ENVS 3502: FINAL REPORT

Investigating Indoor Green Space at Dalhousie University

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AUTHOR INFORMATION

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EXECUTIVE SUMMARY

This research project explores the various benefits of indoor green space on human health and aims to increase the ability of Dalhousie students to reap the benefits of nature exposure. Through reviewing the concepts of Nature Deficit Disorder, Attention Restoration Theory, and the Biophilia Hypothesis a list of criteria was generated in order to evaluate each publicly accessible building on Dalhousie's Studley campus and identify where indoor green space is present.

The health benefits of nature exposure are well documented throughout the literature. It is evident that without nature exposure, humans are at risk of damaging their psychological, emotional, physiological, and spiritual health. In order to form a research project that was relevant to the Dalhousie community, this project aimed to answer the question: What is considered indoor green space and where can it be found on Dalhousie's Studley campus?

To answer this question, an extensive review of the literature was conducted in order to determine what was considered 'indoor green space'. However, a definition of indoor green space was absent. This lead the researchers to develop criteria of their own, reflecting the concepts of biophilic design. Using these criteria, publicly accessible buildings on Dalhousie's Studley campus were evaluated and scored for the presence of indoor green space. The criteria includes 6 areas to be evaluated, including the presence and diversity of greenery, presence of natural light, view of outdoor green space, visible and audible water, level of engagement, and natural analogs.

To make the findings as comprehensive as possible, all 18 publicly accessible buildings were surveyed. Each space was scored independently by all researchers involved to increase the reliability of the findings. The mean scores received range from 2.8 to 22.2 out of a possible 40 points, with a relatively even spread of scores found. Dalhousie's buildings did a good job of incorporating natural light, engaging spaces and natural analogs into indoor spaces on campus, but there was found to be no water features present in the spaces surveyed. It was also found that the presence of plants made a significant impact on the scores, as 20 out of a possible 40 points were allotted to greenery. Adding plants to any space, would help to increase the rating scores applied to these spaces. The incorporation of natural analogs is another method of creating more green indoor spaces on campus.

It is hoped that these findings can be used to learn where elements of indoor green space can best be implemented on campus to maximize their benefits for students, and faculty members. Spaces on campus that are conducive to studying and improving students' health are vital and it is hope that this project can help students find usable indoor green space.

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1. INTRODUCTION

A trend identified within the last few decades has indicated that human beings are spending an increased amount of time in indoor and urban environments, resulting in decreased exposure to the natural world (Schultz, 2009). Studies have found that exposure to natural environments is positively correlated with human physiological, emotional, psychological and spiritual health (Brymer, Cuddihy, & Sharma-Brymer, 2010). The natural environment can be described as "all that which is external to the human host [and] can be divided into physical, biological, social, cultural, etc., any or all of which can influence health status of populations" (WHO, 2006).

Our research study is relevant to the Dalhousie community because the well-being of students is directly affected by the quality of the environment in which they interact and specifically their exposure to nature. In relation to this positive correlation, obtaining the optimal conditions in which students thrive will include the evaluation and implementation of indoor green spaces. For the purposes of this study, we use a working definition of greenspace to include more than simply the presence of living species. Therefore, indoor greenspace includes anything from potted plants to views of nature through a window to natural analogs (McSweeney et. al., 2015).

Research shows that mental ailments such as anxiety, depression, increased levels of stress, and attention fatigue are all conditions associated with a lack of exposure to nature (Maas et al., 2009). These ailments are prevalent within the student population at Dalhousie University, meaning this research matter is context relevant. We identified a lack of documentation pertaining to what classifies as an indoor green space and limited knowledge surrounding where these spaces are located on Dalhousie's Studley Campus.

1.1 Objectives

The objective of this research, and this report, is to examine the research question: What is considered indoor green space and where can it be found on Dalhousie's Studley campus? Our team was unable to find existing criteria that could be used to determine if indoor nature could in fact be considered an indoor green space. Therefore, the first objective was to develop a set of criteria that could be used to evaluate spaces on campus for their level of greenness. The second objective was to determine where and how well indoor green space is incorporated into spaces on Dalhousie's Studley campus, by applying the criteria we developed. The third objective was to create a GIS map of indoor green spaces on campus, as the Dalhousie community would benefit from knowing where on campus indoor green spaces are located.

The overall objective of this research study is to promote social sustainability and increasing student wellbeing, by raising awareness of the benefits and locations of indoor green space on campus.

1.2 Literature Review

There is a significant body of literature outlining the benefits of nature exposure and its correlation with positive health benefits. A disconnect with the natural environment, attributed to an increased use of technology, has resulted in what Richard Louv has termed Nature Deficit Disorder (NDD) ("What is Nature Deficit Disorder", 2015). According to Richard Louv, our current society restricts outdoor play and replaces this natural action with the electronic culture of the online world (Sorrentino, 2014). Symptoms of NDD include anxiety, depression and attention problems, along with physical signs of inactivity that result from spending too much time indoors (Sorrentino, 2014). Studies have shown that at-risk youths respond better in a natural environment, showing better problem solving skills, improved behaviour and better self-esteem when compared to a classroom contained control group (Sorrentino, 2014).

The connection between outdoor green space and human health is well documented within the literature. Outdoor green space can be understood as natural, semi-natural or artificial green land, ranging from parks, sports fields, public and private gardens as well

as street side trees (Zhou, 2012). Human interaction with various types of green space helps trigger psychological responses in humans that promote increased mental wellness (Han et al., 2006). Literature surrounding this relationship continues to suggest that outdoor green space positively affects human health both physically and physiologically (Han et al., 2006). Through population studies and various psychological analyses, green space has been proven to reduce mental fatigue, stress and decrease the symptoms of depression and anxiety disorders (Han et al., 2006). Extensive epidemiological studies with large numbers of the general public have proven that those exposed to outdoor greenery experience better perceived health, greater physical activity, decreased morbidity and longer life spans (Huynh, et al., 2013).

In today's societies urbanization is growing rapidly, decreasing humans ability to interact and be exposed to natural and created green spaces. This can be considered a contributing factor in Canada's growing mental health issues, especially in the youth population. Increasing communities' access to green space is being considered an innovative and cost-effective way to improve health statistics (Beyer et al., 2014). Stress is a catalyst for many illnesses and green space can be used as tool to reduce stress levels and anxiety disorders (Beyer et al., 2014).

Based on the advantages outlined within the outdoor green space research, it is presumed that indoor green space also has a positive effect on the human mind and body. Adding flora to indoor spaces gives humans the opportunity to reconnect with nature, especially in a climate that does not allow for the use of outdoor green space year round. Even though it is not a true ecosystem, having indoor nature provides a number of positive benefits.

The concept of biophilia is used to explain the contribution of nature to human well being. Biophilia is the "inherent human inclination to affiliate with natural systems and processes" (Kellert, 2008, p.3). Biophilia argues that because humans evolved with the natural world, they are inherently dependent on nature (Kellert, 2008). Therefore, people's physical and mental well being is linked to contact with the natural environment (Kellert, 2008). Contact with nature lowers stress, increases cognitive function and motivation, and is associated with an overall increase in quality of life (Kellert, 2008). It is therefore presumed that addressing these associations through the establishment of indoor green space will contribute to the overall productivity of students.

Biophilic design highlights the importance of the connection between human beings and nature through considering the human affinity for nature while designing built environments (Kellert, 2008). Biophilic design seeks to include shapes and forms that "directly, indirectly or symbolically reflect" the human connection to nature (Kellert, 2008, p. 5). Biophilic design has six design elements, each with a number of attributes (Kellert, 2008). These guidelines aided in the development of our criteria for indoor greens spaces, as they help meet our need for contact with the environment.

Furthermore, Attention Restoration Theory (ART), developed by Rachel and Stephen Kaplan (1995), is one method used to explain the benefits of nature on human physiological well being. ART is based on the idea that nature helps to restore the ability to focus on tasks and reduce stress levels. Focusing on tasks requiring mental effort for a prolonged period of time, such as studying, leads to mental fatigue (Kaplan, 1995). Mental fatigue is frequently experienced by university students (Felsten, 2008). This exhaustion is termed "directed attention fatigue" (Kaplan, 1995). People experiencing directed attention fatigue are unable to concentrate, and become highly distractible and irritable (Kaplan, 1995). Surely, many university students can relate to this experience due to immense pressures from course loads and the significant amount of time spent on studies.

