An Investigation into Student Perceptions of Green Spaces on Dalhousie's Studley Campus

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Urban Greenery, Green spaces, University Students, Well-being, Productivity, Green Design, Biodiversity, Urbanization.

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Abstract

Landscaping holds significant importance on university campuses and has traditionally aimed to enhance the visual appeal of environments. Green space, as it refers to natural areas and vegetation, as well as urban parks located on university campuses, plays a crucial role in creating a natural environment (Taylor & Hochuli, 2017). We investigated student perceptions of green space, specifically within the Studley campus of Dalhousie University. Our objectives included gauging whether students consider green space as an important aspect of their on-campus well-being and if they might feel more inclined to spend time on campus green spaces if improvements were made to these areas. By examining how green space is perceived and used, we aimed to ascertain a collective viewpoint among students regarding its significance.

We used a combination of quantitative and qualitative methods to gather data from undergraduate and graduate students on the Studley campus. Quantitatively, we used Likert scale questions and conducted Chi-square analyses to classify opinions regarding green space perception and utility. For qualitative insights, we distributed surveys to answer more open-ended questions on green space perception and utility. Additionally, we used ArcGIS and SketchUp as tools to further enhance our research findings. Overall, the integration of quantitative and qualitative methods, along with visualization tools, has allowed us to understand student perceptions of green space regarding the Studley campus of Dalhousie University.

Introduction

Green spaces, which are natural land areas and spaces of concentrated vegetation, can be found within cities and on university campuses such as urban parks (Taylor & Hochuli, 2017). Green spaces are crucial, especially in dense urban areas where essential biodiversity can be easily overlooked, and improperly managed. Green spaces act as crucial areas for communities to use for leisure, social, physical, and relaxation activities for individuals spending time and/or living in urbanized areas. Urbanized green spaces not only have environmental benefits but many health benefits due to the provision of space for activity and psychological rejuvenation (Lee et al., 2015). The benefits offered by the presence of green spaces in urban areas are prominent and extremely important to the physical and mental health of individuals spending time in and/or living within urban areas.

Green space is a critical planning and design consideration present in any urban environment (Griffith, 1994). The importance of green spaces is such that they act as hubs of activity, as well as gathering spots for social and relaxation activities (Speake, Edmondson & Nawaz, 2013). Research suggests that campus green spaces facilitate social behavior better than indoor or hard outdoor campus facilities (Liprini & Coetzee, 2017). Understanding this, universities around the world have made efforts to improve green spaces and natural environments within their campuses for the increased well-being of students (Li, Ni & Dewancker, 2019).

At Dalhousie University, green spaces are featured prominently in the institution's design guidelines and its natural environment plan (Dalhousie University, 2024). Despite this, little attention is focused on student attitudes towards campus green space within these documents. It is evident that green spaces are an important aspect of a university's constructed environment since there have been extensive plans and talks (Dalhousie University, n.d.). However, the perceptions of students regarding their campus' green space remain relatively understudied. At Dalhousie University, there is a clear lack of research concerning student attitudes and the usage of green space. Given that students are among the primary stakeholders in the university's facilities, we believe that the research we will conduct is valuable and will garner further necessary knowledge regarding student perceptions of university campus green spaces.

Our research objectives include; gaining an understanding of what students at Dalhousie University perceive to be a green space, understanding how students on Studley campus interact with current 'green spaces' on campus, and learning what green space changes students want to see implemented on campus.

Methods

This study was conducted using survey responses (reference Appendix I for survey questions) collected from Dalhousie undergraduate and graduate students in March 2024. We took responses from any students who completed our survey, which was promoted on online platforms like personal Instagram pages, Dalhousie Society pages, and class Brightspace pages. We also distributed physical copies of our survey posters for students with a QR code through which students could access our online survey and posted them in the Student Union Building, Killam Library, Henry Hicks Building, and the Life Sciences Centre. Originally, we aimed to

gather 378 respondents to achieve a 95% significant level within a population of 20,000. We made use of a survey instead of, for example, interviews, because it was felt that an online independently completed survey would reach more students in a shorter amount of time by advertising a quick and anonymous online survey compared to interviews conducted on the Studley campus. Our survey consisted of 10 questions (see Appendix 1) and was created using Microsoft Forms. We provided an incentive of a $25 gift card to Tim Hortons for survey completion, to reach more students who would be unlikely or disinterested in answering our questions. Our research gained approval by the Department of Earth and Environmental Sciences ethics committee.

