UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Digitizing Campus Tree and Shrub Social Value Maps

Marley Lightfoot, Tori Lin

University of British Columbia

VOL 500

Themes: Biodiversity, Land, Climate, Community

Date: Aug 31, 2020

DIGITIZING CAMPUS TREE AND SHRUB SOCIAL VALUE MAPPING

UBC SEEDS PROGRAM

MARLEY LIGHTFOOT & TORI (YACHEN) LIN

SEPTEMBER 2020

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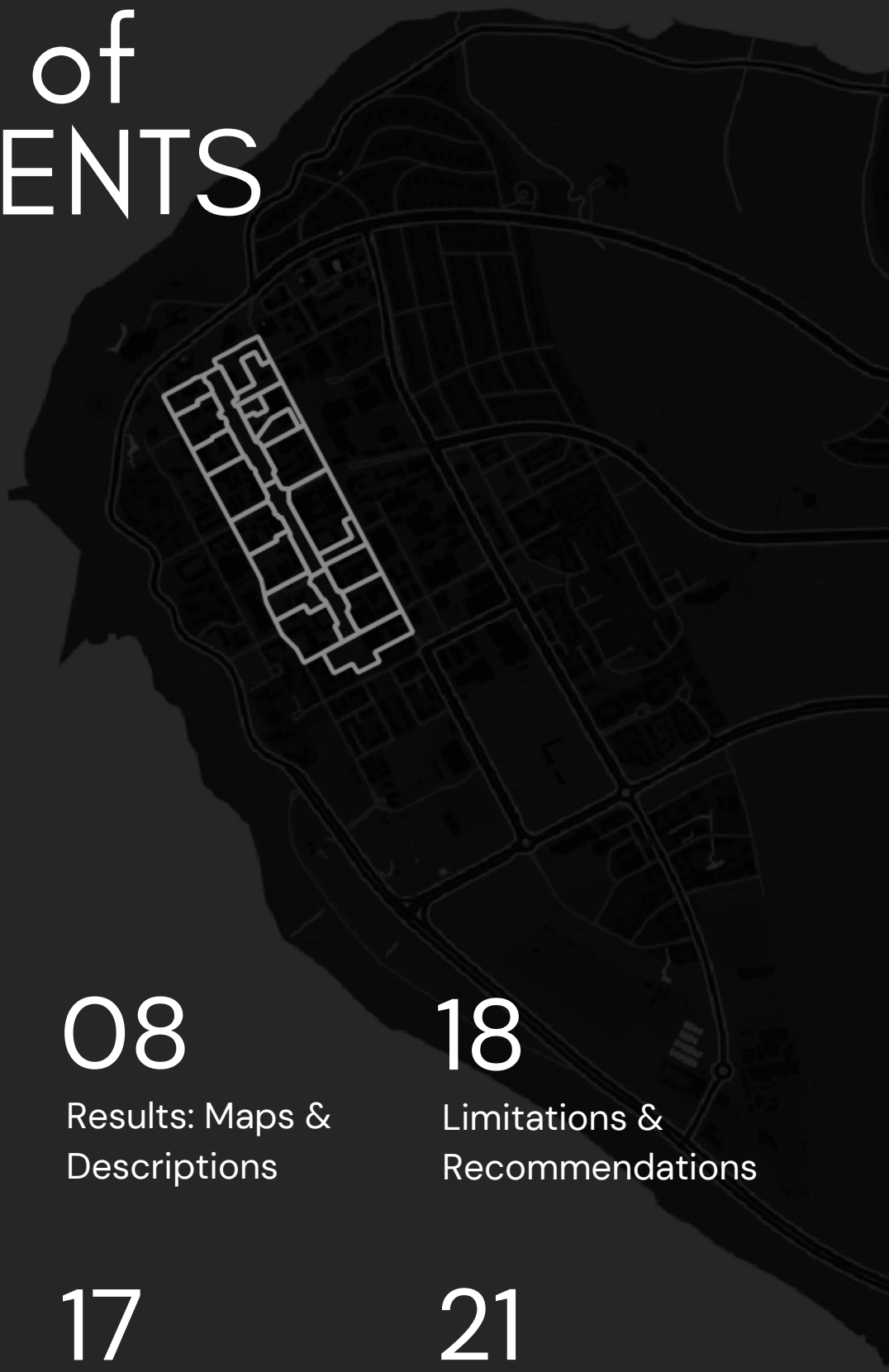


ACKNOWLEDGEMENT

We acknowledge that our study area is an imposition on the ancestral, traditional, and unceded territories of the Musqueam People.

We would like to thank those whose contributions and consultation made this study possible.

UBC SEEDS SUSTAINABILITY PROGRAM

1. Dr. Tahia Devisscher : Banting Research & Teaching Fellow, Department of Forest Resources Management, Centre for Interactive Research on Sustainability
2. Emma Luker: Planning Analyst, UBC's Campus + Community Planning Department
3. Laura Maria Arango: Applied Research Coordinator, UBC SEEDS Sustainability Program

EXECUTIVE SUMMARY

In partnership with UBC Campus + Community Planning, the main purpose of this project is to continue to update UBC Vancouver Campus' tree inventory. In addition to assessing biophysical tree data, spatial data of social values linked to green spaces was collected by students in Phase 1A. The long-term objective is to prepare the data across the whole campus. This project serves as a pedagogical pilot step. Once this data is collected through all of UBC, planners can better understand how people are valuing spaces and what features are more (or less) valued than others. Phase 1A has been completed, and the current priority is assessing what the data formatting steps are to achieve a fully integrated and holistic perspective of UBC's green spaces. The process of this project consisted of gathering the data that was collected by students in 2019 and 2020, and digitizing it. The results of this mapping showed which areas rated highest across the board, and which areas are the most uner-valued on campus. The highest rated areas were the Buchanan complex, the Koerner Library, and the Faculty of Forestry area. The lowest valued areas were the areas around the Irving K. Barber Learning Centre, and around the Sauder School of Business. Once all the data was processed, we created a protocol to be applied to the following phases of the project to help facilitate data integration. This includes spreadsheets with instructions that students will use to fill out data. In addition, we provided recommendations to address the three major limitations: data inconsistency, missing data, and subjectivity. The next phase of this project continues in the next academic year, using the protocol and recommendations listed in this report.

