

Community-Based Design for Urban Nature in Copenhagen

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i. Abstract

The city of Copenhagen has emphasized a strong desire to increase the number of urban nature projects throughout the city, preventing the effects of urban sprawl. Organizations like Growing Pathways support urban nature projects utilizing community involvement throughout Copenhagen due to the various health and environmental benefits. Our goal was to develop an engaging greenspace design for Growing Pathways and the Øresundskollegiet dormitory using community input. Through interviewing experts and stakeholders, surveying dormitory residents, and conducting a design probe, we investigated effective greenspace design. Our team was able to design a 3D model of a greenspace adjacent to blocks J, K, and L of the dormitory complex, with the hopes that they can implement it in the future.

ii. Acknowledgements

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iii. Executive Summary

This document is the written report of Worcester Polytechnic Institute's (WPI) Growing Pathways' Interactive Qualifying Project (IQP) team with collaboration from the Growing Pathways organization of Copenhagen, Denmark. The sponsor organization, Growing Pathways, conducts different nature-based sustainability experiments and initiatives around Copenhagen. The area of focus within the Øresunds region is the Øresundskollegiet dormitory. This dorm is a residential facility for university students in Copenhagen, independently owned and operated (O. Koefoed, personal communication, 2021). Residents of Øresundskollegiet have worked with Growing Pathways to assess the existing plots of land in the neighborhood which have the potential to be developed into community greenspaces. Currently, these plots of land are hidden areas between buildings and are not very accessible to the community.

The city of Copenhagen is working to obtain at least 300 urban nature projects by 2025 (SLA Architects, 2016). The desire for these initiatives stems from Copenhagen's desire to combat climate change as well as give the community areas where they can connect with nature. Nature based solutions for climate adaptation projects or sustainability initiatives also provides individuals with certain health benefits. A study conducted in 2019 concluded that people who spend two hours a week in green spaces were found to report good health and psychological well-being when compared to those who do not (Robbins, 2020).

Our goal was to develop an engaging greenspace design for Growing Pathways and the Øresundskollegiet dormitory using community input. We were able to investigate successful urban nature initiatives by creating a four-step plan:

1. Investigate features of a successful greenspace through interviews with urban nature experts, knowledgeable sources, and district council members in Copenhagen.
2. Utilize a community-driven approach to survey the community and develop a preliminary model of our greenspace design.
3. Conduct a design probe with community members interested in sustainable urban greenspace development, who will propose designs of their ideal greenspace.
4. Create a visual prototype of a sustainable urban greenspace design, based on all previous results, that Growing Pathways could help develop.

Our interviews conducted at the beginning of the project gave us the foundation we needed for creating a survey that contained relevant questions. The interviews also gave us the ability to develop a strict definition of the type of greenspace we wanted to help Growing Pathways create. The survey taught us what features residents desire in a communal greenspace. It served as the first step in encouraging and engaging with the residents to be active members of both the greenspace and the community. We always had the idea in mind of how important community participation is for urban nature initiatives.

Our final deliverable incorporates the lessons learned in greenspace design from the interviews, community input through survey, and the ideas presented to us in the design probe. Based on this our team created a model of what we envisioned for the greenspace using hand-drawn sketches and the Zoo Tycoon video game software (see Appendix A). Our design can be used to create a greenspace that is based almost solely on the community's ideas and input.

We believe that Growing Pathways will benefit from our final greenspace design since it aligns with their community input-based design structure. The final design also fulfills the organization's goal of urban development through urban nature that grants the community agency. Our 3D model of our greenspace was designed with the goal that Growing Pathways could use any or all aspects of the plan in its future development projects in the Øresundskollegiet neighborhood to create a sustainable, community-oriented greenspace.

iv. Authorship

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2.3 Urban Nature and Greenspaces	Matthew Rothman Kathleen Duffy	Emma Williams, Matthew Rothman
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1. Introduction

Sustainability options like greenspaces and urban nature are important initiatives, as they can bring sustainable natural areas to urban environments for the harmonious benefit of humans and nature alike. The city of Copenhagen is currently working to obtain at least 300 urban nature projects by 2025 (SLA Architects, 2016). The desire for these initiatives stems from the government of Copenhagen's mission to combat climate change and give their community areas where they can connect with nature and have pride in the aesthetics of their neighborhood. In addition to their ecological services, nature-based solutions for climate adaptation projects or sustainability initiatives also evidently provide their users with certain health benefits. For instance, a study conducted in 2019 concluded that people who spend two hours a week in greenspaces were found to report good health and psychological well-being when compared to those who do not (Robbins, 2020).

This project focused on serving this larger goal in the geographical area of the Øresundskollegiet dormitory in Copenhagen, a residential facility for university students that is independently owned and operated by the housing organization PAB (O. Koefoed, personal communication, 2021). A group of residents of Øresundskollegiet has worked with Growing Pathways to assess existing plots of land in the neighborhood which have the potential to be developed into community greenspaces. Currently, these plots of land are hidden areas between buildings, and are thus not very accessible to this community. Our team aimed to help bring the aforementioned benefits of urban nature to the residents of Øresundskollegiet through effective greenspace design. This design stemmed from different interactive activities with members of the dormitory, where we learned about what features of a greenspace are the most important to the community. We investigated the successes and failures of previous urban nature initiatives in Copenhagen and worked with the Øresundskollegiet student dormitory complex to design urban nature features using a community-driven approach. This means that the ideas for our greenspace design were sourced bottom-up, with community members having input to our design at every stage in the design process. We then produced a 3D model that improves a space at the dormitory to support a sense of community. Our team collected data through community interviews,

surveys, and a design probe. The culmination of our project is a prototype greenspace design for the Øresundskollegiet community.

The investigation of greenspace design leads to a higher quality of life for city residents and reduces urban sprawl. Urban sprawl is defined as “dispersed and inefficient urbanization at the fringe of urban areas which results in sub-optimal land use, uneven development, and the loss of open farmland and nature” (Sørensen & Torfing, 2019). One of the characteristic factors of urban sprawl that reduces quality of life is a lack of access to green areas. Our design for an urban greenspace with an area of 631m² (6,792 ft²) brings nature into the city, providing a greenspace for urban residents and combats the effects of urban sprawl.

2. Background

2.1 Growing Pathways’ Goals and Organization

Growing Pathways is a Copenhagen-based organization co-founded in 2015 by Oleg Koefoed and Kajsa Paludan. Working with a variety of companies and organizations, such as the Danish Red Cross and the City of Copenhagen, Growing Pathways aims to encourage and support sustainable development in the communities of Copenhagen. Growing Pathways achieves this goal by sponsoring and working on projects in urban nature and cultural mapping. The organization sponsored our project and has worked with us in developing our recommendations for a new urban nature greenspace in the Øresundskollegiet community.

This project puts a strong focus on sustainability for the community of Øresundskollegiet, in alignment with Growing Pathways’ values. Here, sustainability refers to development of projects that can be maintained without detriment to natural resources or the local environment. Sustainability, according to Dr. Oleg Koefoed heavily relies on community participation if it is to be effective. Growing Pathways gauges the success of their projects by the level of involvement of the community throughout a given project. While meeting with the WPI team, Dr. Koefoed emphasized the importance of continuing interest and active participation in learning about the community. Growing Pathways has been conducting a community asset mapping experiment to educate and gather input from the Øresundskollegiet residents about their neighborhood (O. Koefoed, personal communication, 2021). Our goal was to promote community participation in sustainability through designing urban nature projects for the residents of the dormitory.

2.2 European Data Ethics

Due to the nature of the online platform, we will use, our team may need to consider whether our project will comply with the GDPR. The GDPR is the General Data Protection Regulation, a bill created in and for the European Union that has laws to protect peoples' personal information. Projects that use technology accessed by the general public must comply with GDPR guidelines on data protection. Our team and the Growing Pathways organization must follow the principles of "data protection by design and default" and must implement appropriate technical and organizational measures to protect data. This means that anytime we are working with data collected from anyone, we must ensure the protection of that data. We also must ensure to adhere to Article 5 of the GDPR: Principles relating to processing of personal data. Article 5 essentially states that an individual's personal data must be processed lawfully and must have legitimate purposes when being collected or requested (Proton Technologies AG, 2018).

2.3 Urban Nature and Greenspaces

The main focus of this project is on urban nature and greenspaces. Urban nature is essentially an initiative "where the primary focus is on the social, biodiversity and sensing aspects of urban cultivation" (Frimodt-Møller, 2020). The city of Copenhagen plans to implement around 300 urban farming and urban nature projects in the coming years. These projects are all based around a concept called The Copenhagen Model. The Copenhagen Model "brings climate adaptation and urban nature together in a new urban development practice. Nature's processes and the aesthetic nature feeling are used to develop the city's new quality of life, while the city climate adapts at the same time" (SLA Architects, 2016). The model was created by a think tank dedicated to creating an outline for new practices for urban nature throughout the districts of Copenhagen. This outline, presented in **Error! Reference source not found.**, represents how to discuss and prioritize an urban nature project from "the moment of conception until the project is adopted and operational" (SLA Architects, 2016).



Figure 1: The Copenhagen Model for Climate Adaptation & Urban Nature 1.0 (SLA Architects, 2016)

We would like to utilize existing models of urban nature from several different districts within the Copenhagen municipality in our recommendations for a greenspace design that fosters community engagement with urban nature and is comparable to other successful urban nature initiatives. The initiative’s success will be measured in terms of vegetation density, biodiversity, public involvement, and amenity value. Urban nature can take various forms. There are several cases that exist of climate adaptation developments that can directly connect to urban nature and greenspaces. Copenhagen’s first climate adapted urban greenspace lies within Tåsinge Square in the St Kjeld neighborhood. This greenspace’s purpose is for rainwater management to handle heavy cloud bursts (Vej & Klem, n.d.). Due to the unique geography of the area, the activity of the citizens, as well as water flows are all combined into “the natural and self-growth approach to vegetation and water” (Vej & Klem, n.d.). Another urban greenspace project that has been implemented is located in St. Kjelds Plads and Bryggervangen. Almost two-thirds of the area within this region was excavated and replaced with wild nature that serves as a storm water protection system. This wild nature includes more than 600 trees and bushes that have been planted within the green rainwater beds (Eye, 2019).

Our team’s definition of “greenspace” for our goals in this project further developed from insight given to us through an interview conducted by team member Kathleen Duffy with Bergen Jome, an American intern with Growing Pathways (Jome, personal communication, 2021, March 5). In this interview, Bergen spoke about her own definition of greenspaces. As Bergen

explained, “green might not necessarily mean that there are plants everywhere. It could mean that there is now a physical structure for multipurpose community spaces that is taking up the place where a car would have been.” She described examples of good example greenspaces she knew of in Copenhagen, as well as negative aspects in some greenspace designs. For instance, Bergen explained the problematic implementation of non-native, unsustainable palm trees in a local park. Kathleen and Bergen conversed about how “greenspace” itself is complex to define and can be defined in many ways. A greenspace, Bergen pointed out, could include any place not occupied by infrastructure. Copenhagen itself may have differing cultural definitions of greenspace compared to other cities. Bergen pointed out several questions regarding this dilemma throughout the discussion. Should any plants in greenspaces be tamed, cleaned up, or cut? Is a space really a “green” space or 100% sustainable if it caters only to the needs of humans? What are the limitations of a greenspace? Furthermore, Bergen explained, greenspaces need to be usable to residents while also built sustainably to withstand time and climate changes.