Methods used to analyze the visualizing green space interaction occurrences in a density map, and significant statistical calculations for the Likert-scale questions. Another method used to further understand students' perceptions of changes that could be made to the green spaces, a SketchUp design incorporating students' suggestions was made. In the figures below, the SketchUp design allowed us to understand what an improved green space might look like on the Studley campus, according to student recommendations, and better understand the feasibility of implementing these changes. As seen in Figures 1 and 2, we have redesigned the Studley campus quad as per the above incentives to utilize green space. On the leftmost side of the design, there are two umbrella-covered picnic tables. On the rightmost side, there is a bike rack, which consequently encourages sustainable transportation methods. In the center of the design, there is a stone pathway surrounding a serene pond. Surrounding the pond, boxwood borders delineate the transition from pavement to the area dedicated to fostering urban biodiversity. Figure 2 displays a closer examination of the garden. It features 3 benches, a picnic table, 3 corner flower beds, a magnolia tree, and a bird bath.

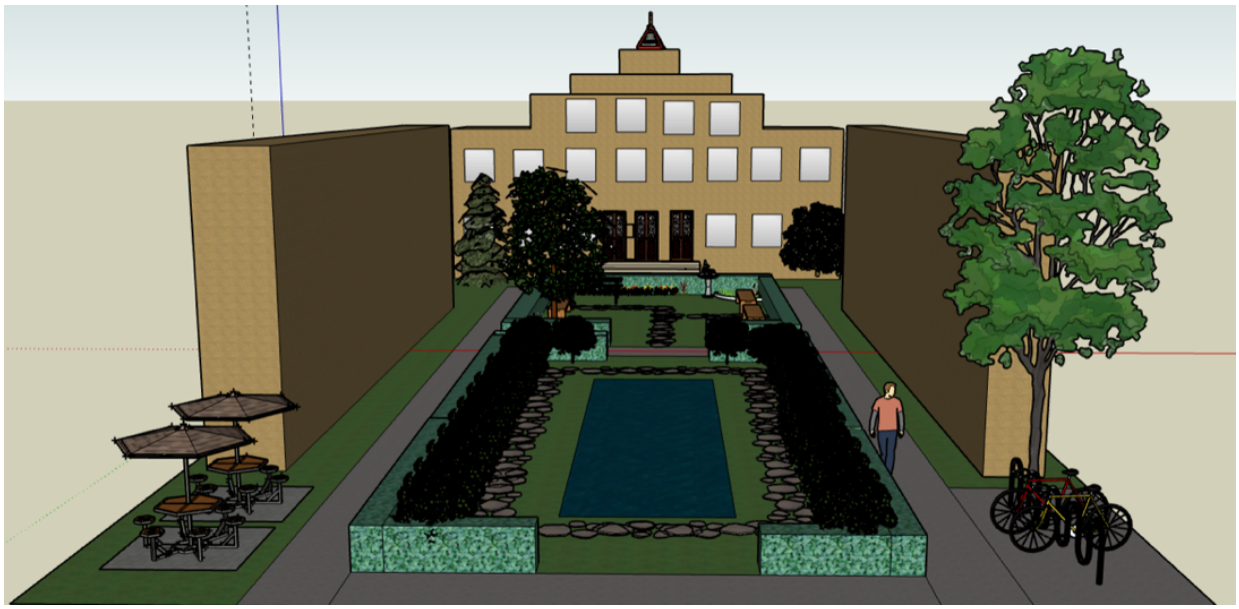

Figure 1. Redesign of the quad green space on Studley campus including improvements that would increase student usage of the space. The redesign includes umbrella-covered picnic tables, a bike rack, and a visually appealing stone pond lined with boxwood borders surrounding it.