Directed attention fatigue can be reduced through restorative environments and experiences. Restorative environments require a more passive form of attention, therefore allowing recovery from directed attention fatigue (Kaplan, 1995). Natural environments are excellent restorative environments since they embody the four characteristics which Kaplan identifies as making environments restorative (Kaplan, 1995). The four characteristics which Kaplan identifies are: fascination, being away, extent and compatibility. Fascination "occurs is in a variety of settings and situations that people find interesting" (Felsten, 2008, p. 160). It involves aesthetically pleasing stimuli, such as a sunset, while still allowing for reflection and directed attention to rest (Felsten, 2008). Being away means that people are able to feel as though they are conceptually in a new environment from the one causing fatigue (Kaplan, 1995). An environment having extent is "rich enough and coherent enough, so that it constitutes a whole other world" and is able to capture the attention of the mind (Kaplan, 1995, p.173). Compatibility means that the setting fits with what one is trying to achieve (Kaplan, 1995).

Kaplan seeks to link attention deficit disorder with stress. Kaplan (1995) defines stress as whether or not an "individual has the resources necessary to deal with a given challenge" (p. 176). Directed attention can be seen as a resource. Therefore, the loss of directed attention results in a stress response (Kaplan, 1995). Spending time in restorative, natural environments can help mitigate stress, as well as prevent it, by contributing to the recovery of directed attention (Kaplan, 1995). ART is often applied in studies relating nature to psychological well being. The perceived restorative value of different environments is often measured in order to gain an understanding of what environments best promote well being. Laumann, Garling and Stormark (2001) developed a series of questions to determine to what extent different environments met the characteristics of restorative environments.

Another tool we used in developing our criteria was the guidelines of Indoor Environmental Quality (IEQ). IEQ investigation exemplifies the positive effects that greenery has on the working environment and can be studied in four parts: thermal environment, indoor air quality, visual environment and acoustic environment (Pei, et al., 2015). These parts include operable windows, shade devices, automatic heating and ventilation systems, indoor greenery and controlled lighting (Pei et al., 2015). These four factors contribute to work productivity, behaviour, and overall satisfaction. A Post Occupational Evaluation (POE) was carried out within both conventional and "green" offices in China, resulting in astonishing discrepancies between the two environments (Pei et al., 2015). Looking specifically at each factor of IEQ and its connection to human productivity and behaviour can guide workspaces to function in relation to the favorability of its workers. Green buildings that held optimal IEQ showed much higher satisfaction ratings than conventional buildings. These types of studies contribute to the increase in IEQ by exploring the optimal conditions of the four contributing factors in order to increase human productivity, behaviour and satisfaction within a working environment. Applying IEQ methods proved instrumental in creating criteria that are appropriate and ideal for the indoor student work space at Dalhousie.

2. METHODS

2.1 Study Design

During this study, a literature review was performed to develop criteria for evaluating indoor green space. Through exploratory methods, 18 publicly accessible buildings on Dalhousie's Studley campus were surveyed. The buildings that were evaluated were scored based on the presence of indoor green space. The goal of this study was to determine were indoor green space can be found on Dalhousie's Studley campus.

2.2 Justification of Measurements

Through our examination of the literature it became evident that indoor green space is more than simply the presence of indoor plants or natural elements. McSweeney et al. (2015) uses the term 'indoor nature exposure' to describe this phenomenon. Indoor nature exposure is considered anything from potted plants, to views of nature through a window, to photos of landscapes or nature vegetation (McSweeney et al., 2015). This understanding, along with the biophilia hypothesis, the Attention Restoration Theory and the guidelines for Indoor Environmental Quality contributed to the development of our criteria.

Based on the results of our literature review, the researchers began by brainstorming a list of potential criteria we could use to evaluate spaces on campus. Below is the original criteria list, as well as the reasoning and/or literature to support the inclusion of each criterion:

Table 1: Original criteria list developed to evaluate indoor green space on Dalhousie's Studley Campus and the justification for each measurement.

Greenery	
Plants	The presence of plants is the most obvious way in which nature can be incorporated into an indoor space. Plants create a direct connection to nature (Guide to Green Embassies, n.d.). Plants are also one of the attributes of biophilic design (Kellert, 2008). Potted plants are associated with improved mood, reduced stress and cognitive performance (Heerwagen & Hase, 2001, McSweeney et al., 2015, Qin et al., 2014).
Percent Coverage	Percent coverage is a measure used to determine the degree to which natural greenery has been incorporated into a space.
Plant Height	Qin et al. (2014) measured the effect of indoor plants on human comfort. The study measured the effects of small, medium and large plants.
Plant Diversity	Having a diversity of plant species reflects outdoor natural environments and makes a space more engaging (Heerwagen & Hase, 2001, Keniger et al. 2013)
Native Plant Species	Native plant species are well suited to the growing environment (although this criteria measures indoor green spaces).
Scented Plants	Qin et al. (2014) found that spaces with slightly scented plants were considered the most favourable.
Natural vs. Natural Analogs	(Included below as a separate section)

Lighting	
Windows	A proxy for measuring the presence of natural light, as well as enabling views of the outdoor world.
Source of Light	Natural light is an important attribute of biophilic design, contributing to comfort, health, productivity, and well being (Kellert, 2008). The cycles of natural light coincide closely with human sleep patterns (Aries, M., Veitch, J., & Newsham, G., 2010).
Room Layout	
Where are the seats facing?	Determines views of and ability to interact with natural elements.
Line of Sight	Determines views of natural elements (indoor and outdoor).
Sense of Enclosure	Having "bounded spaces" or a sense of enclosure is an important aspect of biophilic design, as humans seek places of refuge when needed (Heerwagen & Hase, 2001, Kellert, 2008, p.10).
Spaciousness	Spaciousness is another attribute of biophilic design because "people prefer feelings of openness in natural and built environments" (Kellert, 2008, p. 11). Humans have an innate preference for open space (Guide to Green Embassies, n.d.).
Spatial Variability	Spatial variability is also an attribute of biophilic design stimulating people emotionally and intellectually (Heerwagen & Hase, 2001, Kellert, 2008).

View	
View out the Windows Connection to the Outdoors	Viewing nature through windows also provides the restorative benefits of nature. Ulrich found that patients with views of nature from their hospital rooms recovered better from surgery (as cited in Frumkin, 2013). Felsten (2008) found that viewing nature through windows fosters attention restoration among students and they performed better on tests of their directed attention. View is also discussed by Aries, M., Veitch, J., & Newsham, G., 2010, Bratman, 2012, Heerwagen & Hase, 2001, Kaplan, 1993 and McSweeney et al., 2015.
How far of a distance you can see?	Related to feeling of openness and spaciousness.
Water	
Water Features Is water visible? Is water audible?	The presence of water or water features is one of the most important attributes of biophilic design (Heerwagen & Hase, 2001, Kellert, 2008). Water has both visual and acoustic benefits to humans (Kellert, 2008).
Sensory Variability	Sensory variability is another biophilic element linked to how humans perceive and respond to sensory variability (Heerwagen & Hase, 2001, Kellert, 2008).
Smell	
Sight	
Touch	

Hearing	
Overall Engagement (Is the space interesting to be in?)	Sensory variability and engagement is also related to the ability of a space to capture and restore attention. Spaces which contain elements of fascination, contribute to feelings of 'being away', and have a sufficient extent or scope to engage the mind can be considered restorative environments (Kaplan, 1997).
Biomimicry	
Natural analogs	Biomimicry and natural analogs are terms we used to represent the inclusion of natural shapes and forms (an element of biophilic design) into the spaces (Kellert, 2008). Natural analogs are things such as: -realistic representation of nature, such as fake plants -photos of landscapes, forests and natural elements -natural representational artwork -the inclusion of natural and organic shapes and forms -the use of natural materials (Guide to Green Embassies, n.d., Felsten, 2009, McSweeney et al., 2015) Natural analogs and simulated nature have the same positive effects as real nature. However, there is not always consensus in the literature to fully support this conclusion (Pearson & Craig, 2014).

