contend that they are usually best for plant materials that would be used for restoration, enhancing ecosystem stability and maintaining indigenous biological diversity. These plants have well adapted naturally in response to their local surroundings (an area ranging from 80 to 160 km), and are low maintenance because they eliminate the need for synthetic fertilizers and pesticides while reducing water use in the garden (California Native Plant Society, 2004). There are many environmental, cultural, academic and economic benefits (discussed later) that native plants have.

1.2 Project Definition and Goals

Through our observations and general knowledge of urbanization our group initially believed that there is a lack of native species on campus compared to non-native species which was responsible for student's lack of knowledge in this area. Urban biodiversity is composed of non-native species and horticultural practices, which are used to maintain neat monoculture lawns with shrubs, plants and trees from foreign countries. The landscape on Dalhousie University's campus is of no exception. The Halifax Peninsula that once was a pristine mix-wood forest was developed over a hundred years ago for this University, housing and other major structures. Point Pleasant Park is one exception, as it remains a remnant of what was once was natural still remains isolated mostly from natural woods with native flora and fauna.

It is from this perspective, that Dalhousie offers little to its community composed of students, faculty, staff and visitors for both formal and informal education, enjoyment and awareness of native species. Therefore, we suggest that if student's knowledge and awareness of native species is lacking, then we believe that Dalhousie can play an important role in educating students, faculty, and visitors in this area. Dalhousie University's campus does have native species, but there are few of them and they are not labeled to educate people formally and informally. Because Dalhousie University offers educational programs that teach students about ecology, environment, history and about native plants, it is important that Dalhousie University takes the initiative to allow more natural communities, gardens etc. on campus as educational programs and tools. If student's knowledge is lacking about native species, then we believe that Dalhousie University should implement more native species.

Our goal is to provide empirical evidence through conducting group-administered questionnaires to identify student's knowledge of indigenous flora. Several interviews with biology professors would give us insight into ecological integrity, non-native and native species.

Interviews with Facilities Management would open the door for communication with these important core actors. The following should-be actors are those that are

affected by the research process but are not directly involved. These actors include students, visitors, staff, prospective students, and faculty. These actors would be affected by decisions made about the campus landscape, because they are the actors who are regularly on campus and interact with their local environment. We feel that including indigineous species on campus is of most interest to the should-be actors.

The core actors, who are involved with direct decision-making include: the Director of Facilities Management, Mr. Jeffrey W. Lamb; the Environmental Services Manager, Mr. Mike Murphy; Planning and Project Services Assistant Director, Mary Jane Adams; and Supervisors of Grounds Staff. These people oversee the daily maintenance of the campus and are directly involved with any decisions about changing the landscape. The supporting actors include those people who are still important in the decision-making process, but are not constantly. They include: the President of the University, Dr. Tom Traves, and the Vice-President (Finance and Administration), Mr. Bryan Mason. These two actors may be called in future projects if there are large funding decisions to be made and any other large decisions with respect to landscaping.

Facilities Management would be interviewed to help us see how to go about implementing future projects of this kind. Another important part of our project is to conduct a cost analysis using three selected labour approaches to implement a hypothetical sized area we would be able to show the most cost effective approach to implement a designed project. The analysis would be limited in scope and would not include an analysis of how to obtain funds nor would the analysis be specific to a site on campus with the most appropriate species composition since every site would need a proper site assessment lead by Biology faculty. We hope that in the future this project could be the basis of either further detailed cost analysis or implementation of native species on campus.

2. Research Methods:

2.1 Background research on Indigenous Species and Ecology of Urbanized and Natural Ecosystems of Nova Scotia

In order to implement a designated natural landscape on Studley Campus, we decided to find out which native species would be suitable for the landscape and what kind of landscaping practices would be most suited to the Dalhousie University campus. In order for an area to represent a natural landscape, considerations have to be made about: soil type, topography, composition of species and species interactions with each other, what support systems are currently in place, what previous projects have accomplished, current initiatives, and if this type of project is supported by the student body.

Literature research and interviews were conducted to gain knowledge on what native species would be most appropriate for the campus environment and to gain familiarity with the complexity of the ecology of natural ecosystems native to Nova Scotia. This is explorative research because it has familiarized us with the project and gives us more precise information about the topic of natural landscapes. In *Research Decisions* by Ted Palys, he states that “explorative research provides a heuristic benefit” which will educate the researchers, ourselves, and will produce recommendations, comments, explanations, and any other benefits such as contacts with other people to continue with research in the future (Palys, 72).

We acquired new insights from those who inhabit the research site by interviewing professors on campus who are knowledgeable on the subject and were willing to explain and recommend to us what is needed. The professors interviewed included Dr. Bill Freedman, Dr. Cynthia Staicer, Dr. David Patriquin, and Dr. Martin Willison. All professors interviewed had previous experience with implementing native species on campus and conservation projects such as the ocean pond project. (The questions that we asked the professors can be found in appendix 1).