Through this discussion, a better definition of greenspace for the purposes of our team’s project emerged. A greenspace, as described by Bergen, does not necessarily need to be green in color, as in covered in plants, if it is at least “green” in concept, as in serving purposes for nature, the environment, climate adaptation, or eco-conscious sustainability. A proper greenspace should refer to a sustainably built space, built to last and adapt with climate change, that provides benefits for nature or the environment, minimizing negative ecological impacts, while serving some use to the residents of the area. In summary, a greenspace should benefit both humans and nature, encouraging harmony between the two. It might improve resident quality of life while also serving eco-friendly purposes, such as urban biodiversity or “re-wilding,” climate adaptation, or even something as simple as recycling accessibility.

In addition to ecological services, nature-based solutions for climate adaptation projects or sustainability initiatives, such as urban greenspaces, also evidently provide their users with certain health benefits. For instance, a study conducted in 2019 concluded that people who spend two hours a week in greenspaces were found to report good health and psychological well-being when compared to those who do not (Robbins, 2020). If successful, the greenspace designs proposed by our team should provide similar benefits to the residents of our target neighborhood.

2.4 Biodiversity in Urban Nature

As discussed before, a successful greenspace must benefit nature as well. Research attests that cities, in fact, have a crucial effect on biodiversity, or the balanced support of a diverse variety of species that a healthy ecosystem depends on. Congested cities and construction can decimate natural habitat. Furthermore, certain management procedures done for the standards of humans, such as maintenance of turf grass lawns, tree and shrub pruning, use of pesticide and herbicide, and introduction of non-native plants, can all threaten urban biodiversity. On the contrary, well-planned urban greenspaces that balance the needs of humans and the ecosystem can work to restore healthy support of native species in city spaces (Aronson et al., 2017).

Our team reviewed many positive examples of urban greenspaces that promote healthy biodiversity. GHB Landscape Architects' Tåsinge Square, for example, incorporates sections of lush, sustainable vegetation, fed by captured rainwater, surrounding plaza areas usable to people (Vej & Klem, n.d.). In an interview, urban green infrastructure expert Dr. Connop of the University of East London referred us to review UEL's ARENA urban nature project as well (S. P. Connop, personal communication, March 30, 2021). This project includes case studies in the conservation of biodiversity through a variety of innovative methods. Most notably, the ARENA project has implemented lush biodiverse vegetation, including native wildflowers, on roof spaces and on top of structures such as bicycle shelters in their urban projects (Raguckiene, 2021). Our team plans to incorporate methods of supporting local biodiversity like these projects have in our recommendations to Growing Pathways, while still considering the desires and needs of the community that would use the proposed greenspace based on their input. Thus, our recommendations should serve to support the local ecosystem while providing benefit to the neighborhood, which aligns with our ultimate definition of a successful urban greenspace.

2.5 Native Species to Northern Europe

Over the past 150 years, deforestation in Denmark has been restored with non-native species (Stanturf et al., 2018). Today, reforestation and biodiversity efforts often include the introduction of various native plant species into urban spaces, especially those that can also help support wildlife such as native birds and pollinator insects. Red clover, for example, is the national flower of Denmark and attracts pollinators such as bees. We hope to encourage an increase in the presence of native animals and insects, including bees, butterflies, and other

pollinators, as well as small rodents like squirrels, by proposing various native plants within the greenspace. We also wish to serve several different kinds of birds that will look to use the new greenspace as a new home. The natural addition of all these different species can naturally increase the biodiversity within the ecosystem of the greenspace.

To accomplish this goal, we propose the strategic planting of a variety of native plant species within the greenspace, such as the previously mentioned red clover (*Trifolium pratense*) and many others. Which plants ultimately appear in the final greenspace design, and how they will be planted, depends on the community input on the greenspace's design as well. One source suggests that plants of the Sedum genus work well on urban rooftop gardens and stony areas. Thus, our greenspace could include the native stonecrop plant (*Sedum sexangulare*) on a canopy structure or in stony areas along paths (Aronson et al., 2017). The flowers of this low-maintenance plant could also serve local pollinators. The also low-maintenance native European juniper shrub (*Juniperus communis*), an evergreen, would adapt well in our urban greenspace as well. Other plant species suggestions can be borrowed from other successful greenspaces in Copenhagen. The official brochure for the lush Tåsinge Square greenspace, for instance, details some native species used in the greenspace to encourage biodiversity. To name a couple good native candidates, this source suggests: European rowan trees (*Sorbus aucuparia*) in semi-dry zones, and the alpine currant shrub (*Ribes alpinum*) in lower, wetter areas. (Klimakvarter Østerbro, 2015). Manageable native trees could also include the evergreen Norwegian spruce (*Picea abies*) or the small deciduous European hazel tree (*Corylus avellana*). Native plant species like these make great suggestions as design features in the greenspace proposed and should fit well into the space.

2.6 Øresund Region and Districts of Copenhagen

Our project takes place in the city of Copenhagen, which is part of the Øresund region of Scandinavia. The Øresund region is an international region encompassing the greater Copenhagen metropolitan area in Denmark and the Skåne region of Sweden with a population of over 3.5 million people. A key fixture of this region is a bridge connecting Denmark and Sweden which opened in 2000. This bridge has since allowed the development of a cross-border regional identity in the region. In the realm of economics, life sciences now constitute a key driver in the region, making it a significant hub for the biotechnology and health industries. Another key

focus for the Greater Copenhagen region is sustainable development and the green transition, planned with collaboration between the governments of Denmark and Sweden. The green transition consists of a plan to shift to clean forms of energy and reduce carbon emissions. (Garlick et al., 2006)



Figure 1: Copenhagen District Map (Hazhk, 2016)

The city of Copenhagen is divided into ten official administrative districts, shown in Figure 1. Each district has its own local council, with some districts including separate local councils within the district, for a total of twelve local councils. These districts are Indre By, Østerbro, Nørrebro, Vesterbro/Kongens Enghave, Valby, Vanløse, Frederiksberg, Brønshøj-Husum, Bispebjerg, Amager Øst, and Amager Vest. Frederiksberg is an independent municipality and not part of the Copenhagen Municipality even though it is geographically part of the city of Copenhagen and surrounded by districts governed by the Copenhagen Municipality.

A 2009 sustainability profile of Copenhagen found Amager Øst, Nørrebro, and Vesterbro/Kongens Enghave to be the highest scoring districts in sustainability in Copenhagen.

The scoring system included a combined total of scores from various categories affecting sustainability, including car ownership, energy consumption, and housing consumption. The lowest scoring districts in this study were Vanløse, Brønshøj-Husum and Bispebjerg. In the highest scoring districts, “housing consumption is low (gives a high environmental score), the heating consumption per inhabitant is low, the car ownership is low, and at the same time the action-orientated environmental indicators (numbers of 'Climate citizens', shared cars and companies joined the environmental network of Copenhagen) are all high” (Jensen, 2009). Meanwhile in the lowest scoring districts, “the consumption of heat and housing space per inhabitant is generally high, so is the car ownership, as well as the proportion of people working inside the city limits (indicating longer commuting distances). At the same time, they score low on all of the action-oriented indicators” (Jensen, 2009). Wealth seems to be a large factor here in how much of an environmental impact an individual has, as the factors that lead to a lower sustainability score are associated with higher wealth: car ownership and living in a single-family home.

2.7 Past Growing Pathways Projects

As a team, we investigated past projects sponsored by Growing Pathways to better understand our current objective. Most recently, in the fall of 2020, Growing Pathways sponsored another IQP project through the WPI Denmark project center. This project, titled *Investigating Motivations of Sustainable Development Networks*, focused on facilitating connections between Sustainable Development Networks (SDNs) through research that allowed them to provide tools and services for the SDNs. SDNs are made up of different communities and stakeholders that are involved in sustainable projects in Copenhagen. However, as this project team noted, these SDNs often do not communicate effectively with each other. The students in this project investigated Sustainable Development Networks’ current market demands and motivations in order to improve Growing Pathways tool-creation process (Fay et al., 2020). Working closely with these SDNs, Growing Pathways develops and maintains urban resilience through facilitating positive loops of collaboration within them, according to co-founder Dr. Koefoed.

Another project sponsored by Growing Pathways through the WPI Denmark project center completed in 2019 focused specifically on addressing the needs of the urban agriculture and farming community in the city of Copenhagen. Like many of Growing Pathways' projects, including our own, this tackled issues of sustainability and related concerns of the local community. The team of WPI students that worked on this project assessed the needs of the local urban nature community. With their research, they decided to create a Discord server (Cicione et al., 2019). A Discord server is an individual channel on Discord which "is a group chatting platform originally built for gamers, but has since become a general use platform for all sorts of communities" (Delfino, 2020). They used this server for the community as an online networking tool to share knowledge and resources on local urban nature (Cicione et al., 2019).

Prior to this project, another project through Growing Pathways for the WPI Denmark project center in 2018 worked on the development of multipurpose greenspaces in Copenhagen. The WPI team of students assigned to this project conducted research on the importance of these greenspaces and the involvement of their stakeholders. This research included conducting interviews with these stakeholders. This team's final project utilized social mapping through the use and development of Mapotic, an online mapping tool (Johnson et al., 2018). Their research helped our team better understand Growing Pathways' mapping project.

2.8 Øresundskollegiet



Figure 2: Øresundskollegiet (Øresundskollegiet, 2021)

Øresundskollegiet is a residential dormitory for university students in Copenhagen that is independently operated, and thus not owned by any specific university. This dormitory houses 1,600 residents, including around 100 children (Niels Kristian Bjerg, personal communication). Øresundskollegiet offers many facilities to residents, including a music room, photography studio, wood workshop, gym, ballroom, bicycle workshop, sewing room, and art and ceramics studio (Øresundskollegiet, 2021). It is in the district of Amager Øst, close to University of Copenhagen Amager and the IT University of Denmark. Amager Øst was one of the highest scoring districts of Copenhagen in a 2009 sustainability profile (Jensen, 2009), but Growing Pathways sees a need in this area to create more spaces to foster community activity, primarily in the form of new urban greenspace designs. Growing Pathways notices issues in the layout of this neighborhood that the organization aims to help fix. Notably, most of the area's current greenspaces hide behind buildings, and the community suffers an overall lack of interpersonal interaction.

Some residents of Øresundskollegiet have been engaging in participatory mapping through Growing Pathways, to map places that they believe create value in their community. Through this process, Growing Pathways encourages these members of the community to interact with each other and gain a sense of pride in their community. The resulting map itself is helping the organization to better understand the possibilities for a greenspace in the dormitory complex.

