

**Winding Down and Looking Up:  
Weaving Activity Through Nature as a Method of Biophilic Design**

by

Megan Brianne Carroll

Submitted in partial fulfilment of the requirements  
for the degree of Master of Architecture

at

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**DALHOUSIE UNIVERSITY**  
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## **ABSTRACT**

Biophilia, the human-nature connection, stems from the evolution of humans and our affiliation with natural environments. This need for nature has been proven essential to our health and wellness. Younger generations, especially, have distanced themselves from the natural environment, as they are subjected to conventional forms of architecture. Saint Mary's University in Halifax, Nova Scotia, Canada provides the opportunity to inhabit nature through a 2.7 hectare lawn and forest. By working with the environment and weaving activity through nature, this thesis strives to facilitate interaction in a positive way, through principles of Restorative Environmental Design. As a gateway to the forest, this thesis proposes a learning centre, connected by a network of study pods within the forest canopy. These insertions of activity wind themselves through the forest, creating a series of events to experience nature.

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## CHAPTER 1: INTRODUCTION

Biophilia, first introduced to the language as a term by Edward O. Wilson in the 1980's, is "the idea that humans possess a biological inclination to affiliate with natural systems and processes instrumental in their health and productivity" (Kellert, Heerwagen and Mador 2008, viii). Many writers, psychologists and environmentalists have elaborated on this hypothesis over the years. Studies have proven the importance of nature in human lives, the yearning and negative impacts people have when there is a lack of nature, and the positive impacts that nature provides. Benefits in health, productivity, social problems, cognitive functioning and quality of life have all been attributed to biophilia (Kellert, Heerwagen and Mador 2008, 4).

Nature-deficit disorder is also a new term that has come to represent the lack of direct contact with wild nature, especially within the last few generations. This disconnect between humans and the environment is stronger than ever. Although children these days are more aware of threats to the environment, their intimacy with nature is becoming less and less (Louv 2005, 1).

Recently there has been literature on the importance of biophilia in the built environment. As humans, we understand the world through the built environment. Stephen Kellert believes our approach to the design of the built environment has encouraged massive transformations and degradation to natural systems and increasingly separates us from the natural world (Kellert, Heerwagen and Mador 2008, 5). Furthermore, these degradations and creation of artificial environments have led to a disconnect from the environment that has shaped and nurtured us. Edward Stainbrook states:

Having evolved through aeons of living with nature, organisms including man are genetically programmed to biological rhythms paced by sun, moon, and seasons. Hence we are often out of phase with modern situations—with artificial lighting, central heating and air-conditioning, with work organization and other social institutions structuring wakeful activity around the clock, with distressingly demanding sleep-disturbing attempts at mastery, with rapid travel through time zones. Fatigue and inefficiency and perhaps more subtle impairments of adaptation and biological responsiveness may be the price we pay for disharmony between the body's innate rhythms and the artificial surroundings and demands that press upon us. (Stainbrook 1973)

As humans, we live in the built environment every day. This creates a need for better environmental design, which responds more to the needs of humans as natural beings.

This idea of Restorative Environmental Design, conceived by Kellert, elaborates on the idea of sustainability as being not only about low environmental impact design, but more importantly, about positive environmental impact design (Kellert 2005, 93).

He believes that sustainability is about promoting “the health and integrity of natural systems not only for their physical and material rewards but also because they advance equally important human emotional, intellectual and spiritual needs” (Kellert 2005, 6).

The ethic of sustainability embraces a vastly expanded understanding of human self-interest that reaches far beyond the cramped confines of economic materialism or the unrealistic idealism of nature's value independent of human welfare. This broad utilitarian ethic recognizes and affirms how the natural world serves as an indispensable basis for what it means to be not only physically and materially secure but also emotionally and intellectually whole, endowed with a sense of love and beauty, and reverent of creation. (Kellert 2005, 6)

In regards to sustainability, Kellert also believes that “people will

not be inclined to commit the necessary energy, emotions, and resources to sustaining buildings and constructed landscapes over time, regardless of how technologically sophisticated these efforts may be" if they do not create positive experiences with nature (Kellert 2005, 94).

Low environmental impact design concentrates on mitigating negative impact, which occur from the modern built environment through a systems based approach. These design features aim to create a smaller ecological footprint through the construction of new buildings.

Positive environmental impact design, or biophilic design, concentrates on two areas, organic design and vernacular design. Organic design is about direct, indirect, or symbolic representations of nature, while vernacular design is about the culture and ecology of a specific place.

The research into the productivity and health benefits of nature have all shown a positive benefit to people, yet as architects we design buildings that have little connection to nature and natural qualities; even creating buildings that harm us, documented as sick building syndrome. In a way most buildings hinder us through enabling environments that promote nature-deficit disorder.

These biophilic qualities are important in building design. This idea stems from designing buildings for people, rather than designing buildings which have little concern for the occupants.

Human beings have evolved the ability and the need to process information embedded in their environment. Architects, on the other hand, in the process of distancing their work from what is natural, have come to rely increasingly on artificial criteria and the superficial manipulation of images. When images and surface effects supplant everyday



human desires and sensibilities in the name of artistic endeavor, humans are left to live out their lives in a series of ill-fitting, overexaggerated, and often idiosyncratic formal architectural schemes. Ordinary people see this trend—architecture turning away from human qualities—as the imposition of building design against their most basic instincts. But they have been able to do little about it, given the nature of the business of architecture and the seduction of technological progress. (Kellert, Heerwagen and Mador 2008, 76)

The connection between the benefits of biophilia and the built environment can be explored through the design of educational environments. Benefits such as increased productivity and cognitive functioning, as well as stress reduction, have been documented in many studies of work and learning environments.

Over the years, educational environments have been poorly designed as institutions, having little to do with emotional needs. Many schools are designed with the standard corridors and classrooms, which bring to mind the same archetypal associations of prisons, devoid of human interaction.

Education is a changing process, which is not reflected within the static environment of the classroom (Caudill 1954, 22). Although teaching styles have changed over the years, the built environment has been slower to catch up.

By creating different study environments for students, at a university level, it allows students the flexibility and complexity needed to learn and collaborate to their advantage.

I am proposing direct contact with nature through the idea of drawing students to nature and constructing from natural materials. This thesis pursues building in nature as opposed to the more common greening of the built environment. As a university, utilizing a natural forest for the benefit of students

would be a proactive approach to another level of sustainability.

By sufficiently programming a space for use, that without a solid program, could be left barren to be degraded and abused over time, the university is making a bold move in developing and preserving their campus and the future of their students.

This thesis strives to connect all students to nature, no matter what they are studying at the university, becoming a means for students to get away from the classroom and spend time in a space that transforms their experience of working and nature.

The location on the Saint Mary's University campus is convenient to all students, especially those who live in the residences, as well as study in the Loyola Academic Complex and Sobey's School of Business. The location acts as an informal backyard sphere to the formal arrangement of the quad. The proposed design will act as the hub for this region, much the way the Atrium building acts as a hub on the quad.

The following is an exploration of site and materials as a way to design spaces that provide enclosure in a meaningful way. For example, how can the qualities of this particular site be revealed through the architecture? From there, these qualities and particularities are taken to create a design, which responds to the site, and the program, which fits the location.

This response to connecting students with nature is a different approach, which will facilitate an interaction, which has not been seen in Halifax before.

### **Thesis Question**

How can architecture be integrated with nature to create spaces that reveal the inherent values of nature?

## Biophilia

In 1984, Edward O. Wilson wrote the book *Biophilia*, which brought to attention the correlation between humans and nature. This innate connection with nature stems from the evolution of organisms and the instinct for humans to reference back to how we evolved. In Charles A. Lewis' *Green Nature Human Nature: The Meaning of Plants in Our Lives*, he references that this innate connection with nature stems from the evolution of organisms; humans being only a small portion of evolution.

Richard H. Wagner states:

If you were to consider evolution of life on earth as a thirty-minute film, you would see wave after wave of new species evolving, filling the environment with a diversity of life forms, and then receding—sometimes totally, but occasionally leaving a few of the best adapted species behind. It is humbling to note that man's existence on earth would flash by in the last 3.5 seconds of that film. (Wagner 1971, 5)

This basic connection is believed to be an instinctual preference, with which we as humans are born (Lewis 1996, 21). These remnants are seen with the evolutionary development of birds and mammals, which leads us to believe that humans are the same way (Lewis 1996, 13). Richard Leaky describes this profound effect in regards to Africa as:

Genetic memory...the vast majority of people who come here feel something they feel nowhere else. It is not the wildlife, it is the place. If, as I believe, it is a memory, almost a familiarity, it is very primitive. It is the capacity homing pigeons have, salmon have, to recognize, to go back. You feel it's home. It feels right to be here. (Latham 1991, 33)

This instinctive connection is what draws us to nature, but how does that relate to us as humans? Rachel and Stephen Kaplan, environmental psychologists, suggest there are four characteristics in nature that have been associated with functional advantages. These four characteristics are: Coherence,

Complexity, Mystery and Legibility (Kellert 2005, 15). The first two have been linked with critical thinking, problem solving and creativity, the latter two with organizational, analytical and imaginative skills.

It is mystery that piques curiosity about what further information might be learned. The presence of mystery is identified as the most consistent predictor of landscape preferences (Lewis 1996, 14).

Roger Ulrich's research has involved analyzing landscape preferences by measuring physiological and psychophysiological responses, such as blood pressure and muscle tension. His tests have concluded that nature physically affects people in positive ways. In one of his studies of students, he took a post exam group and split them in two. He showed half of them pictures of nature, and the other half pictures of urban scenes. He found that the students who viewed nature exhibited lower stress, where as the students who viewed the urban scenes were tenser than when they finished the exam (Lewis 1996, 14).

Stephen Kellert has elaborated these theories into the built environment. His book *Building for Life: Designing and Understanding the Human-Nature Connection* focuses on the positive impacts of nature on humans. His book is split into the science and theory of humans and nature, the importance in childhood development, harmonizing nature and built environments, biophilic design and ethics of sustainability. He focuses on many scientific psychological studies that have proven that nature is beneficial and necessary to humans, but also publishes narratives about human experience. I believe this juxtaposition further enforces the idea of nature as a force

that is greater than us, some of which can be understood, while some cannot. His analysis of the importance of nature in childhood development could be related to the learning and development of college students, especially in this day and age where there is less contact between children and nature. This development can be broken down into modes of learning; cognitive, evaluative and affective, and modes of experiencing nature; direct, indirect, and symbolic (Kellert 2005, 67). He positively connects nature to the development of biophilic values, emotional, cognitive and evaluative development.

Richard Louv talks about college students as being on the cusp. In *Last Child in the Woods*, Louv describes college students as being the first generation to grow up in a largely denatured environment, with just enough exposure to know what they're missing (Louv 2005, 3).

In *Green Nature Human Nature: The Meaning of Plants in Our Lives*, Lewis talks about woodland settings as archetypal representation of the natural world, different from the built environment in which daily routines occur. Being in an environment, which lacks facilities and comforts, requires us to use other resources that we don't normally draw upon in urban life (Lewis 1996, 107). Living in the wilderness is popular in many restorative programs geared to certain groups. This is because the natural environment challenges people to discover their untapped potential (Lewis 1996, 107).

A vacation for most people implies a change of scene and pace, a time of respite (Lewis 1996, 108). The great thing about vacationing in nature is the fact that human influences do not dominate. This longing for a different landscape allows us to break from our daily routine and roam in the non-human

influenced landscape.

Vacationing in nature makes people more aware of their surroundings (Lewis 1996, 108). The Kaplans, with the help of colleagues, conducted a ten-year study on the effects of a wilderness trip on high school students in Michigan. This study is described in *Green Nature Human Nature: The Meaning of Plants in Our Lives*. Their findings concluded that self-perceptions and perceptions about relationships to the natural world change as students are on this wilderness trip. They report,

There is a growing sense of wonder, and a complex awareness of spiritual meanings, as individuals feel at one with nature, aware of the transience of individual concerns when seen against the background of enduring natural rhythms... they feel more sure of who they are and what they want to do. (Kaplan 1983)

Lewis concludes this heightened sense of spirituality seems to be inherent in the nature experience. "It is as if a gate opens to a deeper self-understanding and sense of connectedness with larger forces in the universe" (Lewis 1996, 110).

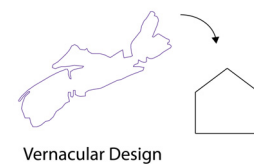
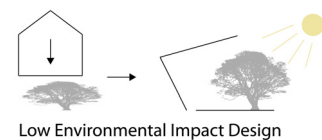
Interestingly this study also follows the students to see if these experiences have any lasting effects. Indeed, The Kaplan's report that these benefits remain. The contrast between the urban and natural environments emphasizes the artificiality of the urban environment. After this experience, the constructed environment seems ugly and boring (Lewis 1996, 110). Students felt closer ties with nature and the people they had become there. When compared to the urban environment, students remembered the woods as peaceful, tranquil places. This experience for the students created a sensitivity to nature in the urban environment and the students seem to have a sharper ability to distinguish between the significant and unimportant in their normal environments (Lewis 1996, 111).

Based on documented research regarding biophilia, it is clear that human interaction with natural environments is important and vital to us as humans. Experiencing the natural environment is beneficial to people for many reasons and something that should be integrated into our daily lives. For some people, such as students, who don't necessarily have the means to get out of the city, preserving easily assessable areas in the city as well as on campus is important to the well-being of students.

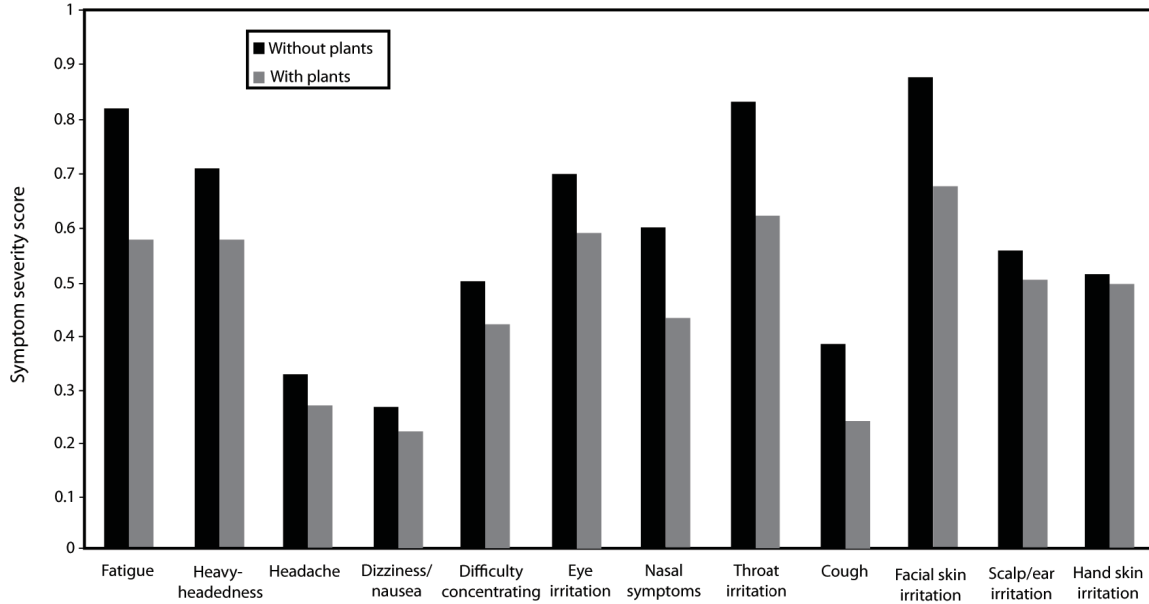
### Restorative Environmental Design

More often than not, there has been a disconnect between biophilia and the built environment. This human need for nature, is rarely considered within the way we design buildings. This disconnect has led to many buildings which have no response to the environment and in turn may be the cause of some health problems.

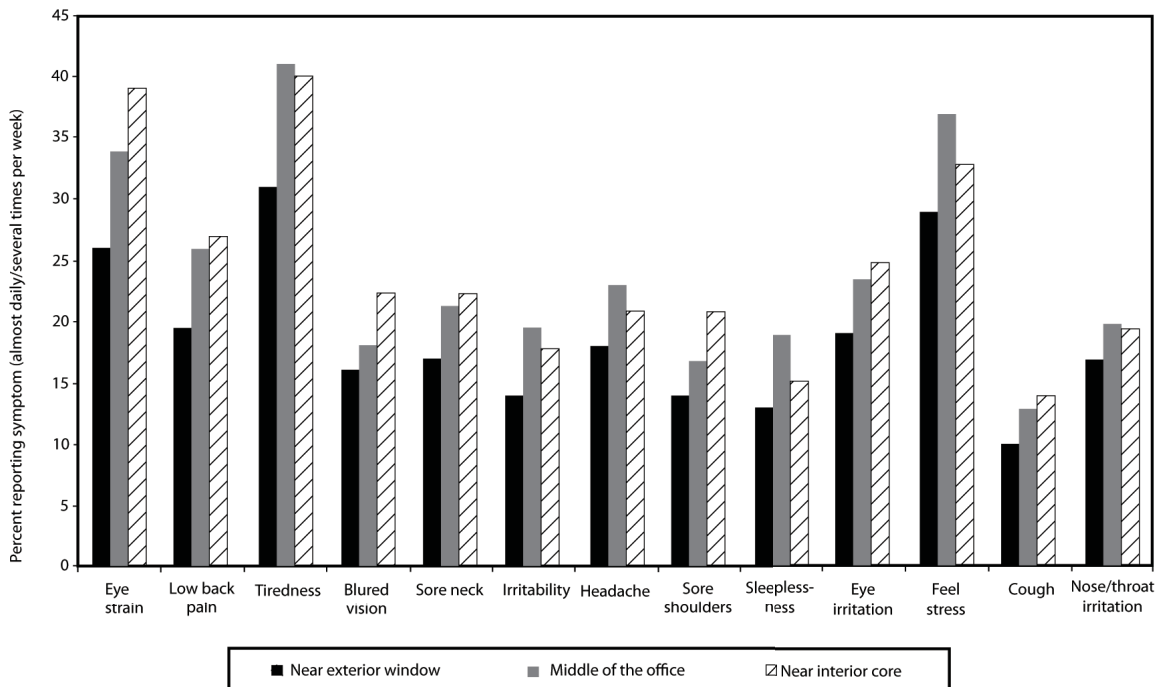
The following tables show the benefits of integrating the natural environment in the design of buildings.



Restorative Environmental Design.

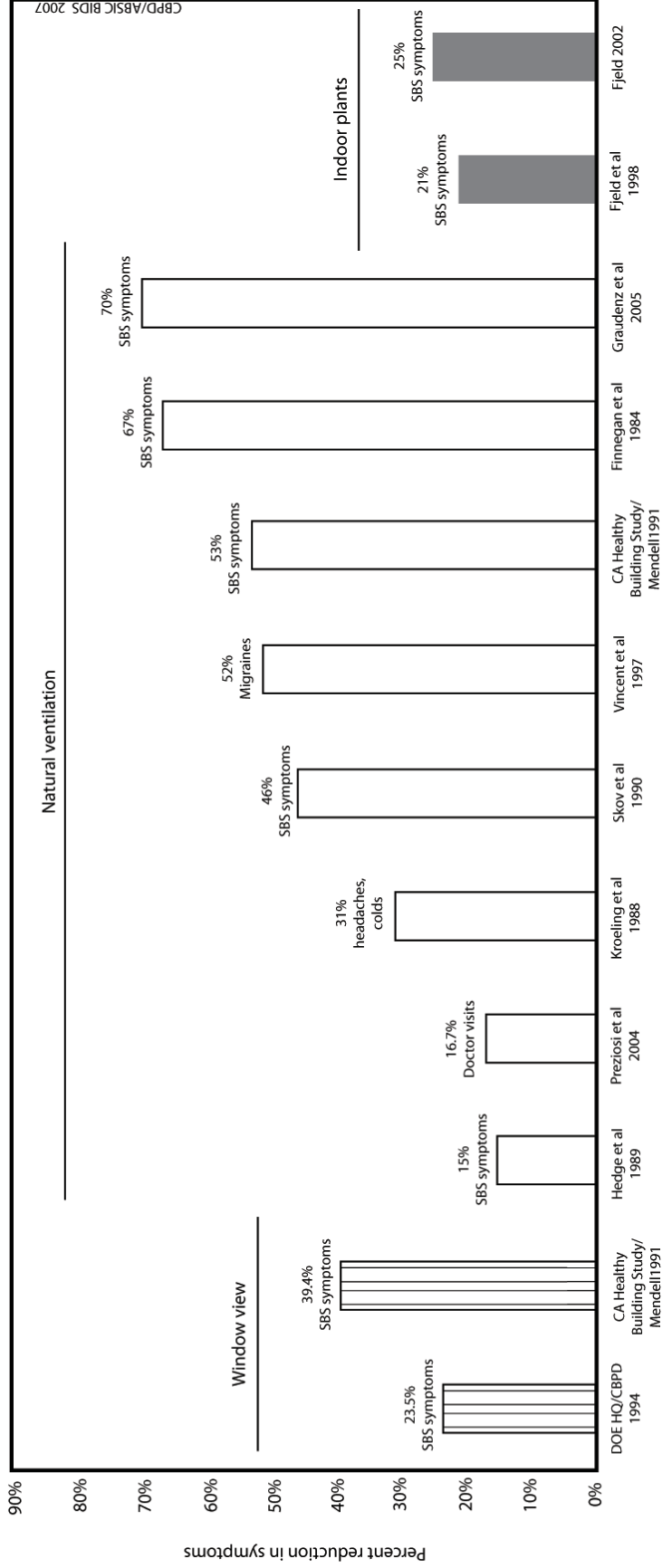


Reported sick building syndrome symptoms in the presence and absence of indoor plants (Fjeld et al 1998).