Following the creation of the above criteria list, we began narrowing our criteria. We excluded criterion that we determined we would be unable to measure objectively and accurately. Specifically, this excluded the 'room layout' section and evaluating 'smell', 'sight', 'touch', and 'hearing' as individual criterion. 'Sensory variability' was condensed to simply include 'level of engagement', with the understanding that our team would consider the various senses that were engaged when evaluating this criterion. We also excluded criterion that was beyond our expertise, such as identifying 'native plant species'. The 'scented plants' criterion was excluded due to Dalhousie's No Scent Policy.

Other criteria were also revised. 'Lighting' was condensed to simply include 'source of light', as counting the number of windows was determined to not necessarily be an accurate measure of the amount of natural light or of the view to outdoors. This is due to the variable size of windows and the view that they afford. 'View' was also condensed to 'visible outdoor green space', as the restorative properties of outdoor nature was determined to be the important characteristic of measuring the view.

The researchers then met with Jill McSweeney, an expert at Dalhousie University in the field of indoor nature exposure. She reviewed and evaluated the criteria that we had developed. Jill McSweeney approved our criteria, as well as offering some suggestions for how we could objectively measure the criteria we had chosen. This resulted in the development of our final criteria (see Appendix III).

2.3 Operationalizing Variables

The team also operationalized the criterion in order to make them specific and measurable. The operationalized criteria can be found in Appendix IV. We decided to create a system where we could score each criterion on a scale from 0 to 4. This enabled us to assign an overall score to each building on Studley campus, based on the degree to which it met the requirements of the criteria. This also created relative consistency as our team scored buildings on campus. Further, this enables others to more easily replicate our work.

We decided that the ‘greenery’ section would be measured based on percent coverage, the number of small, medium and large plants, and the diversity or number of plant species. The percent coverage level assigned to each score was not divided into equal intervals (as in a) below), as we assumed that we would find few spaces that had more than 25% coverage (as in b) below) and therefore all the buildings would receive a score of 1.

a) Percent coverage:	**b) Percent coverage:**
0=0% coverage	0=0% coverage
1=1-10% coverage	1=1-25% coverage
2=11-25%	2=26-50% coverage
3=26-50%	3=51-75% coverage
4=51-100%	4=76-100% coverage

It was decided that the ‘lighting section’ would be evaluated based on the percentage of natural light. The percentage of natural light assigned to each score was divided into equal intervals. This was the same approach used to measure the 'view’. The ‘view’ was based on the percentage of visible outdoor green space or natural elements. It was decided that the audible and visible presence of ‘water’ would be given a score based on how noticeable its presence was.

As mentioned above, it was decided that it would be difficult to measure ‘sensory variability’ based on the individual senses that were engaged. Therefore the criterion for ‘sensory variability’ was operationalized based on the perceived level of engagement. Our team considered the fact that the scoring for this section would be quite subjective between individuals. However, we decided to still include it because of its importance to the Attention Restoration Theory. ‘Biomimicry’ was simply operationalized by counting the number of natural analogs that were present in the space.

2.4 Procedures

To evaluate indoor green space at Dalhousie University, criteria was developed through an extensive literature review. Each building on the specified list was visited and a single space in each was surveyed. These buildings were all located on Dalhousie's Studley Campus and are publicly accessible. The spaces surveyed tended to be a heavily used area in the building, or a space that the researchers were naturally inclined to go based on the layout of the building. Each building was unique and the spaces chosen for evaluating were done to the best of the researchers' abilities.

The same space in each building was evaluated by each group member simultaneously to produce five separate scores for each building. These five scores were then summed and divided by five to produce a mean value for each building surveyed. A detailed list of the buildings surveyed and the space evaluated within each building can be found in Appendix II.

It was decided that only publicly accessible buildings would be surveyed for the purposes of this study. These buildings are unlocked during regular business hours and can be used by students, staff, faculty and the general public. Having, or implementing, indoor green space in these buildings would have the greatest positive effect on the Dalhousie and Halifax communities.

The green spaces scores for each building have been visually represented using a map (see Appendix VI). The map was created using a geographic information system (GIS). GIS is system used to capture, store, analyze and display data that is spatially referenced to a location on the earth (ESRI, n.d.). Data was collected from the Halifax Regional Municipality's Geodatabase from April of 2012 and used under license to Dalhousie University.

The map depicts the green space scores for the buildings on Dalhousie's Studley Campus that our team evaluated. Scores were divided into three categories: high, medium and low. The scores were divided into three classes using the natural breaks or Jenks' optimization classification system. Jenks' optimization is "a method of manual data classification that seeks to partition data into classes based on natural groups in the data distribution" (ESRI, n.d.).

High green space scores are represented in green and show buildings with scores from 13.01 to 22.20. Medium scores are represented in yellow and depict buildings with scores from 5.61 to 13.00. Low scores are represented in red and show buildings with green space scores from 2.80 to 5.60.

The map is a useful tool to aid Dalhousie students, staff and faculty in finding green spaces on campus. Seeing the buildings with low scores in red also highlights the buildings that could use significant work in terms of incorporating green space. One limitation of the map is that it depicts the whole building as having a low, medium or high score, even though our team evaluated specific spaces within each building.

2.5 Discussion of Research Methods

The findings were reliable, valid, and trustworthy. The method of measuring separately and averaging the scores allowed findings to gain reliability. It was important to ensure that the findings were reproducible and that the rating was consistent throughout the data collection process. A pilot test was performed and it involved the evaluation of five buildings on campus followed by discussion of findings and methods of rating. This helped to test the criteria and facilitated discussion surrounding the scores assigned to each element in a space and why. The pilot test also added to the validity of the findings. Learning from the pilot test helped to increase the understanding of why each element was being measured and how it related to indoor greenspace. It is believed that the criteria accurately assessed spaces based on the presence of indoor green space. When examining the scores that each building received and looking at pictures of the spaces, all of the assigned scores were appropriate. These findings were also trustworthy. Each space was rated without bias and the buildings were scored based on the criteria and rating scale of 0-4. The operationalized variables made it easy to score each category. An effort was made to minimize the amount of subjective criteria so as to make the findings as trustworthy and reliable as possible.

2.6 Limitations

This study posited many limitations. The first limitation encountered was time. There was a limited amount of time provided to complete this research and because of this, the scope and depth of this study had to be limited. If there had been more time, more buildings on more campuses could have been surveyed, and the criteria could have been more in-depth. Another limitation was the knowledge of the researchers. The researchers involved in this project are not experts on the topic of indoor green space, but through consultations with experts and a lengthy review of available literature on the topic, effective criteria were created. These criteria can help to assess the basic "green-ness" of an indoor space and they were created and edited to the best abilities of the researchers, but even so, these criteria are not rule.

Another limitation of this study is that the findings cannot be generalized and used to describe other buildings on other campuses. Although the data collected is believed to properly represent the spaces surveyed on Studley Campus, the findings cannot be applied to the greater population or universe of indoor spaces. It is believed however, that the developed criteria can be used to successfully evaluate other spaces in the future. A final limitation was the amount of researchers available to perform the evaluations. The group of researchers assigned to work together consisted of five people. The five scores were averaged to create mean scores for each space, but if there had been more researchers, it would have made the findings more reliable and representative.

2.7 Delimitations

Due to the limitations imposed by this study, it was decided to delimit the scope to only survey buildings on Dalhousie's Studley Campus. This campus has the largest student population of all of Dalhousie's campuses and because of this, the findings would be most effective here. The researchers were also most familiar with this campus, making it easy to survey spaces within buildings that are commonly used by students and others. The study was also delimited to include only publicly accessible buildings. It was easy to gain access to these spaces to survey them, and it also allows the maximum number of people on campus to utilize them. Buildings which are not open to the general public during regular business hours were not evaluated during the study.

Research was delimited to only include the use of the developed criteria to evaluate indoor spaces. No other forms of data collection were used such as questionnaires or interviews. This study aimed only to survey indoor green spaces on campus. The opinions of those who use the spaces were not useful to this study, as it was only based on the building itself including the contents of the space, but not including the people. An indoor green space is not dependent upon the presence of humans, thus people within the spaces were not surveyed.

The final delimitation was identified to be that only one space in each building was chosen for evaluation. It is possible that the space chosen may not properly represent the entire building. It could be more or less "green" than the building as a whole, but due to time constraints, it was decided that only one space per building would be used for the purpose of this study.