Figure 2. A zoomed-in redesign of the garden could be implemented outside of the quad. The redesign includes multiple benches for seating, a picnic table, a bird bath, a magnolia tree, and multiple flower beds. This redesign encourages student accessibility to green spaces with the implementation of seating and supports and increases local biodiversity with the inclusion of flower beds, trees, boxwood borders, and a bird bath.

Some limitations of this study included not all students having regular access to a computer and/or cellular device to fill out the survey. As well as students' initial interest in the

subject matter, meaning students disinterested or unfamiliar with the concept of green spaces may be less likely to pay attention to or respond to a survey concerning that subject. This was a limitation that we needed to consider before posting our survey, as there was a higher likelihood that individuals responding to the survey were in an environmental or sustainability-focused program or simply had a special interest in green spaces. Therefore, the limitations of our survey may be that the survey received answers only from students who had easy access to technology, and potentially an increased interest in or understanding of green spaces and their significance regarding the wellbeing of university students.

Results

In total, we had 76 responses, consisting of 74 from undergraduate students and 2 from graduate students. While our initial target for survey responses was higher, this amount provides a substantive basis for our research. Given the constraint of a ten-day window for survey distribution, we acknowledge that our anticipated participant count was ambitious, and the actual response rate aligns more closely with realistic expectations.

Quantitative results

The percentage of respondents who live off campus is 93% and the percentage of respondents who live in Dalhousie residences is 7% (see Figure 3.)

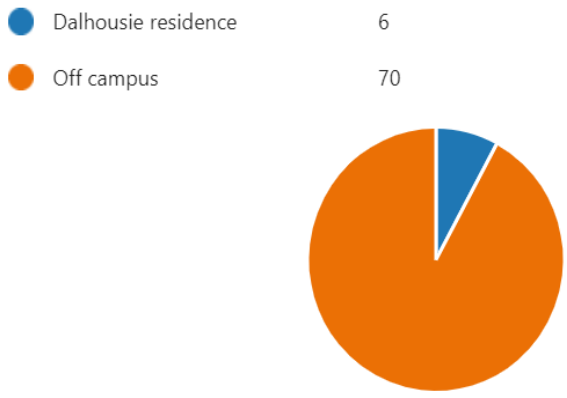

Figure 1. A pie-chart comparison of the number of respondents who live off campus versus in Dalhousie residence. The blue portion of the chart represents the number of respondents who live in Dalhousie residences. The orange portion of the chart represents the number of respondents who live off campus.

The various uses of current on-campus green spaces on Studley campus by respondents are compared in Figure 4. These uses include socialization, studying, exercising, leisure, not

using on-campus green spaces at all, and others. 59% of respondents utilize green spaces primarily for socializing and only the smallest portion of respondents stated that they have not used green spaces at all. Leisure was the second most favoured use of green spaces by respondents, followed by studying, exercising, and no use of green spaces on Studley campus at all. These findings suggest that the vast majority of students recognize and engage with the benefits of green spaces on Studley campus in one form or another.