3. Methodology

3.1 Research Objectives

Our project goal was to develop an engaging greenspace design for Growing Pathways and the Øresundskollegiet dormitory community. Through interviewing experts and stakeholders, conducting a survey with some of the residents of the dorm, and using a small focus group to conduct a design probe we investigated how to design an effective greenspace. This aligned with the mission of our project which was to investigate the successes and failures of existing urban nature initiatives in Copenhagen, and work with the Øresundskollegiet student dormitory complex to design a space for urban nature using our community-driven approach. In order to achieve this goal, our team has devised a four-step plan:

1. Investigate features of a successful greenspace through interviews with urban nature experts, knowledgeable sources, and district council members in Copenhagen.

Step one allowed us to gain the necessary background information we needed to become experts in greenspace design. This gave us an understanding of what does and does not work in existing greenspace design.

2. Utilize a community-driven approach to survey the community and develop a preliminary model of our greenspace design.

After completing step two, our team learned what kind of greenspace the residents can see within their community. We also gained an understanding of different natural and architectural features they would like to see.

3. Conduct a design probe with community members interested in sustainable urban greenspace development, who will propose designs of their ideal greenspace.

Step three allowed us to refine our survey results based on input from a few select involved community members. This allowed participants to visualize their ideas for the greenspace and share more detailed ideas.

4. Create a visual prototype of a sustainable urban greenspace design, based on all previous results, that Growing Pathways could help develop.

Step four represents the culmination of our work. It serves as the final deliverable of our project; a prototype greenspace design using hand-drawn diagrams and the Zoo Tycoon 2 video game interface, incorporating elements proposed to us by the community.

3.2 Interviews with an Expert in Past Urban Nature Projects

To gain understanding of what did and did not work well in previous urban nature projects, we interviewed experts who have been involved in urban nature development. These urban nature projects did not necessarily need to be based in Copenhagen as long as the design methods could seemingly be applied elsewhere. We interviewed Dr. Stuart Paul Connop (see Appendix B) from the University of East London, a Senior Research Fellow who specializes in urban green infrastructure (University of East London, 2021). Dr. Connop's work in urban green infrastructure was valuable to our understanding of urban nature and how to design and implement urban greenspaces.

3.3 Local Council Interviews

As part of our research, we conducted an interview with Marianne Spang Bech. Marianne works as the director of the environmental point in Miljøpunkt Indre By (see Appendix E). When we were looking for local council people to interview, we were searching for people who worked with an organization that has created and worked on multiple urban greenspace projects throughout the city. Marianne has worked on past community based urban nature projects and currently is working on a similar project to ours with Growing Pathways called Agenda 21 (M. Spang Bech, personal communication, April 12, 2021). This plan for sustainable development was originally drafted by the UN, with many different organizations like Growing Pathways adopting it for their own use (Growing Pathways, September 7, 2016). Marianne was able to give us great insight into how to approach community driven projects as well as how to work with the municipality on getting these projects approved.

3.4 Community Interviews

In addition to the interviews aimed at sustainability experts, we conducted interviews with Benjamin Harrus and Niels Kristian Bjerg, both of whom are members of the Øresundskollegiet community. Benjamin is the owner of a café at the dormitory, called the ØK café, and is working with SLA Architects to install an urban farming greenspace on the roof of the café. Benjamin is also expert in vertical farming and has the first indoor vertical farm in Scandinavia. Niels Kristian Bjerg is the president of the governing board of the

Øresundskollegiet Residents Council. Through these interviews we learned more about current Øresundskollegiet sustainable development programs, the needs of the community, and how we can best engage with and help Øresundskollegiet residents through our project.

3.5 Survey with Øresundskollegiet Residents

Once we completed our interviews, our focus shifted towards the general members of the Øresundskollegiet community. We conducted a group survey using the digital questionnaire software Qualtrics (<https://www.qualtrics.com>) that contained multiple questions asking about what each respondent wanted to see within the greenspace for their community (see Appendix G). We aimed to collect a minimum of 30 responses from this survey. Our total response number reached 33, achieving our goal. The survey was distributed through the Øresundskollegiet Facebook group and posters with a QR code link to the survey that were posted around the dorm, shown in Figure 3.



Figure 3: Poster Advertising Our Survey

Most of the questions were in ranked choice, multiple choice, or multi-select format with “other” options allowing respondents an open-ended way to voice their ideas and cover a variety of topics. These topics ranged from their personal beliefs on greenspaces to design preferences. We also included open-ended questions with pictures of various locations in the vicinity of the dorm where we could focus for our greenspace location and asked how the survey respondents can envision using that space. The following figures show all three of the possible locations:

Figure 4 represents the large patch of grass near dormitory blocks J, K, and L. This piece of grass is 631 m² (6,792 ft²) and is within close proximity to the dorm.



Figure 4: Large Patch of Grass Near Dormitory Blocks J, K, and L

Figure 5 is the area adjacent to a shed that is on the opposite side of the dormitory. The shed has room for storage and there is a sizable grassy area for different vegetation.

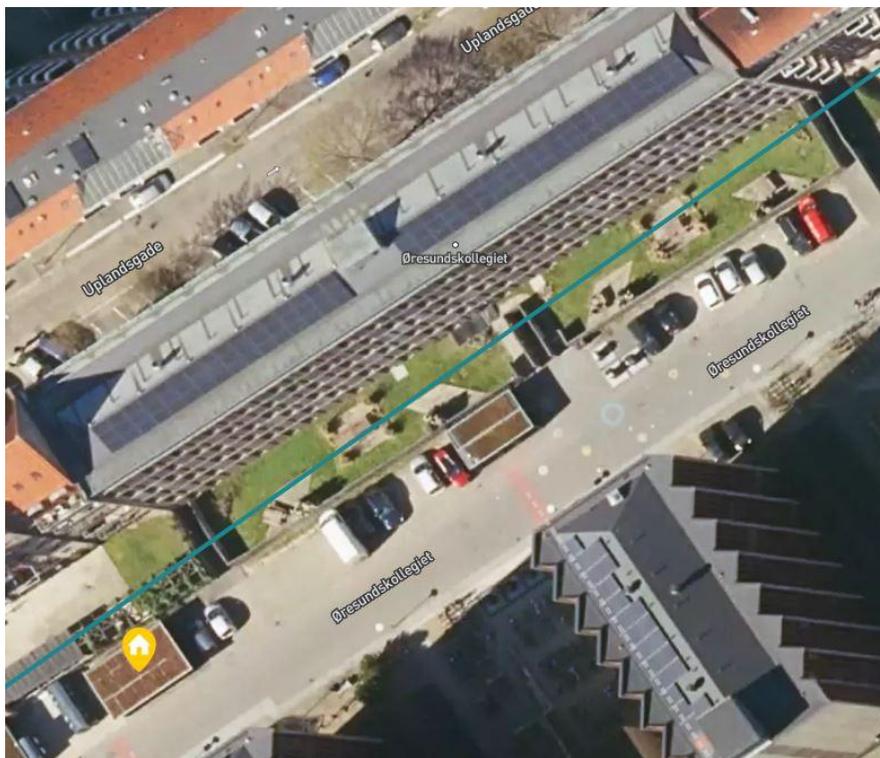


Figure 5: Area Around a Shed Near the Dormitory

Figure 6 is the site for Growing Pathways' Dome of Life. The Dome of Life is a separate project Growing Pathways is working on and will be a three-meter-tall dome made of recycled materials used for either education or another sustainable practice (O. Koefoed, personal

communication, 2021). This aligned well with our project and the possibility for a greenspace exists in the grassy areas surrounding and lining the parking lot.



Figure 6: Area Around the Site for Growing Pathways Dome of Life

At the end of the survey, we included a question that allowed people interested in becoming more involved in the project to join our design probe activity by leaving their name and email. Here we attempted to find focus group participants for our design probe who also already knew about our project and wanted to help us with our goals.

3.6 Design Probe

We conducted an online, unfacilitated design probe activity that could be completed independently with a few select community members to narrow down the results from our survey and to allow these community members to share more detailed visions for the greenspace design. A design probe is defined as “an approach of user-centered design for understanding human phenomena and exploring design opportunities” (Mattelmäki, 2006, p. 39). For our design probe, we aimed to understand how people interacted with greenspaces in their community and explore design opportunities for our greenspace centered around the wants and needs of Øresundskollegiet community members. For this design probe we prepared a two-page document that includes the instructions for the activity and a few questions designed to narrow down the results from our survey (Appendix H). Linked in the document was a LucidSpark board, which is a collaborative online whiteboard where participants could share their ideas and view each

other’s contributions. We created a virtual vision board with the focus group, where participants visualized their ideas for urban nature in their community. The design probe activity asked participants to create a collage of inspirations for how they can envision using the patch of grass near dormitory blocks J, K, and L on the LucidSpark board, shown in Figure 7.

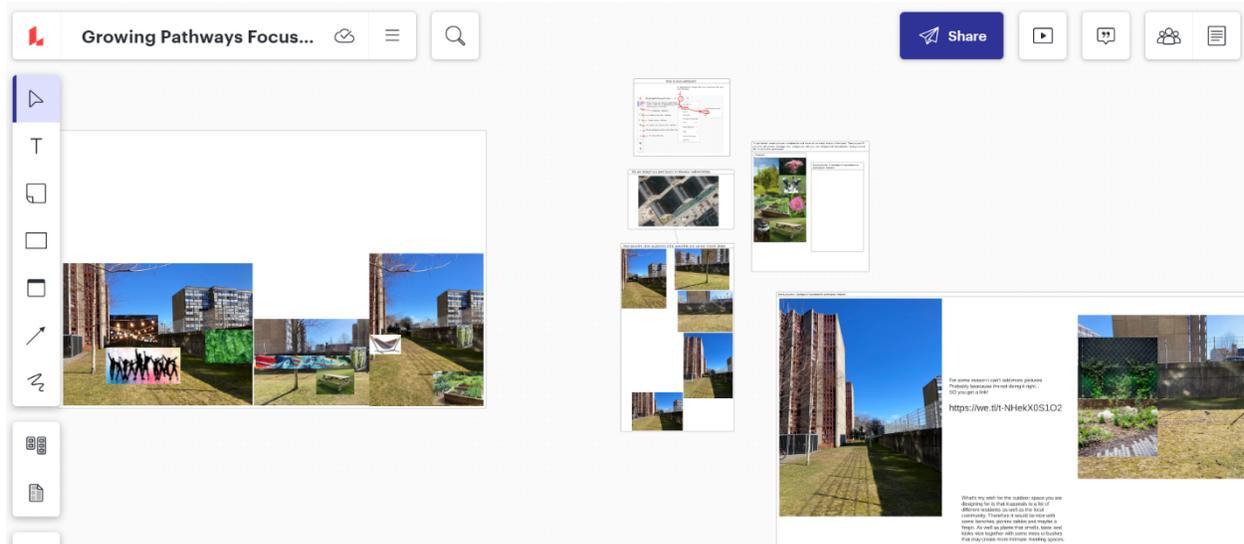


Figure 7: Our LucidSpark Board displaying ideas from Benjamin Harrus and Niels Kristian Bjerg for features such as hydroponic farming, area for socializing, hammocks, and a vegetation-lined stone path.