3. RESULTS

3.1 Presentation of the Results

The results of the examination of each publicly accessible building on the Dalhousie Studley Campus are as follows. A score of 4 is the highest a single criterion could receive, therefore giving the maximum score for an entire space to be 40 points. The scores of each building are displayed in the chart below (Figure 1) and the detailed breakdown of the scores can be seen Appendix V. Photos of notable buildings surveyed can be found in Appendix VII and photos of notable elements can be found in Appendix VIII.

The Chemistry building scored lowest with a total of 2.8 points. The area we examined in the building contained no greenery, a score of 1/4 for natural light, 0.4/4 for the view of visible outdoor greenery, no visual or audible water, 1/4 for level of engagement, and 1.2/4 for natural analogs.

Next, the Dalplex scored 3.8/40. The space contained no greenery, a score of 0.4/4 for natural light, 0.2/4 for the view of visible outdoor greenery, no visual or audible water, 1.4/4 for level of engagement, and 1/4 for natural analogs.

The Henry Hicks building scored 4.6/40. It also contained 0 greenery, scored 1.2/4 for natural light, 1/4 for the view of visible outdoor greenery, no visual or audible water, 1/4 for level of engagement, and 1.2/4 for natural analogs.

The James Dunn Building scored a total of 4.2/40 with 0 greenery, a score of 1/4 for natural light, 0.2/4 for the view of visible outdoor greenery, no visual or audible water, 1/4 for level of engagement, and 1.2/4 for natural analogs.

The Mona Campbell Building scored 5.2/40 with 0 greenery, a score of 1/4 for natural light, 0.6/4 for the view of visible outdoor greenery, no visual or audible water, 2.4 for level of engagement, and 1.2/4 for natural analogs.

The Macdonald Building scored a total of 5.4/40 overall. The space contained no greenery, scored 1/4 for natural lighting, 0.6/4 for Visible outdoor greenery, no visual or audible water, 2/4 for level of engagement and 1.8/4 for natural analogs.

The LeMarchant Place scored a total of 5.6/40 overall. The space also contained no greenery, scored most of its point in natural lighting with 2.6/4, 0.6/4 for Visible outdoor greenery, no visual or audible water, 2/4 for level of engagement and 0.4/4 for natural analogs.

Scores began to get significantly higher when spaces showed evidence of greenery. The University Club scored 8.4/40 with 1/4 for overall plant coverage. The space scored 0.4/4 for small plants, 1.2/4 for large plants and a score of 1/4 for overall plant diversity. The area examined scored 1/4 for natural lighting, 0/4 for Visible outdoor greenery, no visual or audible water, 1.6/4 for level of engagement and 2.2/4 for natural analogs.

The Steele Ocean Science Building scored an overall total of 9/40. The space contained no greenery, scored 3.4/4 for natural lighting, 1.6/4 for Visible outdoor greenery, no visual or audible water, 2.4/4 for level of engagement and 1.6/4 for natural analogs.

The Goldberg Computer Science Building scored a total of 9.6/40. The space held a score of 0.8/4 for plant coverage scoring 0.8/4 for small plants, 0.2/4 for large plants and 1/4 for plant diversity. The space scored 1/4 for natural lighting, 1.4/4 for visible outdoor greenery, no visual or audible water, 2/4 for level of engagement and 1.4/4 for natural analogs.

The Marion McCain Building scored an overall 10/40 points. Although the space contained no plants, its natural lighting score was high at 3/4 and scored 3.4/4 for visible outdoor greenery. The space had no visual or audible water, scored 2.2/4 for its level of engagement and 1.4/4 for natural analogs.

The Kenneth Rowe Building scored a total of 11/40 points. The space scored 1/4 for overall plant coverage, 2.2/4 for large plants and 1/4 for overall plant diversity. The building scored 2.6/4 for natural lighting, 1.2/4 for visible outdoor greenery, 2/4 for its level of engagement and 1/4 for natural analogs.

The Chase Building scored an overall total of 13/40 points. The space evaluated scored 1/4 for overall plant coverage, with multiple small plants giving this criterion a high score of 3.8/4. The overall plant diversity score came in at 2/4. The space scored 1/4

for natural lighting, 1/4 for visible outdoor green space, no visible or audible water, 2.4/4 for its level of engagement and 1.8/4 for natural analogs.

Moving into the top 5 buildings, the Student Union scored a total of 15.6/40. The space scored 1.2/4 for overall plant coverage. The space includes plants of all sizes scoring full marks, 4/4 for small plants, 1.4/4 for medium and 0.2/4 for large with an overall diversity score of 2.2/4. The area scored 1/4 for natural lighting, 1.2/4 for visible outdoor green space, no visual or audible water present, 2.2/4 for level of engagement, and 2.2/4 for natural analogs.

The Life Sciences Building came fourth with a total score of 15.8/40. The space had a score of 1/4 for overall plant coverage with a perfect score for small plants however no plants of other sizes. The space scored 1.8/4 for natural lightening, 2.4/4 for visible outdoor green space, no visible or audible water, 2.2/4 for the spaces overall level of engagement and 3.4 for natural analogs.

Scoring third, The Rebecca Cohn Building had a total of 17.6/40. The space also had plants of all sizes scoring 1/4 for plant coverage, 1.8/4 for small plants, 2.6/4 for medium sized plants, 1/4 for large plants and 3/4 for overall diversity. The space scored 1/4 for natural light, 2/4 for visible outdoor green-space, no visible or audible water, 2.6/4 for overall engagement and 2.6/4 for natural analogs.

In second, the Weldon Law Building scored a total of 20/40 points. The space scored fairly high due to its score in the greenery criteria. The area scored the highest of the buildings in terms of overall plant coverage with 1.6/4, with a score of 4/4 for medium plants, 3.6/4 for large plants and 3.2/4 for overall plant diversity. The space scored 1/4 for natural light, no visible outdoor green space or water, 3.4 for level of engagement and 1.4/4 points for natural analogs.

Scoring the highest with 22.2/40 was the Killam Library's Atrium. The space scored 1.2/4 for overall plant coverage with a perfect score in the small and medium sized plant categories, and 2/4 for large plants and diversity. The space also scored high for natural light with 3.5/4, 1.2/4 for visible outdoor green space, no visible or audible water, 2.4/4 for level of engagement and 1.8/4 for natural analogs.