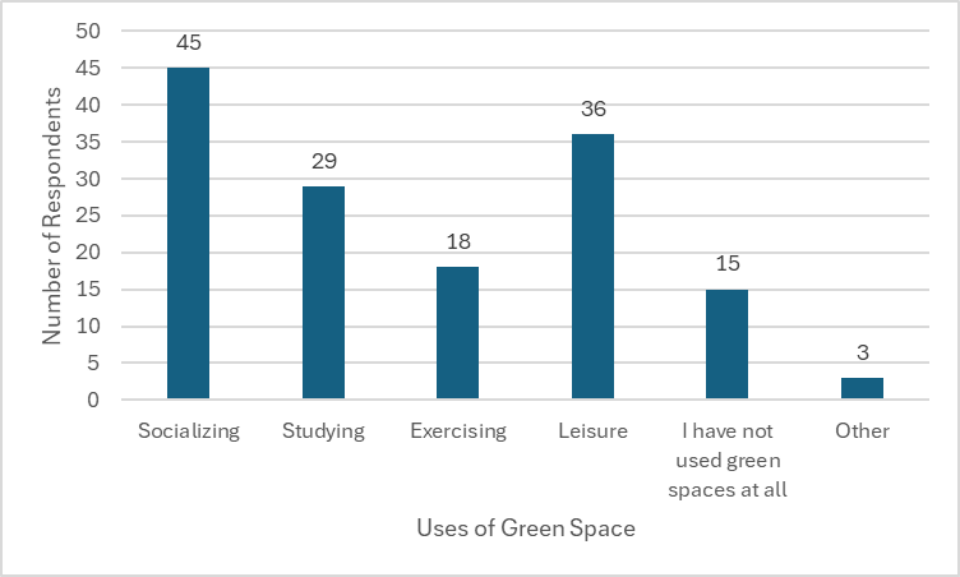

Figure 2. How respondents make use of current on-campus green spaces on Studley campus. Socializing, the most popular response is represented by the blue bar within the graph. Leisure, the second most popular response, is represented by the red bar. Studying, the third most popular response, is represented by the orange bar. Exercising, the fourth most popular response is represented by the green bar. Not using green spaces at all, the second least popular response is represented by the purple bar, and the other, the least popular response, is represented by the brown bar within the graph.

A grid map that shows Dalhousie Studley's campus can be seen in Figure 5. Participants were instructed to indicate within the grid which perceived green space on campus they interacted with the most. According to the survey the area in which students spent the most time was C4, on the east side of the Quad, 30% of the responses mentioned that location. The second most used area was C3, with 22%, on the west side of the Quad. Overall, 52% of the responses indicated that the green space on campus they interacted with the most was the Quad.

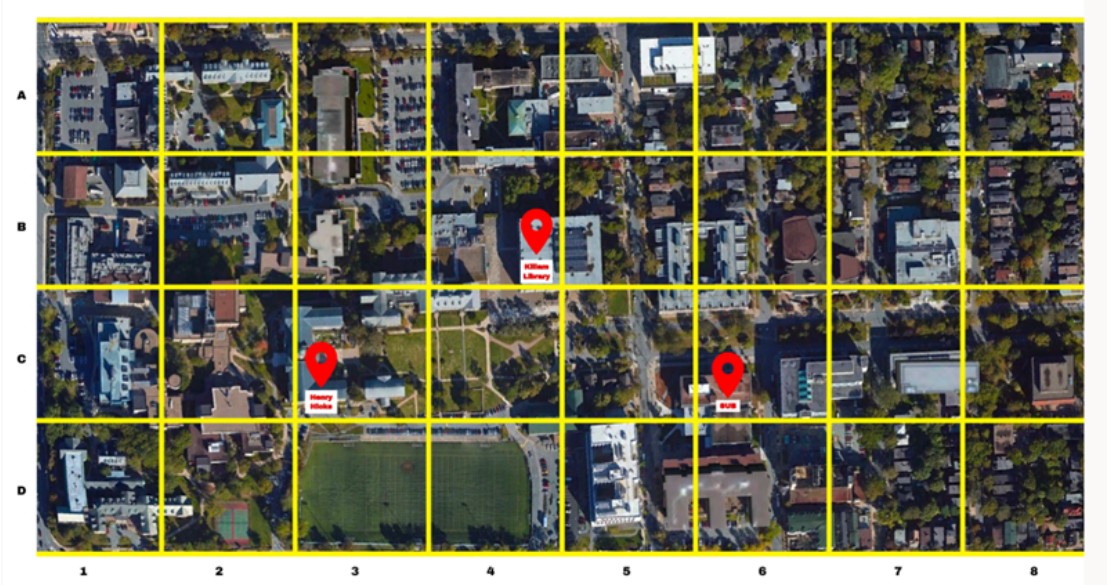

Figure 5. A grid map of Dalhousie Studley campus dividing labelled square areas for respondents to observe and decide in which areas on the grid were green spaces that they most interacted with. Pinpoints were used to indicate major buildings on Studley campus so that respondents could visualize where each point of the grid is located.