3.7 WPI Team Final Deliverable

Once we received the suggestions from the focus group, our team used all the knowledge we gained over the course of our project and created a design of a greenspace to present to Growing Pathways for the Øresundskollegiet neighborhood. We created this design using different visual tools starting on paper, and we then moved it to a digital version for a clean finish that represented a greenspace based almost entirely on the community’s input. The design is also outlined in this report and is accompanied by images of the digital copy. This final report includes detailed recommendations for features of a potential future greenspace, such as features that can be used for different climate adaptation initiatives and to increase biodiversity. These features were derived directly from feedback we received from the community through our research objectives and would therefore be nature helping humans. This idea was part of our group’s definition for a successful greenspace. It describes the symbiosis of not only humans

helping nature through environmentally and eco-friendly practices, but nature helping humans by positively affecting mental health, as well as increasing humans' physical well-being.

3.8 Ethical Considerations

When asking residents of the dormitory to participate in an online survey we must be conscious of individuals' data privacy. Residents completing the survey had different pieces of their personal data shared with us that we must keep confidential. We had to be sure their data stays private while conducting our survey because it is crucial to not only data privacy laws but the community's trust in our project. Our team ensured the privacy of the participants of the survey by keeping the data we collected in a private folder only the members of the group can access.

During the project we conducted several different kinds of interviews outlined in step one of our project plan. While completing these interviews it was important for the group to consider the interviewee's privacy but also to the sensitivity of an individual's opinion. If an individual asked for part of their interview to be left out of the official transcript or that they wanted to be kept anonymous, we had to adhere to their request. The most important consideration was that we, as a group, had to always be sure to obtain proper consent as well as maintain that consent throughout the entire project from everyone participating in either the survey, interviews, or design probe. This was essential to guarantee the success of the project as well as ensure that Growing Pathways or WPI does not fall under any legal action.

4. Findings and Results

The implementation of all our previously outlined methods led us to a final proposal of greenspace design that will meet the needs and desires of our target community while harmoniously serving the local nature and society alike. We carefully analyzed the results from each method employed to extract useful aspects and ideas to then incorporate into our final proposal and recommendations for the dormitory greenspace. Together, these results create a synergistic plan to physically create and then maintain a greenspace in this community that all its members can participate in and benefit from.

4.1 Insights from Interviews

Our team managed to contact and speak to both experts in urban nature and community members related to the Øresundskollegiet greenspace project. These individuals granted us expert insights coming from years of experience, many of which we would have been otherwise unaware of from our own research. As previously described, we first spoke to Growing Pathways intern Bergen Jome in the project preparation period about the definitions of a greenspace. Now, new interview results expand our understanding of this concept.

First, in an email interview, Dr. Stuart Connop of the University of East London, an expert in sustainable greenspace design, described some of his project experiences to us. Dr. Connop stressed that a successful greenspace requires “appropriate planning, delivery, and stewardship,” and further explained how a lack of each of these values could cause a greenspace to fail (S. P. Connop, personal communication, April 6, 2021). Based on this advice, we continued to ensure the community’s involvement in the greenspace implementation process. In a similar manner, Marianne Spang Bech, center leader of the Miljøpunkt Indre By & Christianshavn district environmental group, emphasized a “bottom up” approach in which the residents, who should in practice own this greenspace, form the foundation of the greenspace’s creation and maintenance. During her interview with our team over Zoom video call, Marianne encouraged us to envision the greenspace as a place where both families and individual residents can become engaged with nature in the city, while also noting that it should be built to withstand the tests of time (M. Spang Bech, personal communication, April 12, 2021). Following this

input, we decided their own greenspace designs should incorporate native, sustainable nature and a usable design that could withstand years of exposure to the elements and change, to match Marianne's vision.

Our team also conducted Zoom call interviews with Niels Kristian Bjerg, chairman of the resident council of the Øresundskollegiet dormitory, and Benjamin Harrus, owner of Øresundskollegiet's café, both members of the community with expertise in its residential life. Niels Kristian suggested that we involve the members of the Øresundskollegiet community in fun and engaging ways to ensure they can create value in their space and feel that they can contribute to a worthy end goal. He also explained certain aspects of residential life at the dorm, such as the numerous communities within it that center around a variety of hobbies, from soccer to gymnastics to writing. He also pointed us to the environmental group at the dorm to contact for our upcoming focus group, as this particular community would have useful suggestions in creating a sustainable greenspace for the dorm (N. K. Bjerg, personal communication, April 15, 2021). During this interview, we also gained valuable insight on the potential greenspaces we considered using for the final project on the dormitory campus from Niels Kristian, who had the experience of living in the space and interacting with the community.

Benjamin Harrus, interviewed shortly after Niels Kristian, had his own unique experiences and perspectives about sustainability projects, which he shared with us. In addition to serving as the head of the dormitory's café, Benjamin is also a leader in vertical farming and sustainable food production in Copenhagen. Benjamin discussed sustainability in three branches: social, economic, and environmental, and how each relates to his projects as well as our own. Though Niels Kristian had placed a focus on social sustainability and community involvement, Benjamin pointed out the important role of economic sustainability as well. In order to last and thus be sustainable, a project like a greenspace or a vertical farm would need to manage its demands for time and money (B. Harrus, personal communication, April 15, 2021). Thus, we considered aspects of our planned greenspace that would be most cost effective and not demand high levels of maintenance. These included things like small lights lining a stone path, using large flat rocks for a path instead of paving through the entire patch of grass, and using solar powered lights and electric heaters to save and use renewable energy. Benjamin's projects in vertical farming exemplify the three branches of sustainability beautifully. He provides locally grown produce and involves his community, which can be considered social sustainability.

Through efforts to reduce food waste and minimize water usage, he supports environmental sustainability. Finally, by running his café business efficiently, he meets economic sustainability as well. Our team should strive to meet these three branches of sustainability as well, based on examples such as Benjamin's.

4.2 Survey Trends

Our team designed a multi-question survey, which we then sent out to the Øresundskollegiet community online through various social media posts on Facebook and through community contacts. Approximately 33 participants from this community filled out this survey to completion before we closed it for good on April 28, 2021. This date was chosen as a means to leave us time to complete the rest of our objectives in a timely manner. This satisfactory participation turnout gave us a substantial amount of data to then analyze for the purposes of our community input-backed greenspace design. From this data, our team made several important conclusions that influence the style and design of our proposed greenspace plans.

A variety of interesting trends appear in the answers given to the survey when we analyzed it. As seen in Figure 8, the participants seem to visit greenspaces quite frequently.

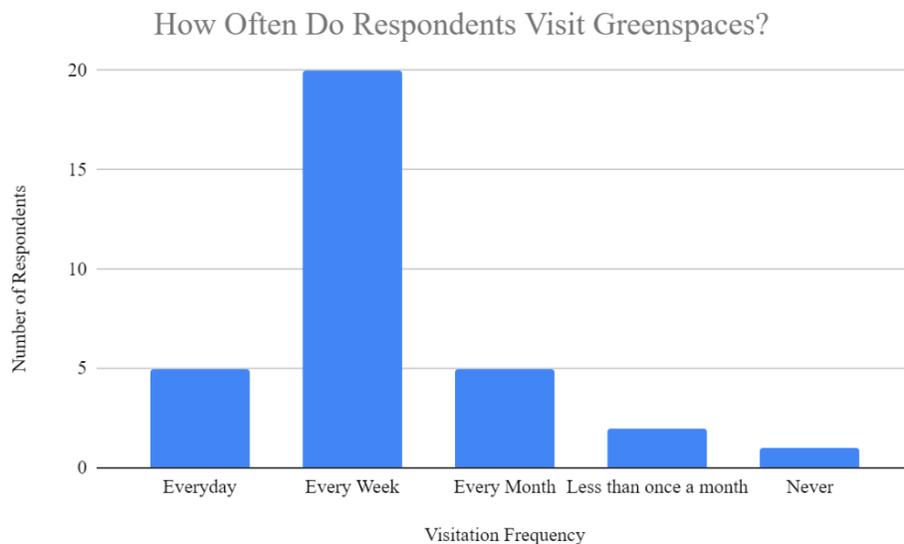


Figure 8: How Often People Visit Greenspaces Within Their Community

Twenty (20) people, almost 61%, said that they visit what we would consider a greenspace at least every week. The other popular answers still showed that people visited greenspaces quite frequently, either daily or monthly. In Figure 9, most answered that they would like to go to such places weekly or daily.

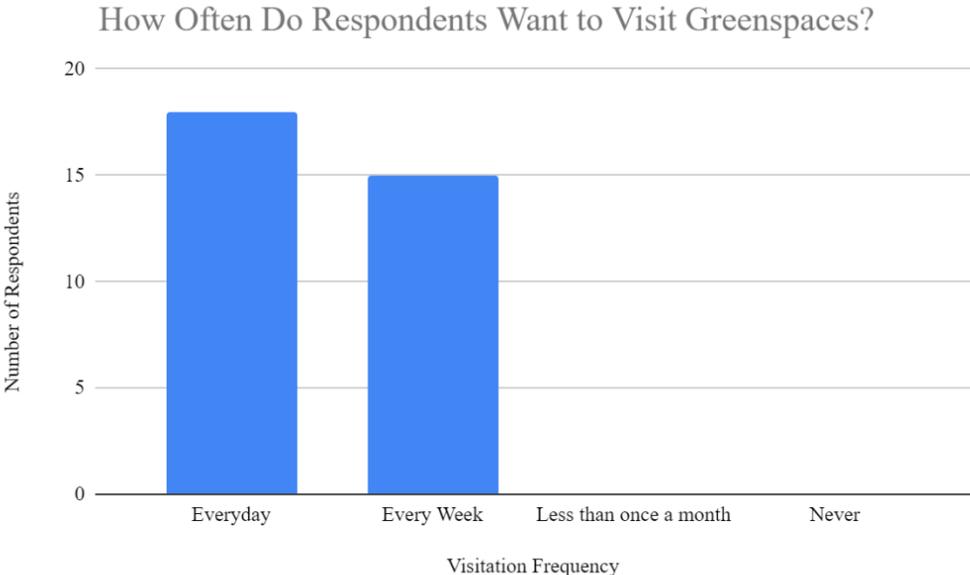


Figure 9: How Often People Would Like to Visit Greenspaces

Eighteen (18) people, nearly 55%, said that they would visit a greenspace everyday if they could, and 15 people, around 45%, said that they would visit a greenspace weekly if they could. These two pieces of data are useful because it will give us an idea as to how much the community interacts with greenspaces currently, and concurrently how much interaction they would like to have with one.

In terms of our future greenspace proposals, the participants certainly had distinct priorities. Figure 10 shows that almost two-thirds of participants ranked “proximity to my home” as a highest priority in a greenspace.