ABOUT US

MARLEY LIGHTFOOT

As a recent UBC graduate from the Urban Forestry program, Marley is continuing her education by building on her passion for GIS and data visualization. She will be pursuing a Masters of GIS from Ulster University beginning in September. Outside of school you can find her walking her dog Theodore in the Burnaby parks, sketching plants, or trying to learn to code.

YACHEN LIN

Yachen is currently a master student of community and regional planning at UBC. She has earned a master degree in urban design from University of Hong Kong. Interested in green space, she plans to explore how to use big data to help analyze urban green space, and to understand how people use different kinds of public green space in cities.

PROJECT BACKGROUND

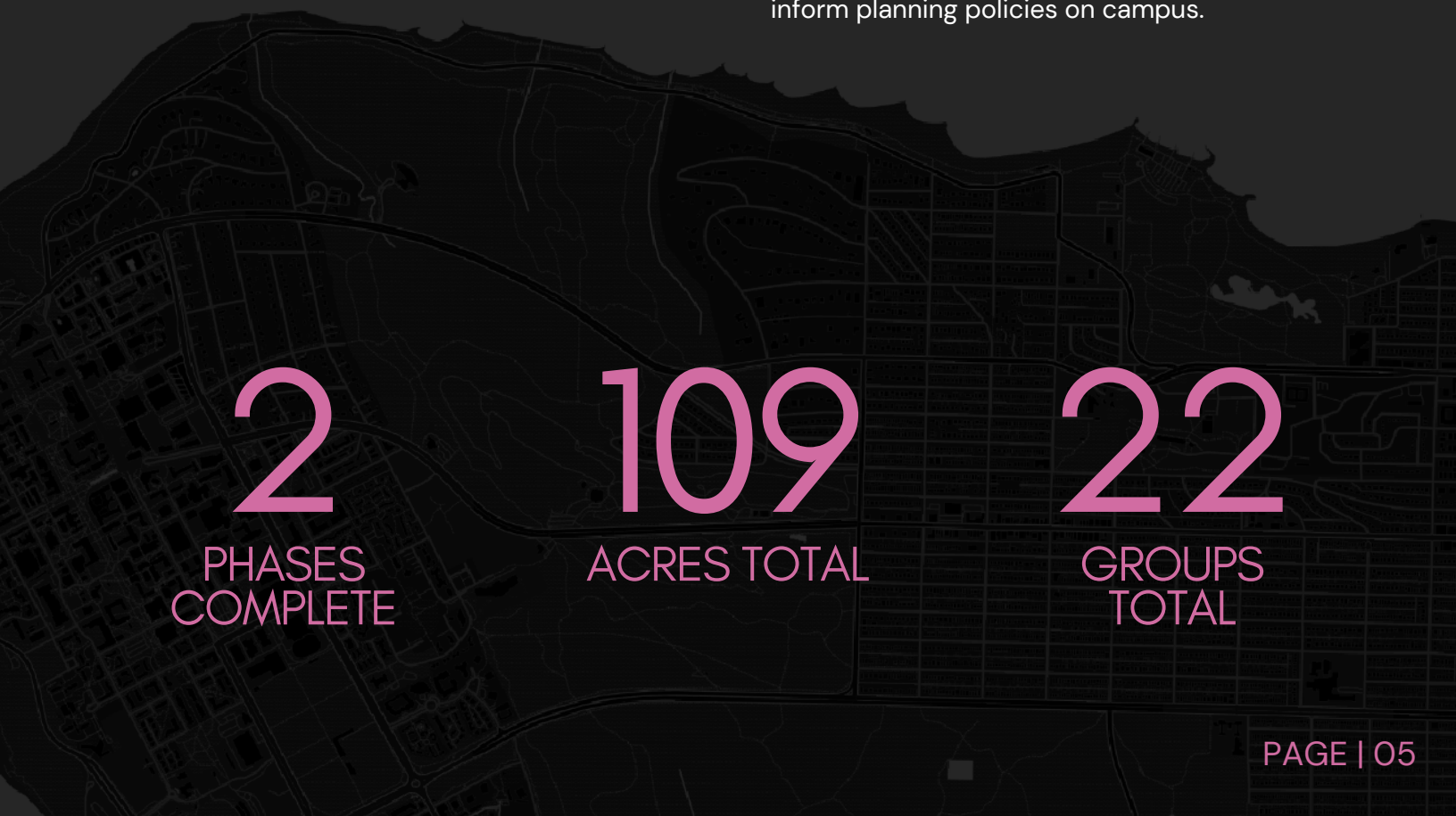
Introduction

This project aims to continue to add to UBC Vancouver Campus' tree inventory database in collaboration with different stakeholders. There are several stakeholders involved in this project, which include:

- UBC Campus & Community Planning (UBC C&CP)
- UBC Information Technology
- UBC Botanical Garden
- UBC SEEDS Program

Our work is one piece of a multi-faceted project that combines urban tree inventory with ecosystem service assessment, specifically social value mapping. Students from Urban Forest Inventory and Assessment (UFOR 101) assessed sites based on 6 social values, and submitted a report based on these findings at the end of the term. This project Uses the data that students created to map the social values, and create recommendations for future data collection and methodology.

This work contributes to a larger project that aims to discover the value of UBC Vancouver's urban forest and discuss how social values can inform planning policies on campus.