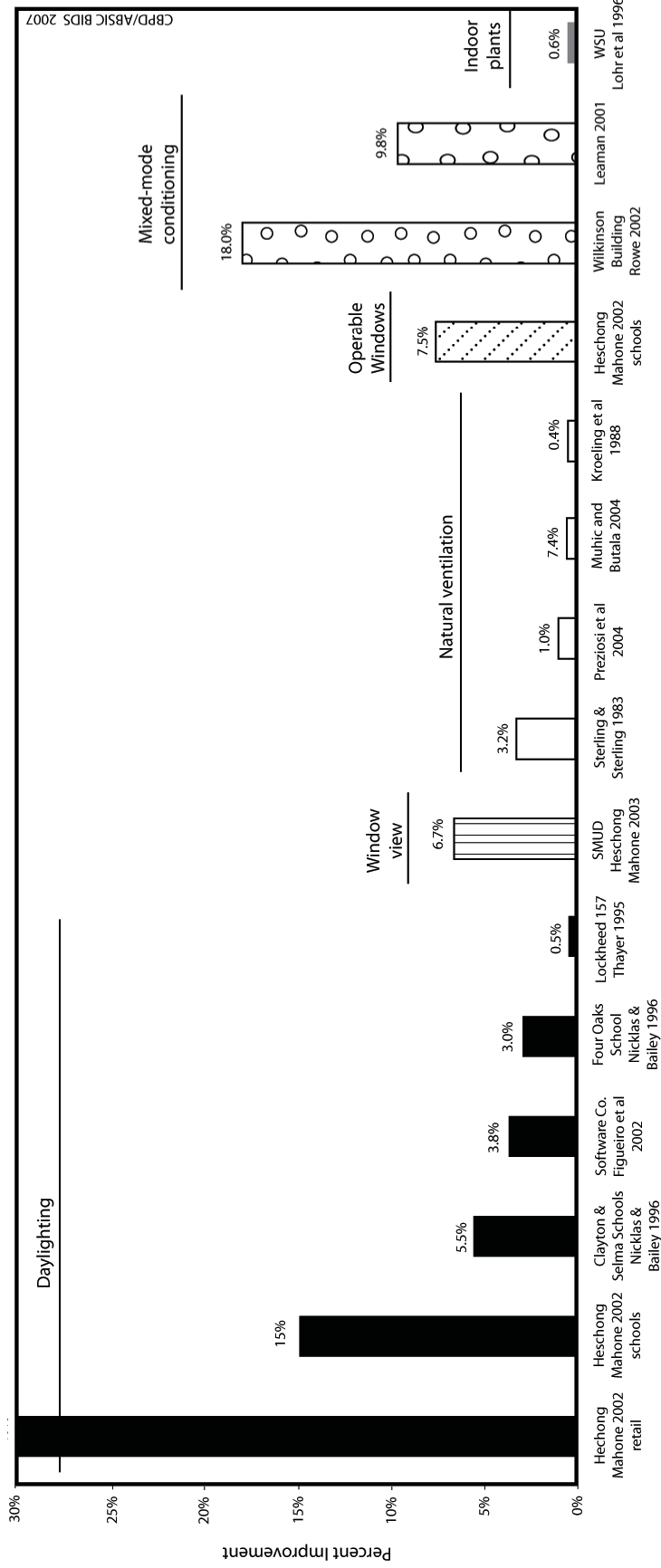


Comparison between window proximity and health complaints at two USDOE offices (Centre for Building Performance and Diagnostics/DOE 1994).

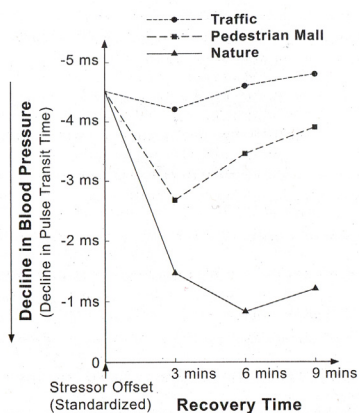




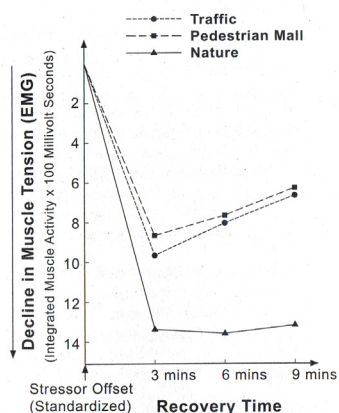
Health gains from access to natural environments table (Center for Building Performance and Diagnostics, Carnegie Mellon University).



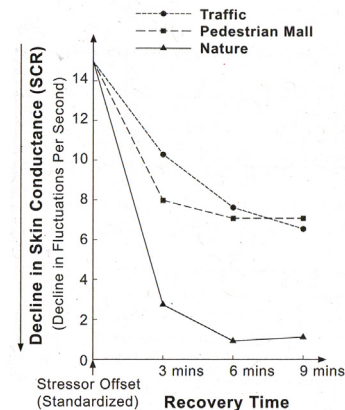
Productivity gains from access to natural environments table (Center for Building Performance and Diagnostics, Carnegie Mellon University).



Systolic blood pressure during recovery from stress in persons exposed to nature settings or urban settings lacking nature (Ulrich et al 1991).



Muscle tension (forehead) during recovery from stress in persons exposed to nature settings or urban settings lacking nature (Ulrich et al 1991).



Skin conductance during recovery from stress in persons exposed to nature settings or urban settings lacking nature (Ulrich et al 1991).

The benefits to people, when designing with the environment in mind, are astounding. Stephen Kellert coined the term 'Restorative Environmental Design'. He believes buildings need to address not only their negative impacts on the environment but also create positive relationships between people and the natural environment. These positive relationships can be addressed through the following biophilic design attributes (Kellert, Heerwagen and Mador 2008, 15).

- Environmental features. For example: Water or plants.
- Natural shapes and forms. For example: Arches or vaults.
- Natural patterns and processes. For example: Sensory variability.
- Light and space. For example: Natural light.
- Place-based relationships. For example: Cultural connection to place.

- Evolved human-nature relationships. For example: Curiosity and enticement.

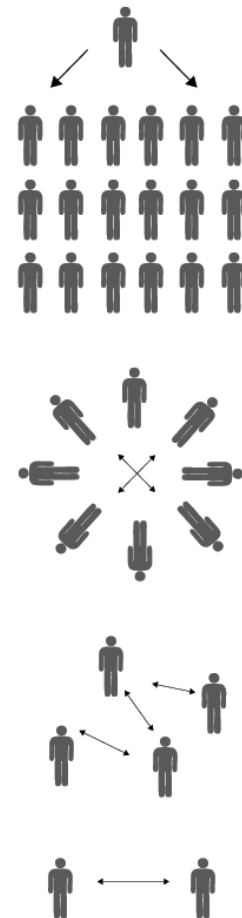
This project aims to use the concepts of restorative environmental design in aiding an architectural response to designing for people in nature.

## Studies on Nature and Education

Architect Louis Kahn once pointed out that the original classroom was likely under the shade of a tree (Bergsagel 2007, foreword).

The Architecture of Learning, a chapter by Jeff Morehen in, *In the Realm of Learning: The University of Sydney's New Law School* by Francis-Jones Morehen Thorp, an architectural firm in Australia, describes the new pedagogy of learning. Jeff Morehen, a partner at the firm, states that students these days have different attitudes, expectations, constraints and methodologies than previous generations. Increased mobility and connectivity, physically and virtually, requires a different model of spatial experience (Francis-Jones Morehen Thorp 2009, 22). He believes modern pedagogy is focused upon learning-by-doing in lieu of learning-by-listening and that learning environments have a direct effect on cognitive and behavioral responses.

He believes contemporary universities should provide diverse experiences for all students. Creating a cohesive campus is important to allow for a range of spaces that accommodate the needs of a variety of students. Learning is a social experience that also develops out of the informal. Chance encounters, peer interaction, spontaneous meetings, and informal interactions, are all important to learning. This balance between traditional and contemporary, formal and informal, and technological



Educational arrangements.

and experiential is key as a way to create environments that promote rather than restrain learning (Francis-Jones Morehen Thorp 2009, 22).

*Plants in the Classroom Can Improve Student Performance* was a study done by John Daly and The Plants and Indoor Environment Quality Group Centre for Environmental Sustainability at the University of Technology, Sydney, Australia. They studied the effects of indoor plants on classroom performance for grade 7 and 8 students. They studied 13 classrooms in three different schools in the Brisbane region. They found plant presence increased performance between 10% and 14% in two schools and had no effect in the other school. However, the school that it did not affect had an active gardening program in which students had regular contact with nature.

Seiji Shibata and Naoto Suzuki's study, *Effects of an Indoor Plant on Creative Task Performance and Mood*, documented a plant's affect on performance and mood among university students. They set up three rooms, one with plants, one with a rack of magazines set up in front of the students and the other with nothing. Thirty-five male and fifty-five female undergraduate students were required to associate up to thirty words with each of twenty specified words in a room with one of these arrangements. The study showed that females performed better with the plant than the magazine rack. Mood was better with the plant or the magazine rack than the empty room. Their conclusion suggested that the compatibility between task demand and the environment is an important factor in facilitating task performances (Shibata and Suzuki 2002, 265).

Rachel Kaplan's study, *Nearby Nature*, also suggests a positive correlation between people and nearby nature. This study was

published in *The Role of Horticulture in Human Well-Being and Social Development : A National Symposium 19-21 April 1990- Arlington Virginia.*

From these studies we can see that plants and nearby nature have been proven to have positive benefits on students.

### **Sacred Space, Rituals and Psychological Impacts of Elevation**

In *The Temple in the House: Finding the Sacred in Everyday Architecture*, Anthony Lawlor talks about the idea of architecture as being born in the mind of the creator, as a story, which is revealed through the built environment (Lawlor 1994, 3). This story is the spirit and the mortar. Gate, Path and Lotus Seat or Wanting, Seeking, Finding, are the three organizing design principles in which all architecture is created (Lawlor 1994, 15). According to Lawlor, the first desire as humans we have to take action, comes in the form of a gate (Lawlor 1994, 19). At the gate many decisions are made. It frames the path ahead and acts as an invitation for you to proceed. The path symbolizes the journey and the transformations that occur. This transformation can occur in many ways. It could be linear, spiral or radial, each affecting us mentally in different ways. The route moulds our experience, emotionally, physically and psychologically. A network then connects the paths, which are vital to our existence. As one moves through the path, there is a series of unfolding layers. This path can take the form of vertical or horizontal movement. Vertical movement is associated with leaving the constraints of the earth and rising up to the sky. In any case, the path always leads to a goal. The idea of transformation cannot be fully realized without a truth or moment of arrival, the Lotus Seat.

Another pattern is the idea of Steeple and Sanctuary (Lawlor 1994, 51). Steeple being the vertical monuments and sanctuary as the sheltering act. The vertical and the gathering forms fit together like yin & yang, whether it's a church, a meeting hall, or an office building.

In *The Concept of Dwelling*, Christian Norberg-Schulz talks about the modes of dwelling, as an existentialist idea rather than a literal idea. These four modes are settlement, collective, public and private dwelling. The book also talks about identification & orientation, paths & domains, and morphology, typology & topology. These ideas all relate to the existentialist philosophy. Much like Lawlor's book it uses abstract notions to understand the environment we live in. Dwelling being what occurs between the earth and the sky. The Axis Mundi is the vertical axis, which connects the two, acting as the sacred dimension of space.

It represents a "path" towards a reality which may be "higher" or "lower" than daily life, a reality which conquers the gravity of the earth, or succumbs to it. The *axis mundi* is therefore more than a centre on earth; being a connection between the cosmic realms, it is the place where a breakthrough from one realm to the other can occur. (Norberg-Schulz 1985, 22)

Researching sacred spaces is important because I perceive the learning center and forest pods as a release from the daily activities of the University. Productivity requires some type of concentration, which comes from a mental release from stress and other distractions. I see the main building as a destination of respite for students, as an informal gathering space in their own backyard. By researching the idea of wanting, seeking, finding, I am able to think about connections and thresholds. How can each step of the way be designed to get you to the point where the environment has become influential in your productivity.

The journey being just as important as the destination. The idea of the steeple being the light that guides you to the sanctuary. At the scale of the University the main building is the sanctuary, but even at a small scale, the forest pods act as a second level of respite as study carrels within the forest. Looking at the Axis Mundi and the idea of verticality as a release, these pods are suited up in the canopy. The vertical dimension acts as another layer of respite, being a completely different environment than most people are used to. This difference in environment is expressed previously in the idea of wilderness vacations by Lewis. The transformation of space, allows for the mental release which is beneficial to productivity.

## **Dwelling in Trees**

### **Treehouse History**

The idea of constructing in trees can be traced back to the first homo sapiens who lived in trees as a means of protection and can also be associated with our closest mammalian relatives (Clark 2003, 11). There is something healing about resting in branches. This may be because it provided a rapid comedown from the adrenaline rush of being potential prey (Louv 2005, 43). Biologically we are still on alert to these situations which make us fight or flee, and climbing high above, especially in the trees, lets you survey over things with a calming relief and sense of security.

Although this mode of living is decreasing in number of inhabitants, currently there are cultures that still live in trees, mostly in the South Pacific. The Korowai people, for example, live in trees 150 feet off the ground. They have done so for protection, natural ventilation, to see the birds and the mountains and to keep sorcerers from climbing their stairs (Tree



Korowai Treehouse in Papua New Guinea. Photograph by G. Steinmetz (Nelson 2004, 22).



Houses of the World 1988, 38).

In the Middle Ages, Franciscan monks meditated and transcribed manuscripts in tree rooms and Hindu monks would live in trees to free themselves from earthbound considerations (Harris 2003, 13). In the early 16th century, treehouses became popular among European royalty, making their way into many Florentine gardens (Nelson, Larkin and Rocheleau 1994, 6). The Medici family and the Roman Emperor Caligula, built multiple palaces in the trees. In Kent, a multistory treehouse was built at Cobham Hall in the late 16th century. Many of these treehouses were elaborate and were used for dinners and banquets. Some of the oldest standing treehouses are those at Pitchford Hall, built in the 16th century, and the 800-year-old Chapel in Allouville-Bellefosse, (Normandy) located in the hollow of an oak tree. The Robinsons in Paris was also a popular restaurant in the trees, in the early 1900's.

### **Fantasy Associated with Treehouses**

Treehouses are also popular images in fiction. Associated with escapism, alternate worlds and a stretch of the imagination. This can be seen in *Winnie-The-Pooh*, *Peter Pan*, *Hook*, *Swiss Family Robinson*, *Lord of the Rings*, *The Return of the Jedi*, and *The Baron in the Trees*.

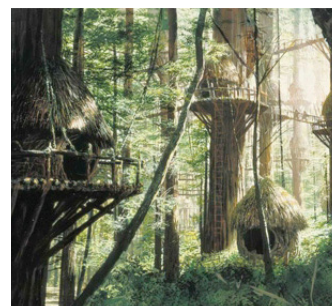
*The Baron in the Trees* is an Italian novel written by Italo Calvino in 1957. It is about a twelve year old baron, who in a fit, leaves the dinner table and climbs a tree. He never comes back down and spends his whole life in the trees. The canopy becomes his kingdom. The book, narrated by his younger brother, describes his life in the trees. Although fiction, the book has a sense of reality. *The Baron in the Trees* became an important resource in imagining the canopy as an inhabitable space.



Pitchford Hall Treehouse (Pitchford Estate 2011).



Chapel in Allouville Bellefosse. Photograph by Radek Kurzaj (Nelson 2004, 141).



Bright Tree Village (Pallister 2009).

## Current Treehouses

Nowadays many treehouses are built for recreational purposes and private enjoyment. Treehouse can be seen in backyards, recreational camps and as accommodation. Treehouse hotels have become popular destinations around the world. These hotels are in a variety of climates, some as north as 66°N and open year round. The Treehotel in Sweden boast multiple living quarters in a variety of themes, everything from a mirrored glass box to a bird's nest.



The Cube Treehouse at Treehotel in Sweden ("Building Tree Hotel in Sweden" 2011).

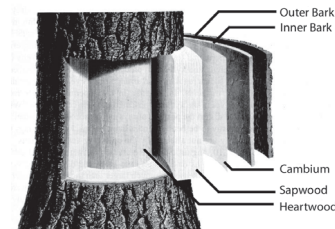
## Treehouse Construction

Treehouses are constructed by attaching directly to trees, or suspending from multiple trees.

Trees grow larger by expanding their diameter and growing new branch tips not by stretching the entire tree (The Treehouse Guide FAQ's). Which means your structure will not be lifted as the tree grows. New layers of wood are added in the spring and summer and the only portion of the tree to get higher are new shoots. Once the season is over these shoots no longer grow in length but grow in diameter. The next season's new shoots, build off the old shoots growth. As trees get older they lose their bottom branches from being shaded by new branches, giving the impression that the trunk has stretched. By attaching to the heartwood the treehouse will remain at a fixed point.

The cambium layer, the layer of the tree that grows, is located just under the bark. This layer grows outwards. It is important to design space between your structure and the tree for growth. The structure should never touch the tree.

As trees are living organisms they can be affected by infection,



Tree Layers (Nix 2012).

compartmentalization, tree growth, and weight distribution (The Treehouse Guide. Tree Damage Caused by Treehouse Building).

Airborne bacteria and fungi can infect a tree by causing localized rot and death. Insects can also infect trees by boring into the tree for shelter and food, exposing and damaging the living tissue of the tree. The bark of a tree is designed to protect it from these incidents, however it is not superior to all species. Likewise, when constructing treehouses it is important to minimize damage to the bark. In treehouse construction it is wise to never cut branches or parts of the tree to allow for more room, this will expose the tree's tissue and be more susceptible to infection.

Attaching with nails and screws are not appropriate as they are weak attachments and require many punctures to create rigidity. Slings, ropes and cables need to be attached in a proper way. If they are tied around a branch or slung over a branch, they will damage a large area of bark and if they are completely squeezing a branch it will eventually strangle the branch and kill the tree.

Bolting is the best possible insertion into a tree. It is important to bolt with a lag bolt or specific treehouse attachment bolts (TABS), rather than a threaded rod, which does not support shear loads (Treetop Builders. Treehouse Construction). When bolting it's important to minimize the amount of attachments to a tree and when inserting it is important not to have more than one insertion in a vertical line up the tree less than 18 inches apart; as there are vertical veins within the tree that transport nutrients. Horizontally a 12" separation is best. With multiple penetrations close together it creates the risk of a large compartmentalization,

resulting in dead areas of the tree. Compartmentalization is what the tree does to protect itself from damage. When a tree is damaged it isolates the damaged section, grows a layer around the section and nutrients no longer access the area (The Treehouse Guide. Tree Damage Caused By Treehouse Building). Trees do not grow new tissue but seals these areas off and continues to grow around them. When inserting a bolt into a tree, the tree will react and immediately compartmentalize the wound as a way to protect itself from infection. This creates a stronger portion, with a solid connection between the tree and the hardware.

It is important to understand where the weight is being distributed in regards to the tree(s) and how that affects the trees position. Trees are supported by their roots, which do not always grow out in a symmetrical fashion. The tree over time will compensate for extra unbalanced weight with the growth of its roots, but this strength takes time to develop. When constructing a treehouse structure, distributing the weight equally around a tree or between trees is best.

For trees to be suitable for development, they should be healthy, hearty and at least 12 inches in diameter at the base of the trunk. The trees I plan to build in are Red Oaks that are between 17 and 24 inches in diameter. Red Oaks are great trees to build in because they are strong, have large branches, grow very straight and are very resilient against environmental factors such as insects and weather.