In addition, we also interviewed Facilities Management representatives Michael Murphy and Mary Jane Adams. They are two key actors within Dalhousie University's decision making process. We wanted to know how Dalhousie manages the current landscape and what species are represented in majority on campus (i.e. whether or not they are mostly native or non-native species). It is important to obtain information about the perceptions of grounds management about promoting a naturalized landscape and would serve us to obtain information about their knowledge of landscaping practices, the costs, roughly how many native species there are in comparison to non-native species, and what steps they would suggest us to take. This kind of qualitative research limits us to really know the true biodiversity of native and non-native species on campus. (The questions we asked Facilities Management are included in appendix 2).

During these interviews, snowball sampling methods became an important part of our research. Palys describes this as, "snowball sampling involves one or two people and then using their connections, and their connections' connections, to generate a larger sample" (145). An important contact provided by Facilities management was the name of their current landscape architect – Vollick, McKee and Petersmann.

Dr. Tarah Wright defines reliability as the "consistency or stability of a measure or test from one use to the next. A measure is reliable to the extent that it is free of random error. The extent to which findings can be replicated, or reproduced by another inquirer" (Lecture notes ENVS 3502 Week 3). The following ensured reliability: the interviews conducted were informal and open ended, the questions that were asked to the professors consisted mostly of three main subject areas: a) the importance of having native species on campus and in the Nova Scotia landscape b) discussion on the current landscape and practices here at Dalhousie University and c) suggestions and recommendations, and these professors are knowledgeable and/or experts in this area. If these same questions were asked to the same professors, the same themes would emerge in the analysis of the interviews. The interview with facilities management was more

formal and the questions that were asked were precise and worded in a manner that would leave little room for misunderstanding or error.

Dr. Tarah Wright describes validity as, “a term to describe a measurement instrument or test that measures what it is supposed to measure; the extent to which a measure is free of systematic error” (Wright, 01/20/04). The analysis of the information gathered by the interviews with both professors and Facilities Management was conducted by all group members. We discussed the main reasons why we conducted the interviews, what we had gained, what the recommendations were, and the major themes in both sets of interviews. The level of subjectivity and biases was reduced because the whole group contributed to this analysis, making the results more valid.

Palys defines catalytic validity as the process whereby “researchers ... evaluate their work by considering the extent to which it empowers people by enhancing their “self-understanding” and shows them possibilities of transformation...” (Palys, 77). The Facilities Management and the successive contacts show the interest and initiative being taken by students in this area and raises awareness to those who make the decisions that this topic is important to students at Dalhousie University. It also raises the level of knowledge and awareness of the respondents who were part of the questionnaire process. It will hopefully encourage more people to look around the campus and become more knowledgeable about the university’s landscape.

2.2 Knowledge and Perceptions of Students

We conducted group-administered questionnaires to gather information about student’s perceptions and their knowledge about the present urbanized landscape and a natural landscape with native species on Dalhousie campus. This is important for our research and for implementing this project because students make up the majority of the community that has such an impact on the environment.

Finding out student's perceptions and knowledge of native species and natural ecosystems is important because we can analyze the current rate of knowledge held by students. The method most suitable for this project was to have group-administered questionnaires to classes on Studley Campus that hold approximately 50-60 students per classroom. We used a stratified random sampling technique, defined by Palys as a process whereby "the researcher first divides the population into groupings of interest and then samples randomly within each stratum"(Palys, 134). Stratified random sampling gives high response rates, are useful to get a lot of data quickly because the population of interest is accessible, and there is a level anonymity. We felt that group-administered questionnaires would save us time and resources because we could quickly get a lot of respondents and reduce paper waste because we planned to present the questionnaire by using an overhead projector. It would have been counterproductive if we asked people waiting in lines for coffee because many may not be interested or meet the focus of our research. We also felt that the initiation of the survey with the support of a professor would be influential in encouraging the students to fill out the survey. This is a disproportionate stratified random sample because the population is stratified into equal subgroups within the faculties so we can compare student's education and perceptions or ethics pertaining to natural ecosystems and their protection (Palys, 2003).

The disadvantage of group-administered questionnaires is that privacy may not be guaranteed if respondents are shoulder to shoulder, and they may be influenced by someone who is vocal about their opinions (Palys, 2003). In group-administered questionnaires, it may be difficult to answer any questions that students may have about the context.

We began our survey by picking six faculties within the Dalhousie community: Arts and Social Sciences, Computer Science, Engineering, Commerce, Science, and Law. From these six faculties we looked to see which classes had enlisted 50 to 60 students because classrooms of 500 people will over represent a student population within a faculty. (Palys, 2003). From the list of classes, the course name and number was written on a piece of paper, torn into individual pieces and put into a hat and drawn randomly.

The classes that were drawn were listed in order of their random selection and this was the order in which we were to approach the classes. We were to approach six classes from the six different faculties by emailing the professors and asking if we may conduct the questionnaire. Unfortunately, due to a poor level of response from professors, we were unable to follow through with the initially proposed research method. Instead, we conducted the survey to only 3 classes. This did not change our method of research sampling, but it did however limit the scope from which we could gather information. The reliability of the questionnaire is ensured by the administration of the same questions and pictures to all three classes and the results were analyzed using statistical formulas that ensure a low level of error thus ensuring validity. (A sample of our questionnaire is included in the Appendices 6 through 10).