2
PHASES COMPLETE

109
ACRES TOTAL

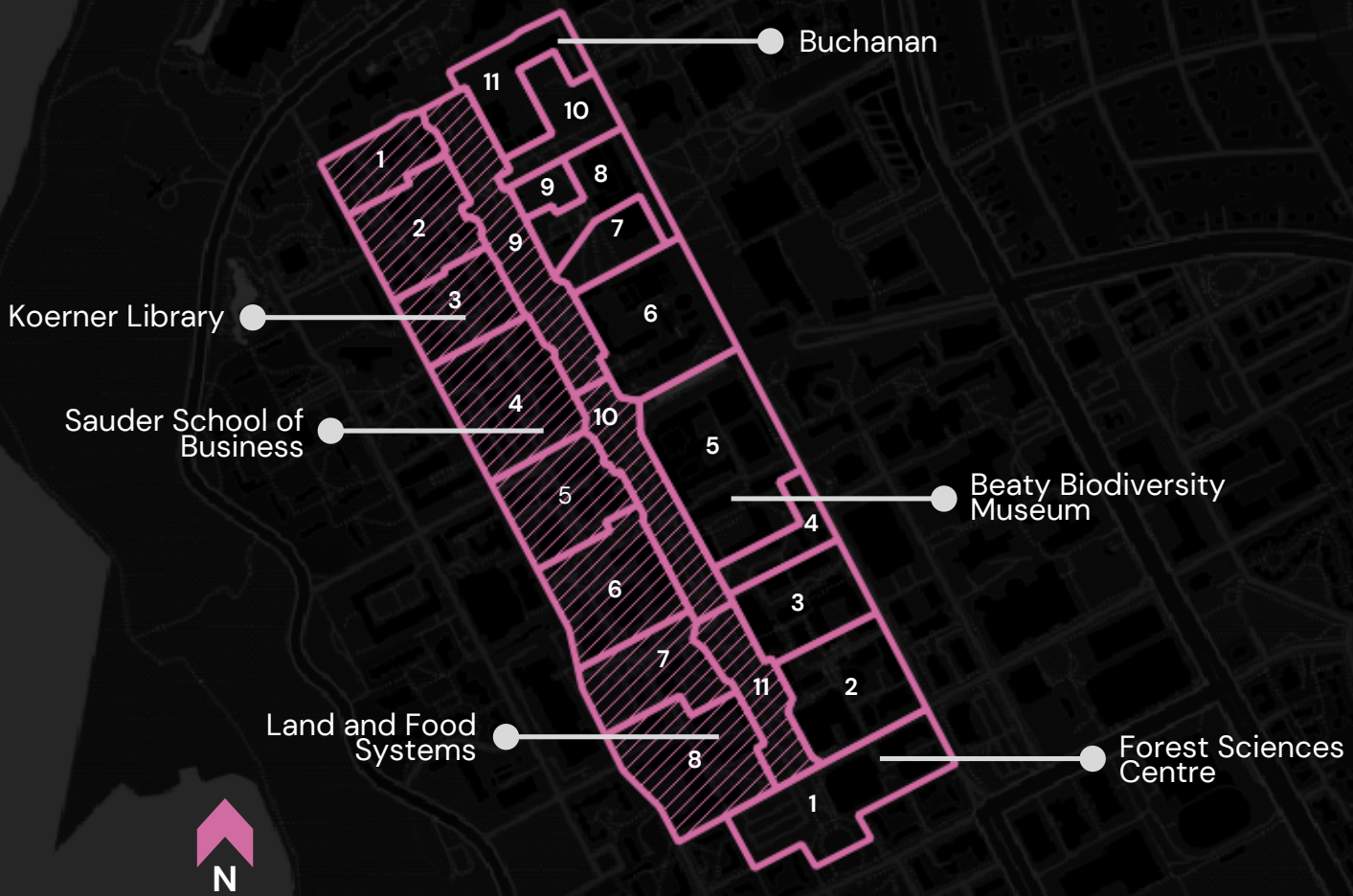
22
GROUPS TOTAL

Project Objectives

- The social value map data currently exists in a segmented format that needs to be evaluated in order to understand the next steps for digitization and integration into the existing tree and shrub inventory dataset and i-Tree Eco data (ecosystem services)
- The priority of this project is to understand what needs to be done to digitize existing social value data, and create a system to streamline future value data collection
- The integration of the biophysical and social data will allow a more comprehensive understanding of the true value of UBC Vancouver's urban forest
- This information will ensure consistency in the data uniformity and accuracy, as well as add legitimacy to the overall tree inventory data collection methodology

Advancing Societal Issues

- Provide recommendations for socio-cultural data collection related to UBC's urban forest and engagement processes based on findings
- To inform and strengthen urban forest and urban forest biodiversity policy and planning work, the CAP 2030 and Campus Vision 2050
- Provide recommendation to the way in which UFOR 101 students collect data so that digitalization can become easier



PROJECT PROCESS

Choosing Values

To determine the social values to be evaluated, students were asked to submit the value(s) that came to their mind in a classroom activity. These words were collected in a word cloud, and the top five/six were used for that year. This activity was done once in each phase, so the values differ slightly between 2019-2020.

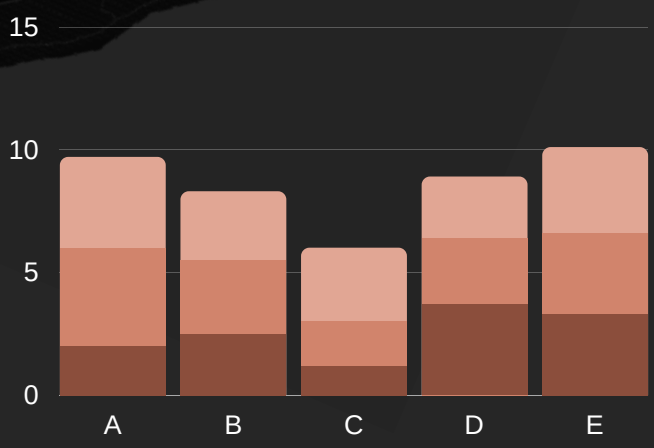
Diversity/Species Richness
Aesthetics
Social Cohesion
Wilderness/Nature
Cultural Significance

Species Diversity
Aesthetics
Community Sharing
Recreation
Serenity/Safety/Refuge
Cultural/Historical Significance

Some of these values are similar enough to be grouped together; for example, social cohesion (2019) and community sharing (2020) were mapped together because they represent similar values. Others were dissimilar, so they were mapped individually such as recreation (2020).

Data Interpretation

At the end of term, students submitted a final report of their findings in their sites. Students were required to submit information about ecosystem services, gathered using iTree and physical observations. Students were not required to submit data on social values, so the submissions had different ways of representing that data. The following is an example (Group 10, 2020):



Using these diagrams and charts, we collected the values and input them into spreadsheets. Once we had all of the values collected, the data was formatted and edited to be converted into shapefiles. Some submissions did not include information on social values, so these zones are displayed as “missing values” in the maps.

Once the data was converted into shapefiles, it was classified to display the range of values. Finally, colors were chosen for readability.

CARTOGRAPHY

Once the data was converted into shapefiles, it was classified to display the range of values. Finally, colours were chosen for readability. For each dimension, there is a different colour theme and a distinctive colour theme for the average of all the different aspects.