Important Features in a Greenspace

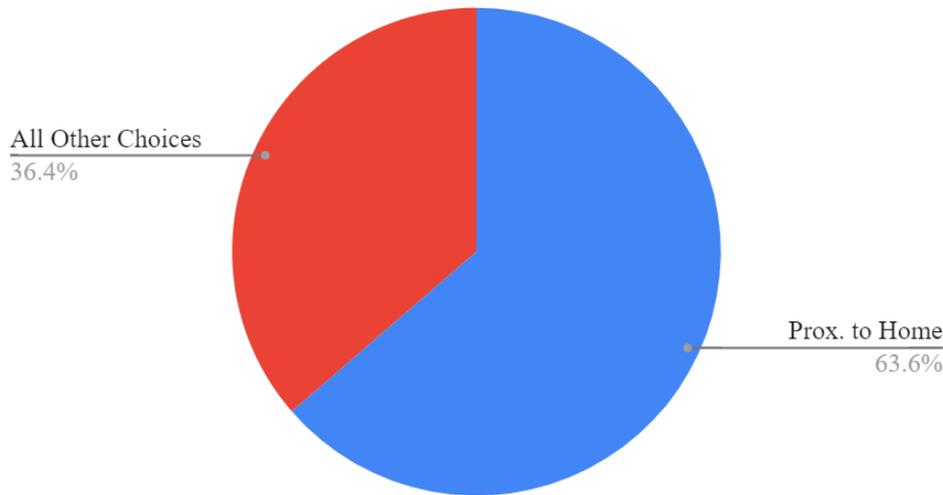


Figure 10: Top Choices for Important Features in a Greenspace

The 63.64% represents the percentage of people who said that the proximity to their home is the most important aspect of a greenspace. This piece of data helped our decision on choosing a particular location for the greenspace since we needed to find an option that was close to all the residents in the dorm. This, along with other factors like its size (around 630 square meters), is why we chose the patch of grass that is shown in Figure 4 **Error! Reference source not found.** near the café as our main area of focus. The exact dimensions of the area are 7.98 m x 82.6 m (26.2 x 271 ft) with an area of 631 m² (6,792 ft²). It borders buildings J, K, and L of the dormitory complex.

Figure 11 shows the responses for this question in terms of the responses mean ranking. Mean ranking is the average rank that each option received with the closer to 1 the higher the popularity of the option as a whole (Descriptive statistics for ranking data, n.d.). This graph is much simpler than the multiple pie charts given to us by the Qualtrics software. While we already had a figure representing the top choice for this question (Figure 10), we wanted to include a graphic that could show all the options in a simple way while also showing the highest ranked ones.

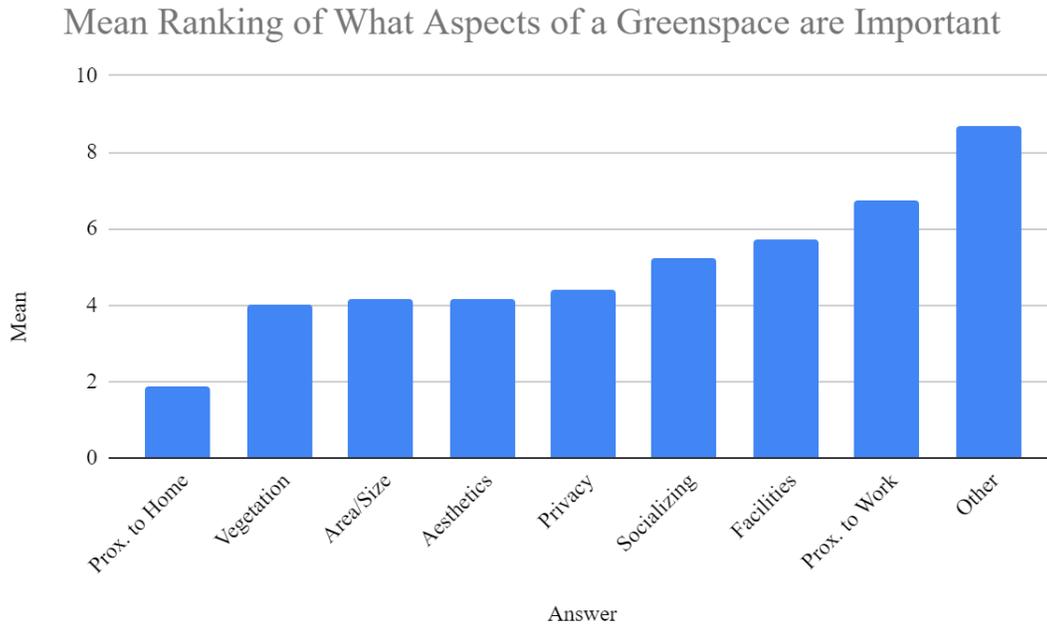


Figure 11: Mean Rankings of Important Features in a Greenspace

Proximity to home was ranked the highest because it had the lowest mean value of 1.85. Next was vegetation with a mean value of 4. After that came area/size (mean value of 4.15) and aesthetics (mean value of 4.18). We can use this question to understand the community better so that we can represent their ideas for a greenspace in the best way possible.

In the following questions, participants chose what kind of natural features they would want in a greenspace. Figure 12 represents their responses for this question.

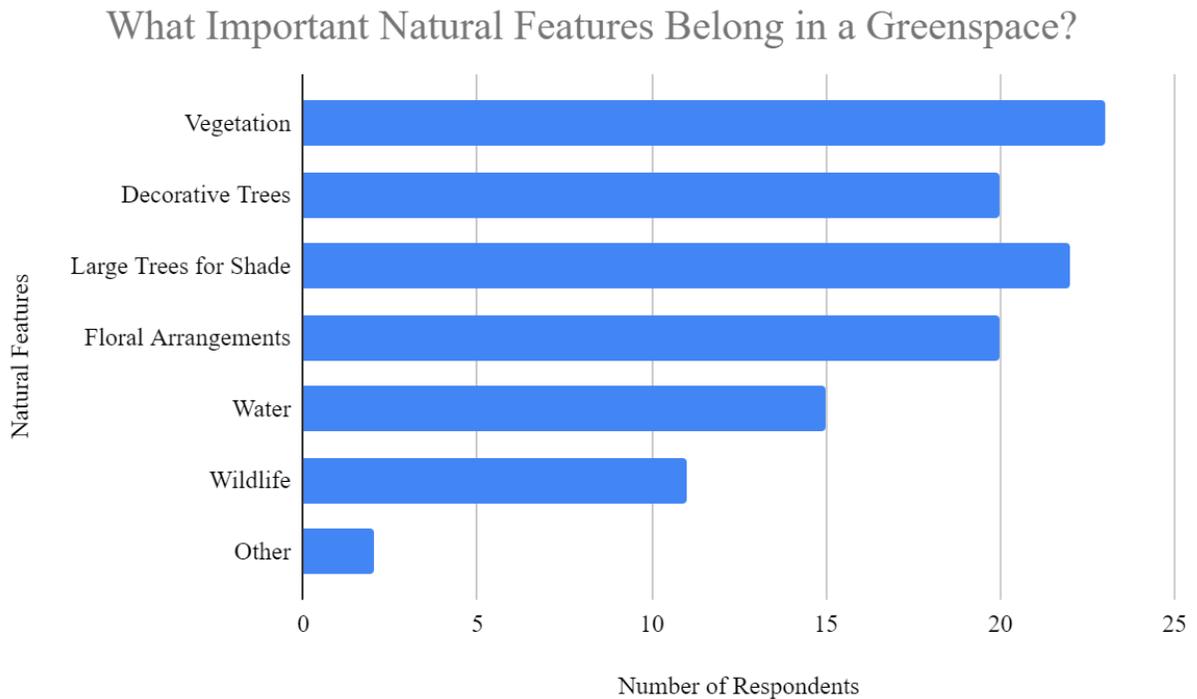


Figure 12: Natural Features that People Believe are Important to a Greenspace

We can see that the most popular responses are aesthetically pleasing trees and flowers, plus trees that provide shade. With almost 70% of respondents selecting vegetation as an important natural feature for the greenspace, our team felt that it was very important to have the focus of the greenspace around vegetation. We wanted to be sure that we included, in our own design, plenty of vegetation that will be discussed later on in the report, as well as space for people to pick their own. Along with vegetation, over 60% of respondents said that decorative trees, trees for shade, and floral arrangements were other natural features that should be present in a greenspace. Therefore, our final greenspace design includes plenty of decorative and shady trees like evergreen and rowan trees, plus plenty of space for attractive flowers and other plants.

Our greenspace includes several different architectural features that the respondents wanted as a part of their greenspace. In Figure 13, we can clearly see that the most important features are places for people to sit and relax.

What Important Architectural Features Belong in a Greenspace?

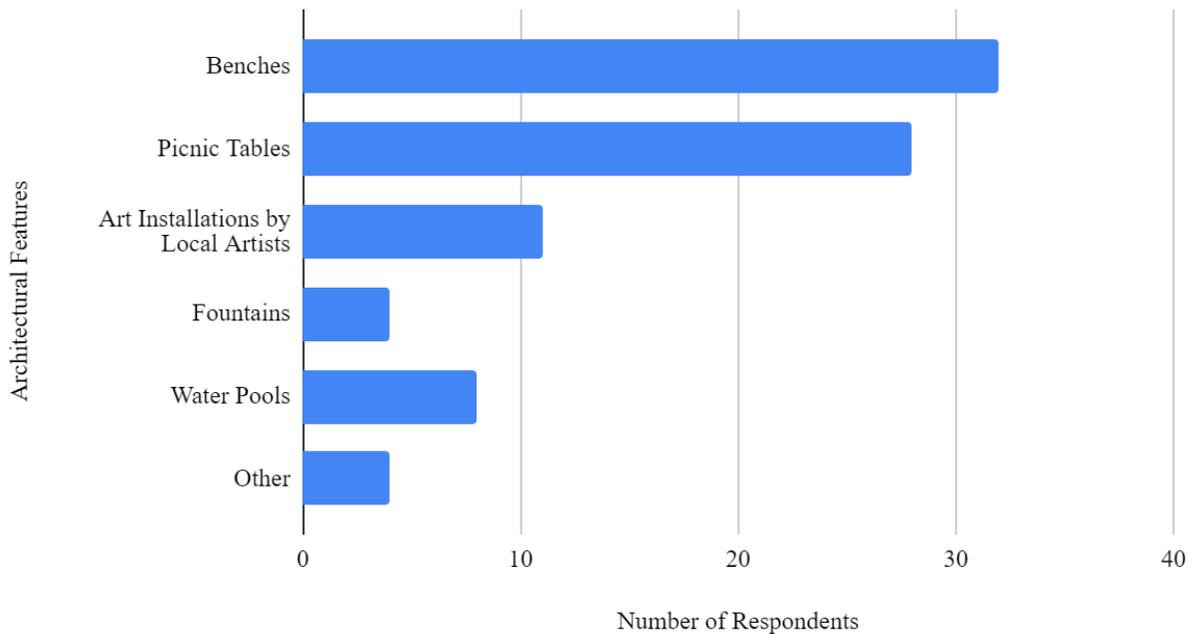


Figure 13: Architectural Features that People Believe are Important to a Greenspace

An overwhelming majority of people selected picnic tables and benches for architectural features to be included within a greenspace. Thirty-two (32) participants, almost 97%, said that they want benches, and 28 participants, almost 85%, also said that they want picnic tables. The next highest answer was an art installation, where 11 people, around 33%, said that they would like to see that in a greenspace. In addition to the answers we provided, four (4) people (12%) wrote in their own ideas about some architectural features we could add. One participant suggested that we include hammocks, further strengthening the argument that people want to sit and relax within the greenspace. Another participant said they would like to include a grill, but it seemed counterintuitive for us to include a device that produces harmful smoke in an area where we are trying to cultivate nature. Another response was that water features are nice, and they positively affect the psyche. Therefore, we added tranquil water features to our greenspace design. This type of feature may require more maintenance, but that would not be more involved than changing the water or filter occasionally.

