THE SCIENCE & AFFECT of ATMOSPHERE in LANDSCAPE ARCHITECTURE

By: Kaleigh Lysenko

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Department of Landscape Architecture
Faculty of Architecture
University of Manitoba
Winnipeg, Manitoba, Canada

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IN LANDSCAPE ARCHITECTURE

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Abstract

Atmosphere carries multi-faceted meaning when considered in the context of spatial design. In an architectural sense, we may speak of atmosphere as a spatial quality or in the way the built or natural environment is capable of moving us emotionally. Yet, when considered in a scientific register, atmosphere may be described as a complex of observable and measurable energies, which give air substance, behavior and force. The practice of landscape architecture entails a heightened awareness of exposure, namely the exposure to meteorological processes that in turn shape much of our perceptual and haptic experience of the 'outside' world. The intent of this practicum will be to draw attention to the importance of both designations of atmosphere, particularly within the discipline of landscape architecture, and set within the context of phenomenology.

The context of this work begins at the scale of the circumpolar boreal forest and examines a particular biological and chemical phenomenon that occurs between the atmosphere and the boreal forest biome. The scale of focus will be drawn to a site at the southern transition zone between the boreal forest and St. Lawrence mixed forest within the Temagami region of northeast Ontario, Canada. Here, the phenomenon in question is quite palpable.

This practicum proposes to engage the total scope of a landscape architecture project inclusive of an atmospheric dimension, wherein the chemical, meteorological, biological, as well as affective exchanges between the atmosphere, the landscape and living beings will be closely considered.

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Figure 1
A blustery day in
Westergasfabriek Park.
Amsterdam, Netherlands

"What is an atmosphere? Where and when does it begin? And how does it transform, structure and shape the lives of people? Such questions are becoming increasingly pressing for scholars in a growing number of academic disciplines ranging from philosophies of atmosphere (Böhme, 1995; Bollnow, 1941; Rauh, 2012) over analyses of urban environments (Edensor, 2012; Hasse, 2008, 2012; Kazig, 2008; Thibaud, 2001) to the applied orchestrations of architectonic settings (Stidsen et al., 2011; Uhrich and Benkenstein, 2010). In recent years, such studies, among others, have argued that atmosphere constitutes a fundamental aspect of the human experience of the world and that it thus is an important part of the identities and conceptualizations of landscapes, architecture and homes"

(Bille, M et al. 2014, p.1)

Figure 2
Early Spring
Southern Saskatchewan

Foreword

The atmosphere has been in my thoughts for many years. Even as a child, the expansive space of the sky fascinated me in all of its beauty and behavior - It has somehow always managed to extend the reach of my sensibilities.

I can remember wondering why the tone of the landscape was made more vibrant before a storm, when the sky was the darkest grey, or why snow or rain could suddenly appear to fall on a sparkling, cloudless day. Perhaps these moments were simply functions of my eyes, in the way they passed fragments of my perceived environment to my brain... Nevertheless, this experience of light, colour and the formation of clouds had always been associated with the behavior of the sky, while air, I considered altogether a separate entity - physical and enveloping, holding a particular weight on my body. For this reason, I find it difficult to separate the sky and the air from any consideration of the landscape.

Figure 3
First snow of 2015
University of Manitoba

Introduction

One way to describe the nature of the atmosphere that I quite like is in the way art historian Sarah Lewis speaks to the nature of beauty, in that it "slips in the back door of our rational thought and gets us to see the world differently" (Lewis, 2014).

If someone asked me to envision a world where the sky never changed, I simply could not imagine it. The inherent unpredictability of the sky has an acute effect on the quality of our lived lives, determining our moods, the ways we move, the smells in our environments, the way we clothe and unclothe ourselves, and so forth. And, since atmospheric events unfold in a rather semi-comprehensible sequence, the ability to measure and piece a story of the atmosphere together through scientific understanding becomes quite critical. What is interesting in this is that when we begin to develop an understanding and a curiosity of the inner workings of a phenomenon, we are suddenly presented with the opportunity to "reawaken to their beauty, essentially re-imagining them and creating them anew" (Papova, 2015). And, although I was not cognizant of it then, my experience of the atmosphere was revealing itself as a powerful corporeal force and as a true wakefulness to the mechanics of atmospheric phenomena. The work that follows finds its inspiration in part from the place that I belong to and in part from a previous studio project that began in the final year of my undergraduate degree.

Figure 4
Before the pour, Grasslands
National Park
Saskatchewan, Canada

I have grown up and for the moment, continue to live in the city of Winnipeg, Manitoba, Canada. To speak generally, those who were born and raised here carry an appreciation and a sense of pride toward the sky, perhaps because it stands as a moment of contrast and movement against the uniformity of the Manitoba prairie horizon. Although geographically Winnipeg may not sit at the extreme north of Canada, “Winnipegers” might still identify with a northern regionalism that acknowledges light and extreme weather as a forceful environmental character. Similar to how Christian Norberg-Shultz introduces the quality of Nordic light in Scandinavia in his book ‘Nightlands”, I believe the same can be said about the Nordic light experienced in much of Canada. He point outs: “If we maintain that light defines the Nordic character, it is to imply that we understand “climate” qualitatively. Light is conjunctive with weather, and in the north, weather plays a more important role than in the South’s more stable world” (1996, 6). One motivation for this work as I mentioned, has grown out of a discovery in the last year of my undergraduate degree, which was the pursuit of a basic understanding of a particular climatic feedback loop between the biosphere and the atmosphere. I will expand on this phenomena as a valuable perspective regarding the relationship between the landscape and the behavior of the atmosphere. However, I would first like to address a select number of encounters throughout my education that have awakened my attention to the atmosphere in relation to the discipline of landscape architecture.

Figure 5
Mirroir d'Eau
Bordeaux, France

One encounter that was particularly memorable took place during the fall of 2009 in Bordeaux, France on the Quay of Garonne where I would experience 'Le Miroir d'eau' (2006), a public space designed by French landscape architect, Michel Corajoud. The space comprises an expansive plaza constructed simply of granite, the element of water in several states, and the striking reflection of the sky and the city's elegant Palais de la bourse in a glass-like sheet of water that lingers on the surface. In 2011, during a frigid January in Toronto, Canada, I was drawn to the blanket of heavy grey-blue clouds that hovered and shifted above the city. The perfect stage for their performance was on the edge of a neighbourhood called *The Beaches* on the north shore of Lake Ontario. The following month, (and you can see how this all unfolds in a short span of time) a young Basque woman named Eunate Torres-Modrego came to the University of Manitoba to share her work at the 'Atmosphere', conference, which is held each year in the Faculty of Architecture. She would eventually lead a group of students on an expedition to find the edge of Winnipeg's frozen prairie horizon. Naturally, it was at this moment that the horizon became a significant subject in my attention to the atmosphere. And finally, on a field study course (June 2014) with self-proclaimed prairie girl Dr. Karen Wilson-Baptist and nine other students, we found ourselves exposed to the unforgiving late spring weather of southern Saskatchewan. Here, we experienced the most fundamental need for shelter and, in hindsight, as there were times when we felt deliriously aggravated by the weather, I can say that we grew quite humbled by the shear strength that the sky could claim over the land, the body and the mind in such a short time.

Figure 6 (left)
The Beaches
Toronto, Canada

Figure 7 (right)
Frozen horizon
Winnipeg, Canada
Photograph by Eunate Torres-Modrego

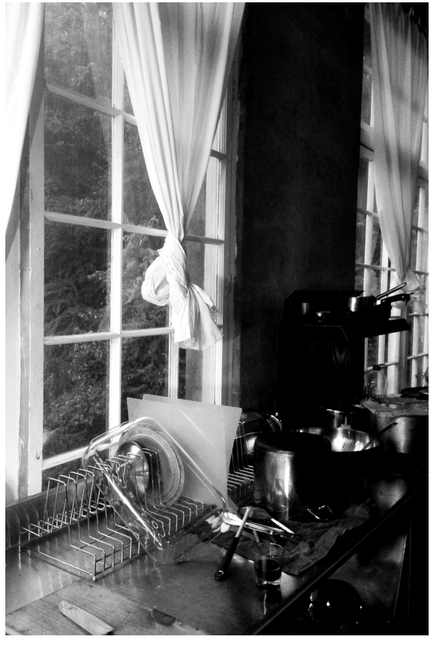


Figure 8
View from the kitchen
Arts, Letters & Numbers
Averill Park, New York State

Peter Zumthor's 'Atmosphere'

An introduction to a type of atmosphere that is inspired by architectural action came in the form of the small but substantial book, entitled 'Atmospheres: Architectural Environments – Surrounding spaces', by Swiss architect Peter Zumthor. Within, he shares a deep curiosity and appreciation for a designer's ability to create spaces that exude a kind of "beautiful, natural presence" (2006, p.11), leading him to ask the difficult but sumptuous question: "What do we mean when we speak of architectural quality?" (p.11). A simple and poetic discussion of such qualities that include materiality, light and sound; scale, temperature, and movement, aspects such as interior-exterior, memory, and intimacy, are presented. The collective impressions of these physical and sensorial qualities create what he calls the 'atmosphere' of designed and built environments. Because this perspective speaks largely, but not exclusively to building architecture, I began to wonder how quality, if following this, approach might be articulated in consideration of landscape and exterior environments. Especially where the 'atmosphere' surrounding landscape is "simultaneously meteorological and affective" (Adey 2013, p.1). Is there the potential within the discipline of landscape architecture to consider the affect as well as the science of atmosphere? And more importantly, how does one begin to defend the rightful place of atmosphere both as a physical and conceptual entity in landscape architecture, if it is inherently difficult to express in writing and even more difficult to determine in a theoretical or built project?

Figure 9
Planning lunch in the clearing
Arts, Letters & Numbers
Averill Park, New York State

Taking the ideas of German philosopher Gernot Böhme, whose interest lies in distilling the concept of atmospheres, I too admit: “It is difficult, owing to the peculiar intermediary position of the phenomenon between subject and object, to determine the status of atmospheres and thereby transform the everyday use of atmospheres into a legitimate concept” (Böhme 1993, p.118). Twenty years later he goes on to express with some determination what was always so hard to put into words:

> The phenomenon of atmosphere is itself something extremely vague, indeterminate, intangible. The reason is primarily that atmospheres are totalities: atmospheres imbue everything, they tinge the whole of the world or a view, they bathe everything in a certain light, unify a diversity of impressions in a single emotive state (2013, p.2).

What I find most compelling, is that Zumthor was able to express this several years before in ‘Atmospheres’, which can be taken to imply that atmosphere has value as a central consideration in design thinking and practice. Italian philosopher and professor of aesthetics, Tonino Giffero suggests in his book 'Atmospheres: Aesthetics of emotional spaces' that the everyday experience of atmospheres allows for an acceptance of the term and we need only say it in the right way to lift it out of its vagueness. He goes on to say: “Why on earth, in fact, should solid and contoured bodies be more real than vague entities, which we experience without referring them to solidity, such as fluids, gas processes or even quasi-things – things like atmospheres?” (Giffero 2014, p.10).

Anthropologist Tim Ingold too contributes to this question of approach, representation and understanding of atmospheres quite succinctly by asking:

> "Do we tease them apart, separate out specific characteristics, categorise atmosphere as distinct from other terms, such as ambiance, affect, emotion, mood, aura, feeling, presence, sense, experience and perception? Or do we seek to maintain the vagueness in the study of atmosphere, allowing the unclear to be taken at face-value as integral to its very nature?" (Ingold 2011, 3).

It was not long before I became aware of a diverse dialogue among an assemblage of individuals; architects, landscape architects, philosophers, writers, psychologists, phenomenologists, anthropologists, who have claimed atmosphere as a fundamental concept and phenomenon within design. One in particular is landscape architect and professor Silvia Benedito, who very reasonably asks what it means to design while considering atmosphere as a crucial actor in landscape architecture. In the syllabus for a course entitled 'On Landscape and Atmosphere' developed and taught by Benedito in the Department of Landscape Architecture at the Harvard Graduate School of Design, she proposes: "One must first claim that atmosphere (scientific term) and atmospherics (aesthetic impression) are interdependent terms in design" (Benedito 2014, p.2). The two terms in effect encourage a dialogue that considers atmosphere as a scientific phenomenon as well as a condition of felt space.

> "...landscape is as much about air and atmosphere, as it is about land and water. The relationship between landscape and atmosphere, while seemingly apparent, has rarely been acknowledged or formalized. The transformation of land lies at the core of landscape architecture, yet the study of atmosphere and associated meteorological subjects—such as wind, temperature, light and humidity — still remain peripheral to design discourse" (Benedito 2014, 2).

ATMOSPHERE
Scientific Term

/ Working in the domain of the optical and the physical
/ Elements and exposure: climate, meteorology: wind, humidity, temperature, sound, and light
/ Impact on health, well-being and comfort
/ Impact on climate warming
/ Drawing inspiration from natural phenomena

ATMOSPHERICS
Aesthetic Impression

/ Working in the domain of the sensual and the imaginative
/ Haptic awareness
/ Asking what lends space mood, ambiance, presence, sense of place
/ Aesthetics and beauty

A FINE SCIENCE
Atmosphere & Atmospherics

/ Working in the domain of the visible (scientific) and the experiential (aesthetic impression)
/ Use of scientific observational and representational practices
/ A balance between pragmatism and creativity, imagination and reality
/ Tracing the genealogy and history of the relationship between scientific inquiry and artistic sensibility

Objectives & Methodology

Building upon Benedito's assertion that atmosphere signifies two interdependent terms in design, I would like to draw attention to the role of atmosphere as an essential subject in landscape architecture discourse, process and practice. The work presented here will unfold in four interconnecting sections, each possessing a specific theme. The first part, 'A Fine Science' is grounded in context and history, conveying attitudes toward the atmosphere and demonstrating how ideas are cultivated through a study of philosophical traditions and culture, particularly, the crossover of the Enlightenment and Romanticism in Northern Europe. The second, entitled 'Atmospherics' will introduce atmosphere as a phenomenological and aesthetic subject, one that is felt, characterized and "sensed in bodily presence by human beings" (Bohme 1993, p.122). The third, 'Atmospheres', will see atmosphere from an empirically grounded perspective, examined as a multi-layered envelope of air surrounding the earth that behaves through chemical, climatic and meteorological structures. Finally, in order to expand these ideas into a landscape architecture practicum, the endeavor of the fourth and final part 'Staging Atmospheres' will be to convene scientific investigation with the poetic inspiration of a "landscape-atmosphere" interaction. Throughout, the work will be informed by the following intentions established within Benedito's course 'On Landscape and Atmosphere', acting as the over-arching and basic guiding principles toward a final design intervention.

1 / To claim the concept of "total-landscape" in which lithosphere, hydrosphere and atmosphere are an overarching scope of inquiry and design in landscape architecture and urbanism.

2 / To trace the genealogy of the relationship between landscape and atmosphere/atmospherics.

3 / To position atmosphere as a fundamental aesthetic and performative medium as a means to expand the ecological, physiological and humanistic scopes in design.