RESULTS

In this section, we will display the results from our data collection, in addition to short summaries and rationale behind color choices.

Each colour theme is split into 50 classes, with an interval of 0.1 for each class. The darker colours represent the higher scores, and the lighter represent the lower scores. Dashed areas are zones or subzones with no valid data. Because the current completed study area is small, using 50 classes is doable. However, once the study area expands to include more of UBC, classes will be reduced to 5-10 for legibility, and to make the information easier to digest. For this report, we used 50 classes to better display the information.

There are 8 maps total: 7 value maps, and one summary map with the averages of all values summarized to display the highest-valued areas of the students.

WILDERNESS

SERENITY

CULTURE

DIVERSITY

AESTHETICS

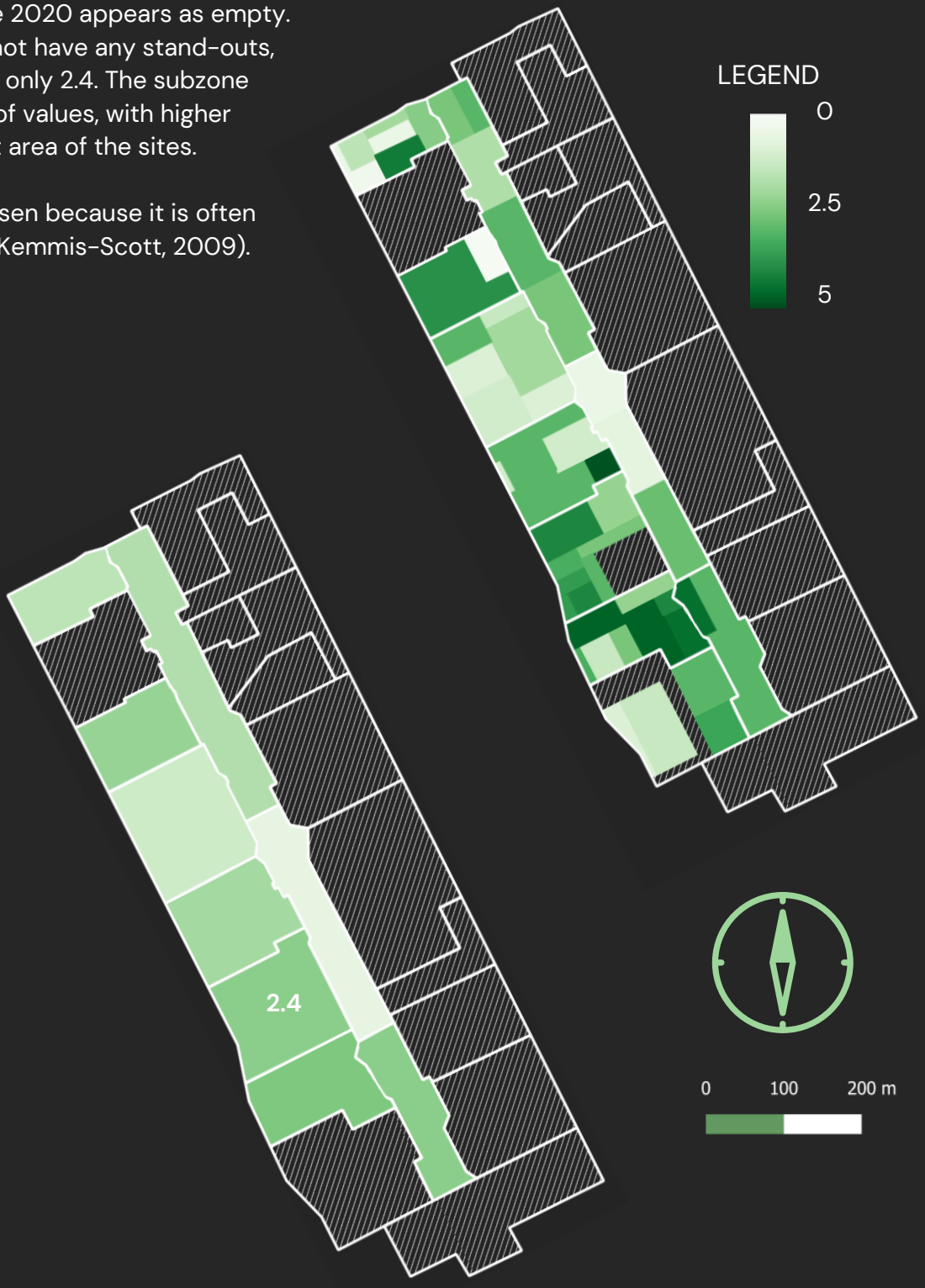
RECREATION

COMMUNITY

WILDERNESS/NATURE

The Wilderness/Nature value was only evaluated in 2019. For this reason, the 2020 appears as empty. The zone average does not have any stand-outs, with the highest value at only 2.4. The subzone map displays the range of values, with higher values in the south-west area of the sites.