Wind can be a problem when creating structures in trees. As Saint Mary's University is located in a windy climate this will be an important factor to design for. During high winds structures can act as sails, which creates stress on the trees roots. Normally

trees withstand winds by shedding parts of their structure, first leaves then small branches. The sites within the forest will have fewer issues with wind than the trees exposed along the rail cut. As well, building lower to the ground will have a reduced effect on the stress to trees, because the leverage effect will be less. The tree will react to the structure and add strength to their roots over time but within the first few years the tree will be more vulnerable. Building in the bottom two thirds of a tree and building with curves and circular shapes can minimize wind resistance.

When attaching to trees you can either build fixed or flexible joints. Flexible joints are a good idea when attaching to multiple trees as they move differently and the supports will have to deal with compression and tension. Flexible joints can be slotted beams, looped metal brackets, cables and suspended attachments. Usually one tree has a fixed joint and the others within the network are flexible (The Treehouse Guide. Flexible Joints). Fixed joints are created with brackets attached to the lag bolt, which can usually move in one direction. Fixed joints are usually acceptable for singular trees. Cables and suspended attachments are good choices because they allow for movement in a range of directions. Cables can also be adjusted over time if there are any issues with leveling.

The Garnier Limb is an attachment invented by treehouse builder Michael Garnier. He was able to develop a system that works like a real limb. His design is a 12" long by 1 1/4" diameter metal rod, threaded on each end, with a 3" diameter by 1" long metal collar in the middle. The rod is inserted into the tree and the collar then sits against the cambium layer. Over time the tree will grow over top of this collar and rod, with considerable room between the end of the rod and the outer layer of the tree.



Garnier Limb Attachment (Garnier Limb 2011).



Flexible joint, looped metal bracket which slips onto the Garnier Limb. By Michael Matisse (Nelson 2004, 9).

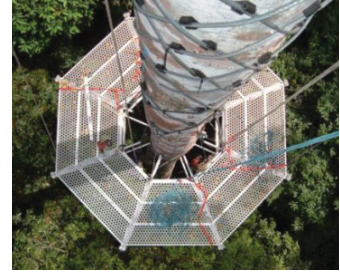


Fixed joint, knee bracket which slips onto the Garnier Limb. By Radek Kurzaj (Nelson 2004, 209).



Along with bolts, garnier limb's attach to a variety of different fixed and flexible brackets.

A British Columbian company, Greenheart Design, has developed a suspension system called "tree hugging". Cable mesh is woven around the tree to suspend the structure. The system works much like a Chinese finger trap. When in use, the platform tightens its grip around the tree but relaxes when not in use.



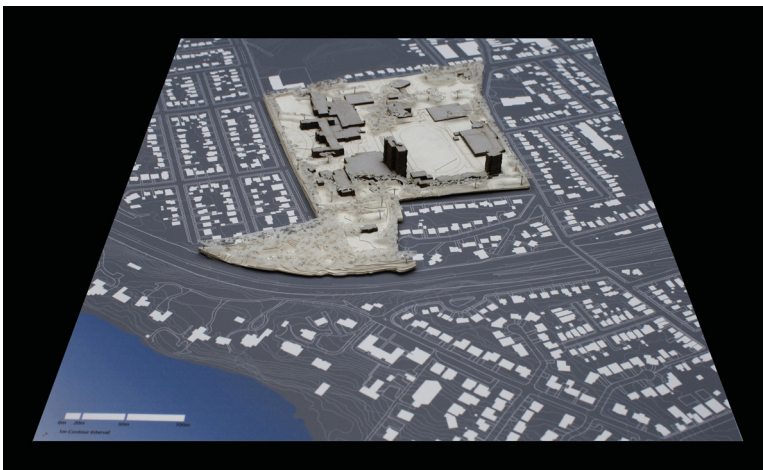
Tree Hugging System  
(Greenheart Conservation  
Company 2012).

## CHAPTER 2: DESIGN

### Saint Mary's University

Saint Mary's University, located in Halifax, Nova Scotia, is the oldest English speaking Roman Catholic University in Canada (Saint Mary's University Website). Established in 1802, it has moved from its original location, downtown on the corner of Spring Garden Road and Barrington Street, to Windsor Street in 1902, and then finally its location at Inglis Street and Robie Street in 1949. The University has had two types of governance, first The Christian Brothers of Ireland, then The Jesuits. The current location in the south end was bought in 1943. The land was the Gorsebrook Golf Club, formerly the estate of Halifax merchant and privateer Enos Collins (Saint Mary's University 2011).

The current location in the south end is one large super block at approximately 16 hectares. The University, with more than 7000 students, is known for its program strength in business, international development studies, astronomy and football (Saint Mary's University 2011).



Saint Mary's University campus model map (Saint Mary's University Survey Plan 2011).



Saint Mary's University campus model map (Saint Mary's University Survey Plan 2011).



Saint Mary's motto is – What you do, do well. Within their university core values environmental sustainability is stated in the first bullet, as well as positive learning environments, global awareness, student growth, academic integrity, pursuit of knowledge, fiscal responsibility, responsiveness to community needs and openness to change (Saint Mary's University. Motto, Vision, Mission, and Core Values). This value of environmental sustainability can be seen through Saint Mary's Society for Sustainability, Saint Mary's University Environmental Society, and Saint Mary's University Community Gardens.

The Society for Sustainability on campus was created out of a university mandate in 2007 for the development of a sustainable strategy for the university as a whole (Sustainability and Saint Mary's. Strategy: Principles). The University wishes to promote sustainable partnerships on campus, awareness and increase dialogue between members and groups in the campus community, and connections related to sustainable stewardship with the larger community (Sustainability and Saint Mary's. Strategy: Principles). The society runs a sustainability week of activities and speaker series. They've documented statistics on the universities consumption stats, including waste, water, electricity and fuel, commuter maps, and custodial cleaning products. Their initiatives include the water bottle and disposable beverage cup survey, reusable mug campaign, community garden, bottled water statistics, alternative transportation, residence energy challenge, institutional bikeways planning document, a Saint Mary's University green map (sustainable locations) and a Saint Mary's University blue map (water locations).

Saint Mary's University Environmental Society, is a student action group, which promotes sustainability on campus. They promote

activities like Muggy Mondays, Dump and Run community garage sale, recycling, composting, paper reduction, Earth Day, and local clean ups.

On the Saint Mary's University Website they have developed an interactive dashboard showing electricity, water, heat, natural gas, green, and operating facts for all the buildings on campus (Saint Mary's University Energy Dashboard). The data is represented in context to tangible things. For example, the university's monthly water consumption for August 2012 was equivalent to 215,000 showers or enough to fill 25,000 Olympic sized swimming pools. The energy consumption for the same month was equivalent to 17 acres of forest, or enough to power 28 average sized homes for a year. By creating comparisons, they are able to create accountability and awareness with people who normally wouldn't comprehend the amount of energy a university actually uses. Saint Mary's University has become serious about documenting and showing what steps the university is making to create a more sustainable future.

Saint Mary's University policies on sustainability are referenced throughout their University Master Plan, as well as some green initiatives they have already introduced in new projects, such as the living wall and green roof in the new Atrium building. The three-story wall is the first of its kind in Atlantic Canada with approximately 1,100 plants (The Atrium Building. Saint Mary's University Website)

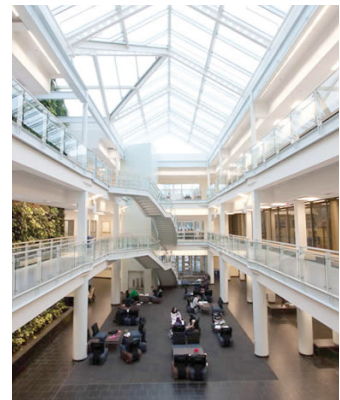
The University is on a single campus superblock, which has room to fill as the University needs it. The arrangement is a series of buildings, which surround the football field. Just north of the field is a formal quadrangle, which is bordered by the Library, Student Centre, Atrium and English building. The first campus

building, the McNally building, is a stone building oriented to Robie Street. The other buildings vary in age, character, and orientation. Most of the buildings are sandwiched or combined together, even with varying styles and characters. Although the university is mostly within this superblock, they also own a piece of property to the south called The Oaks. The Oaks is an undeveloped natural setting.

The University's newest building is the Atrium. Built in 2009, it fills the space between the Science, Library and Burke Building. The building is an atrium with student work, classrooms, labs and social space. This space is well used and a major thoroughfare for traffic between the three buildings.

Even with this, there is a lack of student workspace documented in the Campus Master Plan developed in 2005. It outlines a need for a study pavilion, by 2015. They have situated this future pavilion between the football field and the McNally Building, creating an extension of the quad wall. The plan is to green the quad and make it a more desirable place, along with situating this building just south of the quad. The program will have a better connection to the outdoors and be more assessable to all students on campus if it was sited on the Oaks property. It would draw a second sphere of activity but create a balance, instead of heavily overdeveloping a single area to the north of campus.

Secondly, the Oaks Complex, a four storey research and conference centre proposed for the middle of the Oaks forest, in the campus master plan, is quite large and would take out most of the forest and many old growth trees. The forest itself is not very large, and with the addition of a building of this size, it would not feel like a forest but like a building, which is surrounded by a buffer of trees.



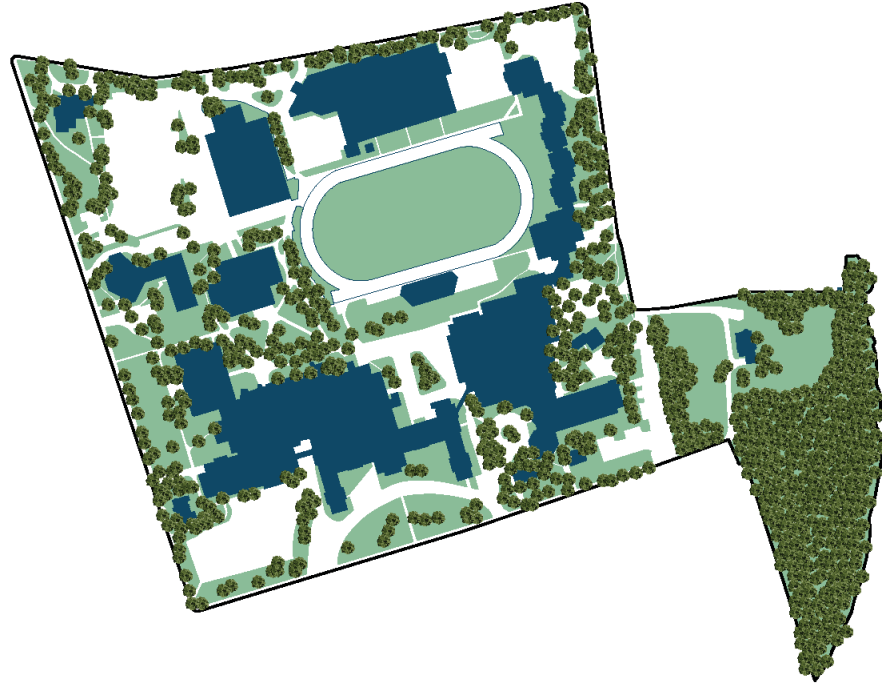
The Atrium Building  
("Saint Mary's University  
Atrium Building" 2011).



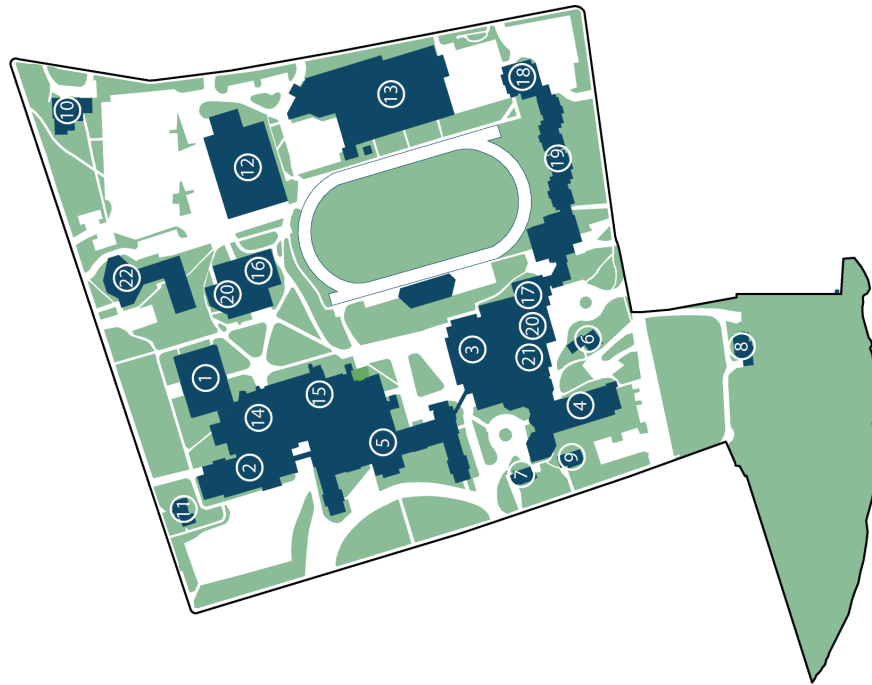
Current Campus Map ("Saint Mary's Campus Master Plan" 2011).



Future Campus Map ("Saint Mary's Campus Master Plan" 2011).



Greenspaces and trees on campus ("Campus Arboreal Survey" 2009, Saint Mary's University Survey Plan 2011).



**Academic Buildings**

- 1. Burke Building
- 2. Science Building
- 3. Loyola Academic Complex
- 4. Sobeys Building

**Administration**

- 5. McNally Building
- 6. External Affairs
- 7. Continuing Education
- 8. The Oaks/  
International Activities
- 9. Development/ Alumni
- 10. TESL Centre
- 11. The Gorsebrook Research Institute  
for Atlantic Canada Studies/CN  
Centre for Occupational Health & Safety

**Sports**

- 12. Alumni Arena
- 13. The Tower Athletic Facilities

**Student Work Space**

- 14. Atrium
- 15. Patrick Power Library

**Student Amenities**

- 16. O'Donnell Hennessey Student Centre
- 17. Loyola Residence
- 18. Rice Residence
- 19. Vanier Residence
- 20. Cafeteria
- 21. Art Gallery

**Other**

- 22. Canadian Martyrs Catholic Church

Campus Buildings ("Saint Mary's University Campus Map" 2011, Saint Mary's University Survey Plan 2011).

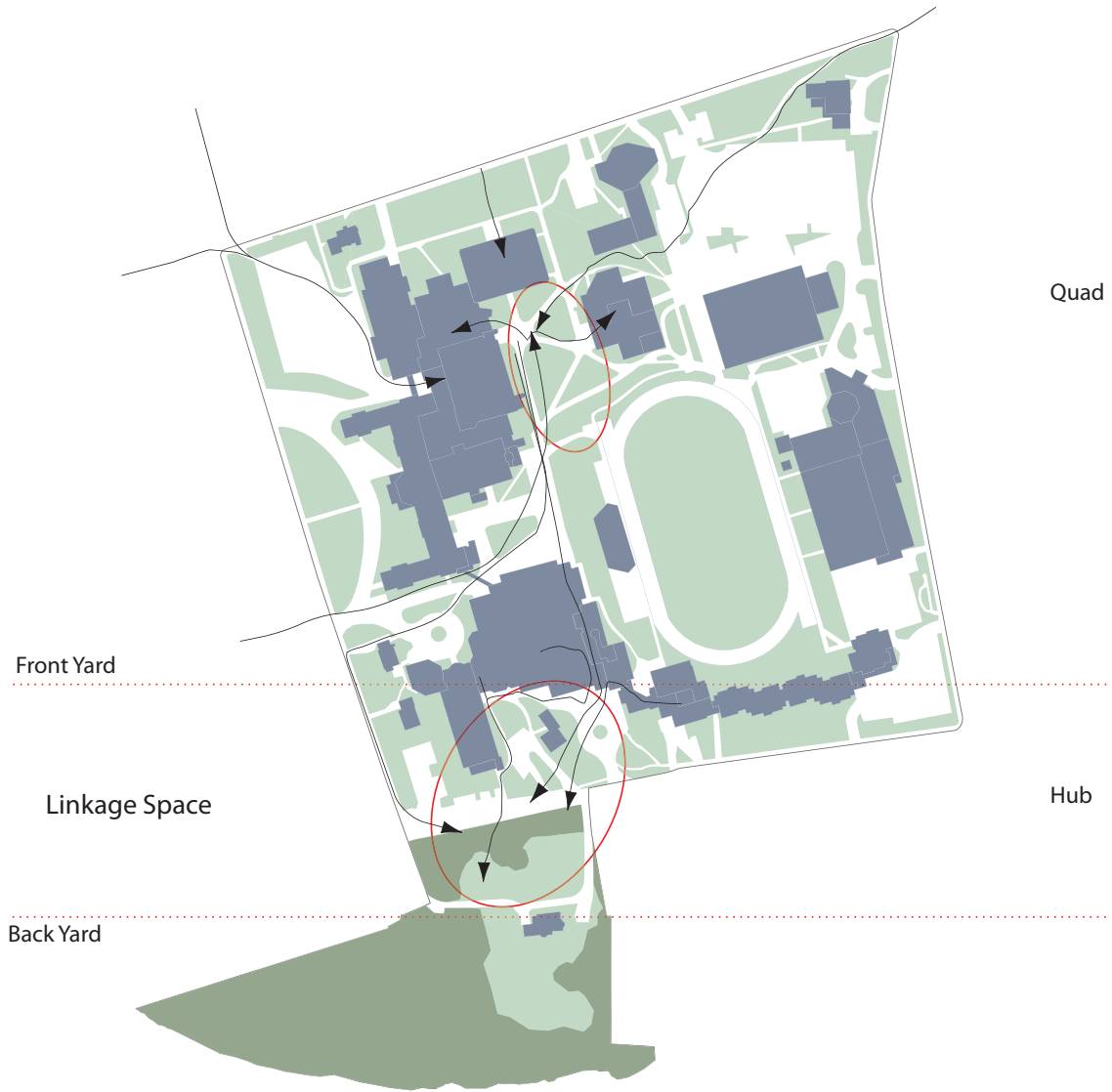


Diagram showing the pathways and nodes.



## **The Oaks Property**

The site of this thesis is the Oaks lawn and forest, located in the southwest corner of Saint Mary's University Campus. The site is bordered by houses, university buildings and the rail cut. The site consists of a forest, lawn and the Stanfield mansion (international activities office). The forest is approximately 1.6 hectares. Well kept it has many mature trees and a variety of plants and natural growth. Mostly deciduous vegetation allows for a filtered, layering effect with light and texture. The elevation is variable and the site undulates throughout. Exposed bedrock appears especially close to the rail cut, where there are a few look out points. Locals have worn pathways throughout the forest, leaving trails for people to explore and traverse freely. Since the forest is not very thick, there is the option to walk anywhere, allowing you to create your own trails, piquing the idea of mystery in environmental psychology. The forested site is quite rocky because of the ground conditions and the proximity to the rail cut. The forest thins out towards the rail cut, as you are exposed to the southern sun and solid rock beneath your feet.

Among the trees you will find Red Oak, Red Maple, Largetooth Aspen, White Birch, Beaked Hazel and Scotts Pine. The common shrubs and flowers include Lambkill, Cinnamon Fern, Hair Grass, Winter Green, Low Bush Blueberry, Poverty Grass, Moss, Mayflower, Blue-bead Lily, Pink Lady's Slipper Orchid, and the Brachen Fern (Wagner 2007, 31).

Currently within the forest are remnants of Maplewood Estate's stone foundations. Maplewood was a popular venue that hosted many of the biggest events in Halifax around the turn of the century (Watts and Raymond 2003, 41).



The Oaks property was bought in 1969. The Stanfield Mansion was used as a fraternity and then leased to the Maritime Conservatory of Music. Currently it is being used by the International Activities office.

The site has a variety of scales, from the scale of the tree, to the forest and lawn, to the entire University, and then within the peninsula of Halifax. For the placements of future buildings the site will be regarded as the space bordered by the Sobey's School of Business, Loyola Academic Complex, Loyola Residence, the Canadian National rail cut, the end of Robie Street and the houses along Greenwood Avenue, Marlborough Avenue, Gorsebrook Avenue, and Rogers Drive. However much of the design is based on the University Campus scale. Analyzing placement in regards to other buildings and programs, the pathways and connections as well as the University's needs.

The Oaks property is currently cut off from the university by a paved parking lot, just south of the Sobey's School of Business and the Loyola Academic Complex. This parking lot is an extension of Gorsebrook Avenue. After the parking lot there is a natural threshold as the ground dips to form a small wooded gully. This threshold defines the edge of the site. Between the wooded gully and the International Activities office is a small clearing. This site, once grassed, and filled with nature, has been turned into a gravel overflow parking area. This space is in need of revitalization and attention to revert back to its original natural environment. This space is prime for inhabitation as it becomes the entrance to the site and the connector piece between the main university and the oaks property.