Figure 6 displays a comparative analysis of respondents' perspectives regarding the contribution of green space on campus to their well-being. For three options (neutral, agree, and strongly agree), the observed value percentage is higher than the expected value percentage. After completing a goodness of fit test, the calculated chi-square value was $x^2 = 35.34$, with a corresponding p-value of less than 0.005. Hence, there is a significant difference between green spaces on campus and well-being.

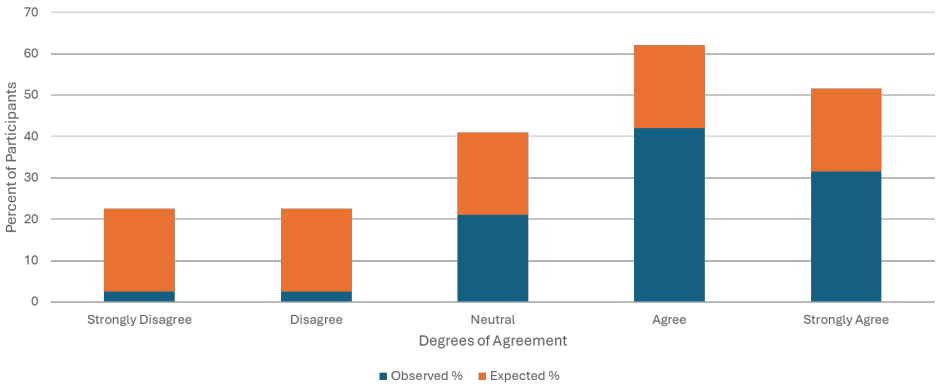

Figure 3. Bar graph representing the agreement of the statement: "Green spaces on Dalhousie's Studley campus contribute and benefit my well-being". The blue bars represent the observed responses to the statement. The orange bars represent the expected responses to the statement.

A comparison of respondents' opinions on whether green spaces on the Studley campus are convenient and accessible to students can be seen in Figure 7. For 1 option (disagree) the observed value percentage and expected value percentage were equal. For 3 options (strongly disagree, neutral, and strongly agree), the observed value percentage is lower than the expected value percentage. Following a goodness-of-fit test, the chi-square value was $x^2 = 29.096$ and the p-value was less than 0.005. Therefore, there is a significant difference between green spaces on campus and how convenient/accessible they are to students.

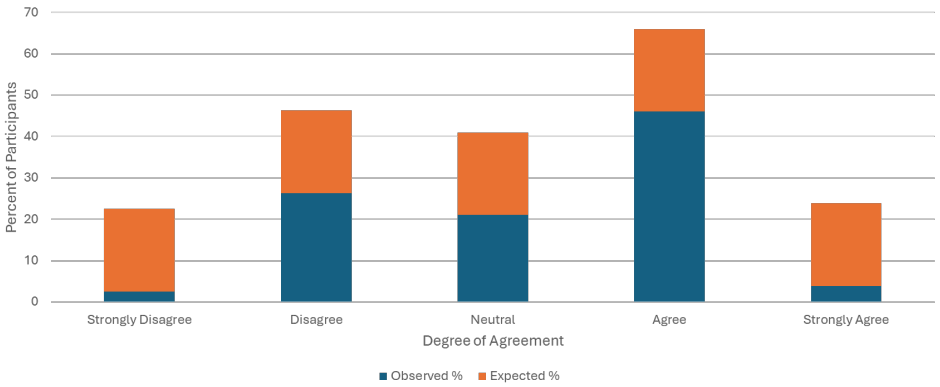

Figure 7. Bar graph representing the agreement of the statement: "Green spaces on Dalhousie University's Studley campus are convenient and accessible to students". The blue bars represent the observed responses to the statement. The orange bars represent the expected responses to the statement.

A comparison of respondents' opinions on whether there are appropriate measures for leisure such as the use of benches, picnic tables, and chairs in green spaces on the Studley campus can be seen in Figure 6. For 2 options (disagree and agree) the observed value percentage was higher than the expected value percentage. For 3 options (strongly disagree, neutral, and strongly agree), the observed value percentage is lower than the expected value percentage. After completing a goodness of fit test: the chi-square value was $x^2 = 26.13$ and the p-value was less than 0.005. Therefore, there is a significant difference between green spaces on campus and appropriate measures for leisure.