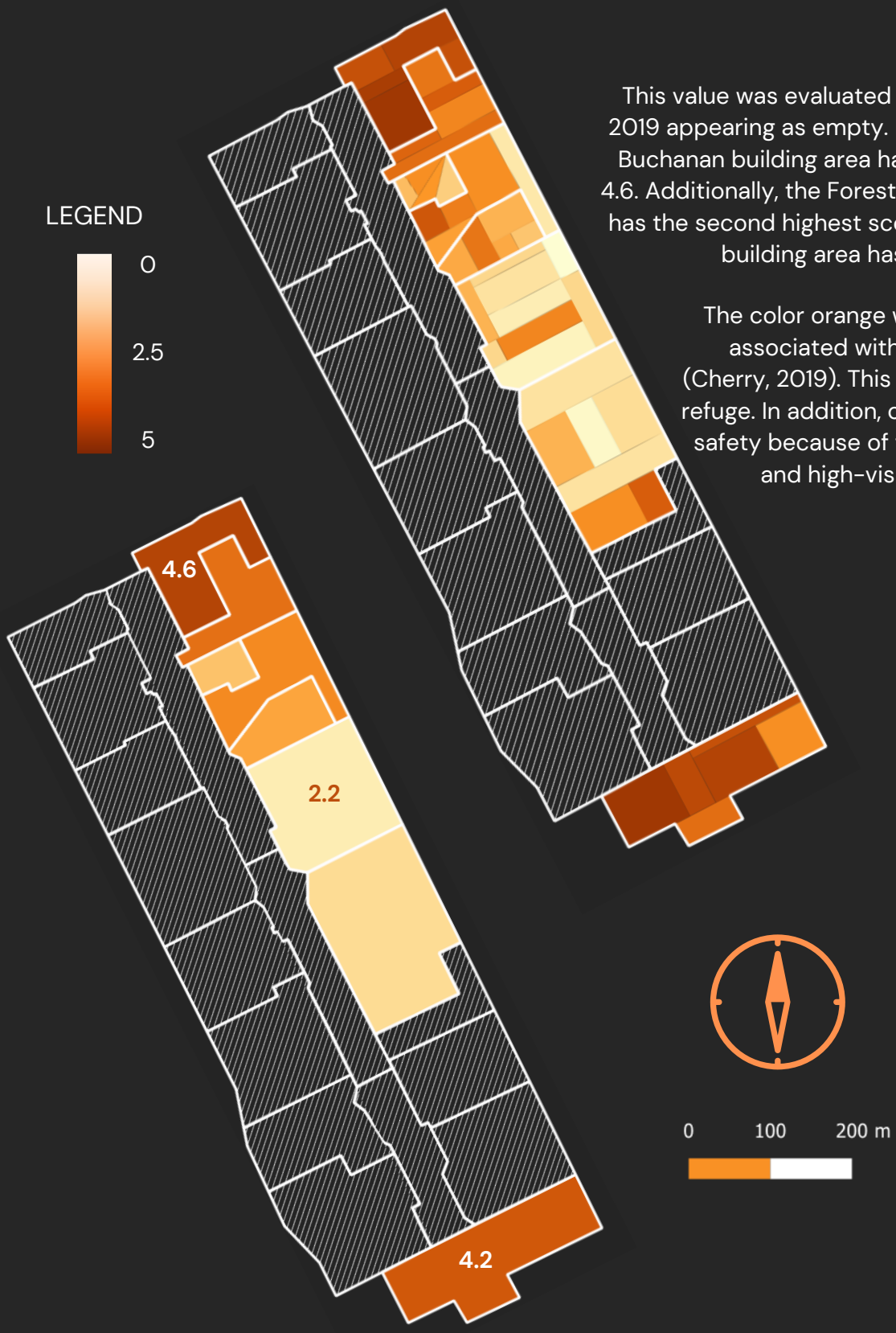
The color green was chosen because it is often associated with nature (Kemmis-Scott, 2009).



SERENITY/SAFETY/ REFUGE

This value was evaluated in 2020 only, resulting in 2019 appearing as empty. In the zone averages, the Buchanan building area has the highest average at 4.6. Additionally, the Forestry building amphitheater has the second highest score at 4.2 The chemistry building area has the lowest rating of 2.2.

The color orange was chosen because it is associated with positivity and calmness (Cherry, 2019). This relates it to serenity and refuge. In addition, orange is associated with safety because of the color of traffic cones and high-vis vests that keep outdoor workers safe.



HISTORICAL SIGNIFICANCE / CULTURE

The values differ slightly here - in 2019 'Cultural Significance' was evaluated, then in 2020 'Cultural/Historical Significance' was evaluated. These values were similar enough to be mapped together. The highest value in the zone average map is the Buchanan complex with a value of 4.0. The chemistry building area has the lowest at 0.9.

Purple was chosen because it is associated with royalty and historically wealthy families (Bourn, 2011).

DIVERSITY/ SPECIES RICHNESS

This value was evaluated as 'Diversity/Species Richness' in 2019, and as 'Species Diversity' in 2020. The zone average rates fairly even across the board, with the chemistry building area rating the highest at 3.8. The lowest for zone is Main Mall, coming in at 1.8.

Red was chosen to represent diversity because it is the most internationally loved color (Morton, 1995). It is significant in Indian, Asian, African, and Native-American cultures as a sign of good luck (Morton, 1995). Because the cultures are diverse, red was chosen to represent species diversity.

DIVERSITY

AESTHETICS

Aesthetics were evaluated in both 2019 and 2020. In the zone average map, aesthetic sis the only value that has a full rating of 5. This zone is home to the Koerner Library and Geography building complex.