(Benedito, 2014 p.3)

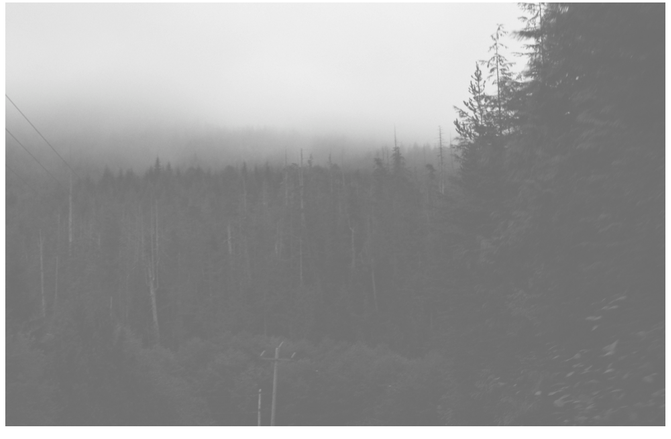


Figure 10
Morning mist
British Colombia, Canada

Context

The success of this work will lie in its ability to answer a key question: What do the sky and the atmosphere have to do with landscape architecture and with the greater global environment? An objective that I hope to fulfill is to provide the scientific awareness as well as imaginative thinking necessary to understand the functioning of terrestrial ecosystems in relation to atmospheric phenomena. I would like to begin by speaking to the boreal forest, which, from my perspective, finds itself at a rather complementary intersection between land and sky. The circumpolar boreal forest is earthly; bound to the soil, yet connected to the atmosphere in a remarkable way. Chemical signaling, coalescence, and capillarity are the delicate processes which are at the core of the survival of this ecosystem. Representing one of the largest terrestrial biomes in the world, its circumpolar distribution occurs between 50° and 60° North latitude. Among the diverse assemblage of vegetation in the boreal forest, it is primarily the coniferous tree species that make up the extent of the forest's dark canopy. Coniferous trees produce a chemical compound that is stored and released from the resin ducts within their needles. This compound is called Terpene. Terpene is one of a grouping of Volatile Organic Compounds (VOCs) responsible for the distinct scent associated with pine forests. When released into the atmosphere, terpenes react with water vapour present in the air, forming small particles called atmospheric aerosols. Aerosols are significant because they play an essential role in the earth's radiation budget by way of their influence on the formation of clouds and the modification of cloud micro-physics, through a process called Cloud Condensation Nuclei (CCN) (Baker, M.B., Peter, T. 2008, 229).

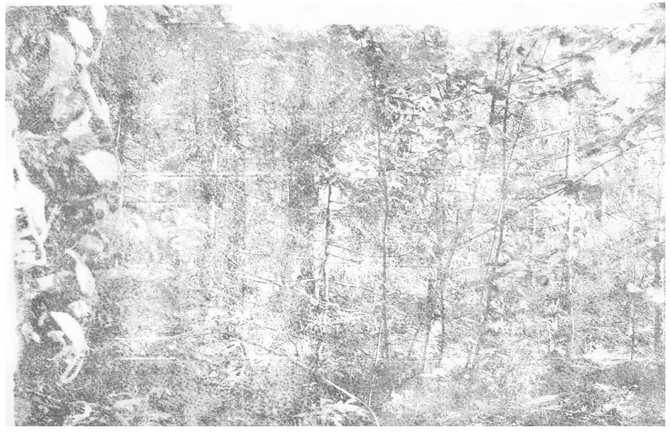


Figure 11
Young understory
Temagami, Canada

This unique adaptation allows coniferous forests to effectively seed the clouds just above their canopy. These cloud formations are quite low-lying, appearing as a subtle fog, but are in fact stratus clouds that form in the lowest layer of the atmosphere - the Troposphere. Stratus clouds help to reflect a fraction of the sun's radiation back into space through scattering and absorption of sunlight, eventually contributing to the unique way in which the boreal forest ecosystem regulates its own internal temperature (Bonan, Pollard & Thomson, 1992). I must give credit to author and scientist Diana Beresford-Kroeger who, with an unbelievable balance of scientific and metaphorical language, shared this story of the boreal forest and the clouds during a visit in 2011 to the University of Manitoba. In her book entitled 'The Global Forest', Beresford-Kroeger has assigned a chapter to describe the chemical dynamics of forest fragrance.

> Trees…are highly effective chemical communicators. A tree's height gives it a greater ability to disperse or inject chemicals in the airways and passages around the forest and atmosphere above it. The aerosols from a forest are emitted from the chemistry of the canopy itself, sometimes from the flowers, other times from the extra floral nectaries or resin canals. Quite often the fragrances are held in special organs called glands or glandular tissue. These glands are microscopic. They are a world unto themselves (Beresford-Kroeger 2010, p.80).

Building on this initial curiosity, I wondered what effect such chemical exchanges have on clouds when considered at the scale of a large forest body like the boreal forest. I was very encouraged to discover that an intimate study of the "boreal forest aerosol-cloud albedo feedback system" (Kulmala et al., 2004) was underway, led by Finnish physicist and atmospheric scientist, Markku Kulmala from the University of Helskini.

Figure 12
First campsite
Temagami, Canada

Kulmala's research has primarily taken place at the 'Station for Measuring Forest Ecosystem - Atmosphere Relations' (SMEAR II) in the Hyytiälä Forestry Field Station in Southern-Finland (61° 51' N, 24°17' E, 181 meters above sea level). The landscape that surrounds the station is representative of the boreal coniferous forest, composed mainly of a 40-year old Scots pine (Pinus sylvestris L.) dominated stand. The station is a unit of the Department of Forest Sciences in the University of Helsinki whose mission is to enable forestry teaching and research in field conditions while bringing together forest ecologists, physicists, meteorologists, chemists as well as artists and designers. Measurements of the 'boreal forest aerosol-cloud albedo feedback system' are carried out at a number of interfaces extending from the subsurface layers of the soil to the atmosphere. Various methods of research are operating simultaneously and at different spatio-temporal scales to monitor the material and energy fluxes between the different layers of the biosphere and the atmosphere. The fascinating and progressive work that has been established at the Hyytiäla Forest Research Station has served as a point of departure for this work, providing a loose framework for the selection of a site within the Canadian boreal zone. The research proposal and design intervention will attempt to express the scientific questions being discussed at Hyytiäla, and further attempt to distill the phenomenon in question through landscape architecture.

Figure 13
Brightness after a rain
Diamond Lake, Temagami, Ontario

The landscape in which the design work will be situated is located within the ecological transition zone between the boreal forest and the southern hardwood forest in the Temagami region of Northeast Ontario. This region is the homeland of the original peoples of Deep Water, Anishnabai (Ojibwa and Algonquins) of the Temagami First Nation. The site in which the design work will take place lies to the west of Temagami Lake, in a sacred and protected forest called the 'Spirit Forest'. The site is home to some of the oldest stands of white pine (Pinus strobus) and red pine (Pinus resinosa) forest in North America. This is a unique forest ecosystem within which to consider the environmental cues, alterations and configurations of the atmosphere and its connection to landscape.

This project is about finding plausible relationships between two environmental dimensions: the atmosphere and the biosphere, namely through the bio-chemical functions of vegetation and their connection to climate fluctuations. The use of modeling and correlation research strategies will work to interrelate what is experienced in the landscape and what is understood about its process (Deming & Swaffield 2011, p.93).

Figure 14
Frozen beaches
Toronto, Canada

Interpreting the poetic and biophysical interactions between trees and the atmosphere is an important aspect of the work. By identifying with Michel Corajoud who said that “the landscape is the place where the sky and the earth touch”, atmosphere will ultimately be considered as inseparable from the discipline of landscape architecture, resting, theoretically, within the broad spectrum of scientific and imaginative thought.

There are many wonderful ways in which the discipline illustrates a balance of artistic and scientific thinking. I say wonderful because what occurs at this intersection is an endless expansion of epistemological and ontological perspectives that essentially open our eyes to the interconnectedness of two, often divided modes of thinking. What comes to mind is the necessity for an interdisciplinary approach in the realm of design. However, building from Integral Theory, as noted in Esbjorn-Hargens and Zimmerman’s extensive volume ‘Integral Ecology’ (2009), there emerges a trans-disciplinary methodology that considers both empirical investigation and philosophical reflection in experimental aesthetic and technological practice.

As a way to gain a significant understanding of the meaning of atmosphere in its affective state, a phenomenological approach will be drawn upon. The phenomenological method is... “anything but detached from life; indeed, it gives us insight into the unity of life and place that psychological and sociological methods cannot” (Schultz 1996, p.vii).

Through an exploration of the quantifiable and phenomenological relationships between the atmosphere and ecosystems (the boreal forest in Canada), the importance of subjective observation and a fascination with nature and natural phenomena becomes a significant part of this work. In this regard, I would like to mediate the practical and the aesthetic aspects of the landscape, to develop design opportunities, which will articulate the functional reverence of the Canadian boreal forest.

PART 1

A FINE SCIENCE

Figure 15
The Mill
Arts Letters & Numbers
Upstate New York, U.S.A

Introduction

One thing that has always been clear to me is that the act of design requires a multifaceted conceptual and practical approach. To design means to accept the movement between rational and creative thought, where a designer is interested in understanding the functional integrity of ecological systems, material quality and built structure, while at the same time engaged in the art of defining space for the experience of sentient bodies. Architect Peter Zumthor, whose perspective I find quite valuable in this respect, believes that the design process is based on:

> "...a constant interplay of feeling and reason. The feelings, preferences, longings, and desires that emerge and demand to be given a form must be controlled by critical powers of reasoning, but it is our feelings that tell us whether abstract considerations really ring true" (Zumthor 2010, p.21).

Of course, many disciplines strive for this level of connectedness of ingenuity, accuracy and practical resolution, however, there seems to be a strong emphasis on the differences rather than what begins to overlap between the natures of creative disciplines and science-based disciplines. As a basic example, cardiologist Lewis Thomas (1881-1945) has expressed:

> "the facts that underlie art, architecture, and music are not really hard facts, and you can change them any way you like by arguing about them, but science is treated as an altogether different kind of learning: an unambiguous, unalterable, and endlessly useful display of data needing only to be packaged and installed somewhere in one's temporal lobe in order to achieve a full understanding of the natural world" (Thomas 1983, p.148).

Figure 16
Drawing, thinking
Arts Letters & Numbers
Upstate New York, U.S.A

In this lies a critical attitude toward the space between the poetic and the pragmatic, where, even though there may be an appreciation for both, the focus tends to lie on their disassociation. As a counterpoint to this, as represented in the candid publication 'Conversations on Science, Culture and Time' (1995), mathematician and philosopher Michel Serres with Bruno Latour share a line of thought that appreciates both an objective and affective engagement with the world. Michel Serres remarks:

> "When you really do the indispensable work on one of the two sides and then on the other, you quickly realize that you can't do the one without being able to tie into the other at a certain point. There is some mythology in science and some science in mythology. What remains is to recount this immense history or legend, without fragmentation" (1995, p.158).

The origins of this dichotomy between rationality and imaginatively inclined thinking can be traced by way of a brief overview of the historical, aesthetic, cultural, and environmental contexts, which have played an important part in shaping the way we engage with and understand natural phenomena. The ambition of this chapter then, is to summarize the wavering tension between feeling and reason that transpired as the Scientific Revolution opened up to romantic scientific approaches to the natural world during the eighteenth and nineteenth centuries in Europe. I will also reflect on the romantic thread that carried into and came to redefine the functionalist world-view of the early and mid-twentieth century throughout Scandinavia, with a particular focus on Nordic appreciations of atmosphere in regard to place-making and identity. Finally I will respond to the prevalent Western scientific world-view by speaking to an Indigenous scientific world-view that is most often left out of the conversation...

Virgil's 'Georgics'

The 'Georgics' as a body of work are important and beautiful because they speak to changes in nature that are indicators of impending weather, such as the behaviour of vegetation, insects, animals and the skies. Intuition and experience were instrumental in understanding the natural world.

"The 'Georgics' derives its title from georgos, the Greek term for farmer. Virgil equates the farmer's virtuous management of the land to the benign management of Rome and emphasises weather's influence on the arts as well as daily life. He even acknowledges inclement weather as a creative stimulus...
(Hill 2012, p.67)

Aristotle's 'Meteorologica'and 'Exhalations'

The very beginnings of meteorology found ways of explaining the phenomena of air movement - wind and air pressure found its articulation as 'Exhalations' according to Aristotle.

"[Aristotle] attributed atmospheric phenomena to the actions of the sun on the earth, which result in two types of exhalation. The first is hot and dry and occurs when the sun's rays fall on land. The second is cool and moist and occurs when the sun's rays fall on water. The exhalations interact with each other and the elements - earth, air, fire and water - to create atmospheric movement: clouds, mists, winds, storms and other conditions"
(ibid, p.62).

Platonist and Cartesian traditions

As the importance and desire for precise measurement in meteorology grew, the invention of new scientific instruments followed and eventually allowed the atmosphere's properties to be categorised and calculated to valuable extents.

s

The beginnings of atmospheric instrumentation

1490, philosopher and astronomer Nicholas de Cusa invented the hygrometer to measure moisture in the air, which was later built by Leonardo da Vinci.

1593, Italian polymath Galileo Galilei invented the thermometer to measure air temperature.

"...it is important to understand that the knowledge of Indigenous peoples emerges from a different philosophical tradition than what is described in the Western tradition as scientific knowledge. To understand this it is essential to consider differences in worldview. Yupiaq scholar Oscar Kawagley suggests that the way to understand the concept of worldview is to consider the answers to the following questions:

(1) What is real? (metaphysics); (2) What can we understand? (epistemology); (3) How should we behave? (ethics); (4) What is pleasing to the sense? (aesthetics); and (5) What are the patterns upon which we can rely? (logic) (Kawagley 1995). Indigenous traditions would answer each of those questions differently than would the European tradition" (Pierotti 2010, pp.7-8).

Observation and instrumentation

1627, English philosopher and scientist Francis Bacon publishes 'Historia Ventorum' (History of the Winds).

1637, René Descartes' 'Discourse on Method, Optics, Geometry and Meteorology' sees weather as an inviting challenge to rational explanation (Hill 2012, p.66).

1644, Italian physicist and mathematician Evangelista Torricelli and Irish natural philosopher Robert Boyle devise term 'barometer', identifying its potential for measuring air pressure (ibid, p.62).

1663, scientist and architect Christopher Wren presents his description of a 'Weather Clock' (ibid, p.65).

1667, English natural philosopher Robert Hooke's desire for consistent weather records are expressed in his publication 'Method for Making a History of the Weather'.

Recording through observation

Scientific reseach in the first half of the 18th existed alongside references to classical precedent...
(ibid, p.65)

"Ships did not (yet) include meteorological instruments, and logbooks were compiled through observation alone. Wind force was described in terms that were widely but not consistently used such as 'fair' and 'strong'... Mariners described the general condition of the weather as a narrative, using terms that were almost lyrical"
(ibid, p.64).

Until 1715, 'Weather Diaries' are written by clerics to record local conditions (p.63). Weather reports are published in 'Philosophical Traditions' journal, which was associated with the Royal Society (The UK National Academy of Science).

Classifications

In the second half of 18th century, empirical science began to emphasize detached observation and reasoned explanation, not committed to engagement with nature, intuitive interpretation and classical precedent. (ibid, p.65)

1737, Carl von Linnaeus developed system of plant calssification in 'Critica Botanica', 'Species Plantarum' (1753), and 'Systema Naturae' (10th ed. 1758).