2.3 Cost Analysis

Our initial information for our cost analysis was obtained through our interview with professors and Facilities Management. This included what kind of naturalized area would be feasible and what kind of budget would be available. We then proceeded to gather information by contacting stores and those who are familiar with landscaping to get a list of approximate costs associated with landscaping.

Initially, the size of our test site would have to be determined. We felt that an area of approximately sixty square meters would suffice our needs. Our reasons for this are discussed in our results.

The costs associated with establishing our indigenous landscaping project are broken down into labour costs, costs of plants and necessary materials, and maintenance or upkeep costs. Each of these costs were explored as if the project were to be carried out by volunteers, using student labour, or employing a local contractor.

2.4 Limitations and Delimitations

The limitations of our research include the time constraints of the project being developed completely over a four month period (half of that time is spent narrowing the focus of the research question and project). This limited our project because we were not able to be as in-depth in our research as we could have been. The season was also identified as a limitation because in the winter it is often difficult to identify natural areas from non-natural areas on the campus due to snow. We were unable to conduct a survey of the current landscape and its species of flora on the Dalhousie University Studley campus. In our interview process we were unable to contact and interview Alec Wilson, who is a botanist with the Nova Scotia Museum of Natural History in Halifax, and Dr. Pierre Taschereau, who is a botanist teaching identification of native species of Nova Scotia using the grounds on campus. The group administered questionnaires proposed methods were not the actual methods that were conducted because of the unavailability of the selected classes to participate in the questionnaire.

Our delimitations included the fact that we only selected students for our questionnaire and not other members of the Dalhousie community. As well, we only conducted interviews with those who we knew would be knowledgeable on the subject. This excluded others who may have had information outside of our frame of reference. Our project itself is a feasibility study, but due to the various limitations identified above, it has remained very broad in scope and assessment.

3. Results and Discussion

3.1 Interviews with Biology Professors at Dalhousie:

Four professors were interviewed and one was not available to be interviewed, which would have been Pierre Taschereau, a botanist teaching identification of native species of Nova Scotia. Dr. Bill Freedman and Cynthia Staicer are knowledgeable in the areas of ecology and urban ecology. Dr. Martin Willison, a conservation biologist who

coordinated the ocean pond project, has had experience implementing native species on campus. Dr. David Patriquin is known for his studies in the areas of nitrogen fixation, agriculture, and marine studies.

3.1.1 Landscape Practices:

All professors agreed that the present landscape is maintained by traditional horticultural practices using chemicals such as fertilizers, insecticides, salt etc. and planting non-native species instead of native species. Thus, as Freedman and Willison pointed out, the ecological integrity of the original landscape is lost and over-ruled by exotic species. Patriquin and Staicer pointed out that there isn't much greenery here. All believe that native species are under-represented here on campus and it would be best ecologically, academically, culturally and economically to implement them.

Specifically Patriquin pointed out that the lawns are mowed at heights of 1-1^{1/2} in. and recommends the Facilities Management to cut at heights from 2^{1/2} inches to 3 inches so the lawn could be robust, healthy, and greener like those of Saint Mary's University and Mount Saint Vincent University, two similar sized universities also located in the Halifax area. Herbicides were banned in 1984, but as far as the professors believe other chemicals, specifically nitrogen and salt, are being used. They are however, unsure if insecticides are used. Patriquin also contends that nitrogen fertilizers on the lawn have not really improved the lawn because it does not look as green as it could. He suggests that to improve the lawn, Dalhousie should allow native species, such as clover, to grow because they are low maintenance and cut at the recommended lawn heights. However, Patriquin expressed mixed feelings too, because by default of the ban of herbicides, it is botanically interesting around certain buildings.

3.1.2 Importance of implementing native species or naturalized areas on campus:

Both Willison and Freedman believe that implementing native species and naturalized areas on campus is important for conservation efforts because it will enrich

the ecological integrity of the original landscape on campus. Others, such as Patriquin and Staicer, had mixed feelings toward this, because as they point out, there is not much land here on campus to naturalize. It is isolated and whenever there is space, either a building will be built or a new parking lot will be implemented. Staicer pointed out that it would be more beneficial to concentrate our conservation efforts towards threatened wild reserves or other areas. However, all agreed that implementing these gardens or semi-natural areas can bring benefits to the University, students and researchers if both non-native and native species were labeled and thus, in an educational context, implementing more native species using any method would bring benefits.

3.1.3 Implementing and Feasibility of establishing sites for native species:

Though the space is limited, all professors concluded that some areas are suitable for a semi-natural, opened mixed- wood forest that was present before the Halifax Peninsula was developed. This project to implement a semi-natural local ecotype had already been initiated between Sheriff Hall and the Life Sciences Building. Freedman and Willison agreed that more work needs to be done behind there to control the exotic species by using heavy cultivation and no-mow practices so that under-story shrubs can subsist, because by soil grafting seeds that were from an original forest are still present below the surface layer of grass.