Our next step was to ask the participants what kind of greenspace they would feel encouraged to be an active member of. Figure 14 shows the rankings of each option and shows what each option is.

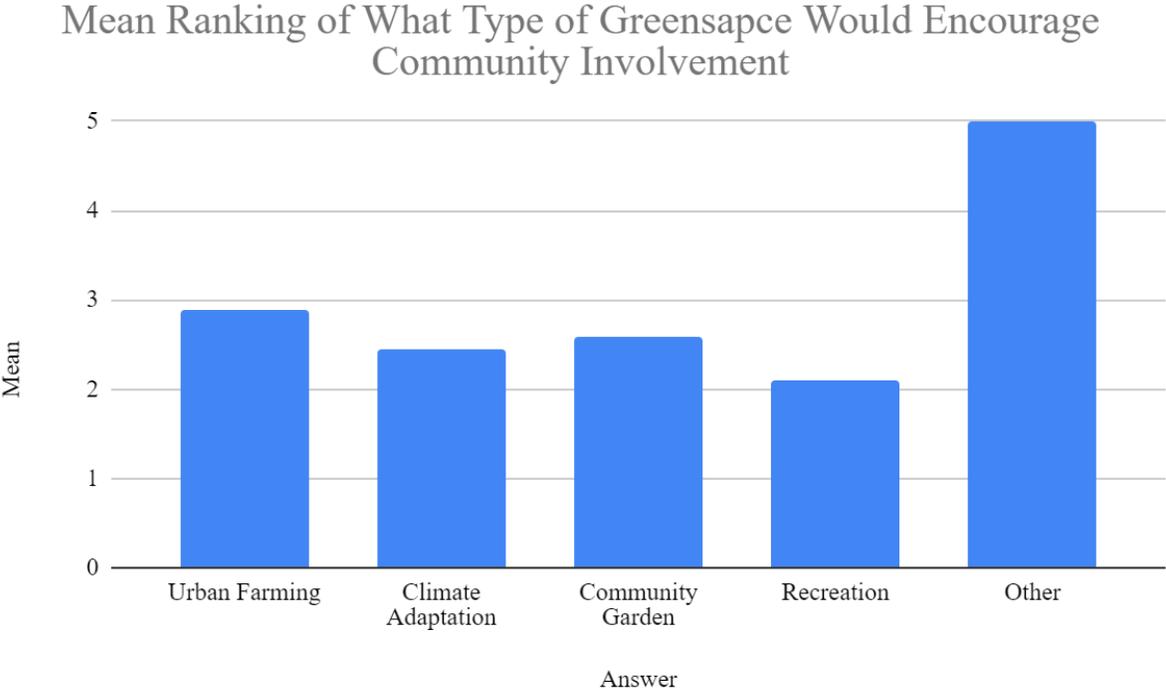


Figure 14: Rankings of Types of Greenspaces to Encourage Community Involvement

Here we can see the mean rankings of five different answer choices, meaning that the lower the value on any particular option, the higher it was ranked by participants. The choices related to what kind of greenspace would encourage a community member to get involved. These choices were Urban Farming, Climate Adaptation, Community Garden, Recreation, and Other which was an open-ended option for the participants to put a write in response. The most popular choice was to have a greenspace as a recreational space with a mean value of 2.09. This was the highest ranked option because it had the lowest number. Next was climate adaptation coming in at a close second with a mean value of 2.44. For people's topped ranked choice however, 34.38% of people put climate adaptation as their top choice, while only 31.25% put recreation as their top choice. A recreational greenspace is a greenspace that does not need community involvement to serve its purpose as a sustainable urban nature initiative. It is solely for the purpose of people going to relax and enjoy nature, similarly to a park. After that,

community gardening was the third most popular answer with a mean value of 2.59, meaning that some people would want to be able to use the greenspace to grow their own garden. These responses really helped our understanding of what type of greenspace we designed. For our purposes, any one of these three greenspaces can serve multiple purposes. This means that a recreational greenspace can also include climate adaptations and a community garden. With that knowledge, we decided to create a design that has a combination all three greenspace that include recreation, climate adaptation, and a community garden.

The next three questions asked participants if they were familiar with different locations around the dormitory: The patch of grass next to dormitory blocks J, K, and L, the location for Growing Pathways Dome of Life, and the area around the ØK shed. Around 62% of people were familiar with the patch of grass next to dormitory blocks J, K, and L, meaning that most people were familiar with that particular location. Around 68% of people were not familiar with the location for the Dome of Life, and so we felt that we could eliminate it as a choice for a potential greenspace, since there was not much community interest in that area. Participants were the most familiar with the area around the ØK shed, with almost 73% knowing where it was. Despite this, our team thought the most potential was in the 631 m² (6,792 ft²) grassy stretch adjacent to dormitory blocks J, K, and L (referenced in Figure 4), based on the responses we got for how each area could be used for a greenspace. Many individuals were excited to participate and gave engaging suggestions for the grassy area next to dormitory blocks, J, K, and L. This is contrasted with both the Dome of Life and the area around the shed, where we found that many people were confused or not enthusiastic. These responses are why we chose the grassy space adjacent to the J, K, and L dormitory blocks. This location is a great choice because it aligns with the respondents' desire for a greenspace to be close to home. It also allowed us to add many different features that aligned with the other responses from the participants because of its larger size.

Overall, these survey results allowed our team to create a list of community priorities to include while designing a future greenspace. Based on this data, the greenspace our team is recommending includes aesthetically pleasing vegetation, which we also selected to support sustainability and biodiversity. This could take the form of community gardens, areas with natural plant coverage for relaxation and enjoyment, or a both. Certain species of plants and flowers like the Calendula or the Alpine Currant could support local insects and birds while also maintaining the aesthetics we strive so hard to maintain. Other species could also be used for

community farming, such as edible flowers, herbs, nuts, berries, or even a raised vegetable garden. We still need to ensure the aesthetics are not lost due to inconsistent gardening, so it is important to make sure the gardens are visually appealing while also allowing the community members who have piece of the garden to have the freedom they desire. We also tried to put a continuous emphasis supporting biodiversity and promoting environmental sustainability. In addition to the vegetation, extra room in the greenspace can support social areas with benches and tables, artistic structures, sustainable infrastructure such as recycling stations and solar-powered lights, and other beneficial features for the community. Our final design attempts to fulfill these community desires wholly, while also staying faithful to the original vision of a space that benefits humans and nature equally in an urban setting.

4.3 Design Probe Input

We created and administered a design probe to complement our survey results and preliminary greenspace design. Our design probe took the form of a take home activity, given to three selected people who are heavily involved in the Øresundskollegiet community. The design probe consisted of two parts, the first being a set of questions the participants would answer based on the results of our survey. These questions asked participants about different environmental, recreational, and architectural features they would like to see in the greenspace. We presented choices based on our own research and the results of the survey, and participants could also add their own ideas. The second part of the design probe directed participants to our LucidSpark board where participants could create collages showing how they could envision using the space and could view the contributions of other participants. Three participants completed our design probe, including Niels Kristian and Benjamin, whom we had previously interviewed, and an anonymous member of the Øresundskollegiet environmental group.

Our first response to the design probe came from an anonymous member of the Øresundskollegiet community, who is involved in the dormitory's environmental committee. This participant emphasized strongly for us to consider covering a section or all of the greenspace inside of a canopy of sorts since Denmark is typically cold and rainy most of the year. Along with the idea of a covered greenspace, they suggested a multi-function solar powered glass greenhouse that can be used as a study room or space for small social events. They thought that having a space for gardening, as well as studying would be a great way to

combine the idea of humans existing and participating in nature and its activities. They also wanted us to include a section for calisthenics, meaning different elevated horizontal bars for exercise activities. This can also mean sectioning off the greenspace, giving people an area to exercise while enjoying nature. They preferred deciduous trees to coniferous, but we feel that including a healthy balance of both is feasible and optimal. As for vegetation, they would like to see a variety of small native trees like evergreens, rowans, and hazel trees. They also thought that incorporating small vegetable and herb gardens could be useful.

Our second response for our design probe came from Benjamin Harrus. Benjamin is the dormitory café's owner, and has interests in urban farming. Benjamin stated that he prefers deciduous trees, and that he would like to see herbs and native flowering plants in the greenspace. Additionally, Benjamin expressed that he would like to see composting, hammocks, and a fire pit in the greenspace. In the LucidSpark board, Benjamin included some hydroponic vertical farming and raised beds for gardening. These features appeal to the sustainability goals of our project by promoting biodiversity and benefitting the community with locally grown food. Figure 15 shows the collage that one of our design probe participants created in our LucidSpark vision board.



Figure 15: A Collage from one of the Design Probe Participants

The people dancing and the picnic bench in the collage highlight the social aspect that the community would like for the greenspace. It shows raised planter beds, hydroponic vertical farming, a hammock, a mural, a picnic bench, and string lighting.

Our third response came from Niels Kristian, who is the president of the dormitory resident's council. Niels Kristian's main priority for the space was to appeal to many different residents and the local community. He recommended having seating areas and picnic tables for people to socialize along with many different plants like trees, bushes and edible plants. His idea

is that large trees, bushes, and edible plants that produce nice scents would create more intimate meeting spaces. Niels Kristian also recommended the inclusion of a hammock as another space for relaxation. Niels Kristian included some additional images that were not uploaded to the LucidSpark board with his response depicting different possibilities for greenspace features. Figure 16 shows a stone path surrounded by greenery both on the ground and the wall. Figure 17 shows a possible option to create a seating area with a fire pit. This idea would allow for a seating area that can be used to socialize at night or during the colder seasons but comes with many regulations surrounding fire sources in the city, and potential fire hazards with the surrounding vegetation. As chairs are typically much easier to move than benches and less likely to be bolted to the ground, there is also a risk of the chairs being stolen. Figure 18 shows the possibility of a covered seating area that people could use during the colder and rainy seasons, as the weather in Denmark is frequently cold and rainy.