1749-1832, Johann Wolfgang von Goethe describes a phenomenology of science in his work 'Metamorphosis of Plants' and 'Theory of Colour'.

1803, Luke Howard's 'On the Modification of Clouds'.

1817, Alexander Von Humbolt develops the 'Isothermic map'.

Architecture and the weather

Just as science accepted the importance of subjectivity in Romantic era, the early 20th Century Nationalism and Romanticism combined in German-speaking and Nordic countries, affecting the hold of modernist/functionalist values in architecture.

"The attention given to subjectivity increased awareness of the conditions that affect perception. Any changes in the weather, the time of day or the knowledge, position or mood of the viewer can influence understanding, so that even an object seemingly as solid as a building may not seem the same from one moment to the next"
(ibid, p.84).

Century	12 th.	13th	14th	15th	16th	17th	18th	19th	20th	21st
Era	*Classical Antiquity*	*Middle Ages 400-1300*	*Renaissance 1300- 1600*	*Enlightenment 1650-1800*		*Romanticism 1800-1850*	*Positivism 1880*		*National Romanticism 1900*	*Modernism 1930-1950*

Settlement of Europeans in the Americas

This time line has been created using information primarily drawn from Jonathan Hill's book 'Weather Architecture', 2012.

HISTORY

The Enlightenment

Extending through the fifteenth and seventeenth centuries in Europe came the materialization of a philosophical and scientific era described as the Enlightenment. The traditions and attitudes regarding environment, sensation and the mind throughout this period were defined foremost by empirical science, which necessitated rational investigation, measured observation, causation and experience above all. In contrast to the Cartesian authority held in the preceding era - the Renaissance, which emphasized that knowledge is acquired by the mind alone – empiricism insisted that experience is crucial to understanding (Hill 2012, p.148), eventually laying the foundations for the natural sciences such as botany, zoology, medicine and chemistry. Advocates of empirical philosophy and methodology included mathematician and scientist René Descartes (1596-1650), philosopher John Locke (1632-1704), physicist and mathematician Sir Isaac Newton (1642-1727), botanist Carl Linnaeus (1707-1778), as well as philosopher and historian David Hume (1711-1776). Also in favor of empiricism was philosopher Immanuel Kant, particularly exhibited in his seminal work 'Critique of Pure Reason', wherein he proposes that "all our knowledge begins with experience" however, "it does not follow that it all arises out of experience" (Kant 1781, p. 41). Empiricism, as designated by Kant, demands a priori concept – knowledge that is derived from reason, however, he argued that we cannot truly perceive objects or phenomena with reason alone, we must experience them – 'a posteriori' – knowledge that is obtained after experience - and the phenomenon must leave an impression on the viewer, so to speak (Kant, as quoted in Hill, 2012 p.191).

Romantic Sensibility

In one sense, the objects and phenomena therefore are made "true by virtue of meanings and independently of fact" (Quine 1951, p. 21), as is indicated by American philosopher Willard Van Orman Quine (1908-2000). Due to empiricism's apparent objectivity, it was soon challenged by romantic philosophies, which followed suit in its approach to scientific investigation and expression.

Romantic attitudes to the natural sciences emerged later in the eighteenth and early nineteenth centuries along side and as a response to the philosophical and scientific traditions of the Enlightenment, and flourished primarily in Great Britain, Germany and France. Romantic philosophical thought and science emphasised the authority of the imagination, emotion and sensibility –

> "[it] conceived the world as a dynamic whole, eulogised nature and primitive origins, cherished a mythical past, denied immutable standards, questioned authority of tradition and the classical canon, emphasised personal histories and individual experiences, and promoted personal liberty and the potential of the imagination" (Hill 2012, p.148).

The Romantic era's contribution to the scientific realm was perceptive at its core, hoping to reveal the essence of phenomena within the realms of meteorology, botany, morphology, geology, and optics to name a few. Science at this time was deemed a method of philosophical and scientific investigation that attempted to stay true to human facilities - a science, which sought to draw together the "intuitive awareness of art with the rigorous observation and thinking of science" (Seamon 1998, p.1).

Goethe's Annual Plant

A basic illustration describing his conception of metamorphosis in plants.

From top to bottom:

1. pistil
2. stamens
3. corolla and sepals
4. calyx
5. stem leaves
6. cotyledons
7. roots

ATTITUDE

A Phenomenology of Science

Nineteenth century science saw no distinction between experience and theory or between fact and conception, for genuine scientific understanding was composed of a mutual interplay of both reason and theory. German poet and playwright Johann Wolfgang Von Goethe (1749-1832) was a defining figure during this time. His intimate investigation and approach to ideas of relationship, becoming and emergence (Reynolds 2007, p.160) in science, culminated in the naming of a new quasi-scientific method called 'Delicate empiricism'. Delicate empiricism speaks to the eventual discovery of the inner-workings of phenomena through the "prolonged empathetic looking and seeing grounded in direct experience" (Seamon 1998, p.2). Goethe's most explicit conviction was that "the human being himself, to the extent that he makes sound use of his senses, is the most exact physical apparatus that can exist" (Goethe, as quoted in Seamon 1998, p.2). His unique appreciation for science and sensibility to the perceptual nature of our being evolved into an original phenomenological approach to the natural world that moved away from purely quantitative investigation.

Figure 17
Goethe's 'Metamorphosis of Plants'

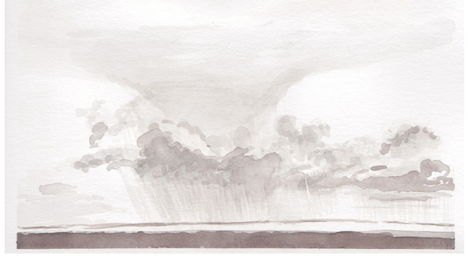


Figure 18
Stratus clouds (top)

Figure 19
Cirro-cumulus clouds (middle)

Figure 20
Cumulus and nimbus rainfall (bottom)

Adapted from Luke Howard's Sketches of Clouds, 1803-1811

Here, phenomenology is integrated as an initial stage of scientific investigation and demands a thorough reading and description of the phenomenon. The purpose of such an accurate description is to enable a means through which one locates the phenomenon's "deeper, more general patterns, structures, and meanings" (Seamon 1998, p.2). Moments of flexibility can be found in such an accurate description. For instance, we see this in chemist Luke Howard's (1772-1864) influential essay 'On the Modification of Clouds' (1832), which was greatly appreciated by Goethe and inspired his thinking on concepts of form and morphology in nature.

> "Recognising that clouds are formed when water vapour cools and condenses in the atmosphere, Howard ordered clouds into three types according to their visual resemblance to either wisps of hair (Cirrus), a bulbous heap (Cumulus) or sheets layered together (Stratus). Combining the basic cloud types, he further identified the Cirro-cumulus…" (Hill 2012, p.150).

The poetry therein may not explicitly convey the processes of cloud formation, but it is nonetheless an informative and descriptive articulation of a commonly experienced phenomenon. Although the original metaphors are somewhat lost or are less renowned, the formal and universal acceptance of these terms remain without the need for much clarification. Howard's work offers a qualitative yet precise interpretation of the structure and classification of clouds. However, he indicates that in order to comprehend any dynamic phenomenon, one must consider that the causes of their formation might be hidden or invisible. He writes: "…the formation and movements [of clouds] are commonly as good visible indications of the operation of these causes as is the countenance of the state of a person's mind or body" (Howard 1832, as cited in Zajonc 1984, p.36).

Altitude / Étage

12000 m

HIGH

7000 m

MEDIUM

2000 m

LOW

1. Cirrus (Ci)
2. Cirro-cumulus (Cc)
3. Cirro-stratus (Cs)
4. Stratocumulus (Sc)
5. Cumulus (Cu)
6. Nimbus (Ni)
7. Stratus (St)

GENUS-TYPES

(Derived from physical form)

Stratiform: Sheets

Cirriform: Wisps and patches

Stratocumuliform: Patches, rolls, and ripples

Cumuliform: Heaps and tufts

Cumulonimbiform: Towers with complex structures

GENUS	SPECIES	VARIETIES
Cumulus	*none*	*radiatus*
Cumulonimbus	*Calvus capillatus*	*calvus capillatus*
Stratus	*Nebulosus fractus*	*calvus capillatus*
Stratocumulus	*Stratiformis lenticularis castellanus*	*translucidus, perlucidus, opacus, duplicatus, undulatus, radiatus, lacunosus*
Altocumulus	*Stratiformus lenticularis castellanus floccus*	*translucidus, perlucidus, opacus, duplicatus, undulatus, radiatus, lacunosus*
Altostratus	*(none)*	*translucidus, perlucidus, opacus, duplicatus, radiatus*
Nimbostratus	*(none)*	*(none)*
Cirrus	*Fibratus uncinus spissatus castellanus*	*intortus, radiatus, vertebratus, duplicatus*
Cirrocumulus	*Stratiformis lenticularis castellanus floccus*	*undulatus, lacunosus*
Cirrostratus	*Fibratus nebulosus*	*duplicatus, undulatus*

Figure 21 (left)
Cloud Formation in the Troposphere as seen from the Earth's surface.

Figure 22 (right)
Tropospheric cloud classification and Latin nomenclature.

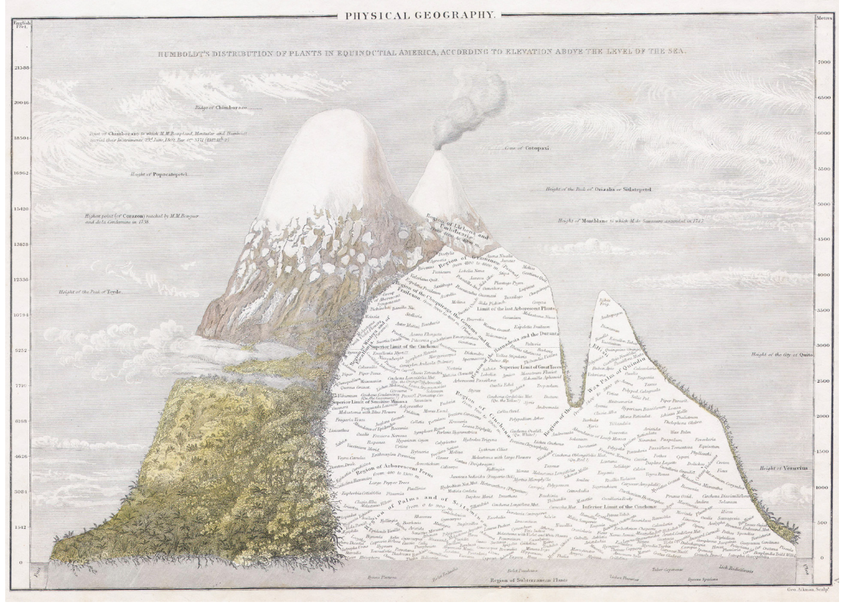


Figure 23
Chart describing distribution of plants in equinoctial America according to elevation above the level of the sea.
Drawn and engraved by George Aikman, 1839, based on Humboldt's isothermal maps.

Building upon this same cognitive duality was Prussian geographer, explorer and naturalist Alexander Von Humboldt (1769-1859), who achieved profound insights in science, notably in meteorology during the romantic period. Humbolt is perhaps most widely known for his quantitative attempts within his respective fields, yet, like Goethe, he entrusted and relied on an ability to be awake to quality while observing a phenomenon in its natural context. Qualities being: variation in form, colour, pattern, and behavior. Michael Dettelbach points out in his essay 'Measurement, Mapping, and Sensibility in the Work of Alexander von Humboldt' that one of Humboldt's favourite conceits was that "the precise instruments which the traveler carried functioned as extensions of the senses, new organs, and this conceit contained both a physiology and philosophy of measurement…"(Dettelbach 1999, p.478).

We can reflect on Humboldt's conviction that the relationship between the aesthetics and its effects on the imagination were very important to understanding phenomena, and that this understanding could be enhanced through the act of measuring, drawing, reading, and philosophical questioning (ibid, p.475). In one sense, the objects and phenomena therefore are made "true by virtue of meanings and independently of fact" (Quine 1951, p. 21), as is indicated by American philosopher Willard Van Orman Quine (1908-2000). Due to the over simplification of identity and its focus on objectivity, empiricism was soon challenged by romantic philosophies, which followed suit in its approach to scientific investigation and expression.

What had eventually solidified Humbolt's scientific work was the development of one of the first meteorological maps: the isothermal map (1817) – which is a map of physical lines tracing heat, magnetism and diversity in plants and animals that convene in places of the same temperature. Previously, weather data were often described in tabular form but by the end of the century the map was accepted as the principal means to describe and analyze the weather (Nebeker, as cited in Hill 2012, p.191). The beauty that can be found in his mapping emerges from this reality: "Humbolt was of course well aware that he is the one drawing these lines across the page, but the key point is that it is drawing going on, and not human, symbolic script, but the script of nature tracing its own shape" (Dettlebach 1999, p.487).

His representation of unity within diverse systems was accomplished neither through the convention of abstraction or idealization, but through the meticulous unpacking and organization of collected data concerning various aspects of the physical world. We ought to acknowledge that there are potentially two capacities of understanding the natural world since phenomena are both physical and qualitative and for that reason are "accessible to the introspection of the sufficiently sensitive individual (on the one hand) and to sufficiently precise measurement (on the other)" (ibid, p.503).

Design, like the weather

Since the direct experience and exploration of nature greatly interested romantic scientists, it is not surprising that their attention was often directed to the dynamic qualities of atmosphere – to spectrum of colour, polarity of light and dark, and to weather as a means to become fully attuned to the qualities of a place (Hill 2012, p.154). As this research has evolved, I have become increasingly aware of the many fascinating pedagogical commonalities between design and science based-disciplines. Namely and appropriate to the context of this work, the study of atmospheric science.

Atmospheric science can be broadly defined as the field of study that considers all physical and chemical phenomena occurring within the Earth's atmosphere (or the atmosphere of any other planet). Atmospheric science attempts to understand the complex dynamics of atmospheric phenomena through observation, analysis of observations, modeling, and theoretical studies (University of British Colombia, Department of Atmospheric Science). The study of meteorology finds itself under the umbrella of atmospheric science and is interested chiefly in climate and weather phenomena, but it is important to clarify that weather and climate vary in respect to duration and scale. "Unlike the weather, which we can see and feel at a specific time and place, we cannot directly perceive climate because it is an idea aggregated over many years and across a region" (Hill 2012, p.2).

"In Classical Greek, climate meant inclination, an association that does not exist in modern languages. The word defined the inclination of the Earth's axis on the plane of the horizon; the angle thus formed corresponded with the latitude of each area. In short, 'climate' was virtually synonymous with 'latitude'.

Lucien Boia 2005, as quoted in Hill 2012, p.133

Both design and the study of the atmosphere and weather patterns involve a level of indeterminacy or unpredictability that relies on the interaction of sensual experience and precise measurement. Examinations of the atmosphere by way of the observer, theorist and forecaster were fundamental to the meteorological profession as it was established in the early nineteenth century. But even if these examinations were initially approached from an empirical standpoint, it became quite apparent that perfectly accurate predictions were nearly impossible to achieve (Hill 2012, p.215). Enlightenment science seemed to divert its focus from the weather simply because it proved extremely difficult to even begin to engage a precise system of measurement.