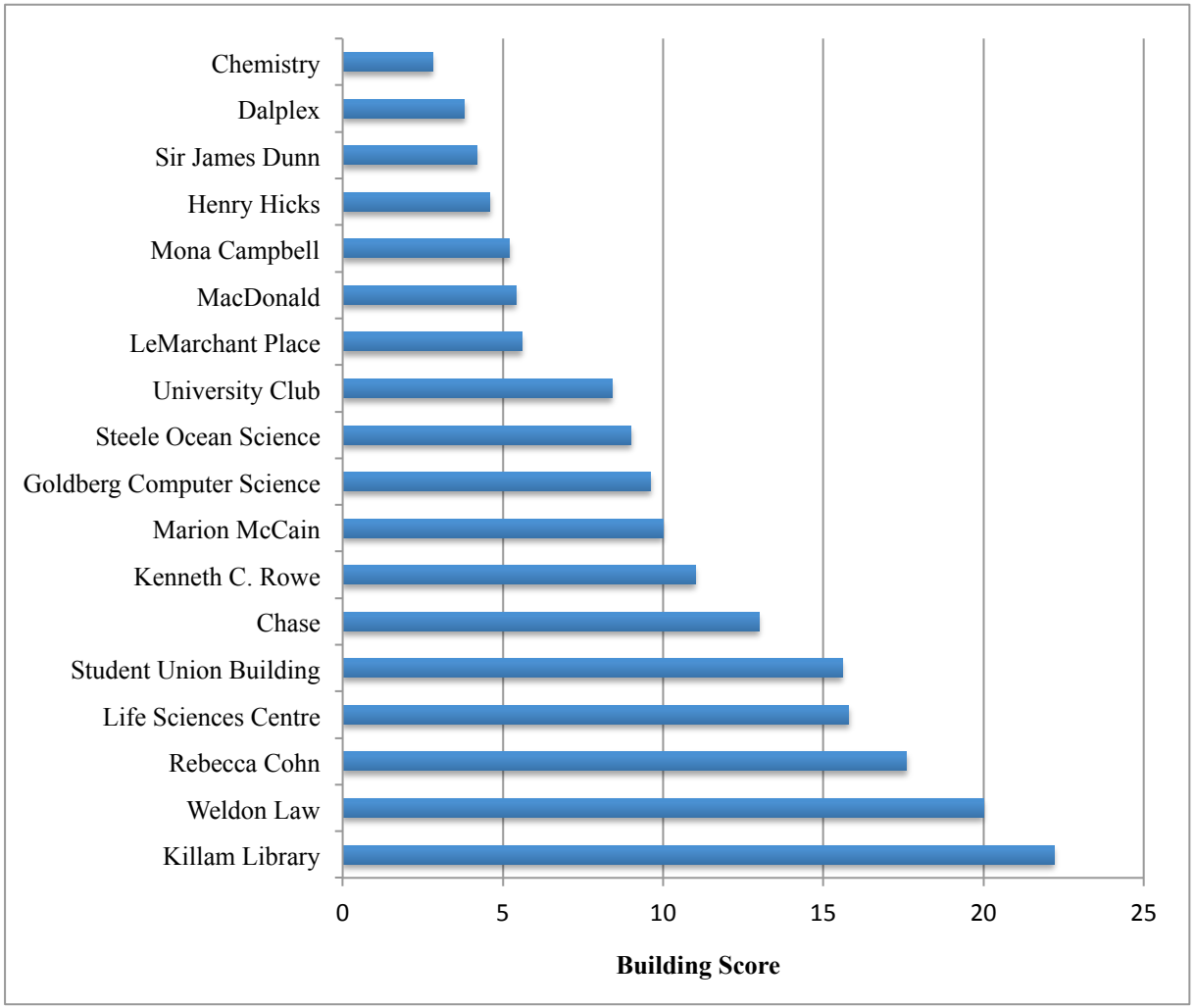

Figure 1 Mean scores given to each building on Dalhousie's Studley campus, based on indoor green space

4. DISCUSSION

At the beginning of this study, we set out to identify what is considered indoor green space and where it can be found on Dalhousie's Studley Campus. After adequately applying our three main proposed research methods of reviewing literature, performing exploratory research and consulting with experts in the field, we gathered the results into observable data in order to infer conclusions about the existing indoor green space on Studley Campus.

4.1 Discussion of Results

Overall, it was found that the presence of indoor green space on Dalhousie's Studley campus was relatively limited. Specific buildings, such as the Killam Library, Weldon Law Building and the Student Union Building, have greenery well incorporated into their spaces. However, it is evident that in other buildings, such as the Chemistry building, no attempts have been made to incorporate nature.

The mean scores received by the spaces surveyed ranged from 2.8 to 22.2 and did not follow a pattern of normal distribution. The spread of scores was even between 2.8 and 22.2 and no scores warranted by the criteria were the same for any two buildings surveyed.

Evaluation of the running totals of each criterion and the overall score of each category helps identify the trends in the data. Since each criterion is scored out of 4 the running total for each is scored out of 72 (4x18 buildings). Some of the most notable results were that of percent coverage of green space and the presence of water. The mean total of all the spaces' percent coverage of greenery was a low 9.8/72 and none of the spaces contained any visual or audible water. The criterion with the highest score was level of engagement, with a score of 36.2. Dalhousie's buildings also have high percentages of natural light and numerous natural analogs.

It can also be noted that the buildings that scored highest generally had the presence of diverse greenery. The top two spaces, The Killam Atrium and the Weldon Law scored highest in plant percent coverage. Both buildings had the presence of multiple plant sizes and scored in the top 4 spaces for plant diversity.

When reviewing the data, it was found that limitations on rating had been imposed by the design of our criteria rating scale. The Weldon Law Building contained more plants than any other building surveyed on campus. Due to the fact that the maximum score a space could be awarded for seven or more of any one size of plant in the space was 4, this building received a score of 4 in this category and low scores in other greenery categories. Although the Weldon Law Building only received a score of 20, it deserves to be mentioned as, barring restrictions imposed by the existing criteria, it would have earned the title of best indoor green space on campus.

Another trend seen within the results was that all of the LEED certified buildings scored relatively low on the rating scale. The Ocean Sciences Building, LeMarchant Place, and the Mona Campbell Building received scores of 9, 5.6, and 5.2, respectively. These buildings all scored highly in the categories of source of light and sense of engagement but they contained no plants. These buildings are very sustainable, yet it is clear that LEED does not put importance in the greenness of indoor spaces. The indoor green spaces in these buildings could be greatly improved by adding plants of varying sizes and species to the spaces surveyed.

In adherence to biophilic design hypothesis, attention restoration theory and nature deficit disorder, we have determined our findings to be significant as the data indicates where and to which extent green space on campus can be improved upon. Due to probabilistic sampling methods and a lack of replicate populations, no statistical significance can be inferred.

4.2 Consideration of the Findings

This study could best be described as an application of previous research. Using the fundamental ideas put forth by the biophilic design hypothesis, and the Attention Restoration Theory, criteria was developed to evaluate indoor spaces for biophilic design elements and the presence of nature or natural analogs. The synthesis of the ideas proposed by these theories led to a better understanding of how humans interact with nature in indoor and outdoor settings.

The findings of this study can help students to improve their wellbeing by allowing them to easily find indoor green spaces on campus. It is well documented that exposure to natural elements has positive effects on human health. The map produced during this study shows students where the best study spaces on campus are located based on the amount of indoor green space contained within

each building. It is believed that this study is a companion piece of literature for previous research involving green space, human health and the interaction between the two.

4.3 Implications for Practice

The findings of this study fill the gap in literature identified in regards to what defines green space and where these spaces are located on Dalhousie's Studley campus. Although there has been no universally accepted definition of green space found, this study has brought the researchers closer to finding a working definition of this concept. Indoor green space is an enclosed area that purposefully includes natural elements and/or natural analogs within its design and/or decor.

It was found that there tended to be higher student traffic and more people spending time in the buildings which scored higher on our rating scale. These spaces have been deemed to be more conducive to learning and stress free studying and this theory is reflected in the amount of use these spaces receive.

It is recognize that receiving a score of 40/ 40 is not ideal for the circumstances proposed because this would mean the space has full greenery coverage. A space with full coverage is not feasible or useable as a study space, and therefore a perfect score is not applicable for the indoor green space study conducted. A score of four out of four in all categories except that of percent coverage would have been a perfect indoor green space, earning a score of 38 or 39 out of 40 (assuming percent coverage receives a score of 2 or 3 out of 4).

5. CONCLUSION

We believe that our findings are catalytically valid and can be used to learn were elements of indoor green space can best be implemented on campus to maximize the benefits to students and staff. The criteria developed are applicable as a planning and development tool for future green spaces on Dalhousie's campuses. Adhering to the basic guidelines we created and examining the individual scores of each building is a way that Dalhousie can effectively support the wellbeing of students and promote social sustainability

There are a few different ways that the Studley campus buildings, of Dalhousie University, can be improved in regards to maximizing the efficiency of green space and the benefits these spaces can have on the campus community. While keeping in mind that fully renovating all of the buildings now to showcase nature would be costly, wasteful and impractical, there is a much simpler approach of bringing nature indoors.

Natural light and analogs (adding wood paneling, stone walls and floors etc.) can be implemented as the buildings get updated (or built) throughout the upcoming years, while more plants and water features can be installed now with less difficulty. The majority of the buildings that had a low score lacked any actual green spaces in general. Living walls, air plants and potted plants would go a long way to improving the learning atmosphere on campus. Small fountains can be placed as centerpieces in indoor garden plots, such as the trees within the Killam Atrium that are surrounded by smaller plants. Air plants have very little need of any kind of care and can simply be placed throughout the campus buildings like many of the natural artifacts displayed in the Life Sciences Center. Furthermore, the usage of fish tanks, with living plants and corals, can be put on display like those of the Life Sciences Center museum.

There are also many possibilities for further research. Although the criteria we came up with worked extremely well for our purposes, it might not be suitable for different evaluations. Our criteria was developed for a university size study, where only the main room that the University community had access, was sampled and not the whole building. The criteria developed can also be used to

evaluate the indoor green space found on other areas of Dalhousie Campus aside from Studley Campus, and other buildings in areas worldwide.