Specifically all Professors agreed that the original forest on the Peninsula was similar to Fleming Park across the Northwest Arm or the Hemlock Ravine Park, which would have included a mix of hardwoods and softwoods such as White and Yellow Birches, Red Oak, Red Spruce, Eastern Hemlock, Silver Maple and other Maples. Also, shrubs such as lambkill, blueberries (which are already present on campus), huckleberries, the Canadian May Flower, and all types of indigenous ferns would be suitable (Freedman). Staicer had pointed out that for implementing a natural area shade, soil moisture and other qualities would need to be considered especially the fact that the

campus is on a drumlin, and the hardwoods specifically are adapted to sunny and dry areas while the softwoods would be suitable to wet and cooler areas.

Because the campus is small, Freedman suggested growing native species on top of roofs as well as anywhere else that there is room for a garden on campus including areas where there are gardens already present. Smaller native gardens would be more feasible and they would also attract wildlife such as birds and butterflies giving them a resting place in this developed area. Patriquin had some suggestions of which native plants would be attractive such as Yarrow, knapweed, and Brown-Eyed Susan among others that were naturalized (i.e. plants introduced that are low-maintenance and not invasive).

Soil grafting is one approach that Willison recommended because that is how he implemented the pond and the area between Sheriff Hall and the Life Sciences Building. This method is cost effective because trucking soil was the only major cost for the forest area and it is easy to implement native species because there are thousands of seeds within the soil. Plant grafting is another approach which Patriquin did himself to make his native garden in his backyard. Buying plants in nurseries should really be left as the last option, because it can be expensive.

Overall, the professors we interviewed tended to be supportive of the idea of implementing more indigenous species on campus. They provided a lot of valuable information with regards to what kind of landscape would be ecologically and economically feasible. It will be important for future students to maintain these contacts if a project such as this is to be implemented.

3.2 Facilities Management Interview

Michael Murphy, Environmental Services Manager; his assistant; and Mary Jane Adams, Planning and Project Services Assistant Director, were interviewed. They are the key actors within the decision making process within Facilities Management. We

obtained valuable information with regards to how the university is run, who to talk to about funding, current projects that are being undertaken by the University, and what projects have been done in the past. There is no specific budget specifically for landscaping but a budget is designated for all of Facilities Management and its operations, including snow removal, maintenance of grounds, transportation, etc. The same landscaping company that dealt with the campus while it was still TUNS currently maintains the Sexton campus. On the Studley campus Joe Barrett is responsible for overseeing the maintenance of the landscape.

The Facilities Management team referred us to several contacts, such as members of Public Relations and the current landscape architect. We were advised to talk to either Amanda Pelham or Mary Sommers with regards to Public Relations because they deal with specific graduate committees that look at planting trees on campus. This avenue would be a possibility if we wanted to look at planting a specific indigenous tree on campus. This would be small-scale funding that would be sufficient to fund the planting of one or two trees.

Dalhousie has hired a landscape architect to draw up a plan to re-design the current landscape because the new Management building is being built. The landscape architect is Carrey Vollick and he is a part of the architectural firm of *Vollick, McKee & Petersmann*. Facilities Management told us that Vollick tagged all of the foliage on campus and informed them that many of the current species of trees and plants on campus are unfit to be in this environment. For the most part, the trees that were destroyed by Hurricane Juan were those that are exotic to the Nova Scotia environment. Adams and Murphy were adamant about the fact that Vollick's recommendations to naturalize the current environment have NOT passed through the Dalhousie Senate and have not yet been presented to the Senate. Currently, Vollick's project is in the planning, evaluation and proposal stages.

Similar projects to ours have been implemented in the past, including: the Ocean Pond, Seymore Green, the Turf pots near the tennis courts, and the tall grasses

experiments that are on-going in the northwest Biology wing and in behind Sherriff Hall. We were encouraged to talk to Martin Willison with regards to the methods we could use to implement our project because he designed and maintains the Ocean Pond. One of the main concerns with implementing these projects is to maintain security on campus and this can sometimes limit the design of a landscape due to visibility and safety.

The interview with Facilities Management was very helpful to our overall view of the University and gave us ideas as to where to go for information within the Dalhousie community. As a result of this interview, we were able to contact the current landscape architect, associate Mik Owen, who is very interested in reading our final report and taking into consideration our ideas. (Our email to Carrey Vollick and Mik Owen's response is found in Appendices 3 and 4.)

3.3 Student Survey

The data we obtained through our survey is analyzed in tables and graphs included in this report. The purpose of this survey was to determine how much knowledge, if any, students had about indigenous flora of Nova Scotia. We analyzed the scores from the identification questions (questions 6 through 9) against student's responses for questions 1 through 5 to see if there was any correlation between them. For analysis purposes, responses in questions 1 and 3 were given numerical weights ranging from 1 (very poor or very unimportant) to 6 (very good or very important), and question 2 was measured in months so that we could have constant units (i.e. some students gave values in years, others gave values in months). (The actual survey is included in appendices 6 through 10).