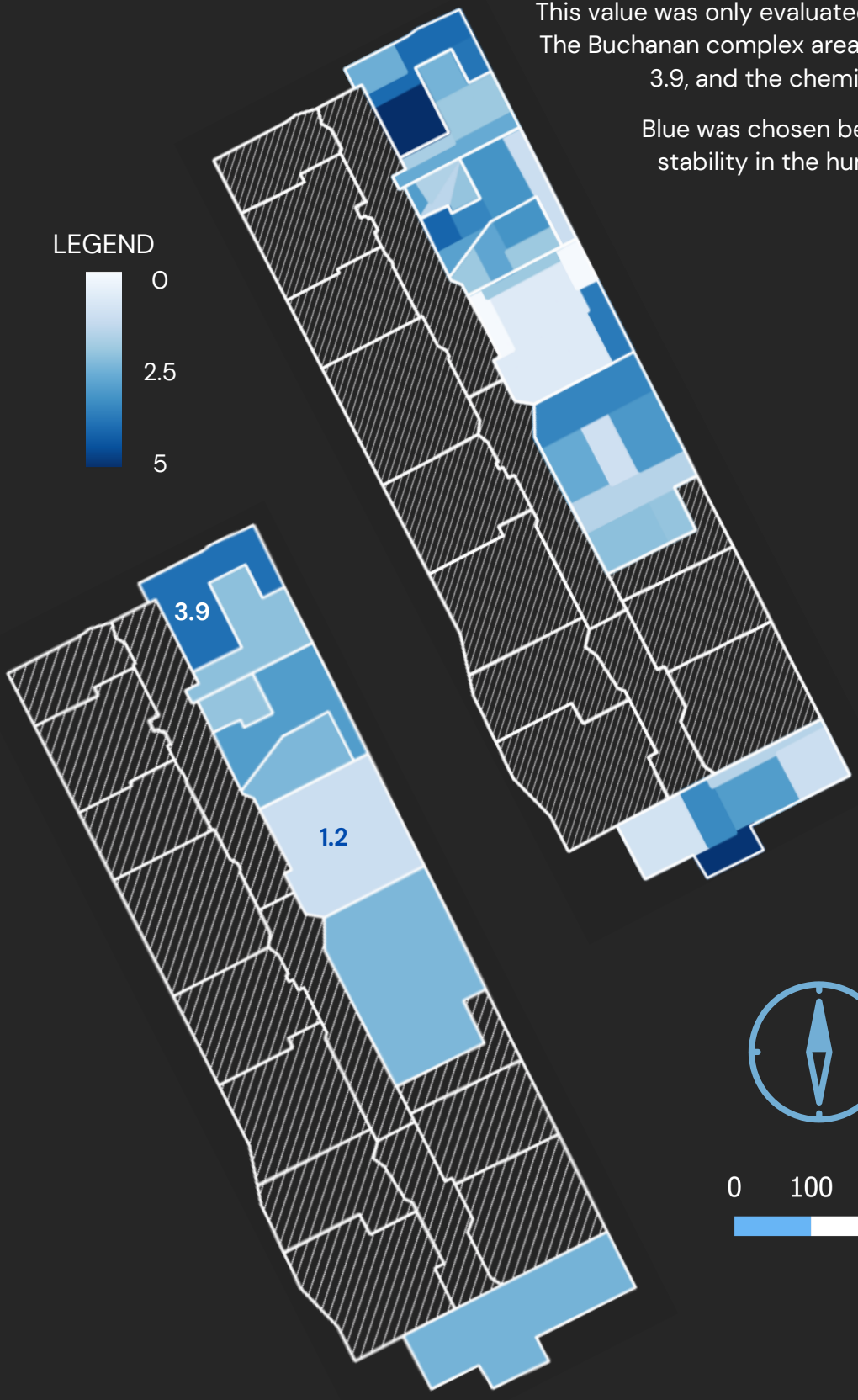
Interestingly, the zone that rates the lowest in this value is directly adjacent to the highest rating zone, with the average rating of 1.9 – the Henry Angus building.

The color pink was chosen because of its association with affection, love, and beauty (Bourn, 2010).

RECREATION

This value was only evaluated in 2020 as 'Recreation/Activity'. The Buchanan complex area has the highest average rating of 3.9, and the chemistry building has the lowest at 1.2.

Blue was chosen because it represents strength and stability in the human body (Kemmis-Scott, 2009).

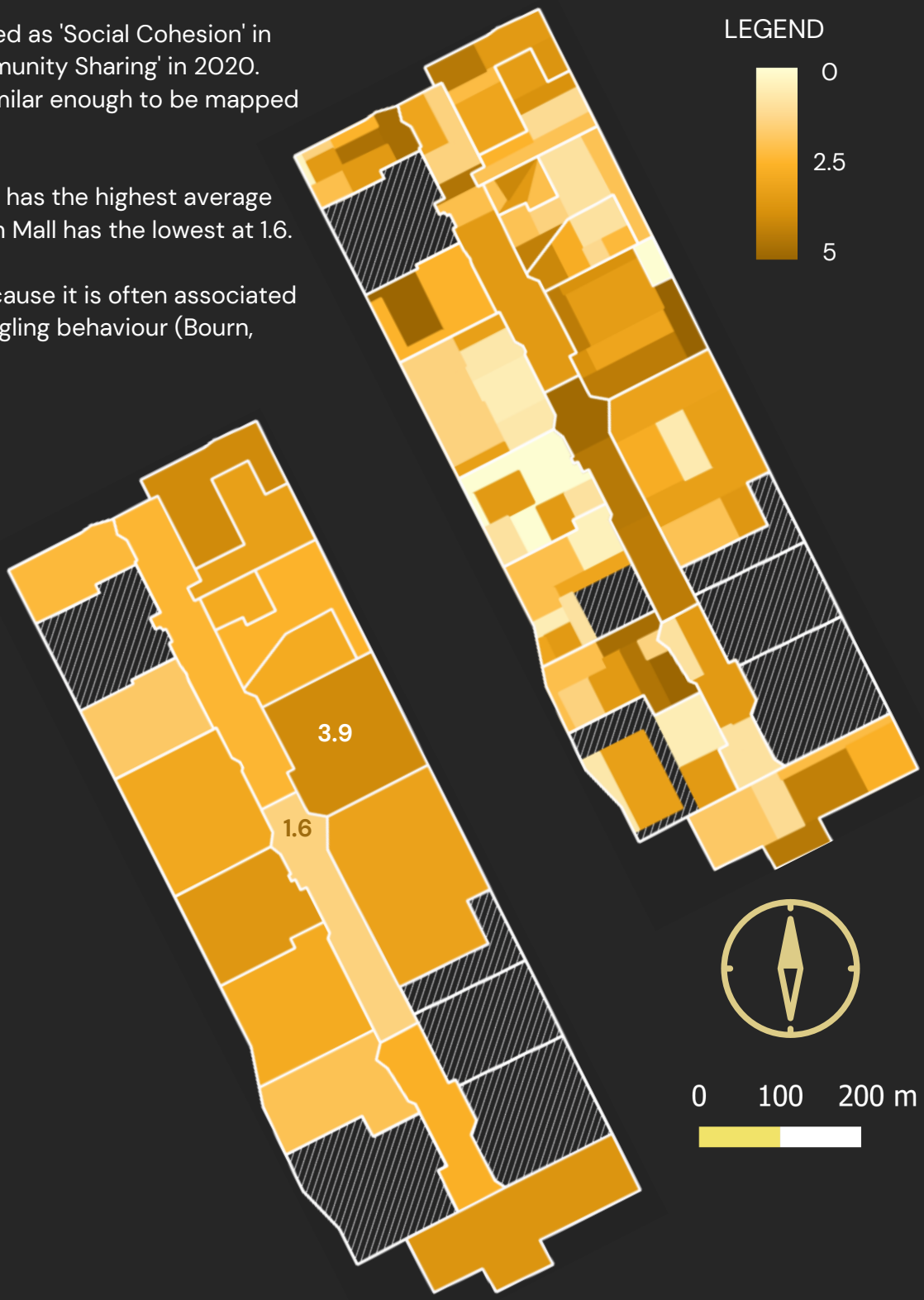


SOCIAL COHESION/ COMMUNITY SHARING

This value was evaluated as 'Social Cohesion' in 2019, and 'Social/Community Sharing' in 2020. These were seen as similar enough to be mapped together.