Figure 16: Stone Path



Figure 17: Seating Area with Fire Pit



Figure 18: Covered Seating Area

4.4 Greenspace Design

Drawing from all prior data from our interviews, surveys, and design probe, we brainstormed a design plan for a greenspace, and then drew multiple drafts on what such a space might look like. These designs were drawn for the long stretch of green area by a few dormitory buildings at Øresundskollegiet, which we had previously chosen as the final placement of the greenspace. One team member sketched the initial drafts on graphing paper, laying out the sections of the greenspace based on our team's decisions of what the space should include. The final version of these drafts is pictured in Figure 19 below:

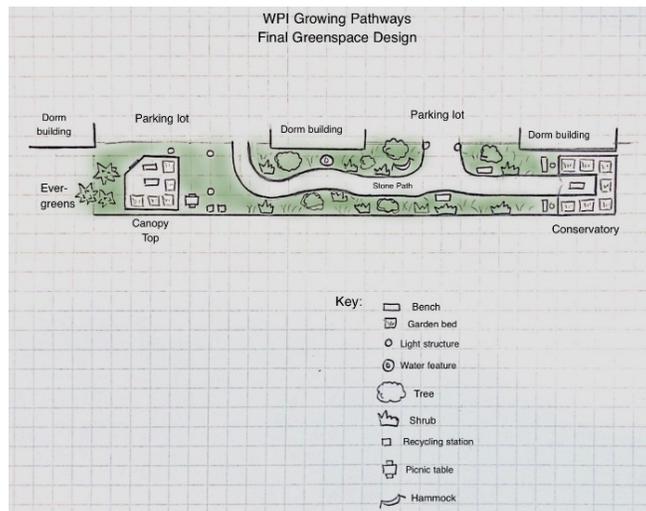


Figure 19: Hand-drawn Greenspace Design by Kathleen Duffy

This design incorporates key features taken from our previous results and research. The layout provides ample space for socialization while leaving stretches of lush greenery and features to promote biodiversity. The main social area on the left side of the diagram includes recycling bins, lighting, and picnic tables. This area also features a partial canopy to provide shelter from the elements, with a green roof and seating on top of this canopy. The green areas on the diagram can host a variety of native plant species, including deciduous rowan and hazel trees, complemented by dense shrubs such as alpine currant and juniper. The canopy area also features space for native coniferous trees like the Norwegian spruce. The central green area features a curving stone path that could blend well with the grass, as well as an aesthetically pleasing water feature that could also provide for wildlife such as bugs or birds. These spaces should also include thick grass and similar native greenery between the aforementioned larger plants to best support natural biodiversity. The right side of the diagram features more lighting and benches for community residents to use, as well as a hammock and an area for a garden conservatory, where these residents could participate in growing vegetables, herbs, and/or flowers.

We also created a three-dimensional model for this proposed greenspace using the Zoo Tycoon 2 game software interface. This design includes a fully modeled glass conservatory, lush foliage that closely represents the chosen plant species, and a partial canopy over part of the main plaza complete with garden beds and benches on its top. Thus, this model fully visualizes

features that the 2D hand-drawn model could not. The computer screenshots below in Figure 20 show a bird's eye view of this 3D greenspace, followed by a ground-level view of what the space might look like to a person walking through it:



Figure 20: Screenshots of 3D Design

The video game software used to create this design allowed the creator from our team to place already fully modeled plants, benches, tables, and other features with a good degree of freedom. It also allowed for the creation of buildings and structures, such as a rough model of the dorm buildings alongside the space, a glass conservatory, and the canopy that covers a portion of the main plaza area. The design also features a small, modeled water feature in the grassy area with shallow water and a rocky fountain for a natural aesthetic and nature-friendly design. The software features natural lighting and other effects that make the final design appear realistic. We believe this design could serve as a useful visualization to show others our vision for the greenspace's design. This software also comes with limitations, however. For instance, the software did not feature anything that could represent a wall mural or string lights around the

greenspace, as we had originally envisioned based on suggestions from our design probe. Additionally, a log bench takes the place of a hammock in Figure 22, as no 3D model of a hammock was available in this software.

As a part of our final deliverables, we created a YouTube channel online, named “WPI Growing Pathways,” and uploaded a video tour of this 3D greenspace, titled “WPI Growing Pathways ’21 Virtual Showcase.” The video is voiced over by team member Kathleen Duffy, who in the 5-minute duration gives an overhead and walk-through tour of the modeled greenspace in the Zoo Tycoon 2 game. The video is freely accessible online on Youtube.com for anyone to view or share at the following link: <https://youtu.be/GbeM6ePy5L0>

5. Conclusions and Recommendations

This project taught our team many things, from how a municipality interacts with non-profit organizations to using our engineering knowledge to design a greenspace for a college dormitory. While we were able to successfully achieve our goal, we did not do so without obstacles to overcome. Despite those obstacles, we created a project that we know can benefit the dormitory residents, as well as a method of creating a greenspace that Growing Pathways can use to build other projects in the future.

5.1 Limitations

Throughout the process of designing a plan to create a viable sustainability initiative for the Øresundskollegiet community our team faced many different challenges that we had to overcome to achieve our goals, especially concerning the COVID-19 pandemic. These COVID-19-related challenges included no face-to-face contact whatsoever with our sponsors, advisors, and each other. Additionally, we were not able to physically travel to Copenhagen to research our project. However, as our results show, our team was able to overcome these challenges through meticulous scheduling with each other and our sponsors, reaching out to community members in virtual settings, and obtaining detailed information about and photos of the location for our greenspace from our sponsors. Within the scope of a lack of contact, our team had trouble achieving clarity as to the direction of the project. For the first few weeks of our research, we struggled to understand the direction our project was taking in relation to Growing Pathways' own projects. This was due to a lack of clarity between our team and the sponsors. We also had trouble understanding our role and the tasks assigned to us by our sponsors and were suffering because of it. We felt that having conversations directly addressing confusion about a specific topic with both ourselves and the advisors could resolve such issues. Once our team had these conversations, we were able to find an avenue in which to take our project. This avenue became the plan of focusing on designing a greenspace within the Øresundskollegiet dormitory.

5.2 Discussion

Our interview process consisted of five interviews, two of which we considered experts in the field of urban nature design, meaning that they have a great deal of knowledge on some or all

the topics our project focused on. We also conducted two community interviews with individuals directly involved with the community. These interviews gave us useful insight into the dorm as a community and what kind of activities and interests many of the residents have. Throughout the interview process, our team learned several things. First, we came to understand that having a conversation with someone, as opposed to just question-and-answer format, proved a much more effective way of learning information in an interview. Conversation allows the interviewee to not feel as though they are being put on the spot, and thus a connection is made between the interviewer and interviewee. We learned many useful concepts on greenspace design using this conversational method. For instance, Marianne Spang Bech, the director of the Miljøpunkt Indre By environmental point, explained to us that getting the community involved is the best way to create a successful and sustainable greenspace. Based on this input, we are recommending Growing Pathways build a greenspace that is created through community involvement, for this project's greenspace and future projects.

Our survey provided many strong suggestions from the members of the community. The survey received as high as 33 responses for most questions, giving us a sample size large enough to work with effectively. We faced some difficulties when originally sending out the survey, in the form of a lack of interest and responses. We realized we had to go about sharing the survey differently than just a Facebook post when we received only nine responses after the first 3 days. Once we reached out to higher profile community members—individual community members who are connected to a lot of people—and asked them to share our survey with people they knew, we saw our response numbers spike overnight. We recommend that Growing Pathways works with community members like Benjamin Harrus or Niels Kristian Bjerg, who have high standings with the residents, to share information and spread the message about the projects Growing Pathways may be working on. We also recommend that Growing Pathways continues to organize meetings with whatever community they are working with to keep the residents up to date on the status of the current objective and overall project. Once we closed the survey and began to analyze the data, we found ourselves struggling to recognize some patterns and trends within the results. We reconciled this by figuring out which questions were the most important and sequentially went through each to build a greenspace design through writing. We were able to construct a preliminary greenspace design using the survey results. Finally, our design probe results showed that using a free-to-use platform for participants to put their own pictures and

designs down could help Growing Pathways obtain community input for this project, and future projects.

5.3 Final Recommendations

Our team firmly believes that the final greenspace design we propose optimally balances the priorities of humans and nature. This design should serve as an outline for Growing Pathways to use in the creation of their future greenspace in the designated area. We also believe, though, that the design should offer enough flexibility that our sponsors could add, change or remove certain aspects depending on their needs and budget. We understand that budget can significantly limit building plans, and so the inclusion of certain features, such as the plaza canopy, remain up to the discretion of Growing Pathways. We would like to stress, however, that certain key concepts of the design should remain intact to maintain the intended purpose of the space. This means that although space to for people socialize is important, we believe that the consideration of promoting biodiversity and the environment should also take priority. It is important for the community to be active members of the greenspace to create a symbiosis with nature. People need to take care of the space by caring for the vegetation and ensuring it does not become riddled with waste or it will not last. For this reason, we consider the areas of green grass and vegetation very important to the greenspace's design. Regardless of all other features, the greenspace could not stay "green" without these areas. Based on this conclusion, we recommend a list of native species for this greenspace and others that Growing Pathways may create in Copenhagen in the future. We formed the list below based on all previous knowledge and research into native species and from insights in our interviews and sponsor meetings. The following species, many of which appear in the final 3D model, should fit well into the greenspace proposed for the purpose of supporting biodiversity and a natural aesthetic:

- Stonecrop: (*Sedum sexangulare*) flowering plant for shallow soil
- Red clover: (*Trifolium pratense*) pollinator-friendly, flower of Denmark
- Calendula and Daisy flowers: (family *Asteraceae*) pollinator-friendly
- Juniper shrub: (*Juniperus communis*) evergreen, berry-producing shrub
- Alpine currant: (*Ribes alpinum*) deciduous, berry-producing shrub
- European rowan tree: (*Sorbus aucuparia*) deciduous, berry-producing tree

- European hazel tree: (*Corylus avellana*) small deciduous, nut-producing tree
- Norwegian spruce: (*Picea abies*) common evergreen tree

We chose these species because of their Northern European native range, adaptability to limited space and urban conditions, and usefulness in a greenspace. Many of these species produce nuts, seeds, or berries that wildlife could eat, or residents could harvest, thus making them multi-purpose features of the space. Growing Pathways could also expand this list in the creation of their greenspaces following the same guidelines we used to select these recommended species.

Our research also stressed the importance of sustainability. Thus, we urge Growing Pathways to build the greenspace with sustainable materials and methods. This means the building of the greenspace should stay conscious of budget, environmental impact, and ensuring that the structures of the space will last over time. Finally, given that we created our design based on community input, we want to stress the importance of community involvement and input in the creation, maintenance, and use of this greenspace. Community residents should have plenty of opportunity to participate in the greenspace at all stages. This could include ongoing collection of community input during its creation, and involvement of residents in activities such as gardening and recycling when the greenspace is complete. Social events and outdoor activities would also encourage residents to enthusiastically involve themselves in this greenspace, and most importantly, to feel that this space is their own.