Similarly, a designer can attest that such a precise system does not exist in the definition or suggestion of spatial form and experience. An architectural work really only begins to take its true shape and presence after the designer has let it go to exist and interact with the world that encompasses it. One of the accomplishments of Jonathon Hill's publication 'Weather Architecture' (2012) - which I have referenced quite frequently for its detailed account of the development of ideas on weather and architecture throughout the Enlightenment, Romantic and Modern periods – is its eloquent expression of how design and meteorological intelligence are not so dissimilar. Hill writes convincingly about the fascinating influence that weather has on a designer's ability to observe and understand context, or in other words, weather's contribution to genius loci. He speaks to a particular architectural vernacular, one in which the processes of architectural making and an attention to weather encourages a physical coexistence with the immediate and wider environments and a responsiveness to time, decay and change (Hill 2012, p.6).

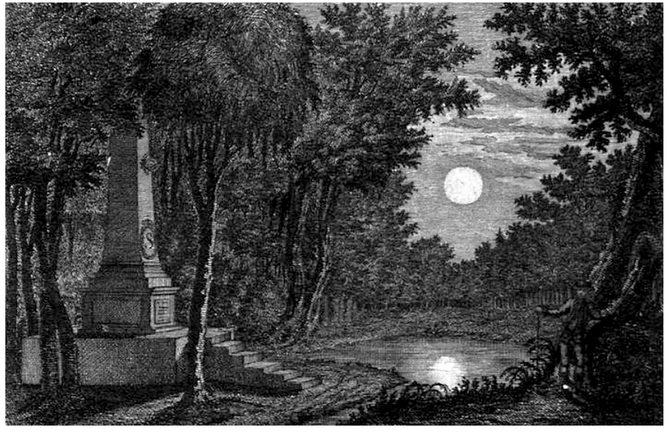


Figure 24
"Gegend von Brandt mit Sulzers Denkmal" - Monument, memorial for Sulzer by Brandt, from C.C.L. Hirschfeld's Theorie der Gartenkunst (Theory of Garden Art), 1779-1785.

He also concedes that one of the first convincing examples of a design practice that focused attention on weather occurred not uniquely with building design but with landscape design, foremost in gardens, which are dynamic and more clearly subject to variation (ibid, p.306). “There is a fundamental difference between an isolated interior in which the designer aims for complete control and a complex and inter-related environment in which the designer accepts other influences” (ibid, p.311). The physical movement invoked by the changing weather in the space of a garden became synonymous with evolving spatial perception and contributed to the facility of architectural creativity and imagination.

For aesthetic theorist and philosopher C.C.L Hirschfeld (1742-1792), ”movement in all of its manifestations is fundamental to the creation of a garden’s meaning; its composition of scenic elements, its three-dimensionality…” (Parshall, 2003, p.36), which is made clear in his extensive five-volume publication ‘Theory of Garden Art’ (published between 1779 and 1785). Hirschfeld was interested in how qualities of the natural world might affect an individual physically and psychologically, but since he was exposed to the ideals of the Enlightenment, he attempted to systematize the aesthetic and psychological processes involved (Parshall 2003, p.38). Associationism, as a theory of mental processes, according to David Hume (1711-1776), maintained that ‘certain experiences evoke specific corresponding emotions, which in turn elicit effects that are at once sensuous and of ethical and didactic significance" (Parshall 2003, p.38).

Figure 25
Stratus clouds
Lake of the Woods, Ontario

Though instinctively an empirical theory, this was truly a question of aesthetic experience, which is drawn from some of romanticism's key concepts: "the desire to protect and isolate nature, the role of subjective thoughts and emotions, and the imagination's ability to elevate the mind, influence society and engage the spiritual" (Hill 2012, p.125). Hirschfeld deepened associationist theory in this regard with ideas on the importance of movement in gardens, which meant empowering self-awareness in the subject "[who is engaged] in the creative process involving stimulus, memory, and imagination" (p.38). And, since reason was not extensively relied upon as the only way to read the causes of movement in the environment, the successes of empiricist standards in this respect were relative.

> "What, then, do we mean with the word "place? Obviously we mean something more than abstract location. We mean a totality made up of concrete things having material substance, shape, texture and colour. Together these things determine an "environmental character", which is the essence of place. In general a place is given as such a character or "atmosphere" (Norberg-Schultz 1996, pp.6-7).

The romantic sensibility that permeated scientific investigation during the eighteenth and nineteenth centuries managed to resonate in the twentieth century in subtle ways, but much less significantly due to a theoretical and practical turn toward functionalist modes of evaluating and shaping the environment. This would signify the emergence of modernism in its many forms. However, in the moments leading up to the modern era, contrasting ideas concerning the representation of national identity, climate, and atmospheric quality materialized as a type of 'northern romanticism', notably in Germany and Scandinavian nations.

Figure 26
"Tupplur i det gröna"
(Nap in the Green),
by Carl Larsson, 1897

CONTEXT

A National Romanticism of the North

The period called National Romanticism (1885-1920) was expressed within the realms of the fine and applied arts, architecture, music, literature, and philosophy (Lane 2000 p.2). From an architectural perspective, the aspiration for National Romantic architects was to develop a monumental, nationally conscious architecture (Lane 2000, p.4). This would be achieved through a profound "concern for domestic architecture…for an ideal home that was at once historic, regional, national, and modern" (Lane 2000, p.3). An attention to nature and folklore; poetic, ethical, and purposeful architectonic assembly and materiality - shaped a distinctive design sensibility in relation to the standardized, consumer-oriented production that underlined much of the modern movement's intention to construct democratic and healthy living environments in the post-war years.

Yet, I would like to note before I go on that architectural theorist Alberto Pérez Gómez has expressed a critical point regarding the efficacy of outlining a history of stylistic movements so conclusively. Since 'style', in essence implies both an objective and a psychological expression, it cannot be absolute. In the introduction to his first publication 'Architecture and the Crisis of Modern Science' (1983) he writes: "form was the embodiment of a style of life, immediately expressive of culture and perhaps more analogous to a system of gestures than to articulated language" (1983, p.12). But he cautions, and I am of the same mind and methodology in writing this in that,

> "Nothing can be gained from a historical perspective basing itself on simplistic formal or stylistic comparisons…
> The illusion that history could refer scientifically either to buildings or ideas as independent data is itself part of the contemporary crisis…" (1983, p.13).

The use of the term "style" is not seen as definitive, rather, it simply defines the frame with which I can examine a particular evolution of place-making and ultimately respond to the reasoned and affective modes of shaping the environment.

Figure 27
"Gården och brygghuset. Ur Ett Hem (26 akvareller)" (The Yard and Washhouse. From a Home (26 watercolours), by Carl Larsson, date unknown

The character and function of the inhabited landscape within the Nordic region at the beginning of the twenty-first century is quite interesting, since the expression of landscape as designed space is not so easily traceable. One reason for this may derive from the profound cultural acceptance and respect from Nordic inhabitants for the spatial and phenomenological scope of the landscape. Here, architecture is simultaneously enclosed, intimate and responsive to the harsh climate, yet engaged with the greater context. The Scandinavian understanding of nature recalls a union of life and place - of light, weather, geography, and enclosure. In this way, landscape and architecture are inseparable and function beautifully to clarify one another. In the North, "…nature implies nearness and empathy; here one lives with and among things as a participant in a web of phenomena. Mood is the basis for participation…" (Norberg-Schulz 1996, p.47).

In this excerpt from the book 'Nightlands' (1996), Norwegian architect Christian Norberg-Schultz explains that the concept of unity is manifested always as mood (p.18) and goes on to say: "In the North, life does not ensue in the piazza but in the home, and this entails that intimacy and warmth are more important than representative grandeur" (p.22). The direct shaping of the landscape was first found in the forest clearing, within which the settlement could then be established. Treatment of the domestic landscape was functional and based on an organic process of growth. The spaces that were created as a result, between the building forms, became spaces for gathering. The formation and cultivation of the garden within the settlement unfolded from the dwelling structure, forming a soft passage toward the more natural surroundings (Norberg-Schulz 1996, p.29).

Architectural and landscape architectural historian Marc Treib has noted that Icelandic, Finnish, and Norwegian landscapes, for the most part and until relatively recently,

> "…have tended to promote the look of the primeval landscape. The rare incursions into noticeably designed terrains such as parks, promenades, and cemeteries were normally foreign imports and relatively few in number…poised between the modernity that accompanied industrialization and a romantic attachment with the forest, sea, and shore" (Treib, 2012 p. 127)

It can be held then that landscape architecture existed mostly within the realm of garden design and its practice was more akin to gardening and horticulture. Attention to the landscape as space to be modified was not apparent until after the First World War. The design values that developed as a reaction to the interwar period called for the construction of a completely new society – a new style and mode of building led by social ambitions, and scientifically driven design methods (Fogelström 1968, in Thorbjörn Andersson 2002). The rise of new housing projects revealed the spatial opportunity for parks and public open space as a contribution to meaningful, equitable and healthy urban living spaces such as with the Götaplatsen in Göteburg (Sigfrid Ericson, Ernst Torulf, Arvid Bjerke 1917-23), the City Theater by Carl Bergsten (1935), and the Torvalmenningen in Bergen (Finn Berger 1022-29). This development ended with the first postwar open city plans, such as the high-rise housing at the Hötorget in Stockholm (Sven Markelius and David Hellén) after 1946 (Norberg-Schulz 1996, p.171-2).

A controlled and geometrically refined design system and style had come to characterize the aesthetic of early twentieth century functionalist landscape architecture and urban planning, and it was soon clear that this way of designing was incapable of invoking the relationship with place that was synonymous with the ability to truly dwell. To dwell, as Norberg-Schulz proclaims, entails "something more than a roof over one's head and elemental joys…"(1996, p.170). And, in being so in tune with a Nordic desire for sincere nearness to the landscape, he goes on to say, "that contact with nature does not consist in spreading buildings throughout the landscape but in a manner that makes visible the understood landscape"(p.170), consequently…"Nordic architecture's identity and history has shown that its aim has always been the creation of an architecture that brings the inhabited landscape close to human society, through the use of forms that represent and complement the given environment" (p.172).

The dialogue between National Romanticism and Functionalism was truly effective in shaping the spatial and stylistic language found throughout Norway, Sweden, Finland, and Denmark today. Barbra Miller Lane speaks to the importance of carefully observing the connections between National Romanticism and Modernism: "The leaders of Functionalism were in fact the loyal students of National Romantic architects" such as Eliel Saarinen, Armas Lindgren and Herman Gesellius, to name a select few. "While postwar modernists discarded the explicitly national and historical references of their mentors, they learned a great deal from the aesthetic, social, and political ideals of the earlier generation" (p.20). Thus, a new type of urban spatial condition had come to re-interpret functionalist design with the same sense for nature, dwelling and social practice, recalling a national romantic sensibility.

Figure 28 (left)
Villa Markelius
Nockeby, Stockholm, 1945
Author unknown

Figure 29 (right)
Finnish Pavilion at the
Paris World Fair, 1900
Author unknown

Architects such as Alvar Aalto, Sverre Fehn and Sigurd Lewerentz led the way in their interpretation of function and connection to place in the way that they expressed a deep consideration for the landscape in their architectural work. Consideration, here, sees architecture as shelter, but it also sees appropriate siting within the landscape as shelter. The most precise definition of Nordic functionalism is presented in the book *accepterá!* (Accept!), written in parallel with the Stockholm Exhibition in 1930 – its forward explains: "Characteristic of the Nordic interpretation of functionalism was its sober scale, its sense for nature and humanism" (Nordisk functionalism, G. Lundahl (ed), Stockholm, 1980, as cited in Norberg-Schulz 1996, p. 170). This indicates that modern sensibility too, could possibly call attention to intimate regional qualities and social well being. The architecture that replied translated as a sharpened vernacular, responding foremost to an authoritative climate and ultimately, to human comfort. Nordic Functionalism, in its original sense, then, was able to bend a little bit, and perhaps find most of its current success in its expression of creativity in face of an extremely evocative landscape and climate.

Figure 30 (left)
Götaplatsen square,
Göteborg (Gothenburg),
Västergötland, Sweden.
Photograph by Fredrik Bruno, 1944.

Figure 31 (right)
Book cover for 'Acceptera!', 1931.
Author unknown.

Figure 32
Nordic Pavilion, Venice Biennale
Designed by architect Sverre
Fehn.
Photograph by Paulo Monti

Closing

Although this chapter has been largely grounded in theory, my hope is to highlight a balance between two seemingly contrasting modes of experiencing and understanding the world. I have tried to do this through an account of historical shifts in thought and representation through the eighteenth, nineteenth, and twentieth centuries, which have conflated 'romantic' ideals with scientific and functionalist principles. On the other hand, some of what I have shared is a typical and widely accepted account of the progression of scientific thinking in the western world. Therefore, it is profoundly inaccurate to leave the discussion at this, since it is critical for the care and thoughtfulness of this document, as well as for the benefit of a legitimate expression of Canadian landscape architecture to consider approaches to scientific knowledge held by Indigenous peoples in Canada.

Perhaps one of the greatest examples of an integrative science that I am trying to illustrate, beyond what the Romantic scientists accomplished, is the Traditional Ecological Knowledge (TEK) base and worldview of Indigenous people. This topic is described in great depth in Raymond Pierotti's book 'Indigenous Knowledge, Ecology, and Evolutionary Biology' (2010). Within, he immediately points out that the age of the Enlightenment conveniently aligned with the settlement of Europeans in North America, South America and Australia in the 15th century. The manner in which Indigenous people saw themselves with respect to nature, was quite different from the European (Western) tradition, which supported the idea that nature was either secondary or objectified by humans (Pierotti 2010, p.1). He also adds that to compare European scientific perspectives during the Romantic movement with Indigenous Ecological Knowledge (even though they align in many respects) is still a stretch. To quote Pierotti: "There has been a tendency in some circles to equate Indigenous philosophical traditions with the Romantic Movement because of the idea that the human spirit reflects nature's orders. This assumption is naïve at a couple of levels" (Pierotti 2010, p. 15). First, he argues: "Indigenous people do not assume a simple order in nature. Second, and more importantly, the Romantics did not really regard themselves as part of nature" (p.15) even though they share a similar critical approach to scientific knowledge, which calls for the prolonged, sensitive study of natural phenomena. A fundamental condition of Indigenous Ecological Knowledge involves the reasoned understanding of the relationships among living entities, landforms and atmospheric events within a specific locality (Barsh 2000, in Pierotti 2010, p.9). It is very difficult to gain detailed knowledge of a vast region compared to a localized, well-travelled and well-observed region (Brody 1982, in Pierotti 2010, p.9). This is in contrast to the attitude of European Romantic scientists who, in the end, sought "solutions that could be generalized across all localities" (Pierotti 2010, p.9). Additionally, the integration of narrative or metaphor that is communicated solely through oral means is intended to support a more accurate and practical understanding of the world and is far from a form of romanticization of basic scientific concepts.