Beyond the International Activities office is the lawn. It is sheltered by the forest on three sides and the International

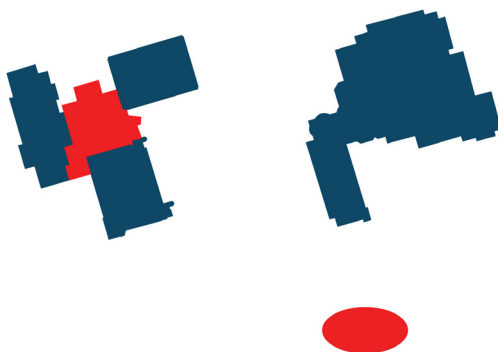
Activities office in the Stanfield mansion. This U shape of trees creates its own microclimate that shelters this space. The lawn is grassed and relatively flat. Light is filtered at the edges by the forest. The mansion is surrounded by a few large Oaks trees that create shade on the south and west side. The lawn is home to many games and activities put on by various campus groups. Saint Mary's community gardens are also located on the lawn in planter boxes.

Saint Mary's community gardens are a combination of the Saint Mary's University Garden Action Group and Saint Mary's Facilities Management. There are twenty six above ground gardening beds in which flowers and food are grown. There is a collective plot for students to garden as well as rental plots for individuals (Community Garden @ Saint Mary's University). The goal of the community garden is to create a place where the community can come together and produce local, organic food, learn gardening skills, meet new people, and spend time outdoors (SMU Community Garden Group). Some long term projects for the future of the gardening society will be establishing a compost, building a spiral herb garden, constructing a sustainable naturally built garden shed out of recycled materials, and construction of a greenhouse (Community Garden @ Saint Mary's University). The society hopes the gardens can be used as an educational tool to promote local and sustainable food production. They have started to use the lawn at the Oaks as an outdoor classroom. A few different faculties have taught classes outdoors.



Saint Mary's Community Garden plots.

As a valuable natural setting, the Oaks provides a perfect opportunity to take advantage of the lawn and forest for student use. This space becomes the 'backyard' of campus, a close destination with a completely different feel than the formal arrangement of the quad. The University itself could be considered a series of buildings dotted with nature. Within what I'm calling the 'backyard' of the campus, the direction I've chosen to pursue is nature dotted with buildings. This juxtaposition creates a shift from buildings being the importance, to nature being the importance.



The Atrium as the interstitial space

The Hub as a designation in their own backyard

Juxtaposition of study spaces on campus.



Nature importance for the Oaks development (Saint Mary's University Survey Plan 2011).

As a gateway to the forest I am proposing a learning centre, connected by a network of study pods within the forest. These pods as well as the main development will strive to create a place where students can interact with nature in a positive way. These pods will be supported by the mature trees in the forest and off the forest floor. Along with this relationship with nature, building in the trees allows you to use their inherent natural structure as support. This element of verticality adds to the effect of escapism and the idea of unwinding. The program will explore different learning environments, ideas of enclosure, thresholds, reverie and the psychology of elevation.

These spaces will manifest themselves as a place where all students can come together, gather and work. This hub will bring students to a natural setting, where they can benefit from biophilic attributes, as they are surrounded by nature and a structure that is formed in and from nature.

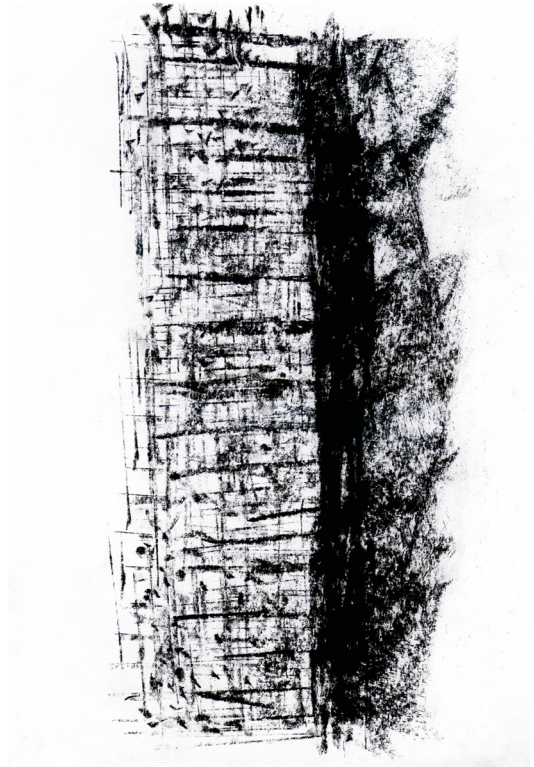
Along with this main study area there will also be study pods within the forest. These pods, tied into the program of the main building, will be available for students to use as private study

carrels. These pods will act as another level of mental unravelling and stress reduction allowing students to focus on their work in nature, rather than be bothered by the distractions of the built environment of Saint Mary's University. Supporting these pods in the trees off of the ground, stemmed from the idea of the Axis Mundi, the vertical sacred axis, the experience of rising up, the psychological effect of verticality, biophilic benefits, the experience of the forest within the canopy and the views. These structures will be made of natural and recycled materials, and as a design method, be simple in nature, taking instincts from natural forms, as small insertions into the natural setting.

The study pods are located within the forest at five different locations. Each location is accessible via the canopy walkway. They vary in size and respond to the particularities of site. Accommodating between one and ten people at varying distances from the ground. They are made from natural and recycled materials. In a way these pods act like campsites in the wilderness.

The main building, along with the pods, will act as a relief to the University for much needed student work and gathering spaces. The spaces will accommodate a range of different learning types. The users of these spaces will be Saint Mary's University students, from all faculties, ranging from undergraduate to Ph.D. level.





Pastel site drawings.



**HUB**

High point on site and midground between the university proper and forest. Surrounded by wooded gully to north, east and west. Southern exposure.

**GATE**

Pods saddle the walkway between the trees. Edge condition between the forest and the lawn. 2-8 people.

**SMU COMMUNITY GARDENS**

Current location of above ground gardening plots.

- Forest
- Overhead Walkway
- Worn in Pathways
- Lookout
- Maplewood Estates Stone Foundation
- Halifax Urban Greenway Proposed Trail

**BEACON**

About view to south and Northwest Arm. Highest point for the pods on site. Double trunk adds extra stability. Fully exposed. Glass to the south. Solar protection. 2-5 people.

**GROVE**

About being surrounded by the trees. Oriented around the tree and outwards. Architectural response could be a horizontal strip window or being hung between the trees. 10+ people.

**HAVEN**

About seclusion and quietness. View is to the sky. Tucked lower to avoid homes. 1-3 people.

**PERCH**

About view to south and Northwest Arm. Work facing south with view out. Unobstructed glass. Solar protection. Light structure that clings. 1-3 people.

The Oaks Property (Saint Mary's University Survey Plan 2011).





Grove.



Haven.



Perch.



Beacon.





Hub looking south.

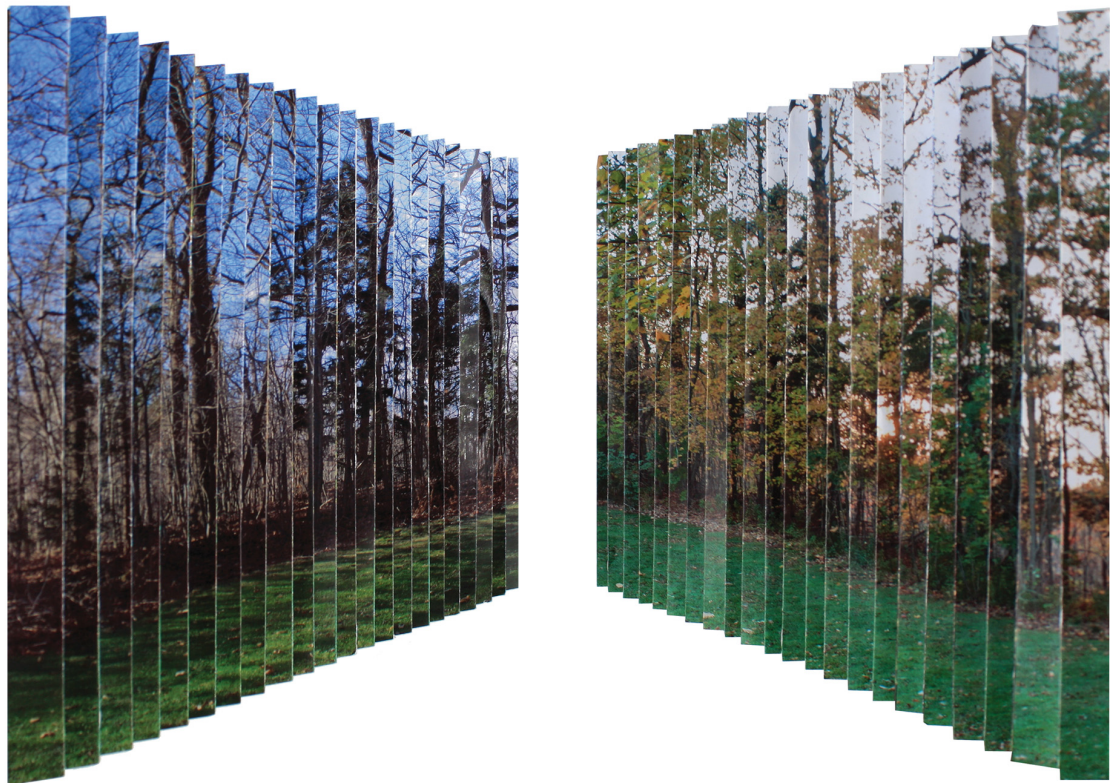
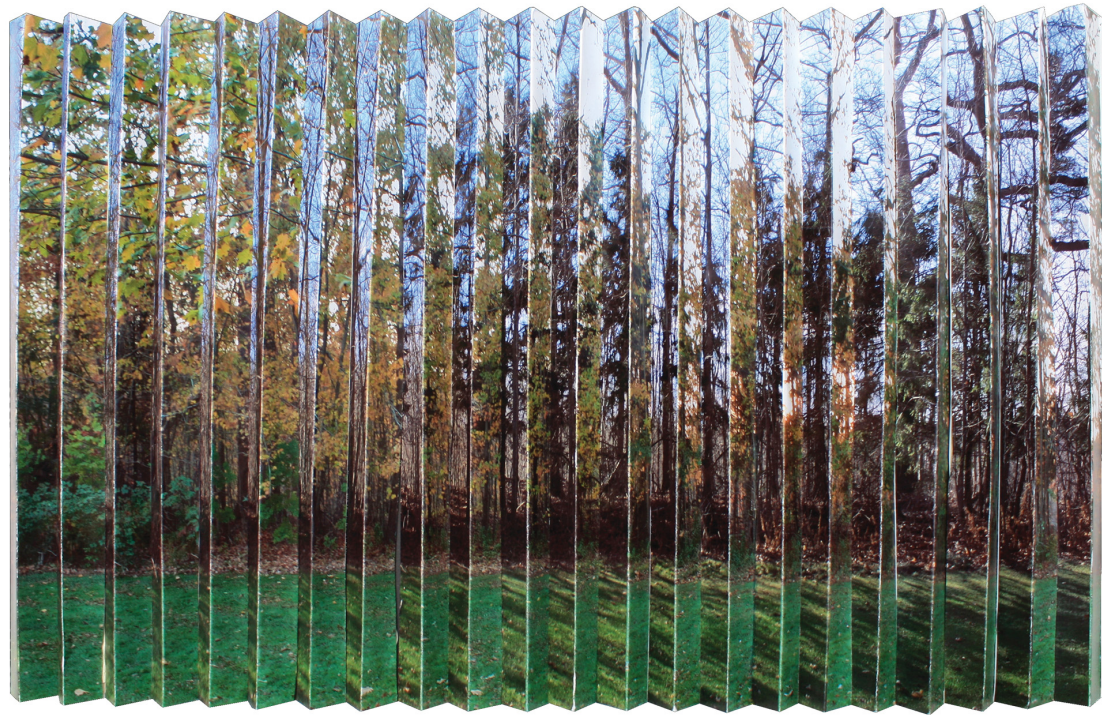


Gate.



View in the forest.





Site lenticulars showing the relationship between seasons from the same point on the site.

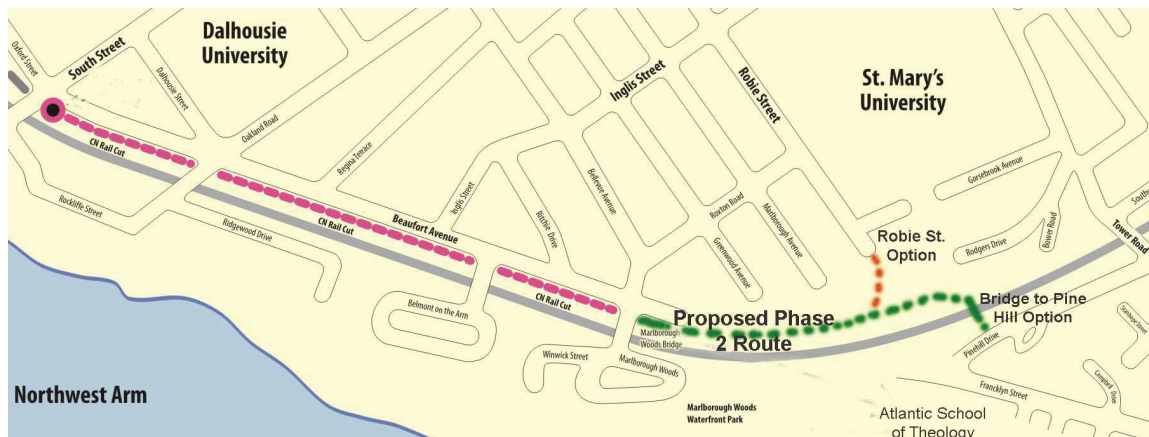




Site lenticulars showing the relationship between seasons from the same point on the site.

## Halifax Urban Greenway Association

The Halifax Urban Greenway Association is a group that is initiating a walking trail from Chebucto Road to Young Avenue along the Canadian National railway cut (Halifax Urban Greenway Association). The initial proposal was developed in 2002, and submitted to the city for approval. Some portions were approved however the portion running through the Oaks forest was not approved. To date, the first section of the trail has been built from South Street to Roxton Road. The portion that will go through the site will likely go along the existing trail next to the rail cut and then cross over the rail cut with a pedestrian bridge at the south east corner of the Oaks property. It may also go through the site and exit onto Robie street. This area is under redesign. There is a lot of community opposition, as the trail would have to be 10 feet wide and paved for accessibility.



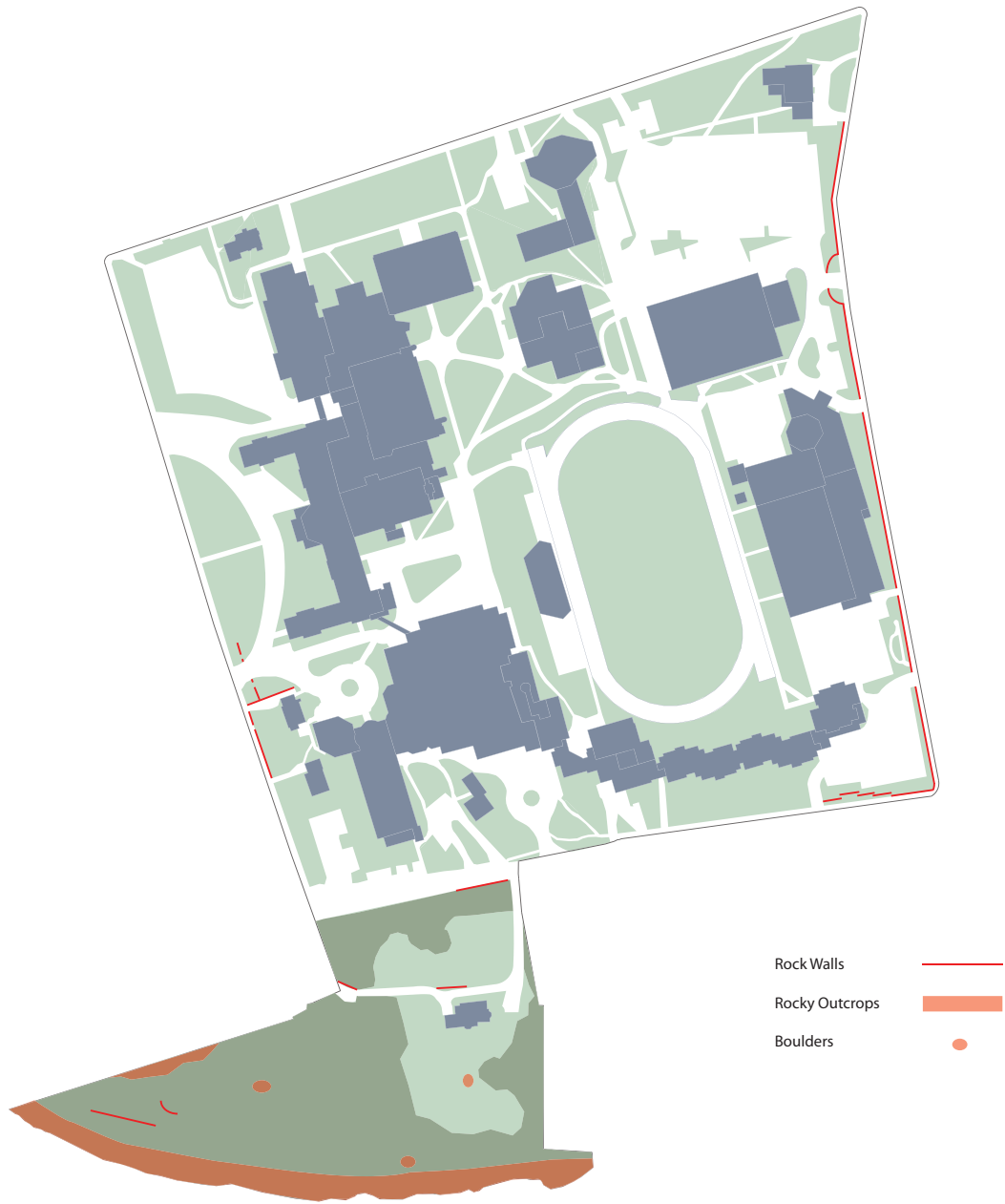
Halifax Urban Greenway route map (Halifax Urban Greenway Association 2011).

## **Rock Walls**

The site has influenced me greatly from the complexity of forms to the textures, materials, and ever changing features available from/ to it.

I have gained interest in the prevalence of ironstone throughout the site. These experiences of ironstone can be seen in the following ways:

Firstly the ground condition in the forest especially near the rail cut is quite rocky. Secondly, there are remnants of the stone foundation walls of Maplewood Estate. Thirdly, people have stacked stones as a way to delineate spaces in the forest. And lastly, stacking ironstone has been a way to create fences and thresholds around the university for generations. These stone walls surround much of the university property and delineate the university among the surrounding neighbourhoods. This delineation is also used at Dalhousie University and throughout a number of other sites in the region. This indicates that the use of the stone is not only iconic to SMU, but also contributes to the material vernacular of the Halifax peninsula.



Rock walls.





University walls.



Rocky nature of site.



Human intervention of stones stacked on site.



Maplewood Estate stone foundation wall.



## Ideas of Activity

The following are ideas of inserting educational activities on site.



Collage of people studying on the site.





Collage of people reading on the site.



Collage of people meeting on the site.



## Light Paintings

By using a tube and attaching LED lights in a row, I was able to create light sticks in which I could go to the site and draw out my ideas. I used light painting as a form of experimentation for the design of the tree pods. By using this method, a definite sinuous form and feel was created. Through dozens of iterations in many locations throughout the forest, I was able to garner ideas for the design of the pods.



Light Painting.





Light Painting.



Light Painting.





Light Painting.

## Site Design

This thesis creates a series of event which allow one to be acquainted with nature.

Starting from the journey of the student to the site, arriving at the site and inhabiting it. This is pursued by a series of components which provide thresholds to experiencing nature.

The first design move is to retract the paved parking which separates the Oaks property from the main university. By removing some parking south of the Sobey's building, it opens up the connection between the two properties.