Table 1: Summary of Results

CATEGORY	CLASS LEVEL			ALL GROUPS
	1000	2000	3000	
Score (out of 4)	0.9	1.5	1.88	1.4865
Q1 Knowledge (1 to 6)	2.17	2.87	2.28	2.45
Q2 Time (in months)	98.8	139.68	191.3	148.71
Q3 Value (1 to 6)	3.28	3.08	3.67	3.36
Q4 Benefits (% Yes)	55%	50%	74%	61%

(Values are average scores for each specified group)

Table 1 is a summary of the data we obtained in our survey. The following figures will refer back to this table.

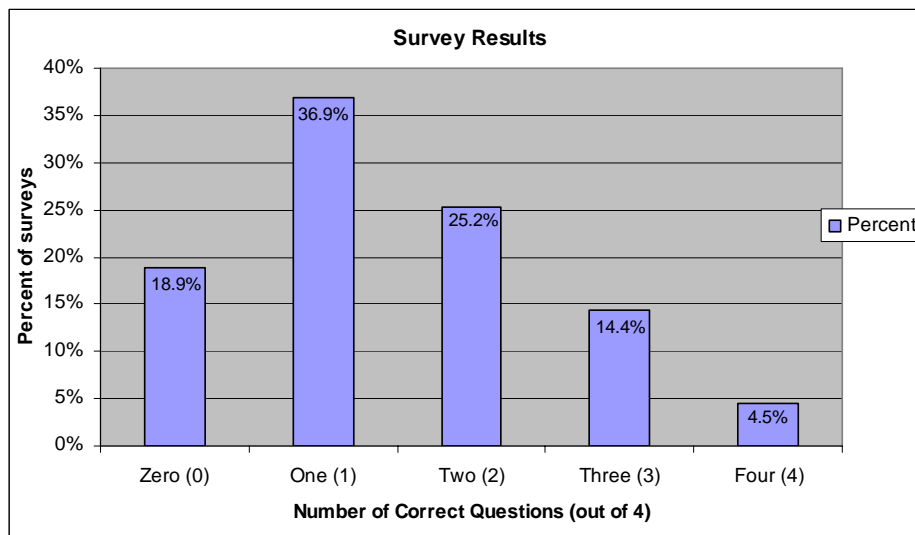
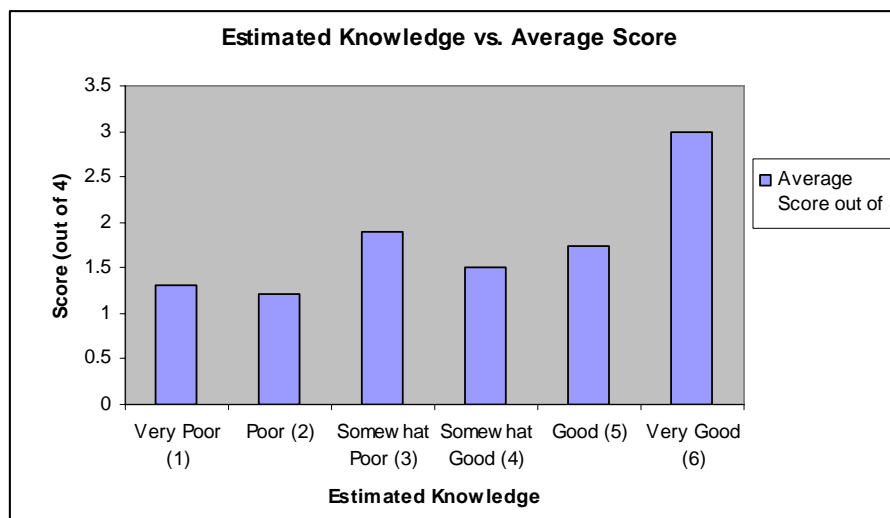
Figure 1

Figure 1 displays the distribution of scores from the identification questions. We discovered that overall, students had a somewhat poor ability to identify indigenous flora from Nova Scotia. The average score for questions 6 through 9 was 1.4865 out of 4, or roughly 37%. If students were not able to identify any native species, we would expect a

score of 0.67 out of 4 (17%), which would have occurred due to the 1 in 6 possibility of guessing correctly, thus our results show that they do have some identification ability. These results were also broken down by level of study. One point that is interesting to note, is that the average score increased with level of study (i.e. the 3000-level students scored significantly higher than the 1000-level students).

Question 1 of the survey asked students to rate their knowledge of native Nova Scotian plant species. Overall, students rated their knowledge fairly low, with an average rating of 2.45 (1 = very poor, 6 = very good). The class level did not seem to matter for this question either.

Figure 2



One thing that was interesting about question 1 was that students who rated their knowledge better tended to score better on the identification questions than those who rated their knowledge lower. Figure 2 shows that the higher students rated their knowledge, the better they were at identifying plants (i.e. their score out of 4 increased with increasing estimated knowledge). Or, in other words, students seem to have an approximate idea of how good their knowledge is regarding indigenous Nova Scotian species.