> "Indigenous stories function as metaphors that allow a philosophical framework to develop. It is not that stories are considered to be literally true, any more than models of exponential and logistic population growth are expected to literally represent the actual behavior of animal populations. Like mathematical models of population phenomena, traditional stories provide a context into which empirical observations can be placed and compared against the assumed state (Pierotti 2010, p.13)

An environmental awareness that is both qualitatively and quantitatively curious is central to engaging a sense of wonder and imagination that aids in sensing character, atmosphere, identity, and ultimately the reality of a place. Climate and weather call for a particular awareness of subjective, perceptual experience directly tied to time and place, but the weather also invokes the need to create modes of construction and spatial organization that are practical and effective. Building architecture is a clear objective expression of shelter that responds to the changing seasons and weather, while shifts in atmospheric activity accentuate the sensual experience of the enclosure. If we turn to consider the expression and experience of landscape architecture in this regard, we see a more absorbing, entangled relationship with the atmosphere. And, it is my interest in what follows to see how a deeper understanding of atmospheric actions might draw out a compelling form of landscape architecture, principally in consideration of the boreal forest atmosphere in Canada.

PART 2

ATMOSPHERICS

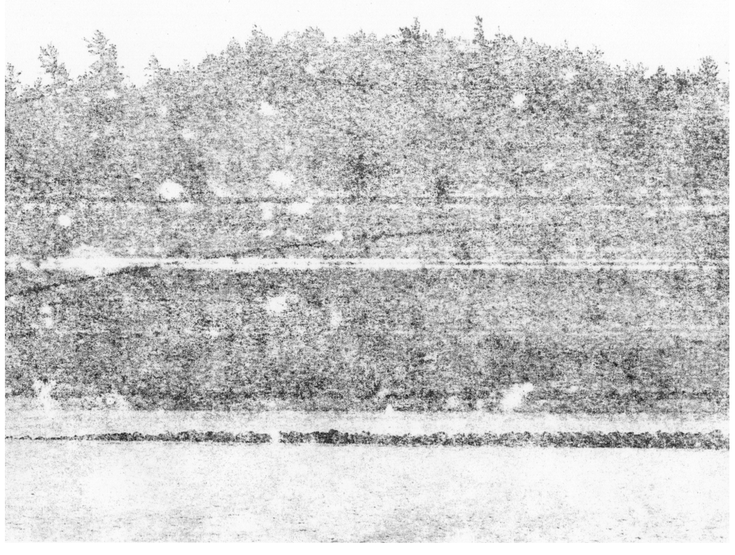


Figure 33
Jetty on the horizon
Diamond Lake
Temagami, Ontario

Introduction

Much has been written about the importance of architectural quality. I rather like this word, "quality" because it acknowledges the substance of considered environmental design. When we speak of quality in the context of an architectural or landscape architectural work, we allude to a type of meaningful and careful articulation of space. We can all acknowledge spatial meaning that is drawn from our memory of particular places, however, does meaning one attaches to place, which emerges from an immediate envelopment in space always stem from such memories? I am referring to the immediate sensation of being physically and emotionally affected by an experience in the designed or natural world. It is my belief that this is also a type of 'atmospheric quality'. Peter Zumthor said: "we perceive atmosphere through our emotional sensibility – a form of perception that works incredibly quickly" (Zumthor 2006, p.12). Anthropologist Tim Ingold, too points out that "…atmosphere has increasingly become a point of reference for the immediate human interaction with particular places" (Ingold 2011, p.2). I would like to emphasize this immediacy in the experience of everyday atmospheres, which can be described as the auras and ambiances, which unfold for us as a kind of wash of sensation. Juhani Pallasmaa quotes American philosopher John Dewey (1859-1952) in his essay 'On Atmosphere, Peripheral Perception and Existential Experiences' (2010), who comments on the immediate and subconscious spirit of atmospheric experience, emphasizing: "The total overwhelming impression comes first, perhaps in a seizure by a sudden glory of the landscape, or by the effect upon us of entrance into a cathedral when dim light, incense, stained glass and majestic proportions fuse in one indistinguishable whole" (Dewey as quoted in Pallasmaa 2012 pp. 238-9). Alternatively, the subtle and intimate experience of everyday atmospheres might seize in a much more familiar way, with less of an 'overwhelming impression', but rather with a kind of comfort that one eases into. The definition of atmospherics as a concept that I quite like for its directness is expressed in the words of Bille et al., who wrote that atmospherics "focuses on the existential in-betweenness of subject and object (Bohme 1998, p. 235), as well as the temporality of atmospheric encounters" (Bille M., et al. 2004, p. 3). Temporality, in many ways links the terms atmosphere and atmospherics, so that the one always informs the other.

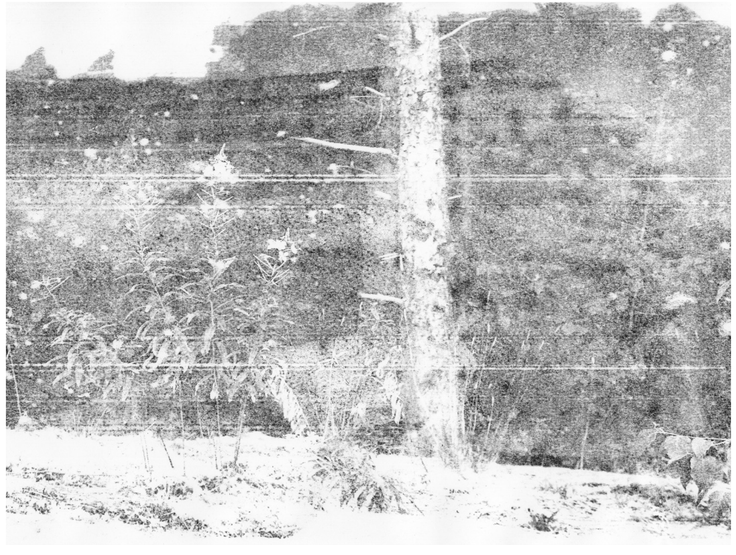


Figure 34
Fireweed and stone
Diamond Lake,
Temagami, Ontario

Atmospherics & Atmosphere

Atmospherics is a term that I initially heard used in a landscape architectural context by landscape architect Silvia Benedito. For her, atmosphere is the space one inhabits and breathes – it is sensual as well as necessary for our existence. This work will follow her lead by extending the conversation to express the dynamism of the term and, as she states, "…the importance of atmosphere as an operational and experiential agent in landscape architecture and urbanism towards fundamental topics such as comfort, delight and wellbeing" (Benedito 2014, p.3). *Atmospherics* differs from atmosphere in its qualitative, affective capacity. *Atmosphere* signifies air in its various elements, as substance, medium and energy; however, the two terms are not mutually exclusive. Atmospheric phenomena (temperature, humidity, wind, precipitation, light etc…) inform one's ability to sense atmospheric quality in space - it foregrounds the perceptual and haptic experience of the landscape, while atmospherics brings to life the sensational essence of atmosphere. Affect, as it relates to the landscape and atmosphere is discussed in Tim Edesor's article 'Aurora Landscapes: Affective atmospheres of light and dark', wherein he suggests that this sensation is "generated by immersion in an atmospheric environment that folds subject and space together … Such notions summon up the effects of the weather and the qualities of light (and dark) as they pervade space and the bodies that perceive them" (Edesor 2010, p.236). Light and weather are the source of transformation of both the physical materials of the landscape as well as the quality and comfort of experience. Yet atmosphere is not simply something that we walk into, since it is not automatically inherent in architecturally defined spaces. Rather, atmosphere is often created and altered through bodily presence, movement, and energy in space. Living beings bring their own impressions and emotional states into the environments they inhabit, outside the capacity of light and weather, but occasionally, those same spaces can be instilled with a new atmosphere if their programmatic use suddenly

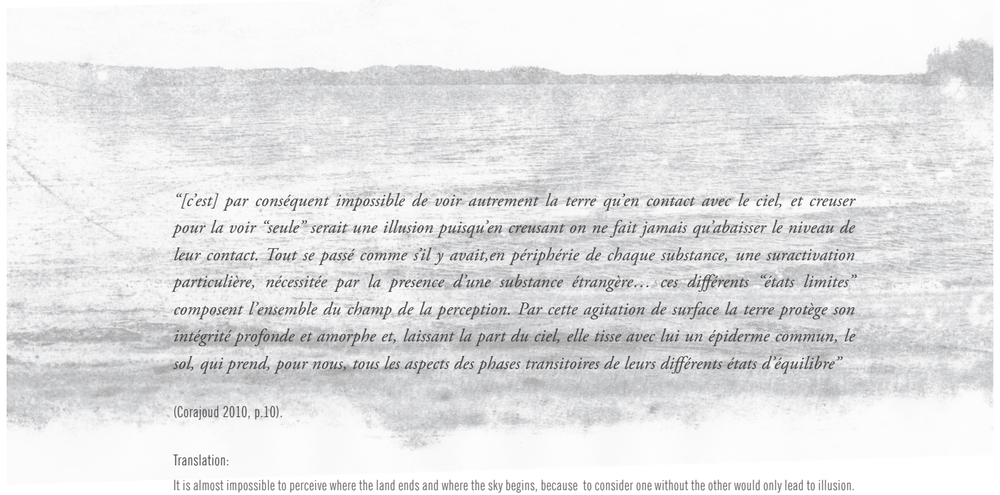
Figure 35
Lily in the marsh
Red Squirrel logging road.
Temagami, Ontario

changes: a busy street unfolds into a market; a school on the last day of classes; the dissipation of chatter at a performance just as the curtain lifts; these are the beautiful ephemeral energies imbued by the activated presence of living beings. To add to this, Böhme has expressed that atmospheres are truly the “spatial bearers of moods” (Böhme 1993 P. 118-19), writing: “A mood contributes to sensing where we are. By feeling our own presence we feel the space in which we are present” (Böhme 2000, p.402). So, to feel our own presence in space, it becomes evident that movement is essential in getting to know where one dwells and reveals architectural character and atmosphere. The definition of movement however should be expanded to include emotional movement as well as activation, which signify one's state of active presence, reciprocity and unity with their surroundings. Böhme’s definition of the vague nature of atmospheres is refreshingly clear. “…[A]tmospheres…are something thinglike, belonging to the thing in that things articulate their presence through qualities”… Atmospheres are also “subjectlike, [and] belong to subjects in that they are sensed in bodily presence by human beings and this sensing is at the same time a bodily state of being of subjects in space” (Böhme 1993, p.122). Alberto Pèrez Gomez is supportive of this too, stating, “… moods are not 'merely' subjective but, rather, are primary in perceptual experience, intertwined with place, setting the tone for cognition, action, and thought” (Pèrez-Gomez 2016, p. 27). Developing his understanding from prominent phenomenological philosophers Maurice Merleau-Ponty and Martin Heiddeger who determined that “our existence is always “mooded”. Heidegger writes: “Attunements … in advance determine our being with one another. It seems as though an attunement is in each case already there, so to speak, like an atmosphere in which we first immerse ourselves … and which then attunes us through and through” (Heidegger as Quoted in Pèrez-Gomez 2016, p. 28). Our presence in, and participation with space is what initiates and carries forward atmospheric unfolding, but we can also acknowledge that environmental and architectural atmospheres possess their own tenor, which attune beings to it, even if no one is there to experience it.

Atmospherics & Landscape Architecture

The experience of atmospherics in landscape architecture, to me, occurs when designed space and the natural environment co-mingle in an aesthetically pleasing and ethically responsible way, and celebrates the effort and intelligence of sensitive human intervention. The sudden impression of beauty through the engagement of all of our senses is an aesthetic experience that is sharpened as the relationship between environmental qualities/phenomena and human states are brought closer together (Böhme 1993, p.114). Achieving this is a profound aspect of the work of a landscape architect, however the matter of how to "approach, represent and understand such atmospheres" (Ingold 2011, p.3) in landscape architecture is a challenge.

Drawing inspiration from conceptions of surfaces, substances and mediums can be helpful in distilling or, perhaps accepting the perceptual nature of atmosphere, particularly for the landscape architect, but indeed for all who are engaged in spatial intervention. According to anthropologist Tim Ingold, the idea of *surfaces* refers to the contour and discernible shape of the land. *Substances* make up the physical properties of the earth (the many constituent parts and particles that compose comprehensible wholes, like soil and clouds), and *mediums*, which express transformation in the land - the perpetual movement of it, which is foremost influenced by the weather (Ingold 2011, p. 117-18). Ingold explains: "it is precisely through the binding of medium and substances that wind and weather leave their mark. Thus the land itself no longer appears as an interface separating the two, but as a vaguely defined zone of admixture and intermingling" (Ingold 2011, p.119). This, too, is a nice reminder of the words of Michel Corajoud, who wrote evocatively about the entangled rapport between land and sky in 'Le paysage c'est l'endroit où le ciel et la terre se touchent' (2010, first published 1981).



(Corajoud 2010, p.10).

Translation:
It is almost impossible to perceive where the land ends and where the sky begins, because to consider one without the other would only lead to illusion. Even if we searched and searched, we could never reach the true depth of their union. It is as if there was, on the edges of these entities (the land and the sky), a particular underlying activation necessitated by the presence of another, stranger entity… These different layers compose the entirety of one's field of perception. By way of this interaction of surfaces, the land is interwoven with the sky, creating a common layer – the soil which, imparts all of the transitory phases of their different states of equilibrium.

Figure 36
On sand, looking south over
Obabika Lake
Temagami, Ontario

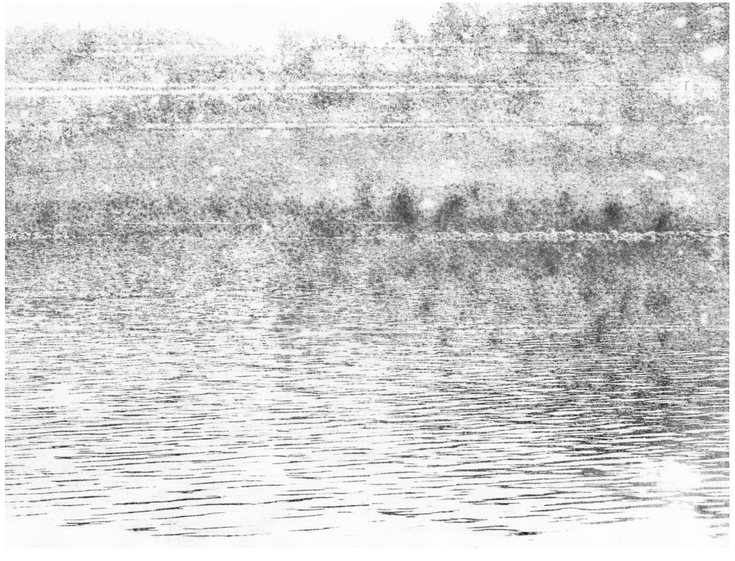


Figure 37
Pebble horizon
Diamond Lake,
Temagami, Canada

The process of reading atmospheric quality invites a deepened dimension to sensing atmosphere, which involves the subconscious impression of atmosphere and landscape, the sudden capacity to discern how we feel about a place without having detailed knowledge of its history, climate or culture. One begins to exist within and accept the surrounding environment beyond the visual and beyond long-term exposure to a locality. Pallasmaa adds to this, writing:

> "…although we do not consciously analyze or understand the interaction of meteorological facts, we grasp the essence of weather at a glance, and it inevitably conditions our mood and intentionality. As we enter a new city, we grasp its overall character similarly, without having consciously analyzed a single one of its myriad properties. This process, advancing from an initial but temporary grasp of the whole towards the details…" (Pallasmaa 2012, p.240).