A trail extends from the south entrance of the Sobey's School of Business to the gully. The wooded gully, the natural threshold of the site, becomes the location of the bridge. This bridge

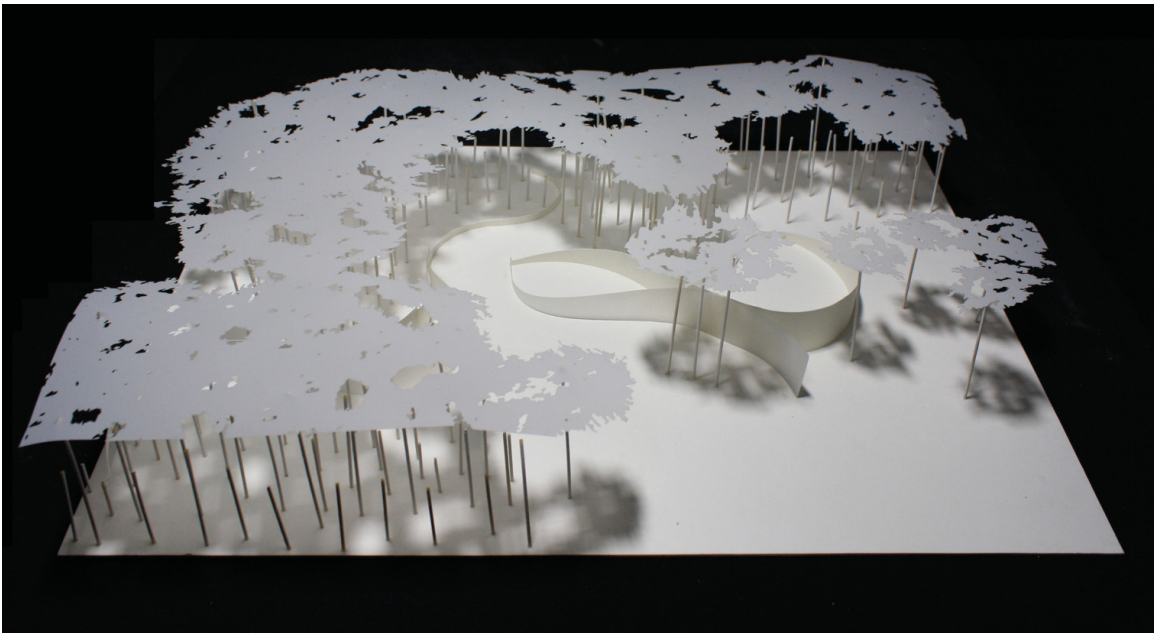
becomes the shortest crossing to the site. Currently students have to walk around the gully and enter from Gorsebrook Avenue or Robie Street via the gravel road. However there is a trail worn through the gully at the point in which the bridge will be located.

Once across the bridge you have entered the site of the main hub. The purpose of inhabiting this space is to connect the university and the forest. At one point in time this area was vegetated but has subsequently been turned into a gravel parking area. The development will also allow for the opportunity to transform an ecosystem, which is currently very homogeneous and artificial, into one that is prosperous and lush.

By reverting this parking back into space for the students, it makes a statement on the importance of students and less on vehicles. Along with the removal of this gravel, I also removed the gravel road which cuts through the site. The entrance from Robie Street will be pedestrian only and the gravel road will only go from Gorsebrook Avenue to the International Activities office. This allows for the learning centre to blend into the forest.

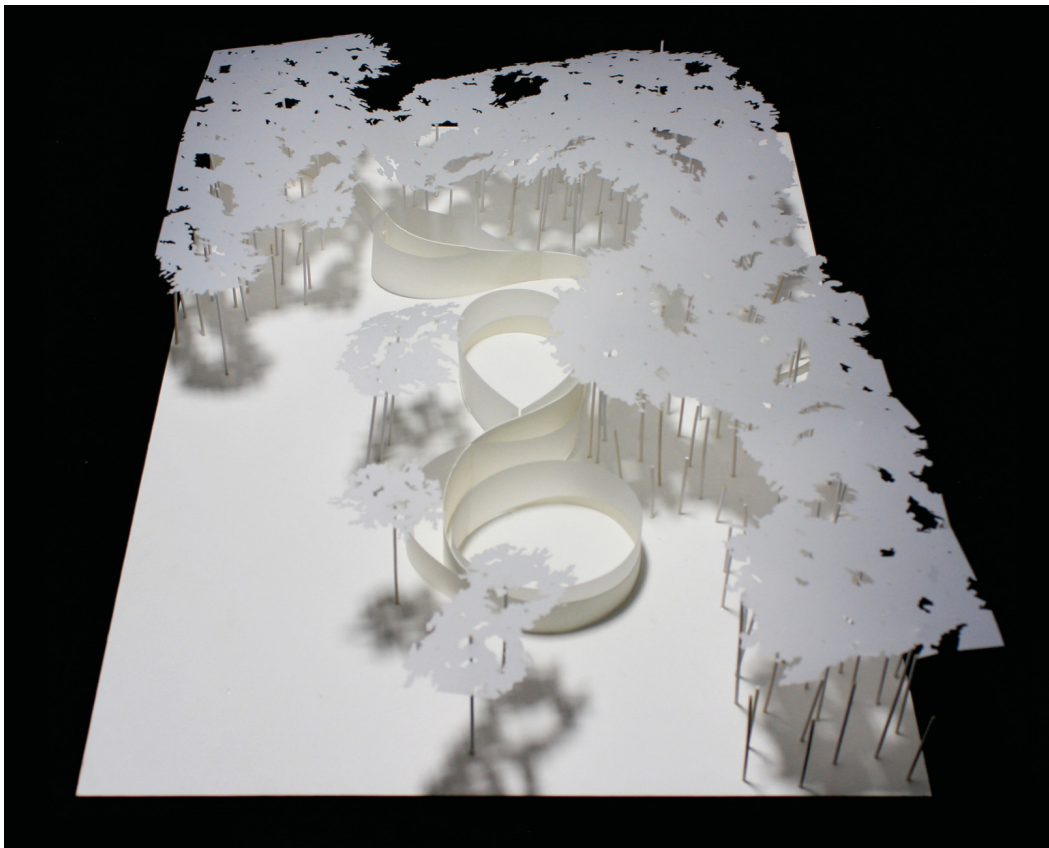
The inspiration for the learning centre came forth through the creation of a series of sketch models. These models, like the light paintings, have a very sinuous feel to them. By bending paper and mylar, organic forms were able to take shape which feel connected to the surrounding environment.

Although the light paintings and site models have been worked on in very different scales, 1:1 and 1:200 respectively, the methods used for each is the same. The environment and the features within it have been used as a tool to dictate the flows and therefore the forms for the proposed design.

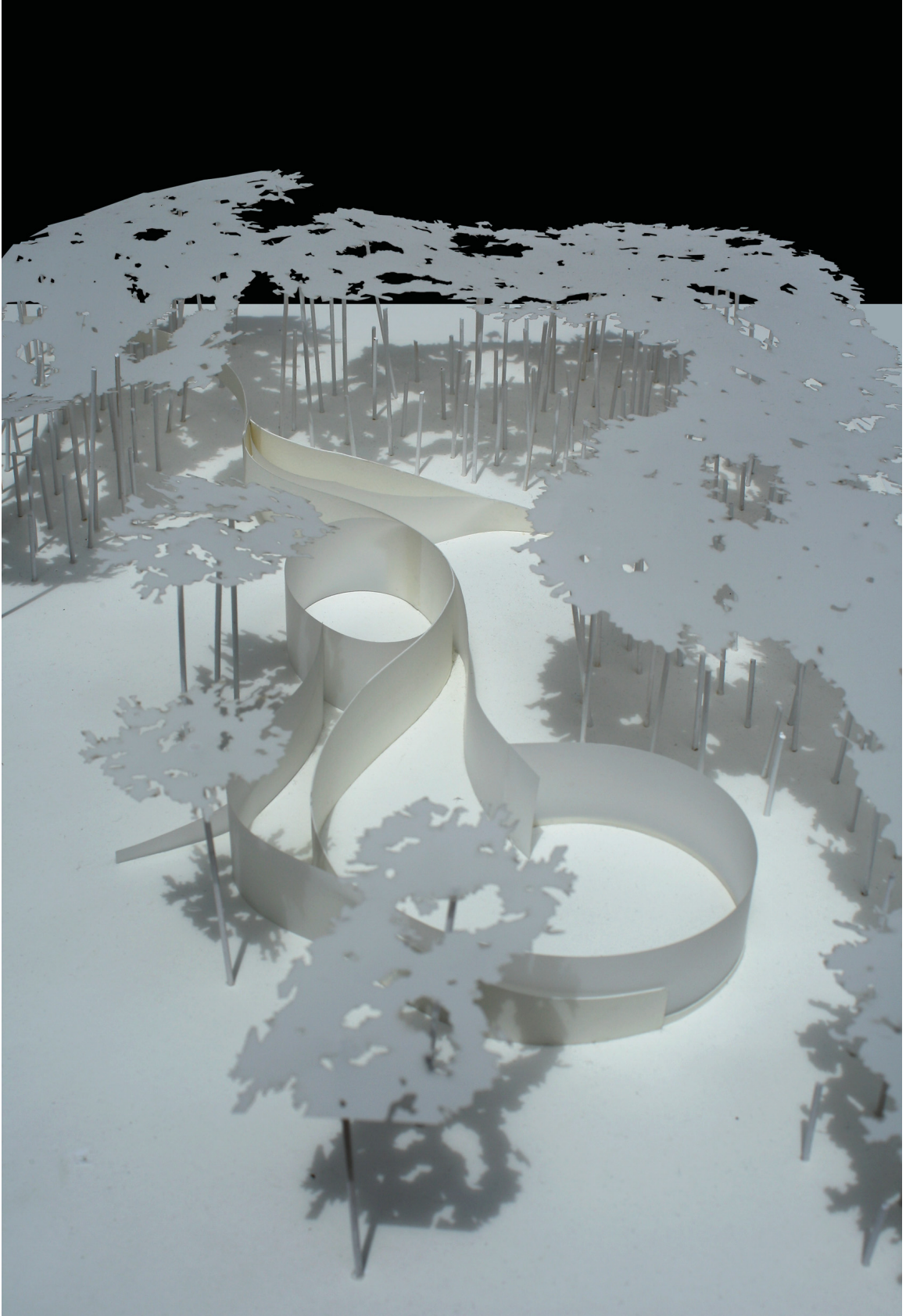


Paper sketch model of main site. 1:200.





Paper sketch model of main site. 1:200.



Final design paper sketch model of main site. 1:200.



Along with these models, I modelled some of the light paintings using paper as a form of representation.



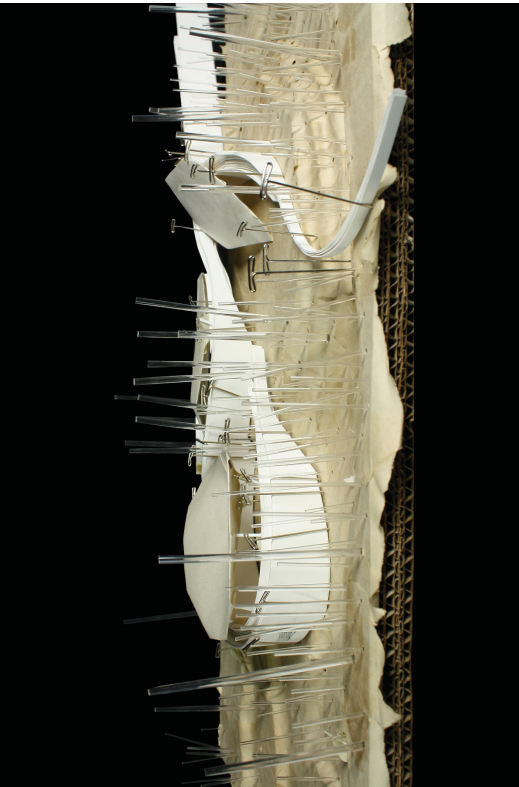
Mylar sketch models of pods based on light painting.

The materials on site and the models I made, led me to the design of the learning centre.

After creating the white models, I used sewing pins to bend wood and paper on topography models as a way of designing the learning centre.

The learning centre in the forest, is a series of pavilions formed by my interaction with the site. The movement of the walls are directly related to the circulation of experience of the site. This circulation is formed as an outdoor canopy walkway on top of the stone walls.

As you leave the main university and approach the site you



follow a stone wall which leads you to the gully. This stone wall becomes the grounding element of the bridge and the wood walkway flows overtop, with wood bent in the direction of travel. The bridge curves over the wooded gully and opens up to the clearing. The pavilions were formed to create a multitude of indoor and outdoor spaces. First across the bridge is an open space created by the two pavilions. The two pavilions on either side of the north-south axis of the site. These spaces are connected by a second level bridge, keeping the axis open on the ground. The 1 meter stone wall continues to the right and creates the outer wall of the quiet study pavilion. The stone walls become the guiding element and the sheltering element which creates and carves out spaces. If you follow the stone wall it rises up to a handrail height at the canopy level via an outdoor staircase within the now 8' thick stone wall. The stone wall is inhabited on the second level by the outdoor canopy walkway and on the first level inside the pavilion with quiet carrels. The stone wall creating the west edge of the pavilion which opens up to the east and northern outdoor space, with a glass facade and pivoting doors.

The quiet pavilion is the most intimate space. It, along with the other building, is wood timber construction and glazing which opens up to the outdoors. The stone walls flow down and become stone floors. The quiet pavilion has carrels, and a main open space for working on both levels.

From this point the canopy walkway on the stone wall flows out into the canopy of the greater forest. The stone walls disintegrate to the ground and the wood glulams running in the direction of travel, continues out into the canopy. Also from this point the walkway flows back to the east where it bridges across the main outdoor axis and becomes the sheltering wall of the

second pavilion. This second pavilion is a two storey structure as well. The wall shelters to the north creating a direction of focus to the south. Within the wall, on the main floor, is the cafe, and the light wood and glass space to the south, is a social gathering space, where louder activities can take place. The glass facade opens up to the south creating an indoor-outdoor space. This space is also two storeys and may be accessed from the outdoor canopy walkway. The stone walls come down and become stone floors which cascade beyond the glass to an outdoor patio space. The stone wall/walkway curves back and creates an exhibition space to the north on the ground level. The interstitial space between these two main activities are filled with tables and chairs for intimate spaces throughout the building and washroom facilities. The space also flows out to another entrance near the International Activities office. The exhibition space is hunkered 2 meters lower than the rest of the building as the wall flows down the embankment, this space however is still hovering above the ground at this level. On the main floor the circulation travels within the 8' wide wall into the exhibition space. The stone wall, which is of handrail height on the second level, flows down to the ground along the east side of the exhibition space. This space with glazing towards the wooded gully opens up as an outdoor access point, where the roof drain comes to a collection point.

On the second level as you bypass the social gathering space you are surrounded by green roofs to walk out on. The roofs of all spaces are green and flow up from the ground arching over the main spaces and the walkway in places. These assessable green roofs cover the interstitial one story space between the two main pavilion spaces. As you follow the walkway/stone wall you come to the auditorium. This theatre in the round is located on the second floor with views of the canopy all around.

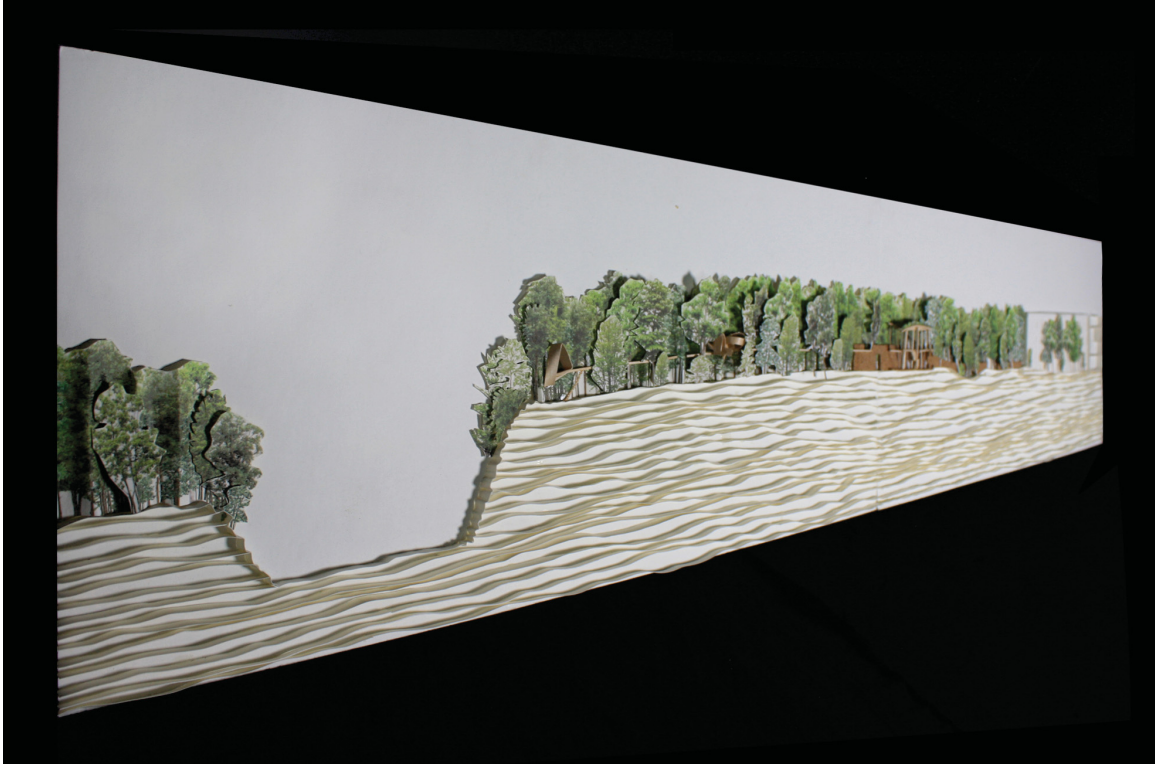




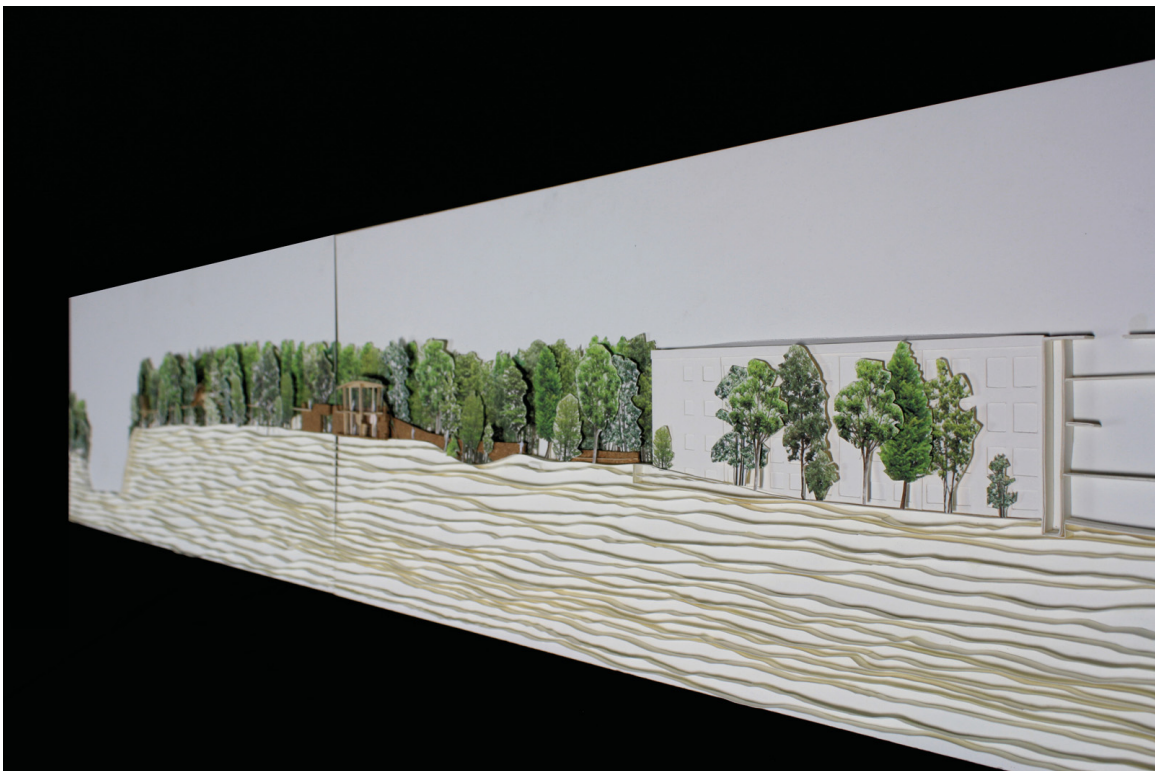
Site section looking west. 1:200. 12" x 60".



Site section looking west. Main site. 1:200. 12" x 60".



Site section looking west. 1:200. 12" x 60".



Site section looking west. 1:200. 12" x 60".