Question 2 on the survey asked students how long they have lived in Nova Scotia. We included this question because we thought that students who had lived in Nova Scotia longer would have been exposed to native Nova Scotian plants more. After the data was collected, there were two distinct groups of students: those who had been here for 18 to 24 years (i.e. their whole lives), and those who had been here for 6 to 72 months (i.e. just for their education). So, we decided to analyse these groups separately, using 18 years (216 months) as the cut-off point. This cut-off also split the data into exactly half just by coincidence.

Figure 3

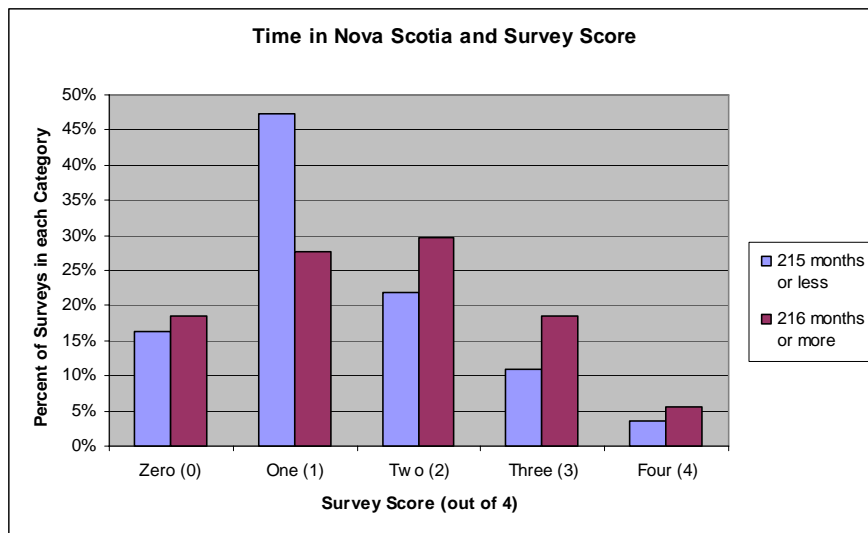


Figure 3 shows students who have been in Nova Scotia for 216 months (18 years) or more scored better on the plant identification than those who have been in Nova Scotia for 215 months or less. The average survey scores for each group were 1.65/4 for the 216 months or longer category and 1.38/4 for the 215 months or less category. We would assume this to be true, as people tend to be more familiar with an environment the longer they are in it. The third question on the survey asked students how important it was to them to have native plants included in the Dalhousie campus landscape. Their choices ranged from 1 (very unimportant) to 6 (very important).

Figure 4

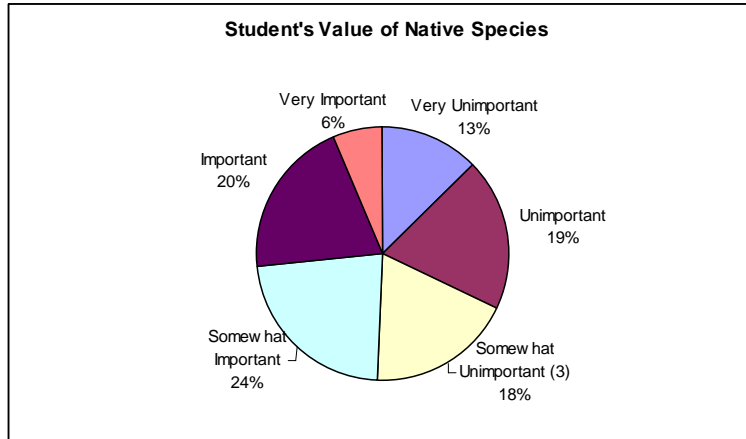


Figure 4 shows the distribution of values that students placed on having native species on campus. The average importance students chose was 3.36, or rather, inbetween somewhat important and somewhat unimportant.

Question 4 of the survey asked students if they felt that there were benefits to having indigenous plants on campus. Sixty-one percent of students answered yes to this question. This is important information, as it shows that the majority of students support the idea of having more indigenous species on Dalhousie campus.

For those students who answered “yes” to question 4 (Do you feel that there are benefits to having native species on campus?), question 5 asked them to list any benefits that they could think of. Their ideas included (in order of most popular to least popular response):

- Allowing international and out-of-province students to become more familiar with their new surroundings
- Creating respect for a natural environment
- Preserves Nova Scotian heritage, students can feel proud
- Educational purposes
- Less need for fertilizers, easier to maintain

- To increase knowledge and awareness of Nova Scotian culture and native Nova Scotian species
- Helps to preserve the natural environment
- They are pretty
- Unsure of what the benefits are
- Helps to preserve the natural environment
- They can tell you about an area – the environmental status, climate
- “This is Nova Scotia...” (i.e. it makes sense)

This question was helpful to us, as it not only provided us with an idea of what students think, but the students made some suggestions of benefits that we did not even think of.