We can recall that this aligns with Goethe's approach to understanding the nature of phenomena, in the way that he would begin by attempting to see the whole in order to grasp the natures of the phenomenon's compositional parts. But, even more important was the process of beginning with a conception of the 'whole' as a way to reveal the particularities recalls an indigenous ecological perspective. "…Indigenous perspectives are most effective in observing and describing wholes, because they operate at the level of human perception and concentrate on functional relationships and co-evolutionary processes rather than structure" (Barsh 200; Alessa 2009, in Pierotti 2010, p. 73). It is only within the past few decades that designers have begun to see the value of Indigenous spatial thinking and the precise, rational and subjective knowledge pertaining to the natural and non-human world.

“The “data” collected using this approach are basically an understanding of relationships between specific biological and physical entities (rocks, bodies of water) landforms (mountains, isolated hills, unusual rock formations), and meteorological phenomenon (Barsh 2000). This knowledge encompasses practical, empirical, and ideological aspects of understanding and is both the information itself and a way of knowing” (Mailhot 1994; Howitt 2001; Henriksen 2009, in Pierotti 2010, pp. 8-9).

The capacity to transition from sensing wholeness towards an appreciation of accuracy and detail is, at once, perceptually, aesthetically, and practically engaged, and very much central to the conceptualization and analysis of atmospherics. Borch sees this in connection with a sensorial attunement to designed space, indicating: “Adopting an atmospheric perspective implies paying attention to how architecture (landscape architecture, interior architecture) and urban planning are able to provide nourishment to the multisensory experiences. It means acknowledging that buildings should not be conceived of as singular entities, but rather as parts of a larger atmospheric whole”(Borch 2014, pp.15-16). These conceptualizations, which actually help to poetically organize the expanses, behaviors and temporalities of the world - such as the horizon and atmosphere – are instrumental in building a non-objective, open perspective toward the environment in which we live and that we shape.

There are several built works of landscape architecture that are expressive in their ability to exhibit an atmospheric totality indicative of the place in which they are situated. Shifts in environmental quality associated with the seasons and one’s latitudinal situation convey a sense of atmosphere that is analogous to Christian Norberg-Schulz’s definition of genius loci, in that it involves an exposure to environmental quality that is perceptible over a long period of time. These projects, I believe, are successful because they exemplify genius loci, but they are also capable of summarizing as well as enhancing a locality within the spatial limits of a project scale. I previously mentioned the public space designed by Michel Corajoud, “Le Miroir d’Eau” in Bordeaux, France. This region of France has a climate that is more oceanic than Mediterranean due to the influence of the Bay of Biscay. This brings long, warm summers accompanied by substantial rainfall in the winter months (World Weather and Climate Information, 2016). The project’s attunement to the seasons and playful use of water and mist envelop the body on a warm summer day and transforms the surface to perpetual glass during the winter. The space takes on a much wider scope of the landscape on a single dynamic plane – it is a reflective stage on which to sense the sky, the adjacent river, the carefully flanked gardens, the classic facades of the government buildings and of course the weather.

South America too is home to many works of landscape architecture, which masterfully unveil the nuances of place, likely as a response to its latitudinal variation. Here, I would like to recall the work of Chilean Landscape Architect Teresa Moller, who is especially receptive to environmental qualities, functionality and phenomenological imperatives. In the preface to her most recent publication entitled 'Teresa Moller: Unveiling the landscape', Dan Pearson offers this summary of her process and intention: "The subtlety of the work and the fact that is sits so well and in context allows you to look harder. It is a deep intuition and an ability to distill only what is necessary that allows this connection – and you, in turn, a way into the landscape to occupy it fully (Pearson in 2014, p.9). One's gaze, beauty, time, traces, symbols, and origin are aspects, which harmonize her work and expand her process of understanding the landscape. The project that is of particular interest in relation to the discussion of atmospherics is 'Punta Pite' (point which projects out into the sea), which is located between two significant coastal areas in central Chile - Zapallar and Papudo. The experience of the site takes place over a 20 km stretch of coastline. There is no prescribed point of access or necessary sequence of movement. Instead, the landscape is provided with subtle interventions that ease the body through many thoughtful moments along the edge of the ocean. One can be drawn down to a hidden sandy beach along the stone shore; suddenly arrive in the serene space of a public park just inland; or taken along a path of stone stairs so perfectly situated within the landscape. What has truly forged the atmospheric quality of this place is the use of in-situ material and the execution of construction details, which beautifully compliment the existing landscape.

Figure 38 (left)
Hewned stone stair, Punta Pite
Papudo, Chile

Figure 39 (right)
Stone gutter,
Park at Punta Pite
Papudo, Chile

Figure 40
Stone path,
Park at Punta pite
Papudo, Chile

This is a common feature of the above-mentioned work. Each is remarkably simple yet very well detailed – and it is often simplicity and tectonic clarity that brings about a strong aesthetic experience. Alberto Pèrez-Gomez, in his most recent publication 'Attunement: Architectural meaning after the crisis of modern science' (2016), points out the atmospheric and affective qualities of built works by such figures as Antoni Gaudì and Le Corbusier, Ludwig Mies van der Rohe and Frederick Kiesler, John Hejduk and Sigurd Lewrentz, Steven Holl and Peter Zumthor. "… [W]hile physically and tectonically very different, [the works are] conducive to the creation of appropriately tuned moods for human situations, revealing affective purpose in and through the human actions they frame" (Pèrez- Gomez 2016, p.22). Comparatively, landscape spaces defined by Michel Corajoud, Georges Descombes, Teresa Moller and Roberto Burle Marx; Carl Theodor Sørenson, Kathryn Gustafson, Peter Latz, and Reed Hildebrand, to name a few - possess this same sensibility. The geometry and functionality of their work is structurally legible but not object-oriented, and forceful enough that the essential qualities of the place are at times more intimately read. But above all, beyond construction, these subtly marked landscapes draw our attention to beauty, feelings and emotion (Georges Descombes in An Architect in the Landscape, 2009).

Figure 41
Deciduous Foliage in a pine forest, Diamond Lake, Temagami, Ontario

The circumpolar boreal forest

As the contextual focus of this work lies within the spatial and atmospheric condition of the boreal forest, what follows will focus on the phenomenological experience of dwelling within forest environments. We are all somewhat familiar with the presence of a forest and the experience of entering a forest. Perhaps it conjures memories from our childhood, or exists as a vision of darkness and enchantment deriving from literary forests, such as in William Shakespeare's 'A Mid Summer Nights Dream' (1590-1597), Kenneth Grahame's 'The Wind in the Willows, and 'The Jungle Book' (1894) by English author Rudyard Kipling. For those who dwell in the northern-most countries, the boreal forest is probably the most dominant image of a forest, even though multiple unique forest ecosystems exist within the varied northern world. The shear scale of the boreal forest supports this feeling. Indeed, "the circumpolar boreal biome or zone is one of the world's largest and most important biogeoclimatic areas" (Brandt 2009, p.101). However, the discussion of dwelling in the boreal forest is most meaningful when it acknowledges the spiritual and existential connection held by North American Indigenous forest-dwelling communities/tribes. To them, the boreal forest is neither an object of culture nor an ecological entity to be broken down in scientific terms. The forest's value is built upon a long-term co-existence with it, and is thus fundamental to their wellbeing and survival. Every nuance of the forest is approached with varying adaptations developed through intimate, localized knowledge. In this way, the practical relationship to the forest is well integrated with philosophical, spiritual, ethical, and aesthetic concerns, which are exhibited through cultural traditions such as ceremonies related to the natural world and their connection to it, and through the invaluable experience and words communicated by elders (Pierotti 2011, p.16). It is important to emphasize that the 'spiritual' aspects of their knowledge of the forest "emerge from attempts to comprehend the nature of a variable and somewhat unpredictable environment and efforts to establish covenants with the natural world that were designed to reduce the negative impact of human actions.

These are a form of science, sort of the equivalent of ‘resource management’ but among ‘relatives,’ rather than between ‘exploiters’ and ‘resources’ ” (Pierotti 2011, p.19). Striving to understand the boreal forest in this manner is quite difficult, but it is important to attempt to do so in order to reach a more dynamic understanding of phenomenology that includes accurate, and more attuned readings of the natural word.

The circumpolar boreal forest binds the northern world between 50° and 70° latitude, defining a particular atmosphere and climate. The character of the boreal forest’s climate is felt over a great distance, but it should not be considered to comprise a single atmospheric totality. Rather, it is composed of many atmospheric conditions based on this slight latitudinal variation that determines different types of forest compositions. Therefore, it is important to see the boreal forest as a series of transition zones and not exclusively one, homogenous zone that exists over a great distance. These transitional spaces– the ecotones – define the boreal region and are especially unique and most often very sensitive to ecological disturbance. The particular forest that I am interested in exists in the transition zone between the northern boreal forest and the Great Lakes - St. Lawrence forest in Ontario, Canada. This is a magnificent forest, composed of virtually all white and red pine forest stands. This zone is characterized by underlying precambrian, metavolcanic and mafic geological formations, and provides a solid ground surface upon which a shallow, yet soft and mossy soil condition is formed and is most loved by pines. Tim Ingold effectively expresses the unique experience of the forest floor at one’s feet:

> "Indeed anyone who has walked through the boreal forest in summer knows that the ‘ground’ is not really a coherent surface at all but a more or less impenetrable mass of tangled undergrowth, leaf litter and detritus, mosses and lichens, stones and boulders, split by cracks and crevasses, threaded by tree roots, and interspersed with swamps and marshes overgrown with rafts of vegetation that are liable to give way underfoot” (Ingold, 2011, p.119).

The experience of walking through this forest calls particular attention to the ground plane, as it is quite varied and precarious. However, the under-story is not quite as dense and fairly easy to push through. Where pines are dominant, the acidity of the fallen pine needles make it difficult for the establishment of most herbaceous plant species (perennials, annuals), and instead are favored by most vascular plants (small shrubs and mosses). The layered canopy composed of slender needles filters a soft diffuse light very different from deciduous trees, and every so often, the air becomes speckled with dust and other floating particles in random beams of sunlight. During the winter, the stillness of the air in the forest renders falling snowflakes practically frozen in mid-air

The boreal forest binds the landscape and the sky together, offering a different kind of experience and understanding of forest atmosphere. This is expressed in the way the boreal forest manages its own internal temperature. When temperatures rise in the summer months, the space of the boreal forest cools and in the winter the internal space warms. The particularities of this biological adaptation are of interest in this work and will be discussed in more detail in the following chapter. But, it is also important to note that at the core, this phenomenon is acutely read through our senses: It is in the slight haze visible above the dark evergreen canopy; in the strong fragrance of resinous chemicals emitted by pine trees; in the cool, moist air of the forest interior.

PART 3

ATMOSPHERE

Figure 42
White pine (pinus strobus) needles
Diamond Lake, Temagami

Figure 43
White pine bark and resin
Diamond Lake, Temagami

"The dazzling completeness and simultaneously effortless simplicity and mind-boggling complexity of nature helps to mediate between the worlds of art and science"

(Pallasmaa 2012, p.18)

Introduction

Recently, strong evidence-based research in the field of forest medicine has emerged, particularly in Japan and European forested regions (Finland and Germany), which are dedicated to the measurable therapeutic aspect of walking through the forest. To walk through the forest with one's well being in mind has been given the name *Shinrin-yoku*. "The term Shinrin-yoku (taking in the forest atmosphere or forest bathing) was coined by the Japanese Ministry of Agriculture, Forestry, and Fisheries in 1982. It can be defined as making contact with and taking in the atmosphere of the forest: a process intended to improve an individual's state of mental and physical relaxation" (Park B J et al. 2010, p. 18). By way of field tests measuring fluxes in physiological parameters in humans, such as salivary cortisol, pulse rate, blood pressure, and heart rate variability (p.19), it was found that participants who were immersed in the forest 'atmosphere' for only a short 10-minute period showed improved physiological states: lower concentrations of cortisol, lower pulse rate, lower blood pressure, enhanced HF (High-Frequency power) components of (HRV) heart rate variability, which reflects parasympathetic nervous system activity), and lower LF/HF (Low Frequency/High-Frequency) ratio, which reflects sympathetic nervous system activity (p.22). This, of course, supports the importance of forested settings and access to them for the health benefits they offer living beings." Atmospheres change as the body moves through space and is exposed to changing sensory stimuli, and so too does the biological composition of our bodies change as we are exposed to different environments (Bille M et al. 2014, p. 8). However, this raises the question of why forests perform this function at all. Certainly it is not random, for the natural world is most often very efficient and purposeful, even when faced with disturbance.

Figure 44 (left)
Red pine (Pinus resinosa)
leaf cross section

Figure 45 (right)
Ponderosa pine (Pinus ponderosa)
leaf cross section

SMEAR II
Hyytiälä forest, Finland

Figure 46
Map of Finland

The exemplary scent of a coniferous forest is created through the release of organic chemical compounds called Terpenes, which are stored within the needles and resin glands of coniferous trees. Terpenes are present in the fragrant essential oils that we detect through our olfactory sense. However, not all trees emit the same composition of this chemical compound. Deciduous trees emit a gas called isoprene as oppose to coniferous trees which, as stated, emit terpene. Professor Jonathon Abbatt from the University of Toronto (atmospheric chemistry) indicated that "[i]soprene will form aerosols, but it just doesn't form them as efficiently as terpenes" (Abbatt, as cited in Nasa Earth Data, 2011). Coniferous trees constantly emit these gases, but higher temperatures spur more emissions.

Keeping the northern world in mind, I would like to draw attention to a forest in Finland where this process of chemical release of terpenes is being closely examined and measured. The SMEAR II (Station for Measuring Forest Ecosystem – Atmosphere Relations) within the Hyytiälä forest in Juupajoki, southern-Finland is a natural laboratory for the study of forest dynamics and its effects on climate. The station is interested in the boreal forest's unique ability to seed the clouds just above their canopy. The clouds that are formed as a result are low-lying and often appearing as a barely perceptible haze, but are in fact stratus clouds, which form in the lowest layer of the atmosphere – the Troposphere. As a result, the seeded stratus clouds produce an albedo effect, reflecting a fraction of the sun's radiation back into space through scattering and absorption of sunlight. This process contributes to the unique way in which the boreal forest ecosystem regulates its own internal temperature (Bonan, Pollard & Thomson, 1992).

Figure 47 (left)
View above the canopy.
Summer Haze. Hyytiälä, Finland

Figure 48 (right)
View above the canopy.
Low winter clouds. Hyytiälä, Finland

Lake
Kuivajärvi

100 m

SMEAR II
Forest Field Station. HyytiäLä, Finland
Approximately 20,000 hectares (area)

100 m

Figure 49 (left)
Aerial image of Hyytiälä and location of primary infrastructure at SMEAR II.

Figure 50 (right)
Figure ground map of cultural, educational and lodging facilities.

Figure 51
Understory vegetation.
Young stand of Picea abies and Populus tremula.