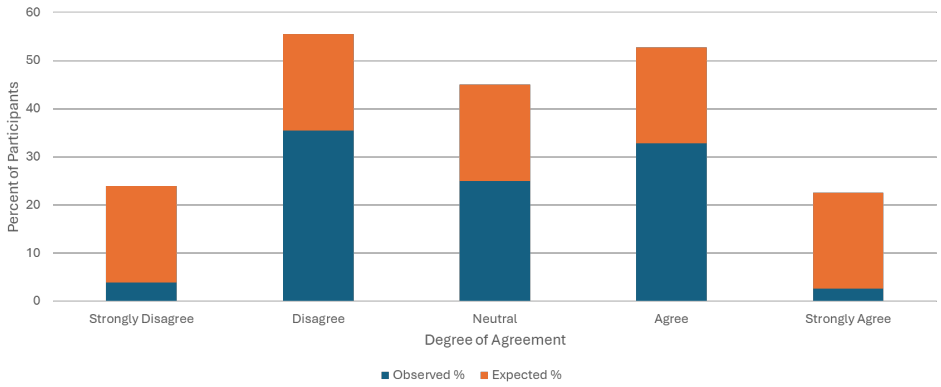

Figure 8. Bar graph representing the agreement of the statement: "Appropriate measures are provided for leisure such as the use of benches, picnic tables, and chairs on green spaces located on Dalhousie's Studley campus". The blue bars represent the observed responses to the statement. The orange bars represent the expected responses to the statement.

Qualitative Results

Through these questions and answers, we will determine what students believe green spaces are and their utility on campus.

Depicting Green Spaces

One of the questions in the survey asked participants to depict a green space on campus. By asking participants to identify what they consider to be a green space, we aimed to determine a common definition or understanding of green spaces that is shared among most students on the Studley campus. The options were as follows: the pathway linking the dentistry to the medical building, the Wickwire turf field, the pathway in the quad, and the Howe parking lot. These options had a range of features, from traditional green areas like lawns to more urban spaces and constructed elements. Option 3, the pathway in the quad, was selected the most with 42%. 1% of the participants believed that the Howe parking lot was a green space. These findings provide valuable insight into student perceptions regarding green spaces on campus.

Barriers Preventing Green Space Usage

Once we established a common perception of what a green space on campus is, our focus shifted to identifying the barriers hindering student utilization of green spaces. The most common answer was limited seating. The lack of adequate seating detracts from the overall comfort of green spaces and the potential of a space to bring the Dalhousie community together. Participants also discussed the lack of green spaces and how poorly they are maintained. With

limited areas designated for greenery and recreation, the green spaces we currently have are often overcrowded. Furthermore, neglected areas detract from the visual appeal of campus. As one participant stated,

> "The fact that there aren't any intentional green spaces. The little greenery we do have on campus is a natural part of the complex, I do not think that there are any intentionally placed green spaces on campus that invite people to use them for leisure and socialization."

Another common answer was 'weather'. Halifax is a rainy city with a long and cold winter (Environment and Climate Change Canada, n.d.), so we are interpreting this as a lack of weather-protected areas, such as umbrellas and covered tables.

Recommended Changes for Increased Green Space Usage

After we identified barriers to utilizing green spaces, we determined what changes would encourage students to spend more time in campus green spaces. The most common answers are more benches and picnic tables (including covered areas), community gardens, and increased focus on urban biodiversity. By expanding seating infrastructure, the campus can accommodate different preferences and activities, from solo activities to social gatherings, therefore enhancing the accessibility and appeal of green spaces. Additionally, community gardens serve as areas for biodiversity and ecological restoration and offer students opportunities for hands-on learning and engagement in sustainable practices. These answers are helpful because they illustrate what aspects of green space the school should focus on to create better incentives for using green spaces.

ArcGIS Pro Kernal Density Map

In Figure 9, using GIS we have demonstrated a density "heat" style map showing the highest points of student-to-green space interactions. The green space most students identified as being of a high interaction occurrence was the Studley Quad, and the second most was the King's Quad. As we can see, these are two green centralized locations, close to the main buildings, and easily accessible, which are possible reasons why these places were the most mentioned. The Wickwire field, although the second most identified space is not a green space under this report's classification, therefore noted, but not included as key information in our conclusions. This, as a limitation, is noted below in the discussion section.