The chemistry building has the highest average rating of 3.9, while Main Mall has the lowest at 1.6.

Yellow was chosen because it is often associated with positivity and mingling behaviour (Bourn, 2011).

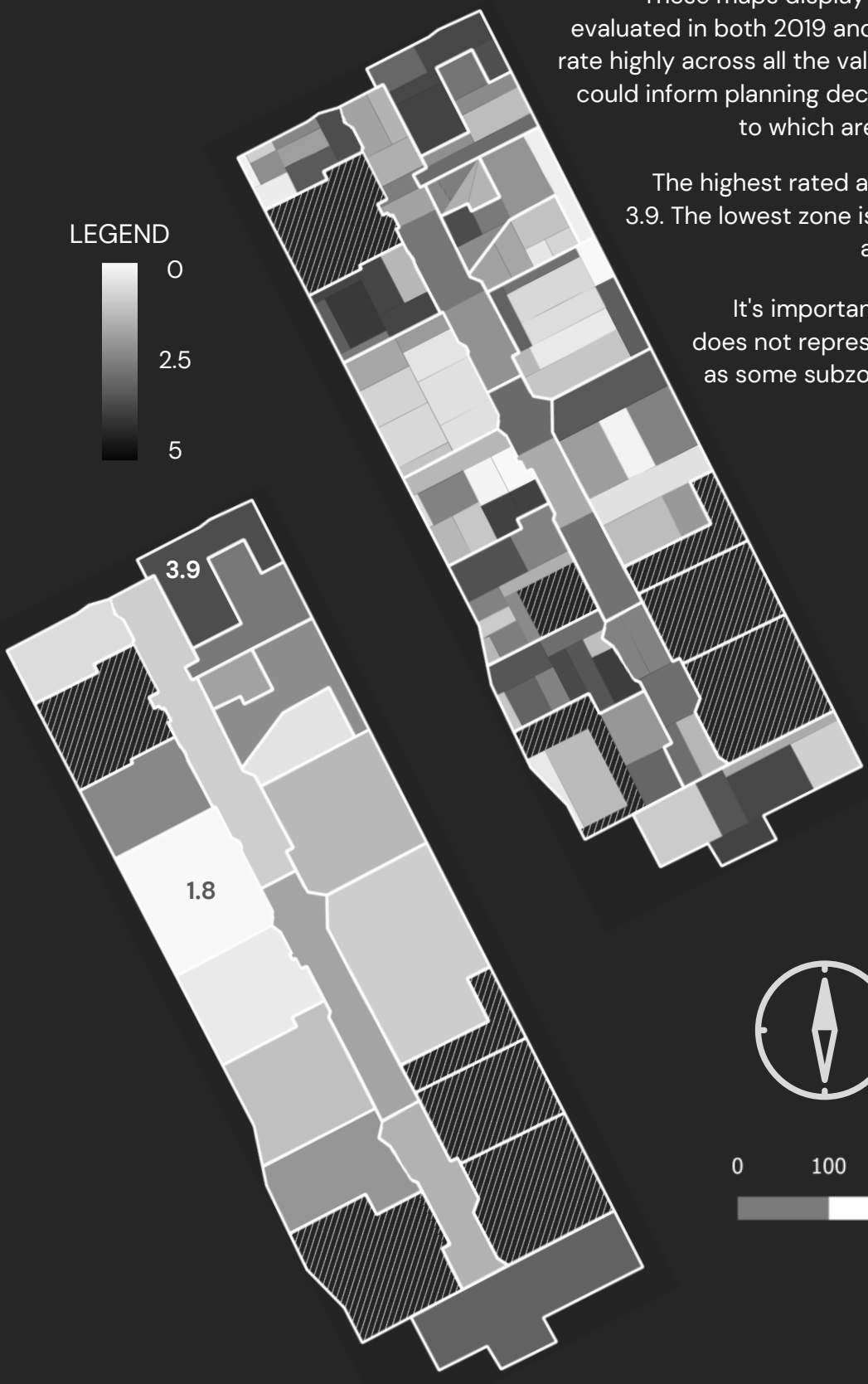


OVERALL AVERAGE

These maps display the overall average of all values evaluated in both 2019 and 2020. This shows which zones rate highly across all the values, and which rate lowest. This could inform planning decisions by providing guidance as to which areas are valued less by students.

The highest rated area is the Buchanan complex at 3.9. The lowest zone is the Sauder School of Business area with an overall rating of 1.8.

It's important to note that the zone average does not represent the value of the entire area, as some subzones are rated very high, but the average brings them down.



PROTOCOL

To develop future projects or research based on this dataset, this project comes up with the following protocol for data collection and visualization.

There can be two ways to group students conducting data collection. In the current practice, each group of students assessed the social value of one zone for all of the dimensions. This project suggests there could be an alternative way of data collection, which is to assign one group of students to evaluate only one dimension in social value (such as aesthetics) across the whole campus or several zones. This way may provide students with a more complete picture of the whole area and enable them to compare between different zones and give fairer scores. This project provides data collection forms for both of the grouping options for the researcher to use and compare. Please refer to Appendix A.

There is also a summary table for the mapping process. This table gathers all the data recorded in the data collection tables and calculates the average values. The summary table can be linked to a shapefile for ArcGIS, QGIS or other cartography software. For now, the tables integrate the dimensions mentioned in the previous two phases of the project, which may be further finalized for future use.

The comment column is for the students or the person conducting data collection to leave important insights about an area and to record the qualitative data of social value. The column has an upper limit of 50 characters or less but can be changed based on the need of the user.

This project also provides instruction for data collection and visualization in the future. As the group may take a long time to complete in multiple phases, a standardized process may be helpful in order to keep the data work in one system for analysis and comparison. Appendix B is the instruction and may be altered accordingly to the actual conduct of the project.

LIMITATIONS & RECOMMENDATIONS

This section outlines the biggest limitations when approaching this project, as well as recommendations to explore in the next phase of the project. These recommendations could be applied to larger plans for the project such as policy planning, o to smaller steps in the project, such as next semester.