One of the consultants throughout the process of criteria development, Jill McSweeney, is organizing the David Suzuki Foundation's 30X30 challenge at Dalhousie. This initiative encourages Canadians to spend 30 minutes in nature for 30 consecutive days. The results of our research, primarily the campus map, can help challenge participants to find spaces where they can be exposed to nature in an indoor environment.

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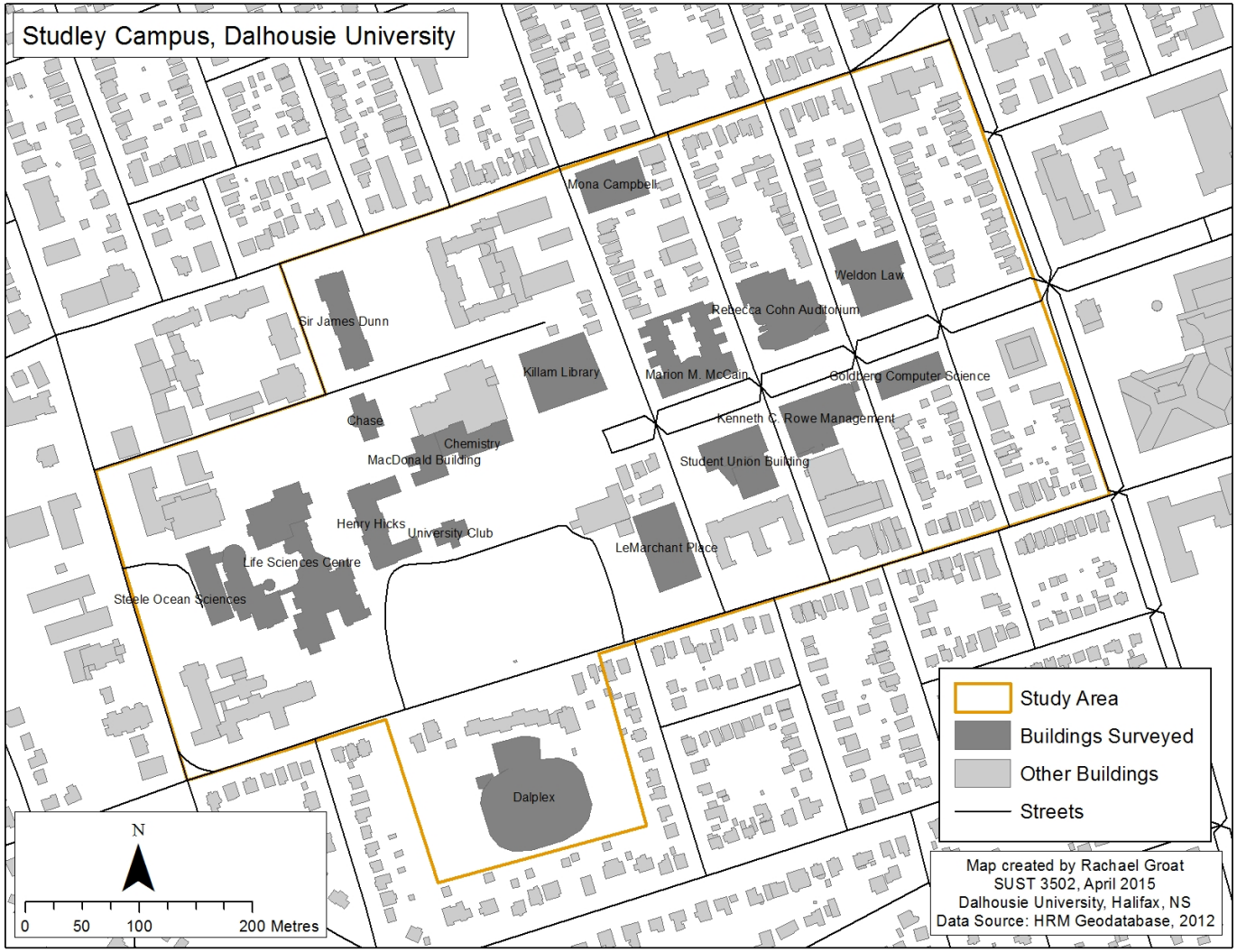
APPENDICES

APPENDIX I: Map 1 Studley Campus; map produced using GIS with surveyed buildings highlighted



APPENDIX II: Building List; including the specific spaces surveyed

- ✓ The Weldon Law Building – Lobby directly outside the doors of the law library
- ✓ The Marion McCain Arts and Social Sciences Building – Seating area overlooking the courtyard on the second floor, directly up the stairs from the front entrance
- ✓ The Rebecca Cohn Auditorium, Art Centre – Main lobby on the third floor
- ✓ The Killam Library – Killam atrium
- ✓ The Kenneth C. Rowe Management Building – Main entrance/ lobby area
- ✓ The Life Sciences Centre – Open area near the food court, third floor
- ✓ The Mona Campbell Building – Main entrance/lobby area on the first floor
- ✓ The Goldberg Computer Science Building – Seating/study area on the first floor
- ✓ The Student Union Building – Seating area directly between the front door and the Grawood
- ✓ The Chemistry Building- Main lobby
- ✓ The Chase Building – Study room, near front entrance
- ✓ The Dalplex – Main lobby, upper floor, by main doors
- ✓ The Sir James Dunn Building – Main lobby
- ✓ The Henry Hicks Building – Main lobby
- ✓ The University Club – Main lobby
- ✓ The MacDonald Building – Seating/waiting area connected to the front entrance
- ✓ Steele Ocean Science Building - Open area with seating on the main floor
- ✓ Le Marchant Place - Open stretch of space on the main floor

APPENDIX III: Final Criteria Scoring Charts

CRITERIA TOPICS	**Chase**	**Chemistry**	**Dalplex**	**Computer Science**	**Henry Hicks**	**Rowe**	**Killam**	**LeMarchant**	**LSC**	Running Total
Greenery										
% Coverage										
Small Plant Presence										
Medium Plant Presence										
Large Plant Presence										
Diversity										
Lighting										
Source of Light										
View										
Visible Outdoor Green Space										
Water										
Visible/ Audible										
Sensory Variability										
Level of Engagement										
Biomimicry										
Natural Analogs										
GRAND TOTAL PER BUILDING										

CRITERIA TOPICS	**MacDonald**	**McCain**	**Mona Campbell**	**Ocean Science**	**Rebecca Cohen**	**Sir James Dunn**	**SUB**	**University Club**	**Weldon Law**	Total
Greenery										
% Coverage										
Small Plant Presence										
Medium Plant Presence										
Large Plant Presence										
Diversity										
Lighting										
Source of Light										
View										
Visible Outdoor Green Space										
Water										
Visible/ Audible										
Sensory Variability										
Level of Engagement										
Biomimicry										
Natural Analogs										
GRAND TOTAL PER BUILDING										

APPENDIX IV: Operationalized Variables

**assumption: all conditions are optimal (i.e. full potential)

GREENERY

-Percent coverage

0=0% coverage
1=1-10% coverage
2=11-25%
3=26-50%
4=51-100%

-Small plants (1-30 cm)

0 = 0
1 = 1-2
2 = 3-4
3 =5-6
4=7+

-Medium plants (31-150 cm)

0 = 0
1 = 1-2
2 = 3-4
3 =5-6
4=7+

-Large plants (151 cm +)

0 = 0
1 = 1-2
2 = 3-4
3 =5-6
4=7+

-Diversity (number of plant species)

0 = 0
1 = 1-2
2 = 3-4
3 =5-6
4=7+

VIEW

-Visible outdoor greenspace (percent natural visible space)

0= 0%
1= 1-25%
2=26-50%
3=51-75%
4=76-100%

WATER

-Visible/audible presence

0 = not present
1 = not very noticeable
2 = somewhat noticeable
3 = noticeable
4 = very noticeable

SENSORY VARIABILITY

0= not engaged
1= not very engaged
2= somewhat engaged
3=engaged
4=very engaged

BIOMIMICRY

-Number of natural analogs present in space (pictures of nature, fake plants)

0=0
1=1-2
2=3-4
3=5-6
4=7+

APPENDIX V: Criteria Score Charts

Mean total scores received by each building and each criteria, when evaluating buildings for indoor green space