Figure 9. ArcGIS Kernal Density Map demonstrating the areas of interest selected from students' responses from Figure 5/Question 4.

Discussion

The objective of the research was to gain insight into student perception and utilization of green spaces on Dalhousie University's Studley campus. This included gaining an understanding of what students currently perceive as "green space", what barriers prevent further utilization of green spaces, and what incentives would encourage greater green space usage. The data collected allowed us to analyze perceptions of green space among Dalhousie students and examine potential improvements that could be made to campus green spaces to encourage greater usage.

Implications

The results of the research revealed insights into how students perceive and interact with green spaces on campus. Most respondents use campus green spaces for socializing or leisure. While there is a dearth of research regarding focused on Canadian students and universities, this is consistent with findings in similar research studies of university campuses globally (Li et al., 2019; Wang et al., 2024) and shows a desire for spaces tailored toward these purposes. Coupled with the fact that the overwhelming majority of respondents (92%) live off-campus, it is clear

that campus green spaces are an important space for students to gather away from home and work environments.

When asked to indicate their most interaction with green space on campus, students noted several different areas, however, the most often interacted with green space was the Studley quad, located in the center of the Studley campus. This space, along with the turf area adjacent to the Killam Library, and the pathway linking the Life Sciences Centre and Sherriff Hall were indicated as the most utilized green spaces. Given that respondents noted these areas as the most utilized, it is reasonable to identify these 3 areas as green spaces with the greatest potential for improvement.

The two open-ended questions included in the survey allowed respondents to state the biggest barriers they perceive in their usage of campus green spaces and the factors that would incentivize greater green space usage. In response to the question regarding perceived barriers, a large portion of respondents (29%) noted 'weather' as a barrier preventing them from using green spaces on campus. This has been noted by respondents in similar studies (Speake et al., 2013), and suggested measures to improve green spaces for bad weather conditions have been identified. Other codes identified in the question regarding barriers are "lack of seating", and "time". Codes for question 10, regarding incentives for greater green space usage, generally centered on greater amounts of seating and benches. One student responded:

> "More picnic tables for studying, gazebos for rain/sun protection, etc., more benches, more chairs, and outside napping spots would be ideal"

Very few (2) students stated no changes would encourage greater green space usage, signaling that there is a high potential for increased usage of green spaces.

These answers, when coupled with the questions concerning previous usage of green spaces, provide a clear picture of student perception of green spaces on Studley campus. A general dissatisfaction is noted, but also a willingness to increase green space usage if changes are made.

Dalhousie University invests large amounts of capital into the aesthetics and maintenance of its green spaces and the campus at large. As such, this research could prove useful in the proper allocation of funds for green space improvements. In the past, Dalhousie has made efforts

to revitalize campus green spaces and make them more attractive for students (Dalhousie University, n.d.). While these planned revitalizations have not always materialized, this research could assist in demonstrating the student body's desire for improved green spaces.

Improvements to a university's campus can also influence enrollment and the desirability of Dalhousie as an institution. It has been established that the campus can greatly impact a student's choice of university (Speake et al., 2013). By following the measures outlined in our report, Dalhousie may improve the desirability of the school.

The results of this research could also prove useful to students working in the faculties of planning or architecture and may be used for future planning and architecture projects regarding Dalhousie's Studley campus. Student societies advocating for greater campus sustainability may also take an interest in this research, as it has applications to improving sustainability from a social and environmental perspective.

Limitations

Potential for bias in the results exists. It can be reasonably assumed that students who feel the most strongly about campus green spaces are the most likely to answer a survey concerning the topic. This may have resulted in skewed results and a disproportionate percentage of students who are dissatisfied with green spaces or perceive greater barriers to usage than the average student.

An additional limitation of the research is the relatively short period allotted for data collection. Data collection only took place over 1.5 weeks. Had more time been allowed for data collection, more respondents would likely have been gathered. More time would have also allowed us to further refine our questionnaire to ensure the data collected is most relevant to the research objectives.