Figure 52
Ground floor vegetation

SMEAR II
Site Conditions

The landscape surrounding the station is not truly exemplary, but only representative of the boreal forest. The Scots pine (*Pinus sylvestris* L.) dominated stand was planted in 1962 (after the Second World War) and contains one percent of species other than *Pinus sylvestris*. These include downy birch (*Betula pubescens*), grey alder (*Alnus incana*) and aspen (*Populus tremula*). The ground vegetation is scattered with heather (*Calluna vulgaris*) lingonberry (*Vaccinuiu, vitisidaea*), and blueberry (*V. myrtillus*), while the most common moss species is *Dicranum undulatum.* The height of the dominant trees in the stand is 13 m with a tree density of 2500 per hectare. The parent material of the soil is course, silty, glacial till and the soil is a haplic podzol. The terrain is subject to slight height variation, and the largest city nearest to the station is Tampere (60 km south-southwest of the measurement site). The annual mean temperature in the area is 3°C and the annual mean precipitation is 700 mm (Kulmala et al. 2000, p.283- 4).

Aerosol Measurement
Instrumentation

One of the most compelling aspects of the forest is the placement of measurement instruments throughout, used to monitor and measure the boreal forest aerosol-cloud albedo feedback system at a number of interfaces extending from the subsurface layers of the soil to the atmosphere. The instruments vary in scale and capacity, and are carefully, almost imperceptibly, situated throughout the forest field station to measure weather, energy, gas and chemical fluxes with a very high degree of sensitivity.

ARG100 TIPPING BUCKET RAIN GAUGE

This instrument measures rain intensity.

Figure 53

SOIL CHAMBER

This device is placed on top of the soil to measure trace gas fluxes of CO_2, H_2O, CH_4, NO, NOx, O_3, N_2O, Volalite Organic Compounds (VOCs), and CO, from and to the soil and forest floor vegetation.

Figure 54

TRACE GAS SAMPLING TUBES

The sampling tubes are buried at different depths within the soil as a way to measure trace gas concentrations.

Many trace gases act as precursors for atmospheric aerosol production.

Figure 55

HITU- COTTAGE

This is one of several cottage facilities that house measurement computation.

The word 'hitu' is of Finnish origin and is freely translated as 'particle'. For international guests, it is often called "aerosol cottage".

Figure 56

Figure 57

SHOOT CHAMBERS

The pine shoot cuvettes measure ambient temperature up to 15 m above ground level (during the summer), sapflow at various levels (summer), as well as the exchange of NO, O_3, CO_2, H_2O by pine shoots.

Figure 58

TREE TOWERS

The tree towers provide access to instruments installed at various levels within the canopy, and measure tree physiology (respiration) and aerosol movement.

Figure 59

EDDY COVARIANCE & IRRADIANCE TOWER

This instrument measures turbulence, aerosol particle flux, and the concentration fluctuations of CO_2, O_3, H_2O, 22 m above ground level.

Figure 60

MAST

The mast measures temperature, wind speed, wind direction, reflected radiation, net radiation, and concentrations of O_3, SO_2, NO, H_2O, and CO_2. As well as concentration fluctuations of CO_2, H_2O, and aerosol particles, dew point temperature, and turbulence.

Measurements are taken from several heights reaching from 6 m to 128 m above the ground surface.

* Instrument descriptions and images are provided by Juho Aalto, Post-doc researcher at the Hyytiälä Forestry Field Station /SMEAR II, University of Helsinki, Department of Physics.

Figure 61 (top)
Indications of elevated wooden pathways through the forest.

Figure 62 (bottom)
Main lodging and educational facilities.

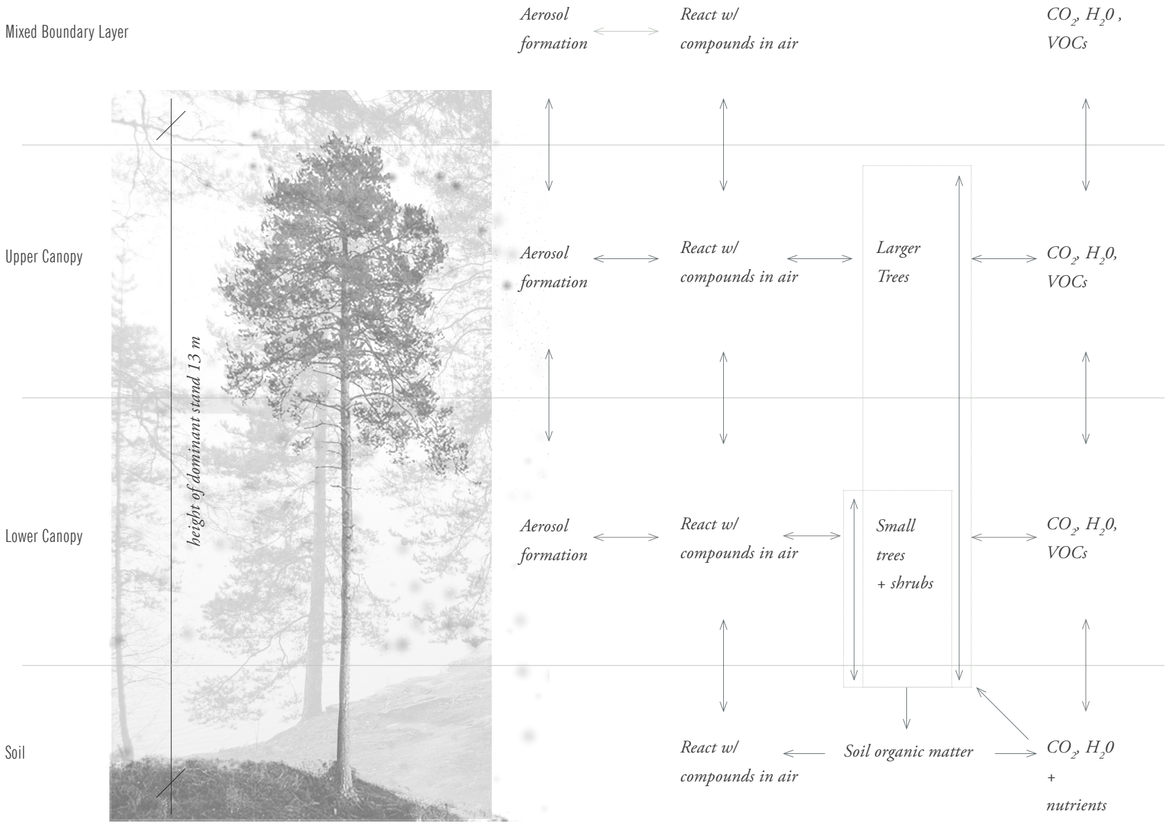
Site Measurement & Organization

The measurement activity is concentrated within an approximate 100 m radius of the forest, where the majority of the robust infrastructure is situated, which include measuring towers and cottages. Movement on foot throughout the measurement site is guided by an interconnected system of narrow wooden pathways, gently raised above the forest floor extending less than one km in total length. Technicians, researchers and guests (in some circumstances) are able to reach the instrumentation installed above the tree canopy by ascending towers, assembled in various compositions using metal scaffolding construction system. Although a large part of the instrumentation is organized in close proximity to the cottages and towers, some instruments are installed beyond this area. Importantly, there are three satellite stations designed for observing gas exchanges and other phenomena within a nearby fen area and lake, which are several hundreds of meters or kilometers away from the original research stand. The extent and location of the infrastructure within the measurement site may seem very straight-forward, however, as implied by Juro Aalto, a post-doc researcher at the site, the area of ***observation*** is much more complicated and highly dependent on many temporal and spatial variables.

> "...many measurement subjects such as long-lived trace gases and pollutants carry signals from far away, up to the distance of several hundreds of kilometers. But then there are also many measurements that represent clearly very local or even spot-like phenomena without any chance to extrapolate the result over larger areas. In this sense the area we are observing is in general undefinable, and dependent to large extent on what method is used and what the research subject is".
>
> (Juho Aalto, email correspondence)

Figure 63
Marsh and Fen landscapes near SMEAR II station.

Figure 64
Measurements taken from on the nearby lake.



Pinus sylvestrus

Volatile Organic Compounds (VOCs) released by the forest.

isoprene (deciduous)

alpha-pinene (coniferous)

Figure 65
Diagram of measurement interfaces at the SMEAR II field station. Arrows indicate the movement of energy and matter fluxes.

One of the main functions of the field station is to monitor the formation and nucleation of primary biogenic aerosols above the forest canopy. Terpenes included, primary biogenic aerosols consist of "small particles of plant debris (cuticular waxes, leaf fragments, etc.) humic matter, and microbial particles (bacteria, fungi, viruses, algae, pollen, spores, etc…)" (Intergovernmental Panel on Climate Change). Contrastingly, and outside the focus of the Hyytiälä Research Station, are secondary aerosols, which are "air pollutants emitted from natural and man-made sources, produced through a complex interaction of sunlight, volatile organic compounds from trees, plants, cars or industrial emissions, and other airborne chemicals" (US Environmental Protection Agency, 2016). Overall, aerosols play an essential role in the earth's radiation budget by way of their influence on the formation of clouds and the modification of cloud micro-physics, through a process called Cloud Condensation Nuclei (CCN) (Baker, M.B., Peter, T. 2008, 229). Particle formation is a regional-scale phenomenon that is triggered under regional-scale meteorological conditions (Dal Maso et al. 2007, p. 356). In addition, aerosol particles influence the climate by two distinct mechanisms: the direct reflection and absorption of solar radiation by aerosol particles, and the indirect increase in cloud reflectivity caused by the enhanced number of cloud condensation nuclei, leading to increased cloud albedo (Kulmala et al. 2000, p.282). Interestingly, O'Dowd et al.(2002) have supported that aerosol particles created over forest environments may have large-scale effects on the global climate, but have not been totally figured into climate warming prediction calculations.

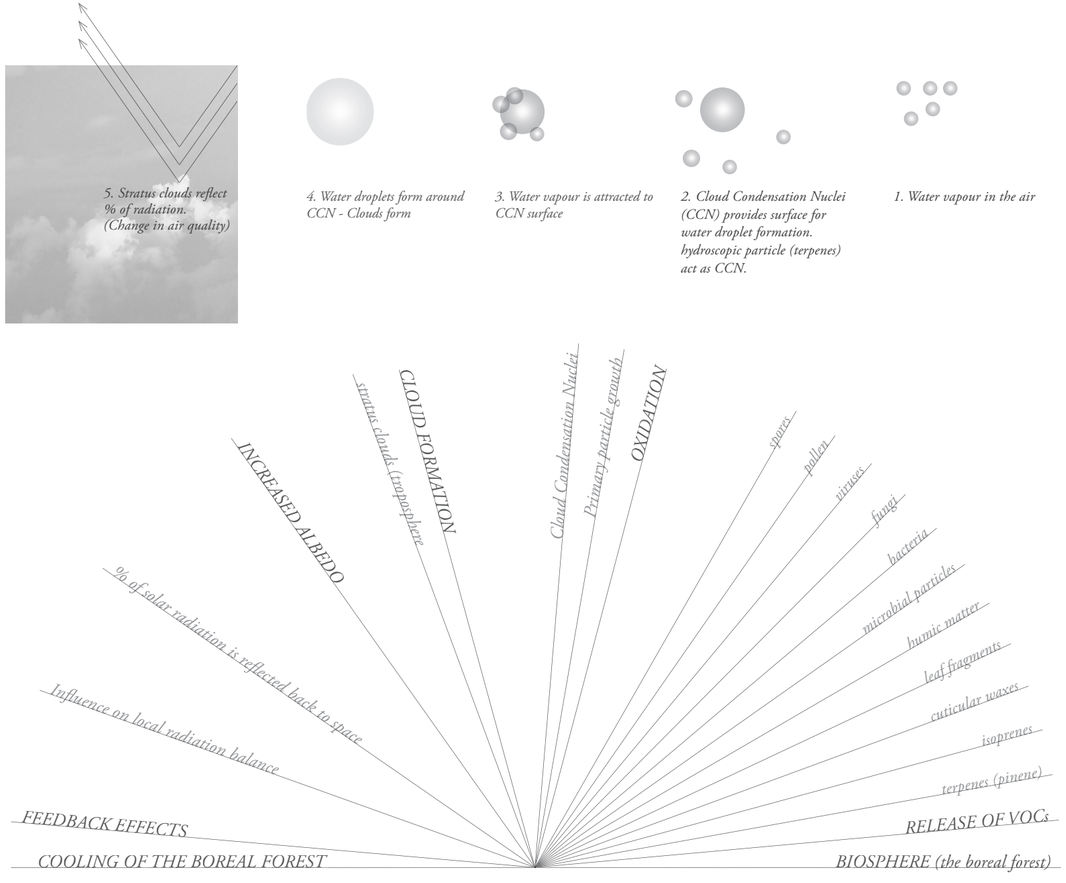


Figure 66
Diagram describing climatic feedback effects (including particle nucleation) between the boreal forest and the atmosphere.

> "Aerosol particles produced over forested areas may affect climate by acting as nuclei for cloud condensation, but their composition (and hence the chemical species that drive their production) remains an open question" …"…newly formed particles (3–5 nanometers in diameter) are composed primarily of organic species, such as cis-pinonic acid and pinic acid, produced by oxidation of terpenes in organic vapours released from the canopy" (O'Dowd et al. 2002, p.497).

Field measurements analyzed by Spracklen et al. from the SMEAR II field station in Hyytiälä have drawn compelling conclusions, which see the increased release of biogenic aerosols from the boreal forest as a kind of adaptation to increasing global temperatures. They note:

> "… boreal forests double regional cloud droplet number concentrations resulting in a significant change to cloud albedo… This effect may be sufficiently large to result in boreal forests having an overall cooling impact on climate. We propose that boreal forest's combination of climate forcings may result in an important global homeostasis. In cold periods, boreal forests emit little organic vapour and so warm the climate (through a dominant snow-vegetation albedo effect), whereas in today's warm climate they may emit sufficiently large amounts of organic vapour to act as climate coolers"
> (Spracklen et al. 2008, abstract).

Conditions for accurate data collection are highly variable, so a successful measurement day requires that new particles in nucleation mode are >25 nanometers and remain in this state for at least one hour. In addition, the size of the new particles needs to increase over time, which means that particle nucleation is successfully occurring at the scale of the forest region. This also verifies that local pollution sources, possibly caused by anthropogenic activity or salt particles from coastal locations are not affecting the air quality of the analysis area (Dal Maso et al. 2007, p.352). "If the period were interrupted by advection from sea, the day would be classified as undefined, as no continuous nucleation mode could be seen. This problem is not encountered at stations that are uniformly surrounded by forest" (Dal Maso et al. 2007, p.353).