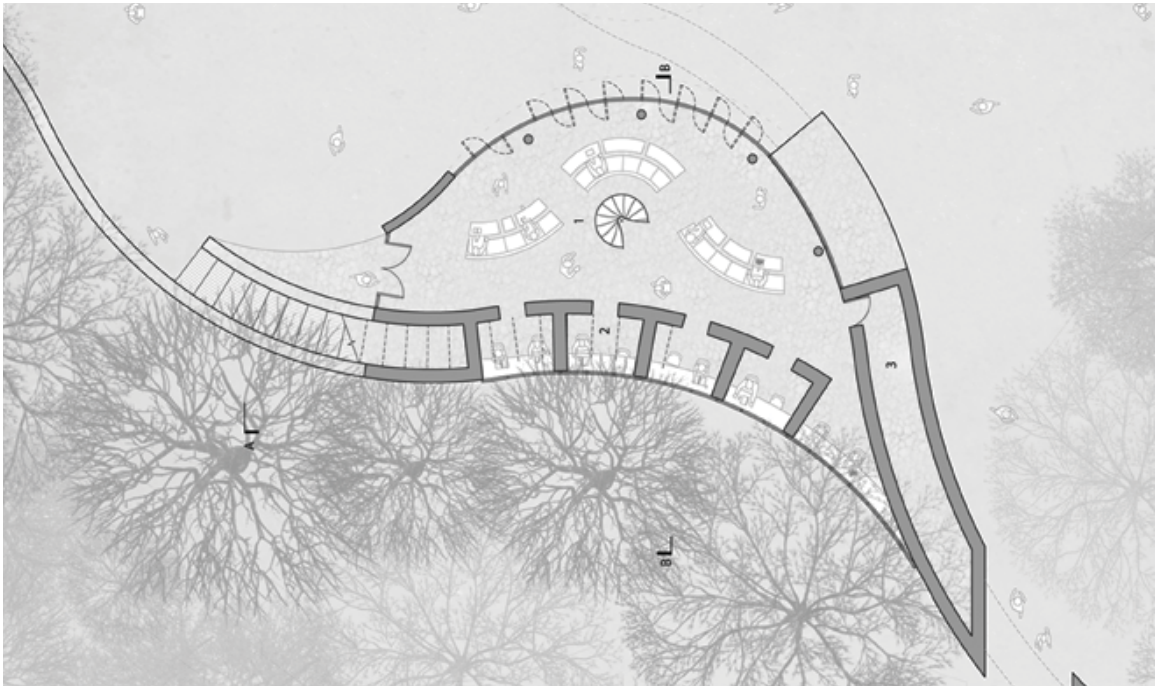


▲ Main pavilions first floor.



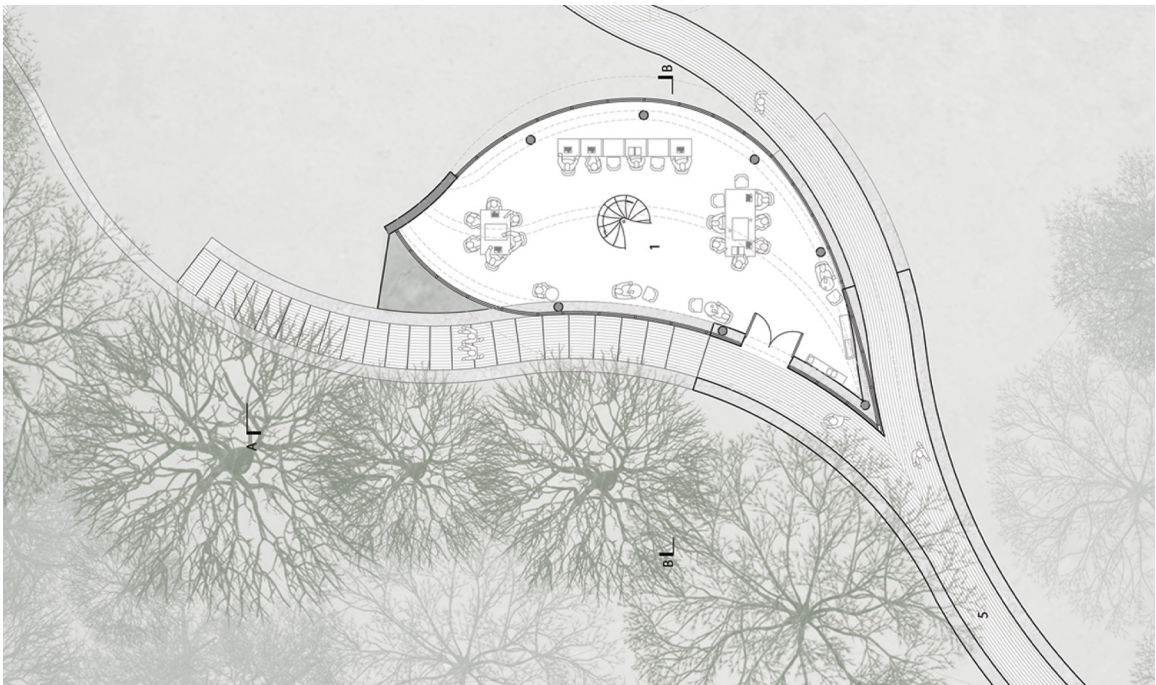
▲ Main pavilions second floor.



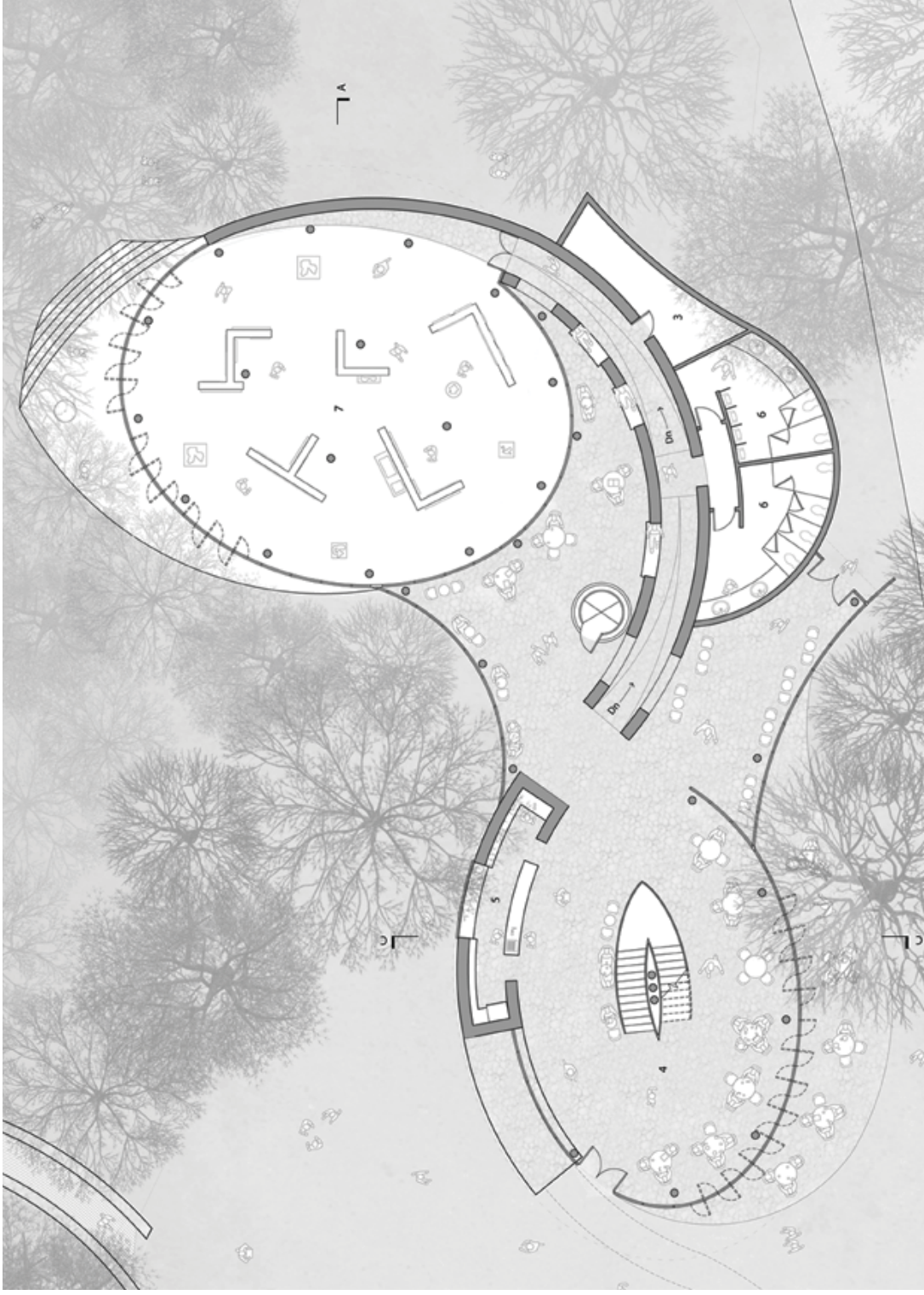


Quiet study pavilion first floor.

- 1 Quiet Study Pavilion
- 2 Quiet Study Carrels
- 3 Storage
- 5 Canopy Walkway



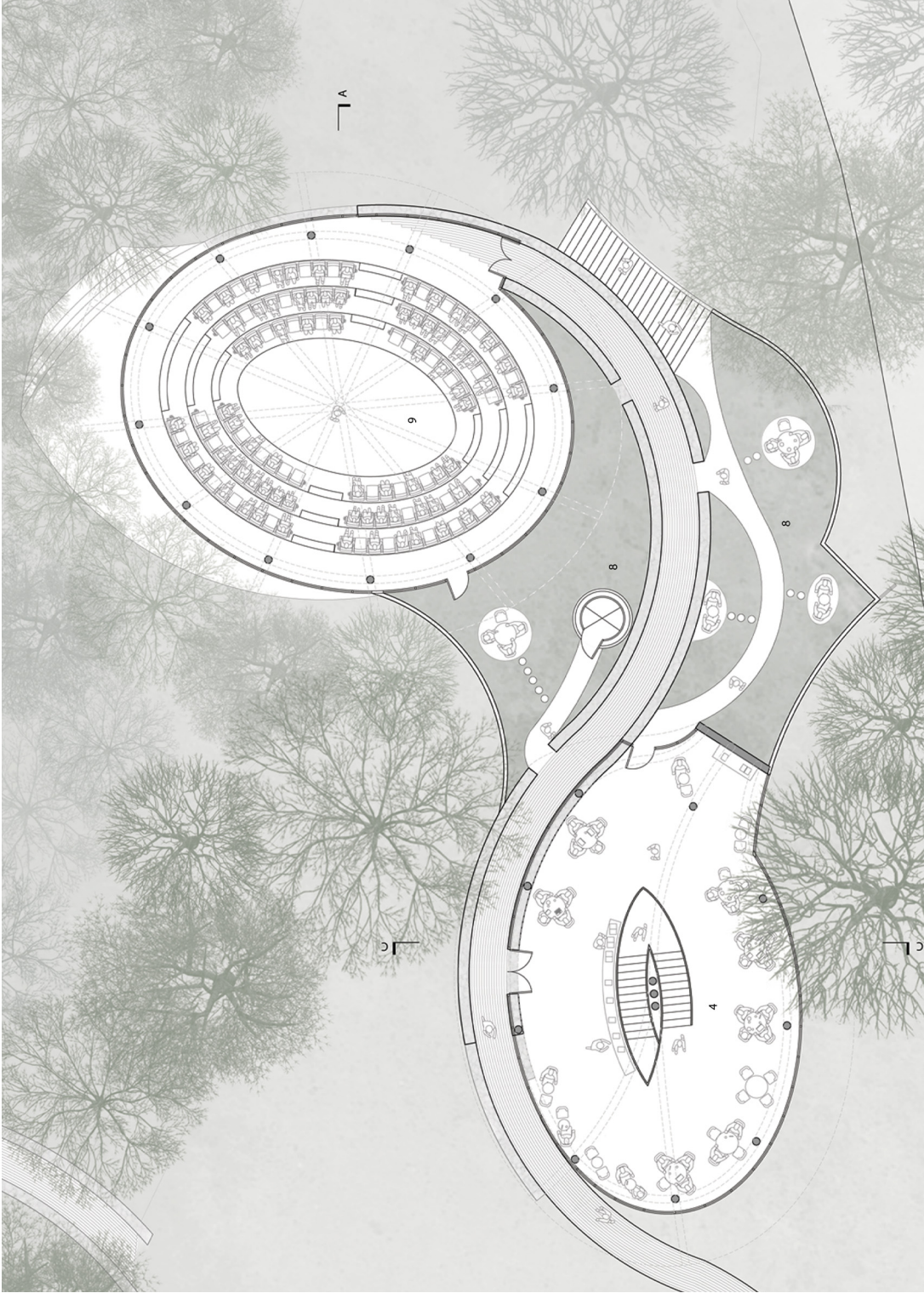
Quiet study pavilion second floor.



First floor. Gathering pavilion, cafe, washrooms and exhibition room.

- 3 Storage
- 4 Social Gathering
- 5 Cafe
- 6 Washrooms
- 7 Exhibition Room

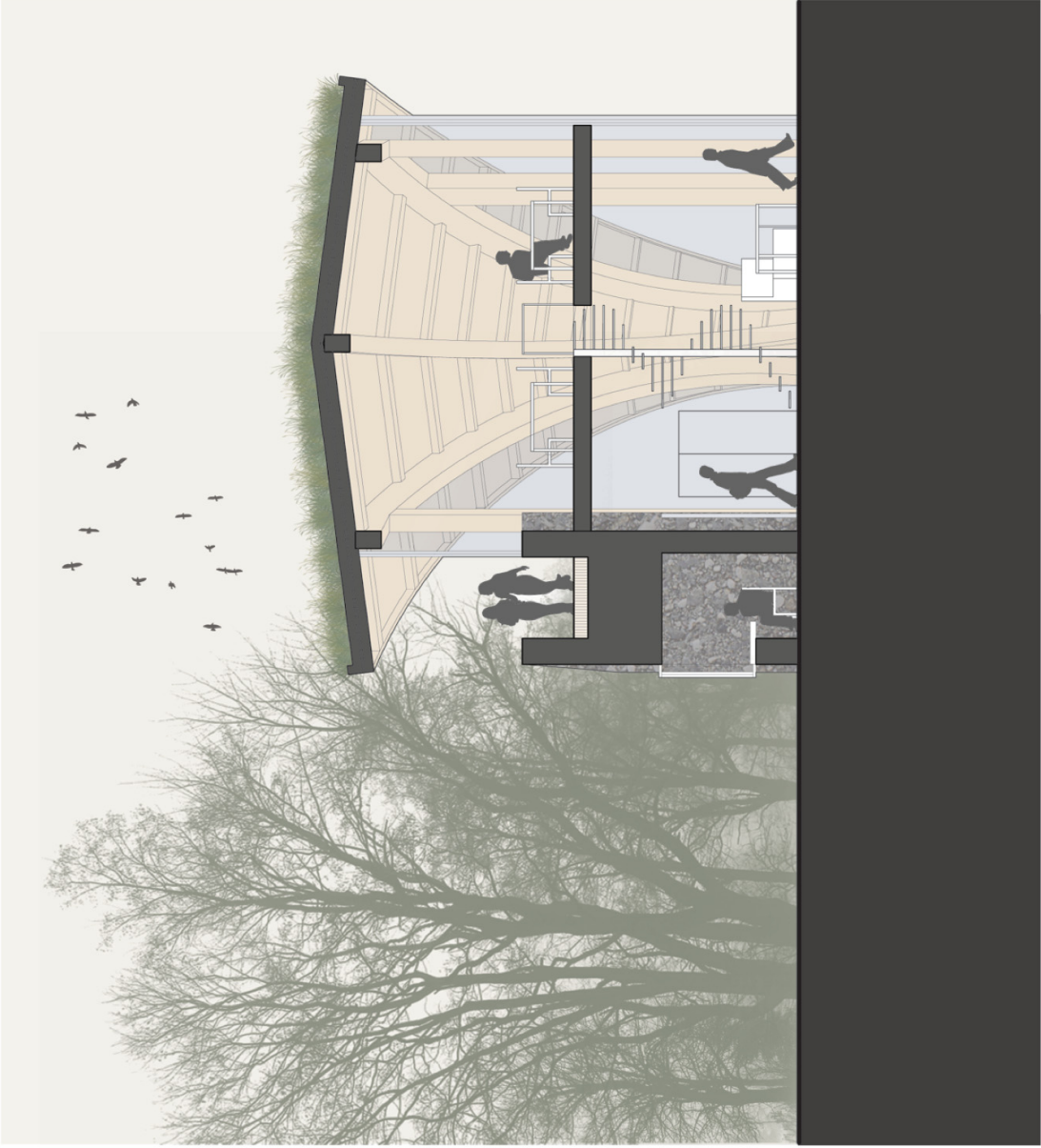




Second Floor. Gathering pavilion, green roofs and auditorium. 4 Social gathering 8 Green roofs 9 Auditorium



Section through auditorium looking south.

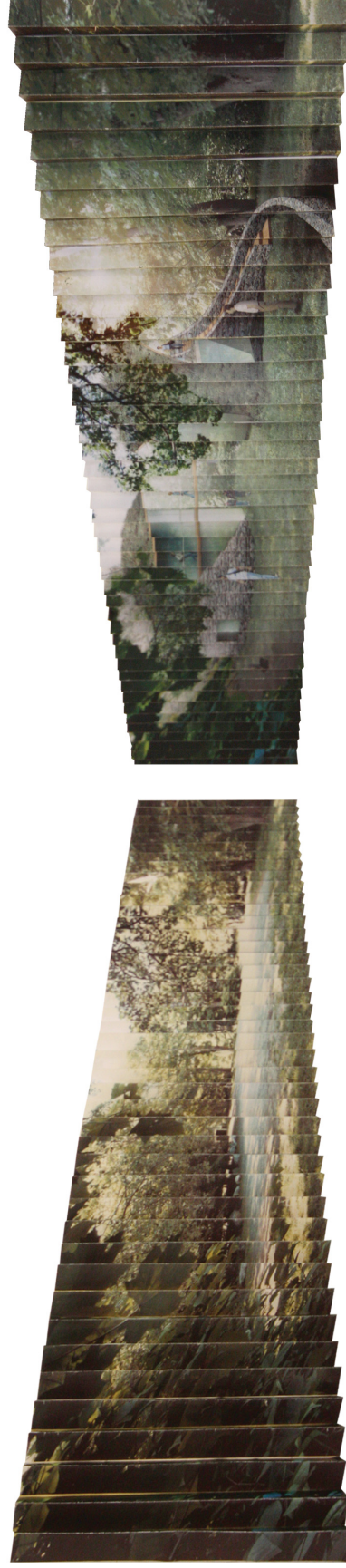


Section through quiet study pavilion looking north.





Section through gathering space looking west.

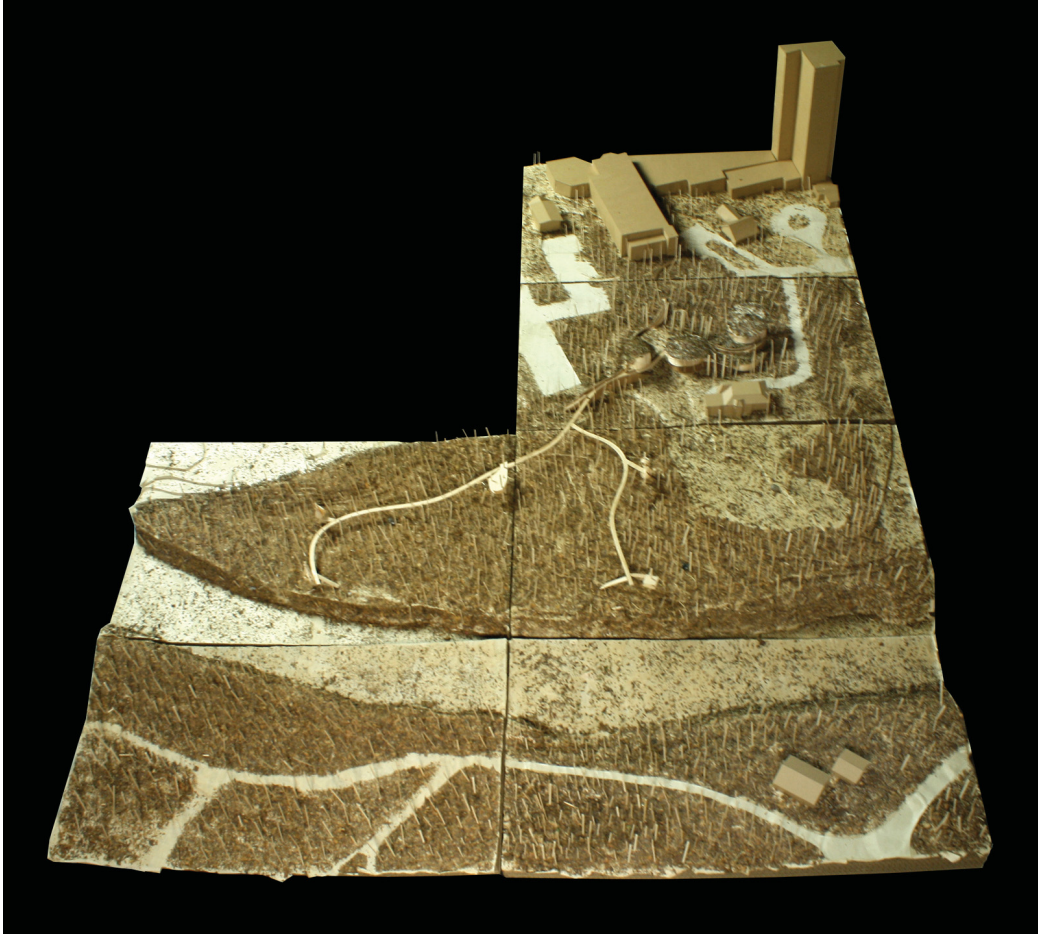


Site lenticulars showing the main site before and after inhabitation.