One of the problems brought up by students with our survey was that the pictures shown on the overhead were not very clear. This may have had an adverse effect of the outcome of our survey. Another problem we encountered was getting professors to give us 10 minutes of their class time to survey their students. Because of this problem, we ended up only surveying 3 classes when we would have liked to have had six or more. On the positive side, each of the three classes we surveyed were different levels (1000, 2000, and 3000) and were from different faculties (Science, Arts, and Engineering).

Our hypothesis was that students would have poor knowledge and awareness of indigenous species and their benefits to the environment. This survey proved that our hypothesis was somewhat correct, in that students did have some knowledge of native species, although it was rather poor. This survey also showed that students are very supportive of having indigenous species on campus and are aware of many benefits of having native plants incorporated into the Dalhousie landscape, which is one of the strongest arguments for the implementation of our project.

3.4 Planting Site and Cost Analysis

Before establishing any kind of cost analysis of the implementation of indigenous flora on campus, we first had to decide on an area that would serve as a hypothetical planting area. A theoretical planting site could easily provide us with an understanding of the feasibility of our initiative, and if realistic, may support arguments that will further our objectives.

Initially, the size of our test site would have to be determined. There was a general understanding that this site could not be too large, as a project on too great a scale would likely not be supported due to excessive costs, and the limited depth of our proposal and background research. Thus, if the site was moderate to small in size, we felt that our objectives would still be realized, and limited funding on behalf of the administration would be sufficient.

Thus, we felt that a naturalized indigenous area of approximately sixty square meters would suffice our needs. Thus, now with the approximate scale of our project in terms of a geographic area, we may investigate as to the costs of that such a planting project would entail. Though, we should note, that the actual location of the site on campus has been left undecided, as the notion of a test site is strictly a tool to gain a bearing on associated monetary costs. A decision of the locality of our site, would likely follow an approval of our feasibility study, and would likely adhere to suggestions of grounds and facilities management, and would attempt to naturalize a current problem area on campus in regards to poor aesthetics and natural foliage. Though, in hindsight such an issue might have been raised in our questionnaire to gain a student perspective, as to where more green space should be introduced.

The costs associated with establishing our indigenous landscaping project are broken down into labour costs, costs of plants and necessary materials, and maintenance or upkeep costs. Each of these cost divisions will be explored as if the project were to be carried out in a variety of scenarios. The possible planting applications may include

initiating a volunteer, replanting project; employing the services of a local contractor, and as a student labour project.

If we undergo the project as a student labour project, this will involve hiring students, as labourers, likely at near minimum hourly wages. The project would require leadership by us (the research team) and further guidance from a Dalhousie professor with applicable expertise in natural ecosystems (i.e. a member of the faculty of biology). In addition, we would also likely need the help of a private landscaping contractor, as this would give us access to necessary tools, know-how, and a source for purchasing the necessary flora. Such guidance would ensure the quality of the project, which would otherwise essentially be conducted by laymen, with little background in planting and landscape developments.

The possibility of undergoing the project as a strictly volunteer based, donation procedure would likely be the most cost –effective strategy. In such a situation, all of those involved in the planting and upkeep of the garden would be unpaid volunteers, (we the research team), and any other Dalhousie students that are interested. This would integrate to form some kind of community co-op similar to that of the *Seymour Green* campus garden. All saplings and flowers, would be replanted, likely excavated from crown lands (depending on legality), or donated from private lands, from a willing contributor. Though, all soil and necessary materials and ground nourishment (peat, manure, compost, and fertilizer) would have to be purchased from an outside source. Such a method of acquiring our flora, though cost efficient, would require further research into the knowledge and care of different plant species and some knowledge required in their identification in a natural environment. We would need a biology professor or graduate student to act as a source of knowledge, and perhaps acting project supervisor. In addition, in acquiring such flora, we would require trucks for their transportation (rentals) and the purchase of sufficient tools required for their excavation and subsequent re-introduction on Dalhousie Campus.

As for the actual costs involved in the projects implementation, we ran into many limitations. This was largely due to our lack of knowledge of planting projects. In terms of cost, we were looking at the various component costs involved including plants, soils and fertilizers, tools, truck rentals, and maintenance costs. A nursery north of the city was able to give us the prices of an array of native tree saplings including: white Pine 80cm- \$79.50, Hemlock 60cm- \$56.50, Balsam Fir 50cm \$38.50, White Ash 200cm- \$44.50, Sugar Maple 200cm- \$58.50, Red Oak 200cm, White Birch 50cm- \$34.50 (Pleasant Valley Nurseries, www.infinitymedia.ns.ca/pvn/welcome.html). Because our planting area is only 60 square meters, we can only fit in a limited number of saplings, and therefore costs will be based on the average costs of six of the said species.

As for the soil, peat, manure and fertilizer etc., we could not determine the amount or varieties that were required on a Dalhousie University planting site, and therefore prices had to be estimated. In such a situation, the employment of a knowledgeable project coordinator would become paramount. Furthermore, without such a knowledgeable individual involved in the project, we did not know the tools that would be required during the planting process and if such costs could be subsidized by the Dalhousie Facilities Management. Perhaps tools already used in landscape maintenance could be loaned to us for the implementation process.