1. DATA INCONSISTENCY

Although there were specific ways for students to collect and submit ecosystem services data they collected, there were no specifics related to the value data collected. Submissions ranged from bar graphs, 3D graphs, highlighted areas on maps, and hand-drawn indicators to no data submitted at all. This was a challenge when collecting data for mapping, and resulted in some areas displaying as 'no data' due to lack of usable information.

Some students did submit the raw data in tables, however it differed between the groups. The areas that differed were in the table titles, and general formatting of the documents. This took some time to evaluate and put into formatted tables that GIS software would recognize.

RECOMMENDATION

A good way to address this is to have students submit the raw data collected in a table, rather than representation of the data (ie. bar graphs). This is outlined in the protocol, where students fill out a standardized graph to help with the consistency of the data. Having the data submitted in spreadsheets would also facilitate translating the data to maps in an easier way.

2. MISSING INFORMATION

Missing data is the most difficult to rectify. In the cases where data was submitted in different formats, it could be worked through and figured out with time. Working with no data from the beginning goes right to the 'no data' category. It's also worth noting that the students may choose to not do parts of assignments, which means it can be hard to avoid.

RECOMMENDATION

There is little to be done when students do not submit any data, however making the value-data a core part of the report in addition to the ecosystem services data could create incentive for students to collect the data in full.

3. EMBRACING SUBJECTIVITY

Subjectivity is usually unwelcome in data science, and in this project, subjectivity is everywhere. The subjectivity begins at the beginning of the semester when students choose what they feel are the most important values. Then, the students evaluate the sites based on how they feel in the space. This makes it difficult to have standardized maps if the values change year to year. This is a challenge, but also it's what makes this project unique. Societal values change all the time, reflected in the differing values among the students. This is a challenge to map, however it's important to embrace subjectivity as it represents a large part of how we behave as humans.

RECOMMENDATION

There is a fine line between making the data more consistent, and reducing subjectivity. One thing that might help is to use the same values each year, and have the changes reflected in the students' evaluations. In addition, increasing the sample size would help reduce the extreme values to get a more accurate rating for each zone.

4. OTHER RECOMMENDATIONS

In addition to the limitations realized in the process of this project, we have a couple thoughts/things to consider while moving forward into the next phases: selecting software, and the method of assessment.

SELECTING SOFTWARE

There are several GIS programs readily available for use nowadays. For this project, we suggest using ArcGIS or QGIS to achieve the desired results. ArcGIS has more robust analysis capabilities, while QGIS is more beginner-friendly.

Another aspect to consider is accessibility. ArcGIS requires the use of school computers, while QGIS is free to download and works on basic laptops. If students will be expected to generate maps in the future, it would be beneficial to select a software and have a basic lab exercise to provide students with some knowledge.

METHOD OF ASSESSMENT

To collect this data, a group of students were assigned to one zone and its subzones. The students then collected data for each of the 5-6 values. So, at the end, the group of students have looked at their site and collected a list of values. The limitation with this procedure is that the group is not seeing other sites/areas of the campus, so their decisions may be limited.

An alternative way to approach this is to assign one value to each group (ex, aesthetics), and have the students evaluate each zone and subzone. At the end of term, the students would have a list of zones with the associated value rating (aesthetics in this case). This gives the students a more holistic view of the zones, and could result in more accurate assessments once the students have seen the zones that are the lowest or highest in that values.

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APPENDIX A: TABLES

OPTION 1: EACH GROUP EVALUATE ALL DIMENSIONS IN ONE ZONE

Group 1 (Zone 1)								
Group Member								
	Species Diversity	**Aesthetics**	**Social Cohesion/ Community Sharing**	**Wilderness / Nature**	**Cultural / Historical Significance**	**Recreation**	**Serenity / Safety / Refuge**	**Comment (less than 50 characters)**
Final Score (Average)	(Automatic Calculation)							
Subzone 1A								
Subzone 1B								
Subzone 1C								
Subzone 1D								
Subzone 1E								
...								

OPTION 2: ONE GROUP EVALUATE ONE DIMENSION FOR ALL ZONES

Group 1 (Species Diversity)								
Group Member								
	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**	**Zone 7**	**Zone 8**
Comment (<50 Characters)								
Final Score (Average)	(Automatic Calculation)							
Subzone A								
Subzone B								
Subzone C								
Subzone D								
...								

SUMMARY TABLE: ZONES (FOR SOFTWARE)

	Species_Diversity	Aesthetics	Social_Cohesion_Community_Sharing	Wilderness_Nature	Cultural_Historical_Significance	Recreation	Serenity_Safety_Refuge	Average	Comment
Zone_1									
Zone_2									
Zone_3									
Zone_4									
Zone_5									
Zone_6									
...									

SUMMARY TABLE: SUBZONES (FOR SOFTWARE)

	Species_Diversity	Aesthetics	Social_Cohesion_Community_Sharing	Wilderness_Nature	Cultural_Historical_Significance	Recreation	Serenity_Safety_Refuge	Average	Comment
Zone_1A									
Zone_1B									
Zone_1C									
Zone_2A									
Zone_2B									
Zone_2C									
...									

APPENDIX B: INSTRUCTIONS

Data Collection Option 1: Group Evaluates One Zone

1. Please have the table with you when you are doing the fieldwork. (either printed out or on your mobile device in an editable mode)
2. Please do not change the format or the layout of the table.
3. Visit each of the areas on the table and assign a score to each of the dimensions. 0 being the lowest score, and five being the highest.
4. Please keep the score to one decimal point. Please leave the top row of "Final Score (Average)" blank for now.
5. Please record any comments you have for any of the areas.Please take pictures of the subzones to help support the result of the score.
6. Please name the pictures with the area name (e.g. subzone1A_1 if you have multiple pictures or subzone1A if you only have one picture)
7. After completing the fieldwork, please enter all the scores into excel. The top row should calculate itself.
8. Please enter the comments into the comment column. The final comment in each cell should be less than 50 characters.Please submit the excel table in xls. or xlsx. form, more details will be provided by the instructor

Instructions for Data Visualization

1. Copy data from the excel tables for each zone to the summary tables. There are two summary tables, one for each zone, and one for each subzone
2. Please make sure the zone_ID/subzone_ID matches the way the shapefile names each area
3. Join the table to the corresponding shapefile
4. Adjust the symbology as desired