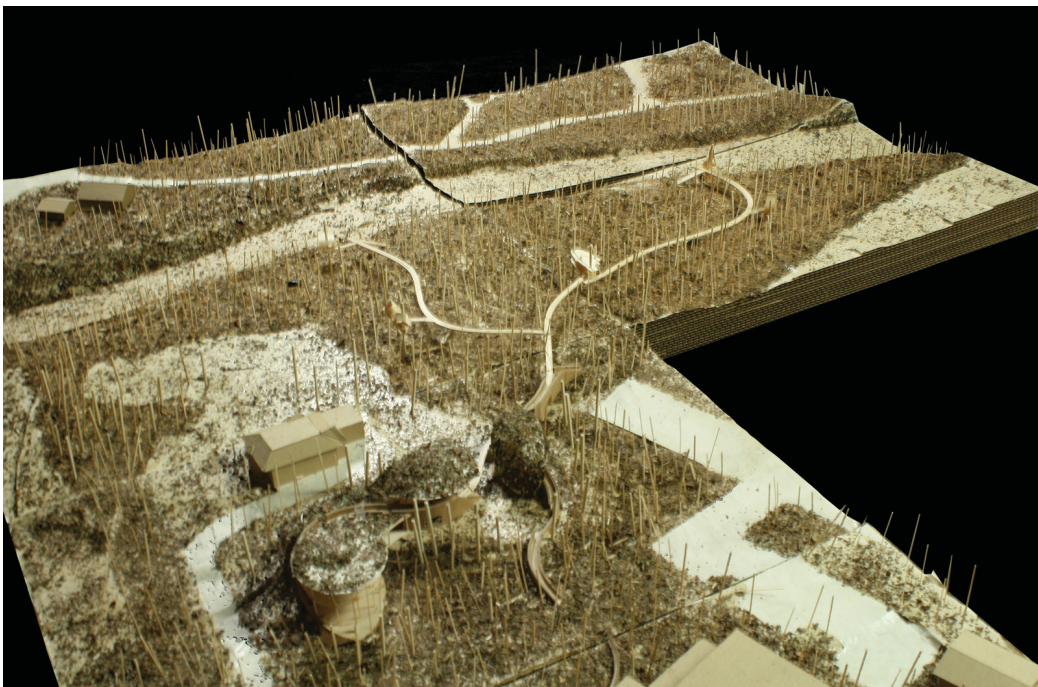




Main site design.

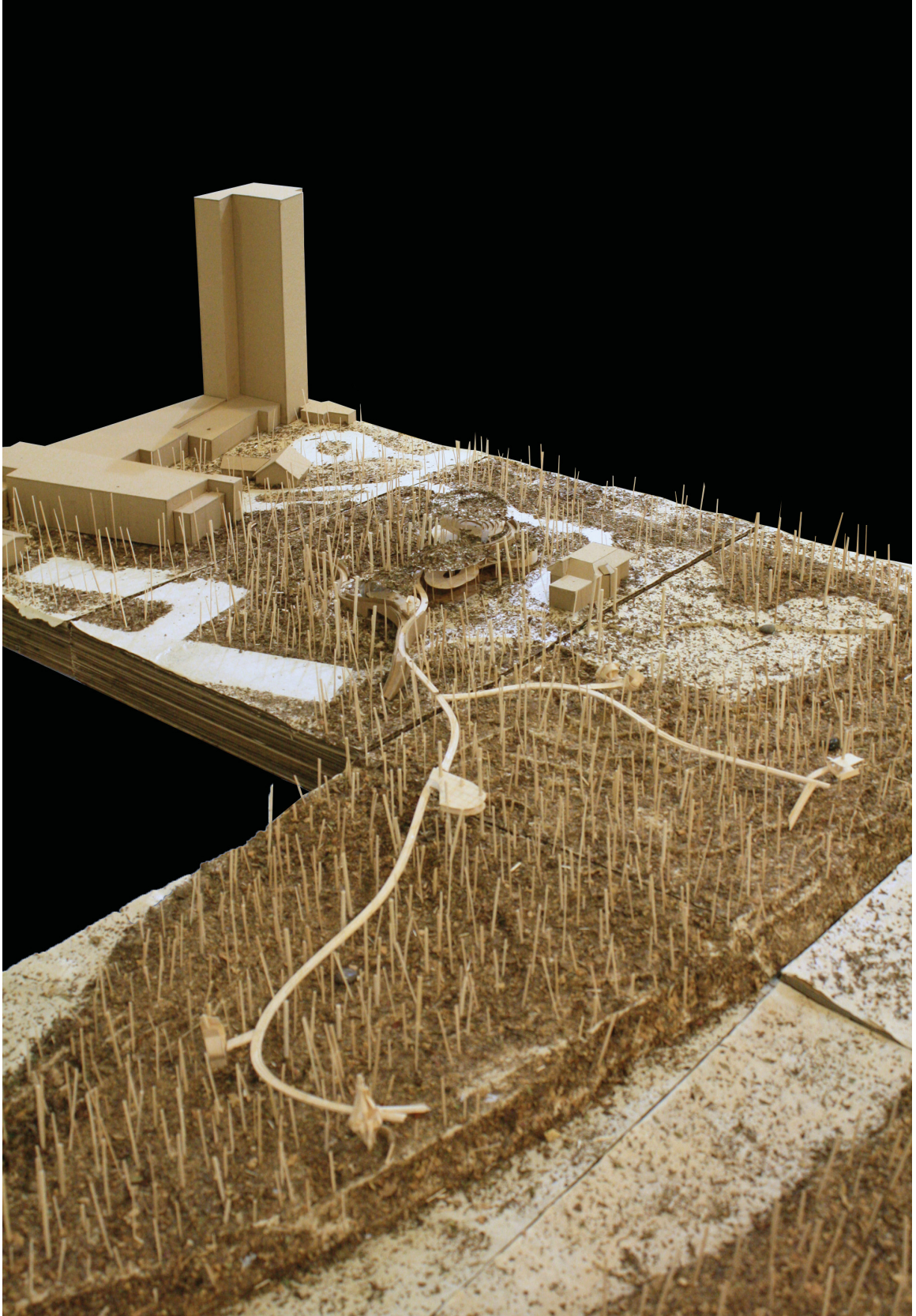


Site model with design looking north. 1:200. 68" x 56".



Site model with design looking south. 1:200. 68" x 56".



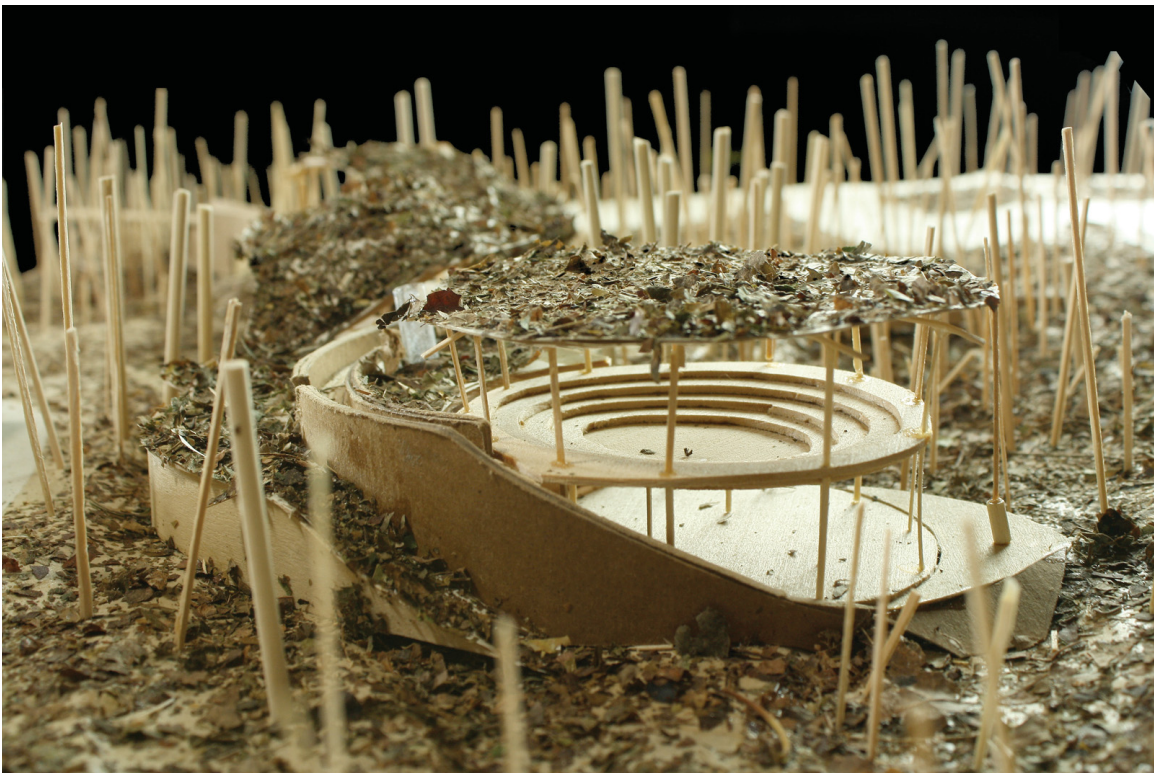


Site model with design looking northeast. 1:200. 68" x 56".





Site model with design looking east. 1:200. 68" x 56".



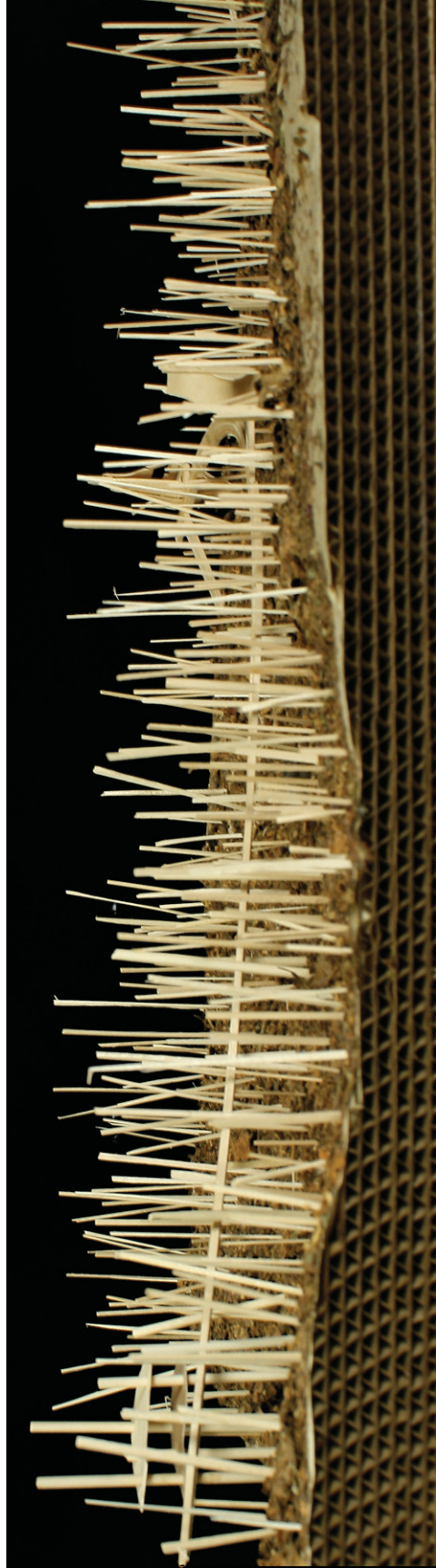
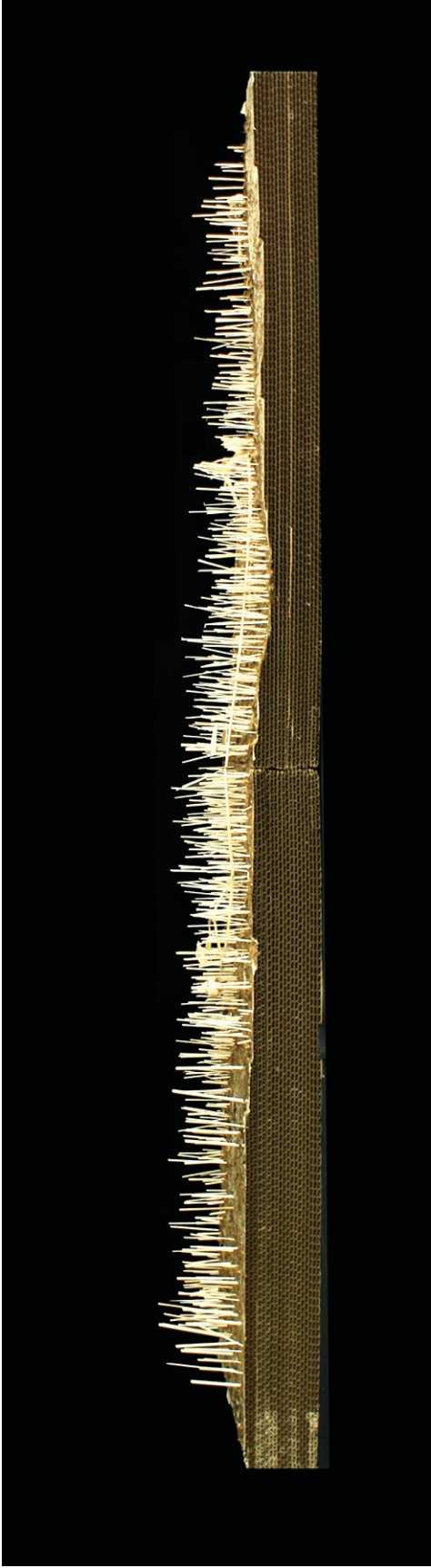
Site model with design looking west. 1:200. 68" x 56".





Site model with design looking east. 1:200. 68" x 56".

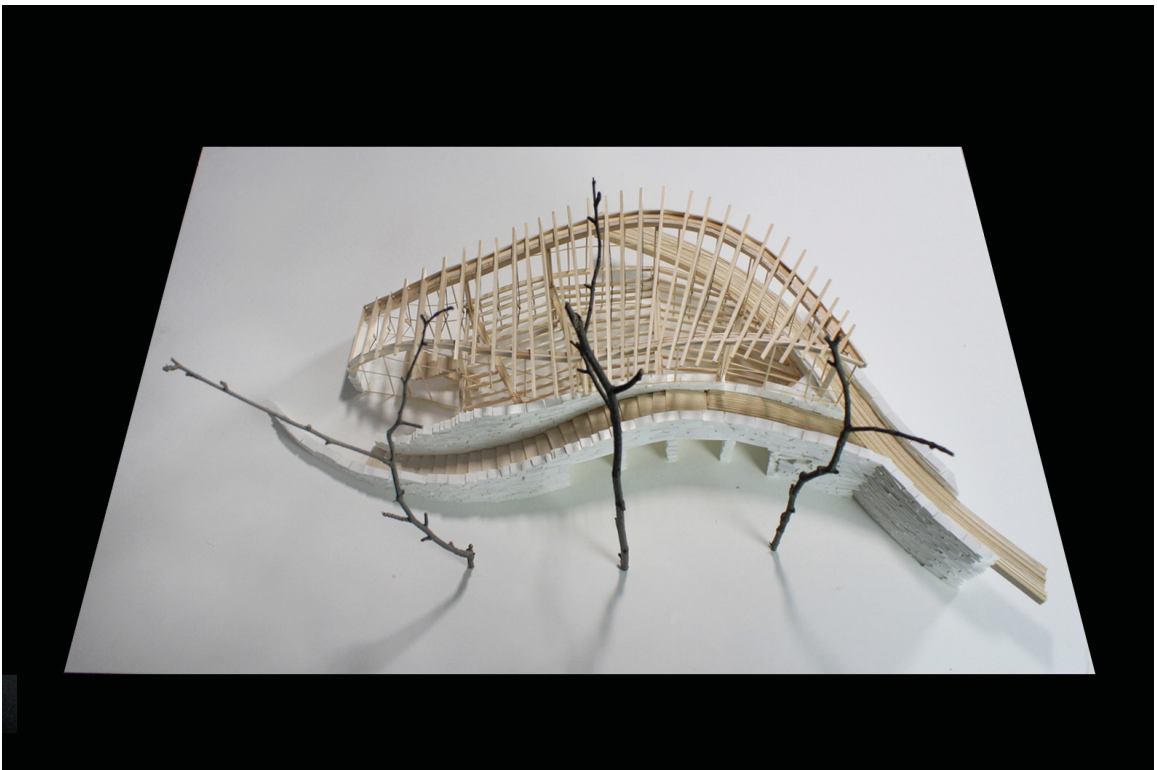




Site model with design. 1:200. 68" x 56".



Model of quiet study pavilion. 1:50. 30" x 40".

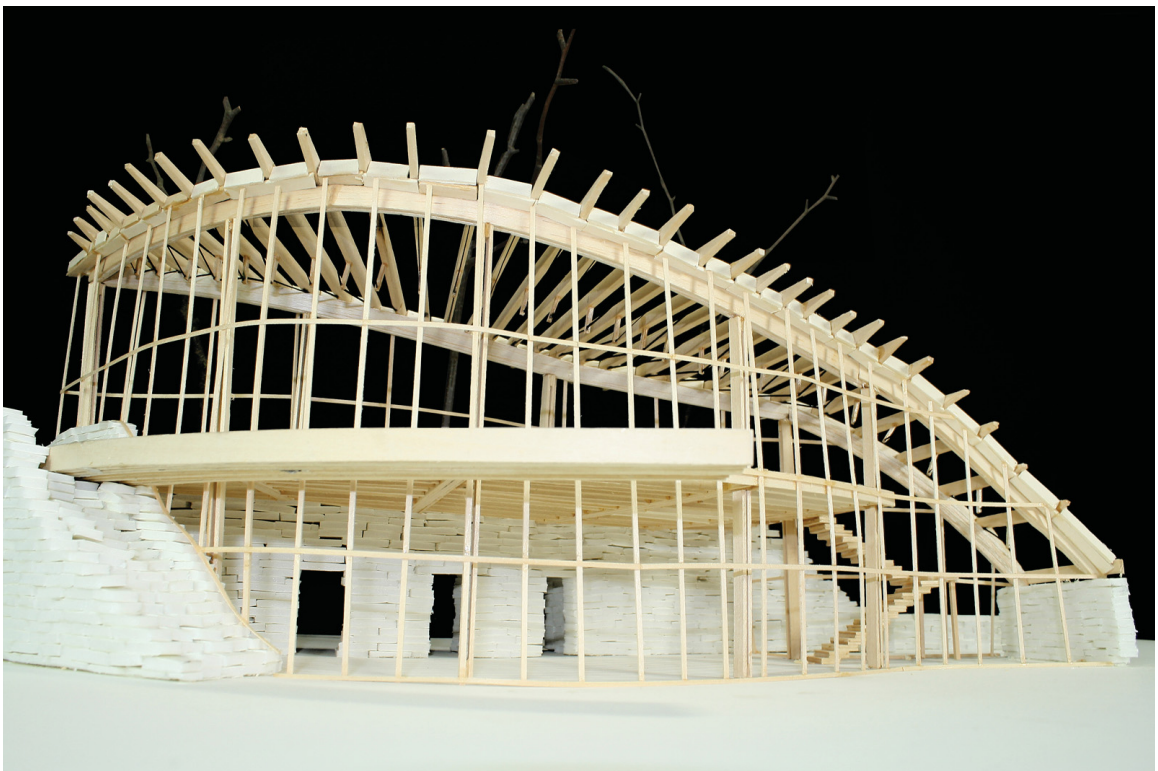


Model of quiet study pavilion. 1:50. 30" x 40".





Model of quiet study pavilion. 1:50. 30" x 40".