Another possible limitation would be ongoing uncertainty and misunderstanding surrounding the true meaning of "green space," which although defined in the survey may have not been fully understood or remembered throughout taking the survey.

The fast-paced nature of the research, coupled with a lack of commitment from the wider student body, meant we fell well short of our target sample size. Of our respondents, only 1

(1.3%) was a graduate-level student, and only 6 (8.6%) lived on the campus full-time. Improving engagement and attracting a greater diversity of students should be a key consideration in future research of this nature.

Suggestions for Future Research

Because such a large portion of respondents indicated weather as a perceived barrier to green space usage, future research is required to better understand how this problem can be addressed from a planning perspective. While perceived barriers such as seating and shade can be addressed via tangible measures, weather may require more intricate solutions. Additional research should be considered to address the best types of seating for Studley campus green spaces, as well as the most viable types of shade coverage. This may include an analysis of the best types of native trees suitable for green spaces.

Any large-scale changes in green space infrastructure come with an associated cost. Before any changes are implemented on the Dalhousie campus, further research should be done to determine the feasibility and costs of changes. This should address factors such as material costs, labour costs, as well as the long-term viability of plants and wildlife.

Conclusion

This study aims to gain an enhanced understanding of undergraduate and graduate students' perceptions of and relationship to Dalhousie's Studley campus' green spaces. With a deeper understanding of student perceptions and relationships to on-campus green spaces, recommendations can be made to increase the use and enjoyment of green spaces that can benefit the welfare of undergraduate and graduate students on Dalhousie's Studley campus.

Our study found that the green spaces on Studley campus are primarily used for socialization by undergraduate and graduate students, with 52% of our survey respondents indicating that they most commonly interact with the quad as a typical green space for socializing. The majority of respondents indicated that they 'agree' that green spaces on Dalhousie's Studley campus contribute to and benefit their well-being. It was also found that our survey respondents agreed that Studley campus green spaces are convenient and accessible to students, however, most respondents disagreed with the statement that the green spaces have appropriate measures for leisure such as the use of benches, picnic tables, and chairs. Similarly,

most survey respondents stated that the largest barrier to the utilization of these spaces is the lack of seating options present on campus green spaces.

Our findings allow us to understand what changes are necessary for the increased use of green spaces and their increased benefit to student well-being such as increased benches, picnic tables, and chairs, community gardens, and increased urban biodiversity.

Acknowledgments

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Appendix 1

Survey Question:

1. Are you currently an undergraduate or graduate student at Dalhousie University?
   - Undergraduate
   - Graduate
2. Do you currently live in Dalhousie residence or off campus?
   - Residence
   - Off-Campus
3. In the past year, I have used Dalhousie 'green spaces' (*Green spaces are defined as: accessible spaces on campus with natural grass, trees, plants, and vegetation that can be used as spaces meant for socialization, study, exercise, and/or leisure*) on Studley campus for the following activities:
   - Socializing
   - Studying
   - Exercising
   - Leisure
   - I have not used green spaces at all
4. Where on campus do you interact with green space(s) the most currently? Please indicate a grid space. (Example. 7, B) [See Figure 3 for accompanying photo.]
5. Indicate your agreement with the following statement: Green spaces on Dalhousie's Studley campus contribute to and benefit my personal well-being.
   - Strongly Disagree → Strongly Agree
6. Indicate your agreement with the following statement: Green spaces on Dalhousie University's Studley campus are convenient and accessible to students.
   - Strongly Disagree → Strongly Agree
7. Indicate your agreement with the following statement: Appropriate measures are provided for leisure such as the use of benches, picnic tables, and chairs on green spaces located on Dalhousie's Studley campus.
   - Strongly Disagree → Strongly Agree

8. Which photos depict a green space on campus? [Accompanying photo consists of four images of Dalhousie spaces, not all green spaces.]
9. What barriers, if any, currently prevent you from using green spaces on campus? (in 2-3 sentences)
10. What changes would encourage you to spend more time in campus green spaces? (in 2-3

Appendix 2