Criteria Topics	Chase	Chemistry	Dalplex	Computer Science	Henry Hicks	Rowe	Killam	LeMarchant	LSC	MacDonald	McCain	Mona Campbell	Ocean Sciences	Rebecca Cohn	James Dunn	SUB	University Club	Weldon Law	Running Total
Greenery																			
% Coverage	1	0	0	0.8	0	1	1.2	0	1	0	0	0	0	1	0	1.2	1	1.6	9.8
Small Plant Presence	3.8	0	0	0	0	0	4	0	4	0	0	0	0	1.8	0	4	0.4	0	18
Medium Plant Presence	0	0	0	0.8	0	0	4	0	0	0	0	0	0	2.6	0	1.4	0	4	12.8
Large Plant Presence	0	0	0	0.2	0	2.2	2	0	0	0	0	0	0	1	0	0.2	1.2	3.6	10.4
Diversity	2	0	0	1	0	1	2	0	1	0	0	0	0	3	0	2.2	1	2.2	15.4
Lighting																			
Source of Light	1	0.4	1	2	1.2	2.6	3.6	2.6	1.8	1	3	1	3.4	1	1	1	1	2.8	31.4
View																			
Visible Out.Greenspace	1	0.2	0.4	1.4	1.2	1.2	1.2	0.6	2.4	0.6	3.4	0.6	1.6	2	1	1.2	0	1	21
Water																			
Visible/ Audible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sensory Variability																			
Level of Engagement	2.4	1	1.4	2	1	2	2.4	2	2.2	2	2.2	2.4	2.4	2.6	1	2.2	1.6	3.4	36.2
Biomimicry																			
Natural Analogs	1.8	1.2	1	1.4	1.2	1	1.8	0.4	3.4	1.8	1.4	1.2	1.6	2.6	1.2	2.2	2.2	1.4	28.8
GRAND TOTAL PER BUILDING	13	2.8	3.8	9.6	4.6	11	22.2	5.6	15.8	5.4	10	5.2	9	17.6	4.2	15.6	8.4	20	183.8

Scores given by Mairi Milne to each building and each criteria, when evaluating buildings for indoor green space

Criteria Topics	Chase	Chemistry	Dalplex	Computer Science	Henry Hicks	Rowe	Killam	LeMarch ant	LSC	MacDonald	McCain	Mona Campbell	Ocean Sciences	Rebecca Cohn	James Dunn	SUB	University Club	Weldon Law	Running Total
Greenery																			
% Coverage	1	0	0	1	0	1	1	0	1	0	0	0	0	1	0	1	1	2	10
Small Plant Presence	5	0	0	0	0	0	4	0	4	0	0	0	0	4	0	4	0	0	21
Medium Plant Presence	0	0	0	1	0	0	4	0	0	0	0	0	0	1	0	1	0	4	11
Large Plant Presence	0	0	0	0	0	2	2	0	0	0	0	0	0	1	0	1	2	4	12
Diversity	2	0	0	1	0	1	2	0	1	0	0	0	0	3	0	2	1	3	16
Lighting																			
Source of Light	1	1	1	3	1	3	4	3	2	1	2	1	3	1	1	1	2	4	35
View																			
Visible Out.Greenspace	1	1	1	3	1	2	2	1	3	1	2	1	3	3	1	1	0	1	28
Water																			
Visible/ Audible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sensory Variability																			
Level of Engagement	4	2	2	3	1	2	3	2	3	1	3	3	3	4	1	3	2	4	46
Biomimicry																			
Natural Analogs	3	2	2	2	2	1	2	1	4	2	1	2	2	4	2	3	3	2	40
GRAND TOTAL PER BUILDING	17	6	6	14	5	12	24	7	18	5	8	7	11	22	5	17	11	24	219

Scores given by Rebecca Aucoin to each building and each criteria, when evaluating buildings for indoor green space

Criteria Topics	Chase	Chemistry	Dalplex	Computer Science	Henry Hicks	Rowe	Killam	LeMarchant	LSC	MacDonald	McCain	Mona Campbell	Ocean Sciences	Rebecca Cohn	James Dunn	SUB	University Club	Weldon Law	Running Total
Greenery																			
% Coverage	1	0	0	1	0	1	1	0	1	0	0	0	0	1	0	1	1	2	10
Small Plant Presence	3	0	0	0	0	0	4	0	4	0	0	0	0	1	0	4	1	0	17
Medium Plant Presence	0	0	0	1	0	0	4	0	0	0	0	0	0	3	0	2	0	4	14
Large Plant Presence	0	0	0	0	0	2	2	0	0	0	0	0	0	1	0	0	1	4	10
Diversity	2	0	0	1	0	1	2	0	1	0	0	0	0	3	0	3	1	2	16
Lighting																			
Source of Light	1	0	1	2	2	2	4	3	2	1	3	1	3	1	1	1	1	3	32
View																			
Visible Out.Greenspace	1	0	0	1	2	1	1	1	3	1	4	1	1	2	1	1	0	1	22
Water																			
Visible/ Audible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sensory Variability																			
Level of Engagement	2	1	1	1	1	1	2	2	1	2	1	2	2	2	1	2	1	3	28
Biomimicry																			
Natural Analogs	1	1	1	1	1	1	2	0	4	2	1	1	2	3	1	3	2	1	28
GRAND TOTAL PER BUILDING	11	2	3	8	6	9	22	6	16	6	9	5	8	17	4	17	8	20	177

Scores given by Annie Metcalfe to each building and each criteria, when evaluating buildings for indoor green space

Criteria Topics	Chase	Chemistry	Dalplex	Computer Science	Henry Hicks	Rowe	Killam	LeMarchant	LSC	MacDonald	McCain	Mona Campbell	Ocean Sciences	Rebecca Cohn	James Dunn	SUB	University Club	Weldon Law	Running Total
Greenery																			
% Coverage	1	0	0	0	0	1	1	0	1	0	0	0	0	1	0	1	1	1	8
Small Plant Presence	5	0	0	0	0	0	4	0	4	0	0	0	0	2	0	4	0	0	19
Medium Plant Presence	0	0	0	0	0	0	4	0	0	0	0	0	0	3	0	1	0	4	12
Large Plant Presence	0	0	0	1	0	3	2	0	0	0	0	0	0	1	0	0	1	3	11
Diversity	2	0	0	1	0	1	2	0	1	0	0	0	0	3	0	1	1	2	14
Lighting																			
Source of Light	1	0	1	2	1	2	3	2	2	1	4	1	3	1	1	1	1	2	29
View																			
Visible Out.Greenspace	1	0	0	1	1	1	1	0	2	0	4	0	1	2	1	1	0	1	17
Water																			
Visible/ Audible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sensory Variability																			
Level of Engagement	1	0	1	2	1	2	2	1	2	1	3	2	1	1	1	2	1	2	26
Biomimicry																			
Natural Analogs	2	1	1	2	1	1	2	0	2	2	3	1	1	2	1	2	2	2	28
GRAND TOTAL PER BUILDING	13	1	3	9	4	11	21	3	14	4	14	4	6	16	4	13	7	17	164