Model of quiet study pavilion. 1:50. 30" x 40".

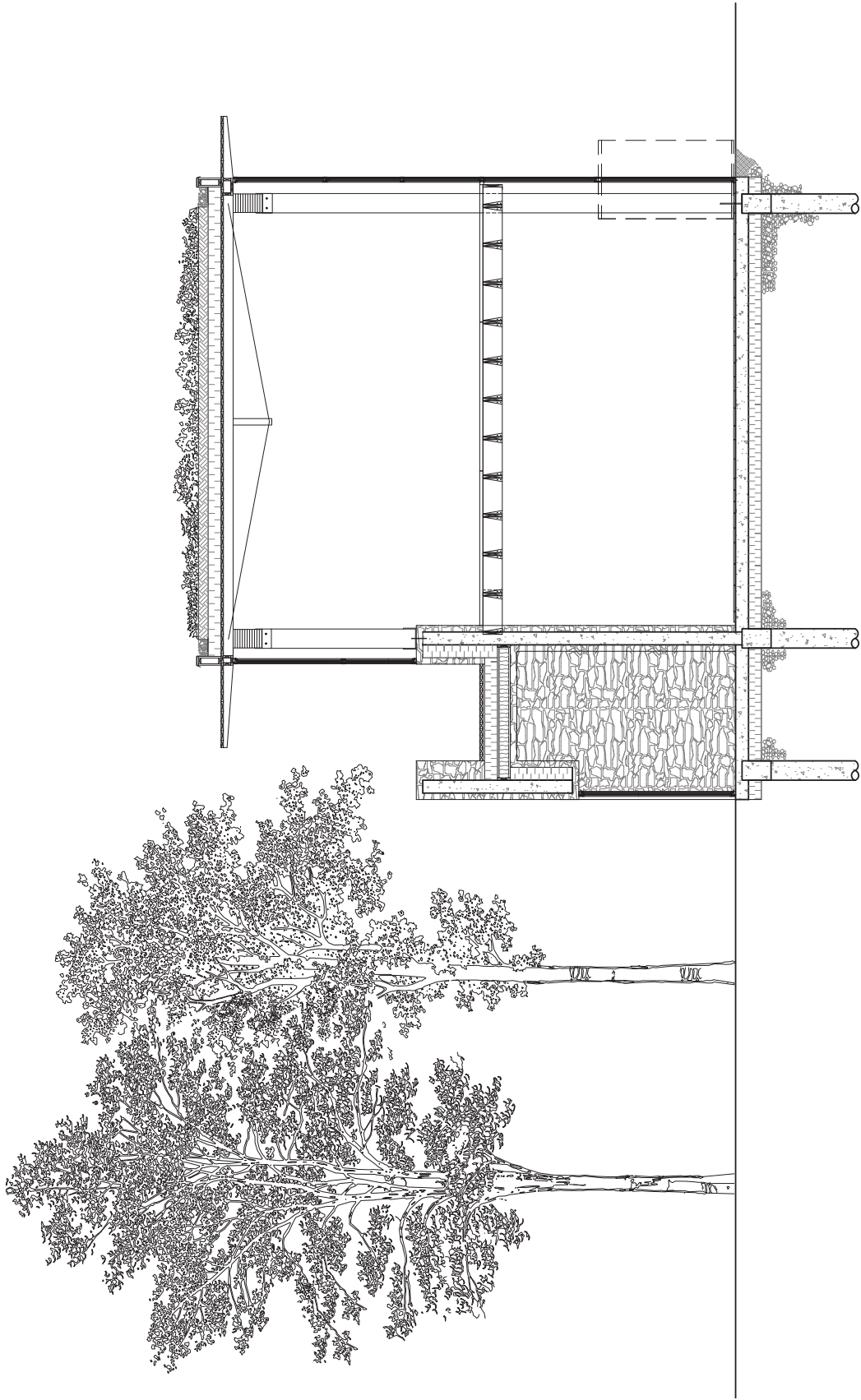




Model of quiet study pavilion. 1:50. 30" x 40".



Model of quiet study pavilion. 1:50. 30" x 40".



Section through quiet study pavilion looking north.

This is the site of the main pavilions, the grounded elements. As you travel into the canopy the path winds through the trees to the different pods within. The pathway splits, early on, and travels to each end of the forest. When travelling to the west, the first pod off the walkway is Grove. It is a larger pod supported by multiple mature trees, within the thicker portion of the forest. With completely open walls, it has a roof and floor that direct the view out to the surroundings. Large groups can gather here.



Grove.

The next pod on the walkway is Haven. It is made of two individual pods that are hunkered around the tree, like little nests. These are closer to the ground in the deepest part of the forest.



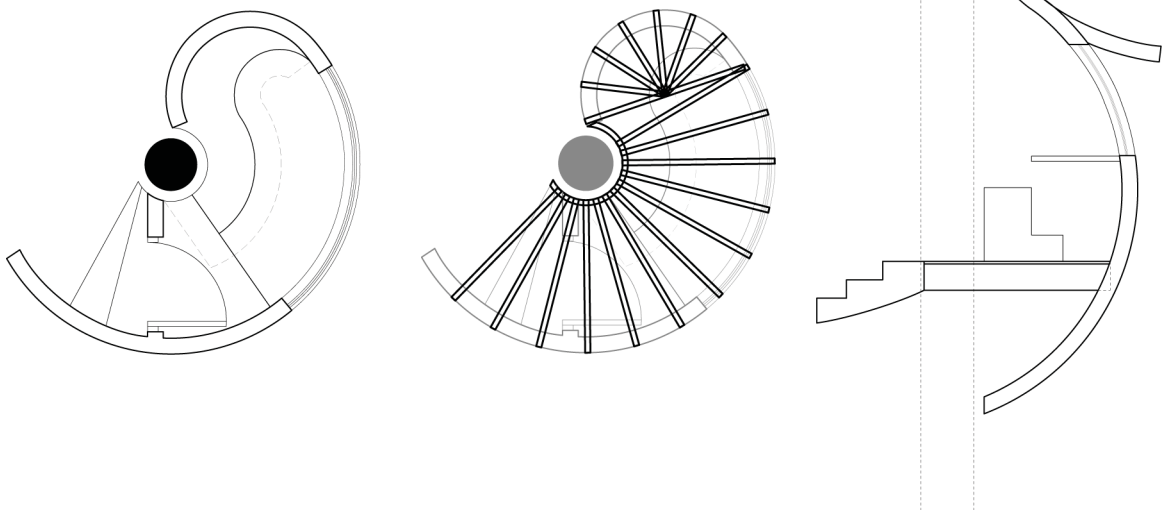
Haven.



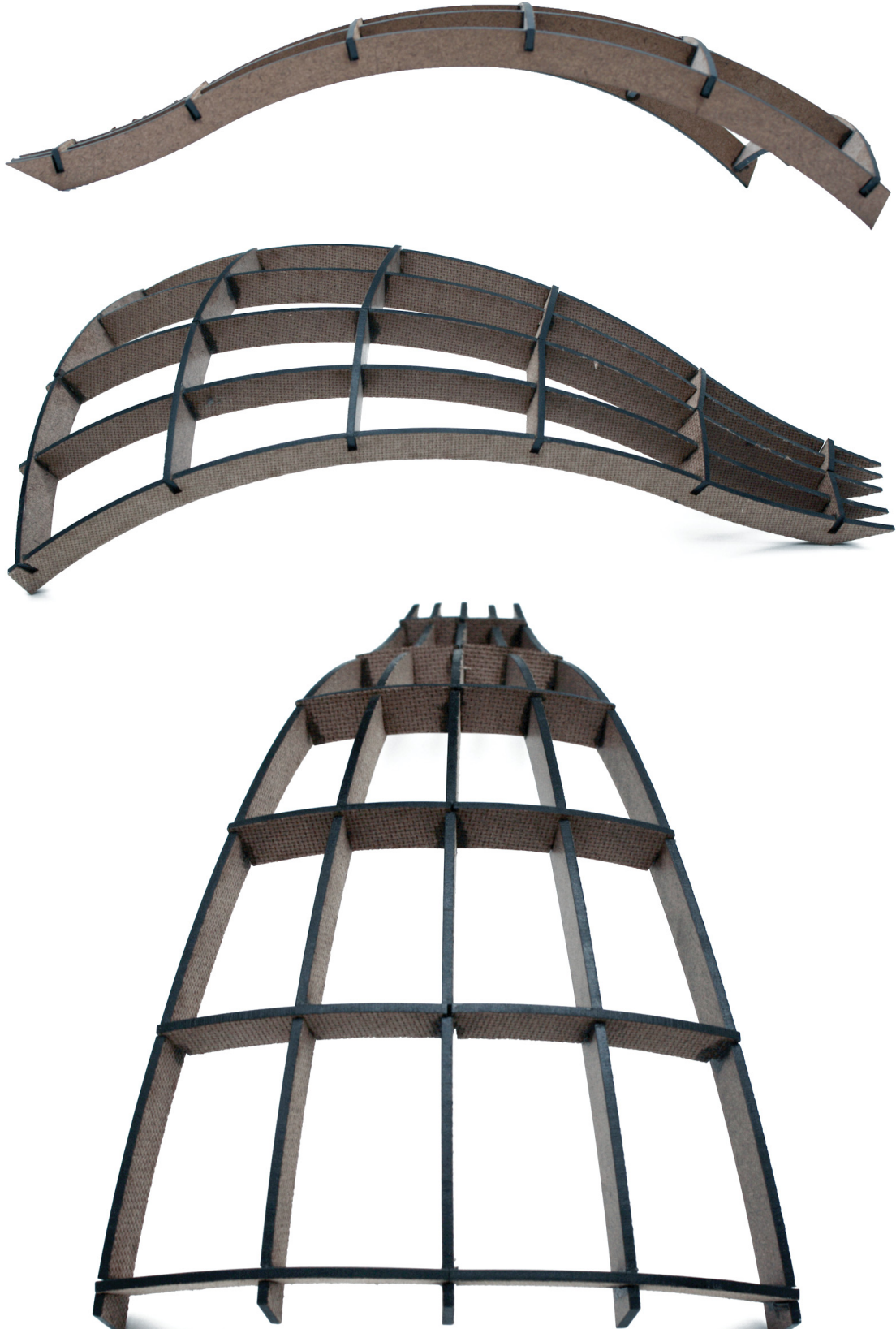
The walkway then bends south towards the rail cut, where there is a stair down to the forest floor. At the end of the walkway is Perch. Perch is a 2 person pod directed towards the Northwest Arm and the rail cut. With the tree at your back you are cocooned in a wasp nest form with a window out for the view. The following are explorations of possible structures for Perch.



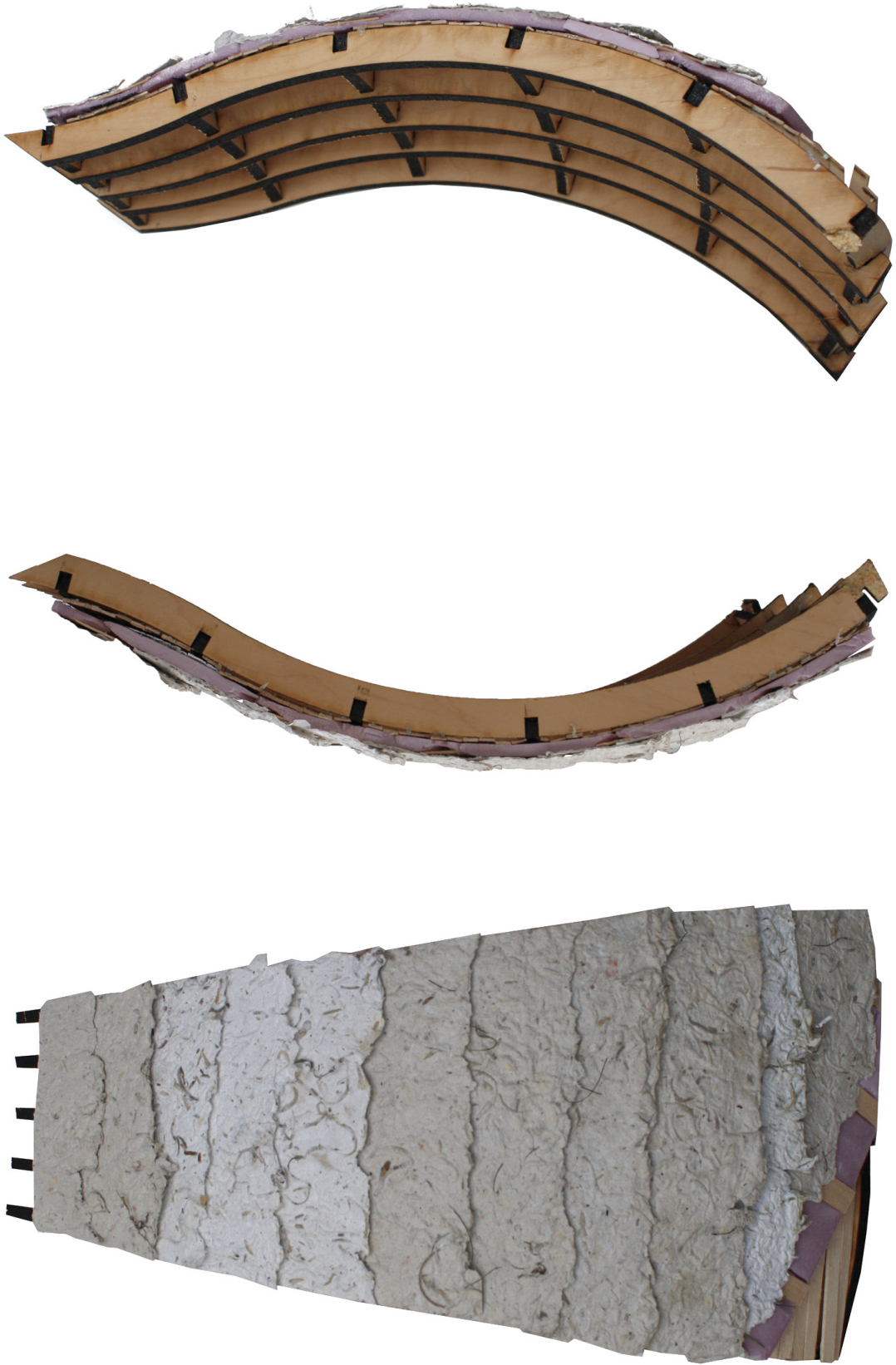
Perch.



Perch plan, roof plan and section.



Wall structure of perch.



Wall structure of perch with cladding. Paper cladding made from recycled paper and organic material.



Back where the walkway splits if you travel to the south east you pass by Gate. Gate is formed by two large trees spaced 6' apart, which create a gate to the edge of the forest and lawn. The pods sit on both outer sides of the tree and are interwoven in form, leaving the path in the middle.



Gate.

As you come to the end of the walkway at the highest point on the railcut, you see Beacon the last pod. At this point the walkway also stairs down to the forest floor. Beacon overlooks the Northwest Arm and the rest of the site. Its floor and wall wrap up to direct the view to the south.



Beacon.

These pods within the forest allow for more intimate study situations, directly in nature. They are placed and designed in a way to experience the forest and its calming benefits.

## **CHAPTER 3: CONCLUSION**

This thesis strives to interpret the ways in which nature affect us as humans, and how that could form a relationship through the insertion of architectural interventions. Specifically how can we strengthen the relationship between our younger generations and nature and how can they benefit from this.

Saint Mary's University became an example of a typical university lacking the physical connection with the environment but had a very unique opportunity through the Oaks property. The Oaks became an experiment in weaving activity through nature, which could be implemented at many universities interested in this direction of learning.

This idea of weaving manifested itself though the method of making models and light paintings, and became a way of working within this thesis topic.

## APPENDIX

### Material Investigations

#### Handmade Paper

I made paper as an experiment in possible facade materials for the pods. I experimented with recycled paper, dryer lint, newsprint, alone and with a mixture of moss and fibres.



Handmade paper.

#### Leaf Lamp

Through material testing I made a lampshade out of leaves from the site.



Lamp shade constructed from leaves from the site, glue, water and cheesecloth as an experiment in light filtration.



## Precedents

### Villa Mairea

Location: Noormarkku, Finland



View of the Landscape from the Front Door. Photograph by Martti Kapanen (Kapanen 2012).

The Villa Mairea by Alvar Aalto is an example of a home built in nature. The organic forms, materials, rhythms and intricacies all tie together the idea of being at one with nature.

### Elleray Preparatory School

Location: Lake District National Park, UK.



Elleray Preparatory School (Meinhold 2009).

Elleray Preparatory School features treehouse classrooms in the forest. The classrooms were designed from recycled materials and provide renewable energy. The central platform is made of recycled plastic milk bottles and wood shavings. The buildings are made from ribbed timber on douglas fir stilts and clad in english shingles. Each pod has solar panels, rainwater collection, and ground source heating and cooling.

### **Outlandia Treehouse Art Studio**

Location: Lochaber, Scotland



Outlandia Treehouse Art Studio (Space Cool Hunting 2011).

Outlandia is a series of three small artist studios, connected to a larger hub tower. Built with a minimal footprint, it is constructed of local timber by local workers. The studio can be reached by a bridge which spans from the main hub, which is a common area where artists in residence may eat, socialize, rest, or dry clothing and it serves as a visitor welcome centre and meeting place for art events and lectures. The isolated studio offers solitude amid nature, with a birds eye view.

## Local Hand Built Shelter

Location: Halifax, Nova Scotia, Canada

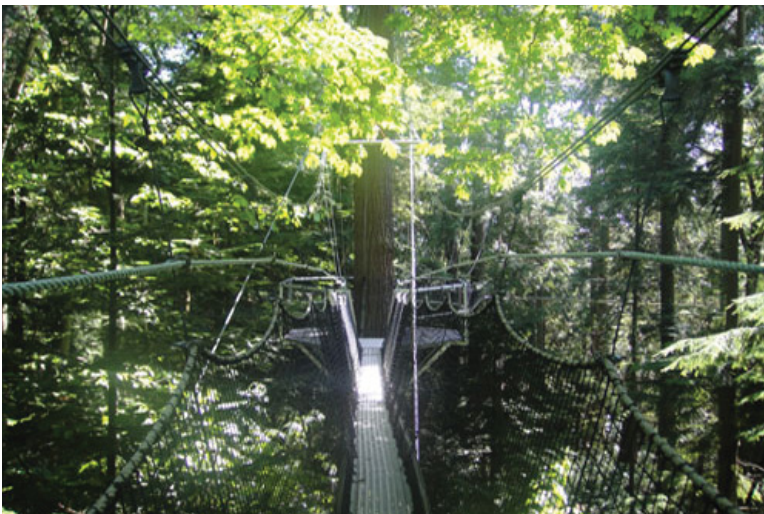


Wood shelter.

A hand built shelter on the Halifax Urban Greenway Trail at the corner of South Street and Oxford Street. It is made of twigs and branches and the entry is marked with a stone threshold.

## Greenheart Canopy Walkway at the University of British Columbia

Location: Vancouver, British Columbia, Canada



Greenheart Canopy Walkway (Inside Vancouver 2012).



The Greenheart Walkway at the botanical gardens of the University of British Columbia is the only canopy walkway of its kind in Canada and is a great example of canopy walkways at Universities. Built by Greenheart Design in 2008, the walkway is 308 meters of trail system, 50 feet off the ground. The walkway uses a system of attaching to trees called tree hugging.

### **VanDusen Botanical Garden Visitor Centre**

Location: Vancouver, British Columbia, Canada



VanDusen Botanical Gardens ("VanDusen Botanical Gardens Visitor Centre" 2012).

The VanDusen Botanical Gardens was completed in the fall of 2011. It is one of the first buildings in Canada to be registered in the Living Building Challenge. This is classified by buildings which generate their own energy, harvest and treat their own water, and use locally sourced nontoxic materials. The design of the building is inspired by an orchid.

## Brooklyn Botanic Garden Visitor Centre

Location: Brooklyn, New York, United States.



Brooklyn Botanic Garden Visitor Centre ("Brooklyn Botanic Gardens Visitor Centre" 2012).

The design for the visitor's centre was inspired by a need to tie the city and the garden together. The building lightly undulates through the landscape along a path until it reaches out to the city. It's sinuous form blends nicely with the surroundings.

## Vegetal Cities of Luc Schuiten

Luc Schuiten, a Belgian architect, with interest in the environment and nature, has created many different utopian cities and modes of transportation. These utopian vegetal cities are incredible ideas, which he has drawn out over the years. These inspirational and visionary ideas of the future are made

of living growing material. His ideas and concepts draw from natural influences, which currently exist in nature. His concepts, although out there, feel possible. He calls them Archiborescence, named for “tree” and “architecture”.



The Tree-house City. Drawing by Luc Schuiten (Schuiten 2012).



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