In regards to hauling all said plants and materials to the planting site, it quickly became understood that a rear loading truck would be required, whether it be for the transport of the indigenous flora, soil and soil replenishments, or required planting tools. Costs involved in a pick up truck rental will be based on a quote of \$399.99, per week, with our initial start up period of two weeks (Discount car and truck rental). We included a gas budget of \$400 for the two week period.

With the issue of labour, in the case of a student volunteer co-op, these labour costs would be virtually non-existent, though a petty cash fund allocated to supply such things as food and refreshments on the job site. In a student labour scenario, we

concluded that wages set at \$7.00/hr would be sufficient incentive and would be based on six employees for a period of two weeks.

Finally, maintenance and upkeep costs could not be firmly established because they would likely fall under the duties of the current groundskeeper and would likely not pose any further monetary costs. Table 2 shows a summary of the costs we calculated and compares the two methods, volunteer and student labour, which were discussed.

Table 2: Costs Associated with Implementation

	Labour costs	Plants and associated planting costs	<u>TOTAL</u>
Volunteer project	\$300	\$2200	\$2500
Student labour	\$4420	\$2530	\$6950

From Table 2, we can see that the costs for plants and planting costs would be roughly the same for either method. It is the difference in the price of labour, which has the greatest effect on the difference in total price.

In establishing our cost analysis, we were quite limited. The numbers allocated to the planting schemes are very approximate and their accuracy is low due to a lack of appropriate sources of price quotes. These limitations occurred for a variety of reasons including the following: soil, peat, and fertilizer suppliers were closed for the season during the period of study. Landscape contractors were unsupportive or also closed for the season and a lack of cost information supplied on behalf of Dalhousie Facilities Management in regards to landscaping practices; along with a general lack of expertise in such planting projects. We must point out that without the guidance of an experienced landscaper, we may not be familiar with many of the relevant practices involved and subsequently our costs as laid out above could inflate dramatically. It should also be known that we were unable to receive an approximate quote from a private contractor in

the undertaking of an indigenous project of this scale, so this could not be a benchmark value to use in cost comparison.

Many stipulations will have to be adhered to prior to the implementation of any planting initiative. For one, Facilities Management has made it clear that any planting must not cause an overwhelming amount of foliage as it may impose a safety hazard on campus. In addition, further study must be established to determine what flora should co-exist in this project to best resemble a natural environment indigenous to Nova Scotia. Furthermore, we would like to see that the plants that are selected are of a variety that will be best suited to adapt to the Dalhousie University landscape and will thrive under the conditions in a relatively short period of time so that the project will become firmly established with minimal upkeep, and thus minimal cost.

4. Conclusions and Recommendations

Through an examination of the current practices, education, species and costs associated with a project of this magnitude, we have concluded that there is a lack of indigenous species on campus, a lack of knowledge pertaining to the indigenous species of Nova Scotia and a general basis of support for initiatives that would implement their presence on campus.

Through interviews with Facilities Management, we received pertinent data as to how the campus community maintains its current landscapes and with regards to the decision making process at Dalhousie University. Although certain information pertaining to landscaping budgets was not available for examination, we opened the doors of communication with this important university actor. The decision making staff at Facilities Management expressed interest in considering the implementation of our project and are always open for suggestions. We recommend that future groups considering a project similar to this one keep in communication with Facilities Management. Prospective students looking at implementing a test area should work actively with Facilities Management to develop a test site of indigenous species.

The surveys were an important tool in gathering information about student knowledge and concern pertaining to this issue. We were given valuable insight into the reasons for the importance of indigenous species and their educational value within the university environment. In the future we would recommend the implementation of a survey that would question students as to what location would be most accessible, convenient and suitable for the implementation of a “naturalized” area. Our method of stratified random sampling, though a noble idea on paper, does not work as the best method to receive support for implementing a survey. We suggest that students in the future revise their methods for conduction surveys.

Valuable knowledge pertaining to what flora would be suitable for implementation on campus was retrieved from biology faculty and literature research. Biology faculty are important actors within the implementation of this project due to their specified knowledge in this area and their concerns with regards to the ecological integrity of the campus. We suggest continued work with biology faculty when examining what methods would be best for implementing a “naturalized” area.

The cost analysis offered two different modes of implementing a “naturalized” area and concluded that either a volunteer based or student employed implementation would be most cost effective. The costs of implementing this project would range from either \$2500- \$6950 depending on the method chosen. We recommend that prospective students evaluate this area further to examine where such funds could be allocated: whether the university has money set aside for student projects such as this, whether corporations that already play a part in funding the university would be interested in supporting this project and if Facilities Management could support this initiative in upcoming budgetary reviews.

Due to time constraints and limitations in our scope, we were unable to examine a lot of the other issues surrounding this problem. Future students should take into consideration the research pertaining to the maintenance of exotic versus indigenous species; the costs associated with their maintenance and should do an inventory of the

current species on campus. A lot of the preliminary and background work has been examined in this area now future groups should focus on the planning and/or implementation of a naturalized area. We believe that this project is a realistic one and with time and dedication, progress can be made in this area.

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