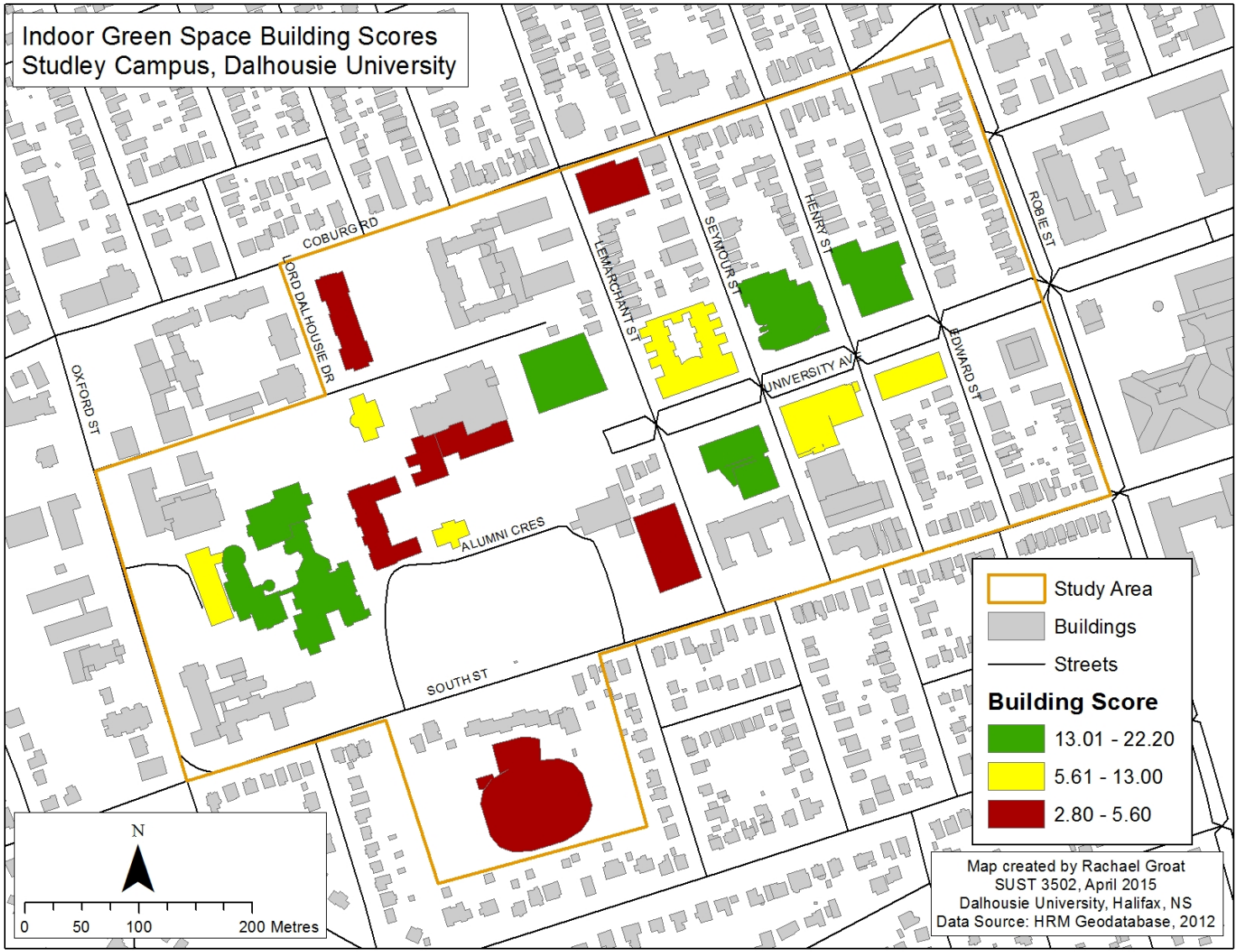
Scores given by Mackenzie Meens to each building and each criteria, when evaluating buildings for indoor green space

Criteria Topics	Chase	Chemistry	Dalplex	Computer Science	Henry Hicks	Rowe	Killam	LeMarchant	LSC	MacDonald	McCain	Mona Campbell	Ocean Sciences	Rebecca Cohn	James Dunn	SUB	University Club	Weldon Law	Running Total
Greenery																			
% Coverage	1	0	0	1	0	1	2	0	1	0	0	0	0	1	0	2	1	2	12
Small Plant Presence	3	0	0	0	0	0	4	0	4	0	0	0	0	1	0	4	1	0	17
Medium Plant Presence	0	0	0	1	0	0	4	0	0	0	0	0	0	3	0	1	0	4	13
Large Plant Presence	0	0	0	0	0	2	2	0	0	0	0	0	0	1	0	0	1	3	9
Diversity	2	0	0	1	0	1	2	0	1	0	0	0	0	3	0	3	1	2	16
Lighting																			
Source of Light	1	0	1	1	1	2	3	3	1	1	3	1	4	1	1	1	1	2	28
View																			
Visible Out.Greenspace	1	0	0	1	1	1	1	1	2	1	4	0	1	1	1	2	0	1	19
Water																			
Visible/ Audible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sensory Variability																			
Level of Engagement	2	1	2	2	1	4	3	3	4	4	3	2	4	3	1	3	3	4	49
Biomimicry																			
Natural Analogs	2	1	1	1	1	1	2	0	4	2	1	1	1	2	1	2	2	1	26
GRAND TOTAL PER BUILDING	12	2	4	8	4	12	23	7	17	8	11	4	10	16	4	18	10	19	189

Scores given by Rachael Groat to each building and each criteria, when evaluating buildings for indoor green space

Criteria Topics	Chase	Chemistry	Dalplex	Computer Science	Henry Hicks	Rowe	Killam	LeMarchant	LSC	MacDonald	McCain	Mona Campbell	Ocean Sciences	Rebecca Cohn	James Dunn	SUB	University Club	Weldon Law	Running Total
Greenery																			
% Coverage	1	0	0	1	0	1	1	0	1	0	0	0	0	1	0	1	1	1	9
Small Plant Presence	3	0	0	0	0	0	4	0	4	0	0	0	0	1	0	4	0	0	16
Medium Plant Presence	0	0	0	1	0	0	4	0	0	0	0	0	0	3	0	2	0	4	14
Large Plant Presence	0	0	0	0	0	2	2	0	0	0	0	0	0	1	0	0	1	4	10
Diversity	2	0	0	1	0	1	2	0	1	0	0	0	0	3	0	2	1	2	15
Lighting																			
Source of Light	1	1	1	2	1	4	4	2	2	1	3	1	4	1	1	1	0	3	33
View																			
Visible Out.Greenspace	1	0	1	1	1	1	1	0	2	0	3	1	2	2	1	1	0	1	19
Water																			
Visible/ Audible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sensory Variability																			
Level of Engagement	3	1	1	2	1	1	2	2	1	2	1	3	2	3	1	1	1	4	32
Biomimicry																			
Natural Analogs	1	1	0	1	1	1	1	1	3	1	1	1	2	2	1	1	2	1	22
GRAND TOTAL PER BUILDING	12	3	3	9	4	11	21	5	14	4	8	6	10	17	4	13	6	20	170

APPENDIX VI: Map 2 Indoor Green Space Building Scores for Studley Campus, created using GIS



APPENDIX VII: Photos of Notable Spaces Surveyed

Figure 2: Chemistry Building Main Entrance

Figure 3: Killam Library Atrium

Figure 4: Weldon Law Library Lobby

Figure 5: LeMarchant Place Main Lobby

Appendix VIII: Photos of Notable Elements

Figure 6: A Natural Analog in the Rebecca Cohn

Figure 7: Photographic representation of nature in the LSC

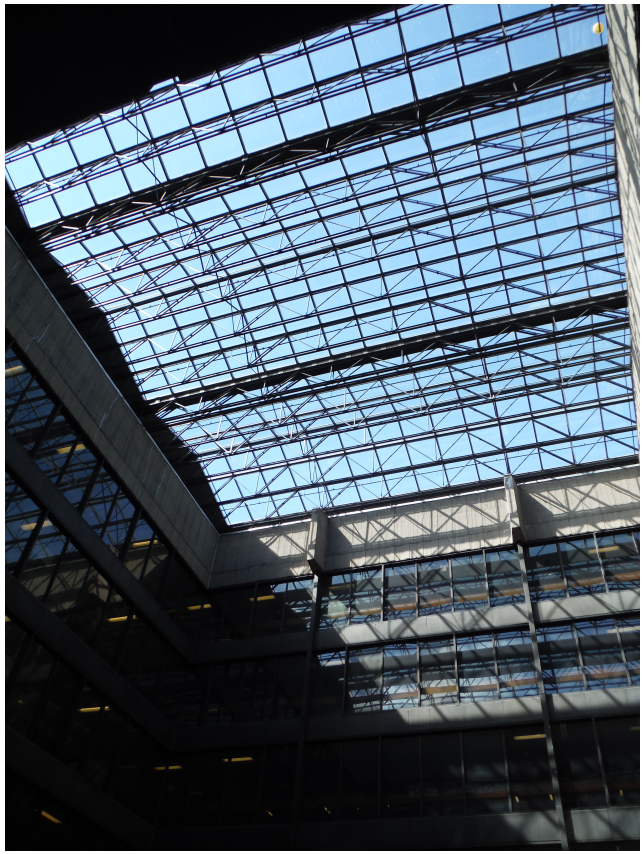


Figure 8: Natural Light in the Killam

Figure 9: View of outdoor green space from McCain