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7. Appendices

Appendix A: Video Tour of Our 3D Visualization of Our Greenspace Design

Link to YouTube Video:

<https://www.youtube.com/watch?v=GbeM6ePy5L0>

Appendix B: Dr. Stuart Connop Interview Questions

- Questions for Dr. Connop
 - Can you tell us, in your own words, more about Connecting Nature?
 - What makes this particular organization successful in implementing its vision?
 - Have you heard of Growing Pathways before, and if not, have you heard of any of organizations that do similar work to what they have done besides your own?
 - Want to hear his thoughts on the program and possibly see if he has any information about the project from an outside standpoint
 - What type of other urban nature projects have you worked on in the past and what projects do you have planned for the future?
 - What makes a successful greenspace?
 - What would be the reason for a greenspace to fail?
 - This will open the conversation to find out what we should consider including and excluding in our greenspace.
 - How important is community participation in the creation and maintenance of greenspaces?
 - What is the design process like? Are there many hurdles to overcome when designing and implementing urban nature in a larger city?
 - How has the development of your Nature-Based Solutions helped you and other innovators like yourself implement urban nature in and around Europe?
 - If you could create a nature-based initiative within a city without restrictions from a government agency, what would that look like?
 - Since this is a major research project, the interviewer(s) team has been researching greenspaces and urban nature excessively to really gain a good understanding of how to go about doing this project in the best way possible. Are there any resources you would recommend that we could look into to learn more?

Appendix C: Marianne Spang Bech Interview Questions

- Can you tell us more about the urban nature project you have collaborated with Growing Pathways on?
- How has this project changed how people think about nature in the city?
- What is blue nature?
- What aspect of sustainability did this project focus on?
- Reiterate our understanding of the main goals of their project
- How has this project changed the view of the local government on what urban nature projects to give funding to?
- How can community-based projects be sustainable in terms of longevity of ongoing community involvement?
- What kinds of obstacles has this project faced when talking with the local government?
- Do you think it is harder to get the message out to people about these projects or do you think it is harder to convey the importance of these projects to people who may not really know what a project like this can do for the city?
- In the dorm, is there any advice or any strategies you think we could use to get that out there and kind of advertise to the people?
- What suggestions do you have for questions we should ask in our survey?
- Ask if she has any more questions for us and if there's anything else she wants to share with us

Appendix D: Benjamin Harrus Interview Questions Outline

- What are your plans for the urban farming project you are working on with SLA Architects?
- If we share our survey with you, can you share it with people in the kollegium?
- What is sustainability to the Øresundskollegiet, and how important is it to the community within the kollegium as well as the kollegium itself?
 - What practices has the kollegium preferred in the past?
- What does the kollegium itself do to promote sustainability?
 - How does it get the students and residents involved with different sustainable projects and practices?
 - What is the level of a person's individual involvement in sustainable practices dictated by Øresundskollegiet?
- How are these projects funded?
- What is the process for reaching out to a group like Growing Pathways and organizing a project like this?
- What is the kollegium's stance on the work growing pathways is doing in relation to the following Growing Pathways projects?
 - Dome of life
 - Greenspaces
 - Mapping
 - Increasing community involvement
- What are the kollegium's plans for the future of sustainability within the scope of this project?
- Since you have a much stronger connection than us to the members of Øresundskollegiet, what kind of greenspace do you think they would like to see within their community?

Appendix E: Niels Kristian Bjerg Interview Questions Outline

- What is sustainability to the Øresundskollegiet, and how important is it to the community within the kollegium as well as the kollegium itself?
 - What practices has the kollegium preferred in the past?
- What does the kollegium itself do to promote sustainability?
 - How does it get the students and residents involved with different sustainable projects and practices?
 - What is the level of a person's individual involvement in sustainable practices dictated by Øresundskollegiet?
- What is the process for reaching out to a group like Growing Pathways and organizing a project like this?
- What is the kollegium's stance on the work growing pathways is doing in relation to the following Growing Pathways projects?
 - Dome of life
 - Greenspaces
 - Mapping
 - Increasing community involvement
- What are the kollegium's plans for the future of sustainability within the scope of this project?
- Since you have a much stronger connection than us to the members of Øresundskollegiet, what kind of greenspace do you think they would like to see within their community?
- We are planning on conducting a survey within the next few days and are trying to figure out the best way to get the attention of as many residents as possible. Do you have any good ways to let them know about the survey?
 - We were thinking about a poster that we can design and have Growing Pathways post it around the dorm
- How good are the kollegium residents at English? Our sponsor has recommended including a statement at the beginning of our survey to let survey respondents know that they can write in Danish if that would be more comfortable for them rather than translating the whole survey to Danish.

Appendix F: Survey Questions Outline

- Our team’s greenspace definition: In terms of our project, greenspace does not just involve putting plants everywhere, but also incorporates the idea of “green”: being eco and environmentally friendly. The idea of a greenspace is to serve society and nature equally.
- (Show informed consent form) Do you consent to participating in this study?
 - Yes
 - No
- How often do you visit greenspaces in the community?
 - Every day
 - Every week
 - Less than once a month
 - Never
- How often would like you visit greenspaces in the community?
 - Every day
 - Every week
 - Less than once a month
 - Never
- What features in a greenspace do you find most important in your decision to spend time there? (Ranked Choice)
 - Proximity to my home
 - Area/size
 - Type of vegetation
 - Privacy/Seclusion
 - Ability to socialize
 - Proximity to my workplace
 - Aesthetics
 - Facilities (restrooms, vending machines, ect.)
 - Other (enter your own option):
- What natural features do you believe are important in your greenspace?
 - Vegetation

- Decorative Trees
- Large Trees for shade
- Floral Arrangements
- Water
- Wildlife
- Other (enter your own option):
- What architectural features would you like to see in a greenspace?
 - Benches
 - Picnic tables
 - Art installations
 - Fountains
 - Water pools
 - Other (enter your own options):
- Of the following, which type of greenspace would encourage you to be an active member within it?
 - Urban farming: This type of greenspace will involve the community producing crops that can provide to the local community
 - Climate adaptation: This type of greenspace will be used to assist a climate change issue
 - Community garden(s): This type of greenspace will involve giving the interested community members different opportunities to actively participate in gardening while simultaneously promoting a diverse ecosystem
 - Recreation: This type of greenspace will involve the community being able to enjoy the aesthetics and will have Growing Pathways promoting a diverse ecosystem
 - Other (enter your own option):
- (Show the map) Are you familiar with this location? Patch of grass near the café.
 - Yes
 - No
- How can you see this location being used to meet your expectations for a greenspace?

- (Show the map) Are you familiar with this location? Location for Growing Pathways Dome of Life
 - Yes
 - No
- How can you see this location being used to meet your expectations for a greenspace?
- (Show the map) Are you familiar with this location? Area around the OK shed.
 - Yes
 - No
- How can you see this location being used to meet your expectations for a greenspace?
- Please rank each location based on which location you would prefer to see utilized as a greenspace. (ranked choice)
 - Area around the OK shed
 - Patch of grass near the café
 - Location for Growing Pathways Dome of Life
- Would you be interested in being part of a focus group we will be conducting to get a better understanding of what the community would like to see in a greenspace?
 - Yes
 - Maybe
 - No
- If yes, leave your name and email address (text entry)

Appendix G: Design Probe Questions and Activity

Greenspace Design Probe

This activity is designed to narrow down what features community members would like to see in a greenspace around Øresundskollegiet and what you can envision in that space. Please complete this and return it to gr-Growing-Pathways-D21@wpi.edu by 4 May 2021.

The space we will be designing for is the grassy area near the playground, outlined in blue below.



Highlight or underline your answer to the following questions:

Which type of trees do you prefer?

Evergreen

Deciduous

Which type of vegetation do you most prefer? (Select up to two)

Vegetable Garden

Herb Garden (eg Dill, etc.)

Native Flowering plants (eg calendula, red clover, stonecrop, etc.)

Shrubs (alpine currant, etc.)

Native small trees (evergreen, rowan, hazel, etc.)

Which type of climate adaptation features would you like to see in a greenspace?

Solar powered lights

Recycling Bins

Composting

What recreational features would you like to see in a greenspace?

Picnic tables

Benches

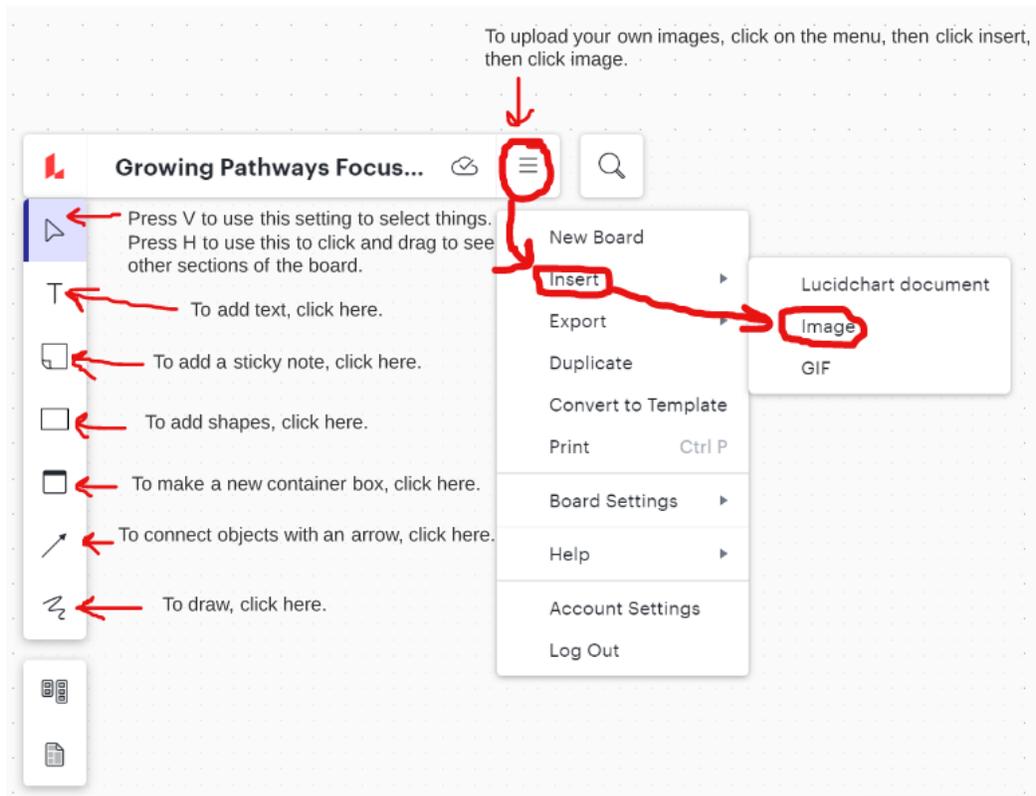
Fire pit

Places to hang hammocks

Lawn chairs

Please use this link to add pictures and ideas for the greenspace for our collaborative vision board. You may be prompted to sign up for a free account using your personal or work/university email. https://lucid.app/lucidspark/invitations/accept/inv_60a38e60-6fa8-4f53-bc37-b184a24ad4d9?viewport_loc=-807%2C-8%2C2560%2C969%2C0_0

Getting started with Lucidspark:



To get started, create your own container box and move it to an empty section of the board. Then you can fill your box with photos, drawings, text, collages, etc. with your own designs and inspirations for what you would like to see in this greenspace.