Figure 67
'Tealemetree' (2014)
Agnes Meyer Brandis
Forest Field Station,
Hyytiälä, Finland

Interpretations of the forest

"…in Finland; the personal and cultural memory of the forest was as a palimpsest"

(Menin 2001, p.282)

Beyond the careful gathering of data through instrumented techniques and consideration of multiple environmental parameters, the research at the SMEAR II station has evolved to become truly holistic. The method of research is fundamentally concerned with the boreal forest ecosystem - climate relationship, but it is also concerned with greater global issues such as climate change and interdisciplinary engagement and knowledge transfer within this study area (Juurola et al. 2014). Other concepts and methods of obtaining and expressing knowledge about the forest-atmosphere phenomenon have began to emerge through trans-disciplinary programming. "…[I]n addition to top quality research and advanced education, remarkable scientific design and innovations take place. It is essential that these unique achievements reach audiences outside the scientific community. However, it is not a simple task to demonstrate the value and significance of the work at the stations" (Juurola et al. 2014, p.407). The 'Climate Whirl Project' is one example of such an initiative, which utilizes different media, art and science exhibitions and other public events as a way to further communication about climate change and ecosystem processes (Ibid., p.407). Two projects (among many), initiated within the scope of the Climate Whirl Project are the 'Carbon Tree website' (http://www.carbontree.fi/), and the 'Hyytiälä Art Residency' at the SMEAR II station. The Carbon Tree website was launched in 2009 and expresses "both artistic animation and traditional graphs to visualize the real time uptake and release (Lagergren et al. 2008, Kolari et al. 2009) of carbon in a Scots pine forest at SMEAR II" (Ibid.,p.407).

One example of a fascinating body of work which has emerged from the Hyytiälä Art Residency is "Tealeametree" (2013). The project is guided by German artist Agnès Meyer Brandis in collaboration with the Department of Forest Sciences and Department of Physics (University of Helsinki), the curatorial research group 'Capsula', Simosal Oy, and the Institute for Art and Subjective Science. The artwork and performance engages a captivating tea ceremony deep within shade of the SMEAR II forest, and desires to make legible the invisible aspects of climate and forest atmosphere through inventive instrumentation devices, called "Teacup Tools" (Capsula [art science nature], 2014).

Reflecting upon these unexpected interpretations of the boreal forest - atmosphere relationship, it is not difficult to imagine the creative possibilities for a landscape architectural approach, which could further draw attention and awareness to climate phenomena and forest -atmosphere relationships.

"The notion of staging an atmosphere is at first sight a paradox, since it can appear somewhat impossible to even try to stage a phenomenon as fleeting, ambiguous and vague as atmosphere (Böhme, 2013). Still, architects and designers intentionally shape the experience of, and emotional response to, a place through the material environment, seeking with various degrees of success to affect people's moods and guide their behavior for aesthetic, artistic, utilitarian or commercial reasons"

(Bille M et al. 2014, p.3)

PART 4

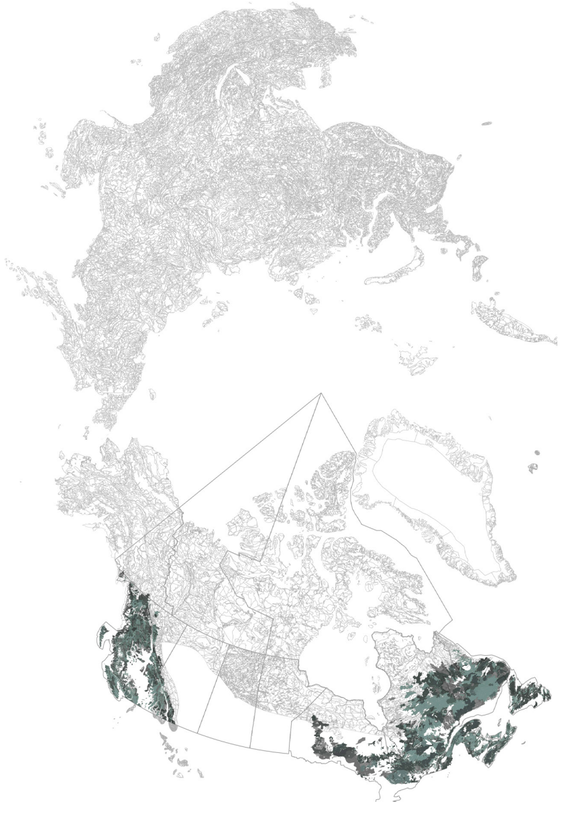
STAGING ATMOSPHERE

Figure 68
Map of circumpolar boreal region
and circumpolar arctic region (bottom).

Into the forest

The captivating research taking place within the Hyytiälä forest has been the catalyst for establishing a measuring station at a site in Canada, but one that might be expressed and newly interpreted through a landscape architectural lens. The criterion for the site selection was to locate a similar boreal forest condition, but one that could offer unique observation and measurement opportunities that will expand current studies.

The Temagami region of northeast Ontario thus became the area of focus. Temagami encompasses a distinctive forest ecosystem within which to consider the environmental cues, alterations and configurations of the atmosphere and its relationship to landscape. It is nestled within the transition zone between the boreal forest and the southern Laurentian hardwood forest and is the homeland of the original peoples of Teme-Augama (Deep Water by the Shore) Anishnabai (Ojibwa and Algonquins) of the Temagami First Nation. Further, it is home to some of the oldest stands of white pine *(Pinus strobus)* and red pine (*Pinus resinosa*) forest in North America. Temagami is similar in its homogeneity to the Hyytiälä forest, but despite the omnipresence of pine species, the condition of such an old growth forest exhibits enormous ecological diversity and complexity compared to the latter. The area is also ideal as a site for measurement and observation of forest-atmosphere interactions as it is not negatively influenced by air masses containing a significant amount of anthropogenic pollutants, nor is it influenced by salty air masses from coastal areas. The particular setting within which the design work will take place lies northwest of Lake Temagami, on the water and along the shoreline of beautiful Diamond Lake. What follows is a brief overview of the natural and cultural context expressed within the Temagami region.



DISTRIBUTION OF PODZOL SOILS
(an indication of coniferous forest)

10,000 km

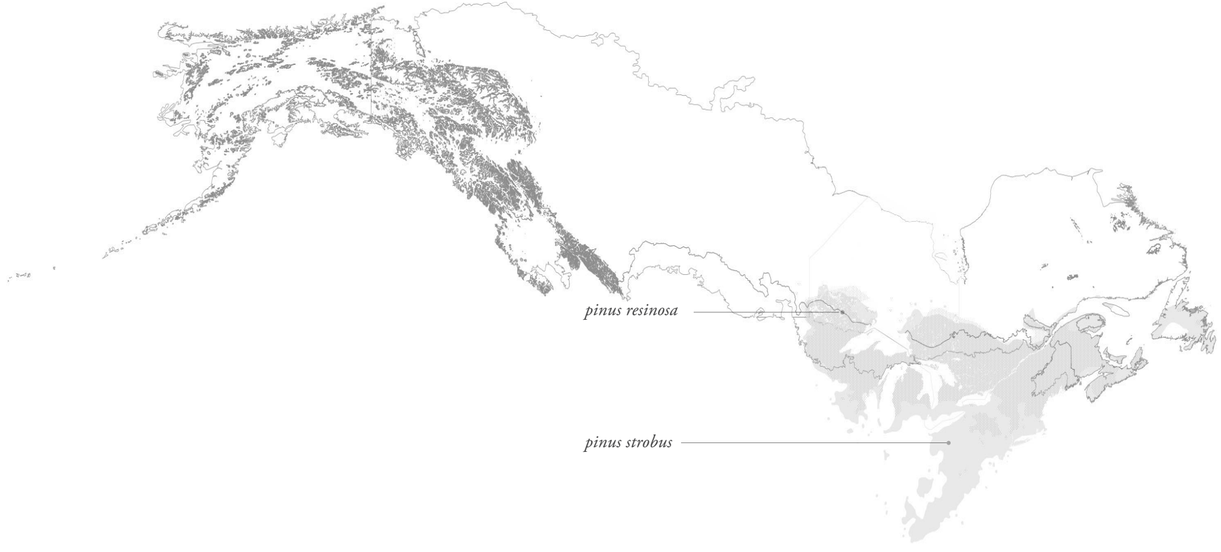


Figure 69 (left)
Figure 70 (right)

DISTRIBUTION OF *Pinus resinosa* AND *Pinus strobus*
WITHIN THE NORTH AMERICAN BOREAL FOREST

10 000 km

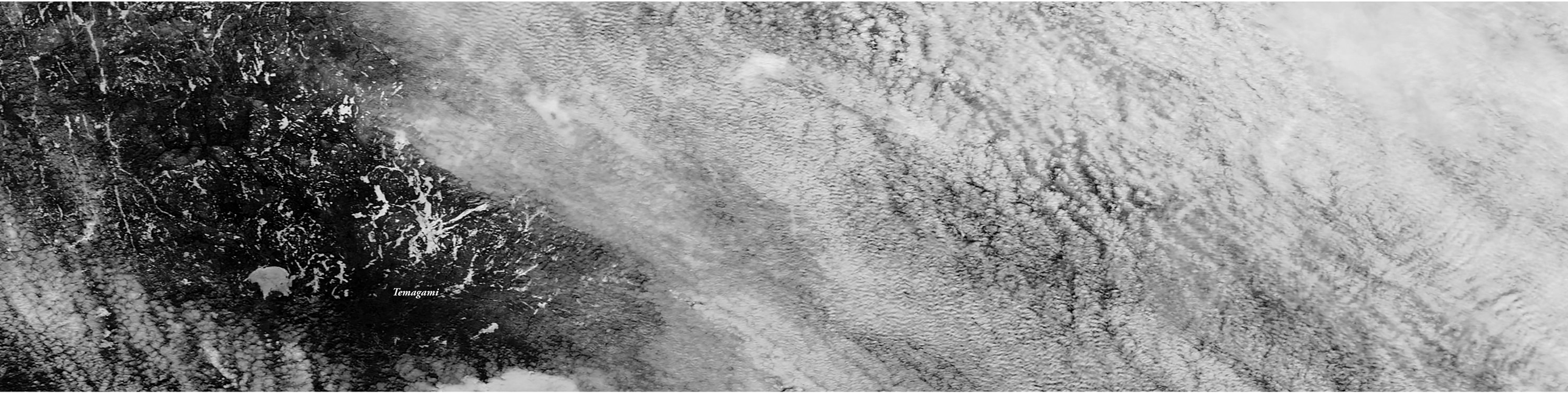


Figure 71
Nasa Worldview satellite image, over
northeast Ontario April 24th, 2015

TEMAGAMI, ONTARIO

Natural Setting: Waters

The Temagami region covers approximately 12,000 km^2 and is characteristically defined by its far-reaching interconnected system of lakes, bays and streams. The region's watershed moves in two directions: north and south. "From Diamond Lake to the north, one enters the Montreal River drainage into Lake Timiskaming and the Ottawa River system…From Cross Lake to the south and the Temagami River, there is access to Sturgeon River, Lake Nipissing, the French River, and Lake Huron" (Gordon 2013, p. 54). The mainland shoreline measures a length of 592 km, and the lake's 1,200 islands contribute another 320 km (OMNR, 1973). Long-established routes along the shores and waters define a beautiful history of movement, hunting and settlement within Temagami and the surrounding region, which has been given the name *n'Daki Menan – Our Land*, by the Teme-Augama Anishnabae. *Nastawgan* is the Ojibwe term for the ways or the routes for travel by canoe and on foot through the landscape. *Onigum*, (canoe portage trails) were established as alternative crossing points on land where shallow, fast moving water, or heights-of-land occurred along waterways. Where Onigum traversed shallow waters or marsh areas, logs were often laid on the ground in the direction of travel to offer much safer, balanced footing. This type of path was called *metigo-mikana*.

As European settlement increased in the 1830s, an almost immediate interest in forest resources within the area instigated the construction of dams for logging, which effectively raised water levels in certain areas of the Temagami drainage system. Previously the rapids at Sharp Rock Inlet offered a northern outlet, but after being dammed, water moved quickly into the Diamond Lake – Lady Evelyn – Montreal River - Lake Timiskaming – Ottawa River drainage system, significantly raising the depth of the lakes. Presently, the active outlet is to the south through Outlet Bay and Cross Lake into the Sturgeon River – Lake Nipissing – Great Lakes drainage basin (Gordon 2013, p. 54).

Figure 72
Temagami region watershed

10 km

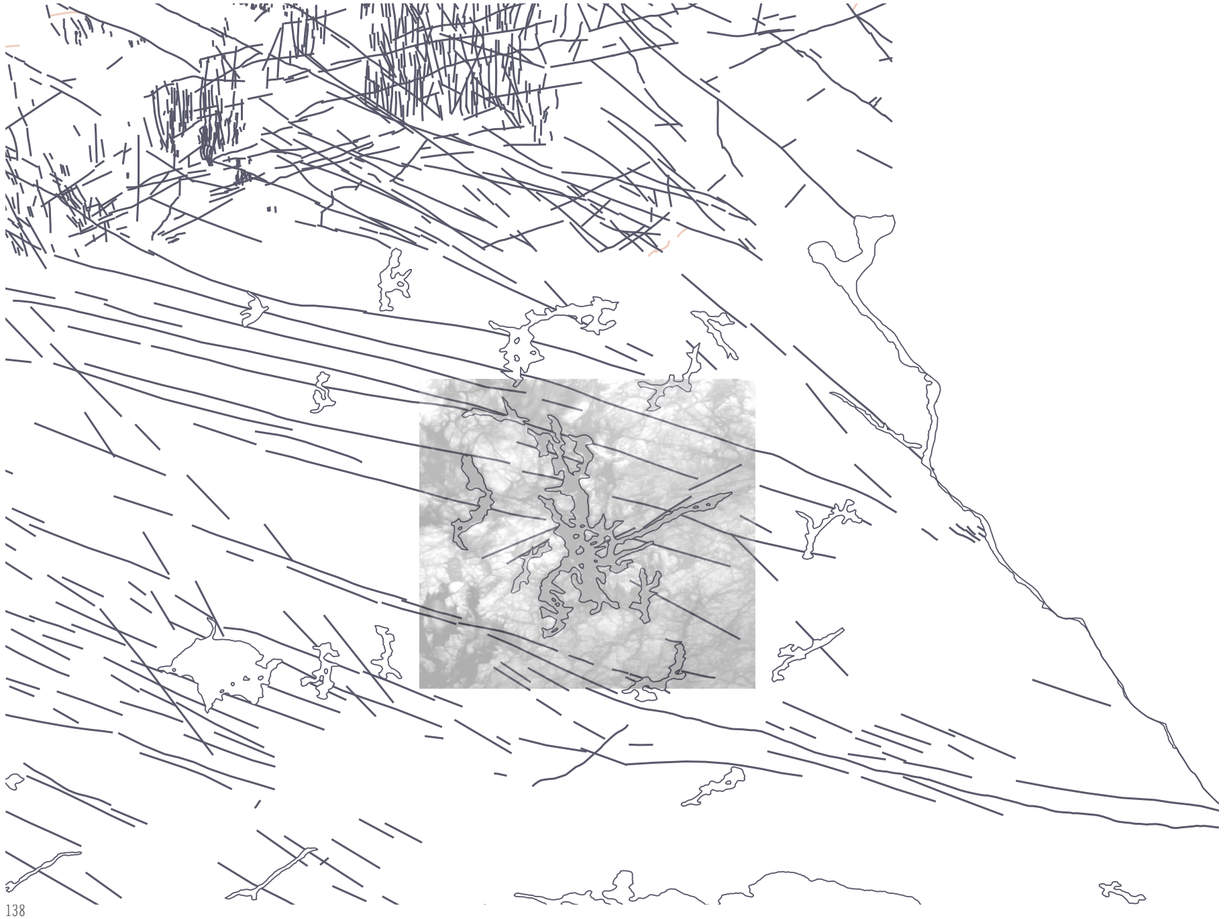
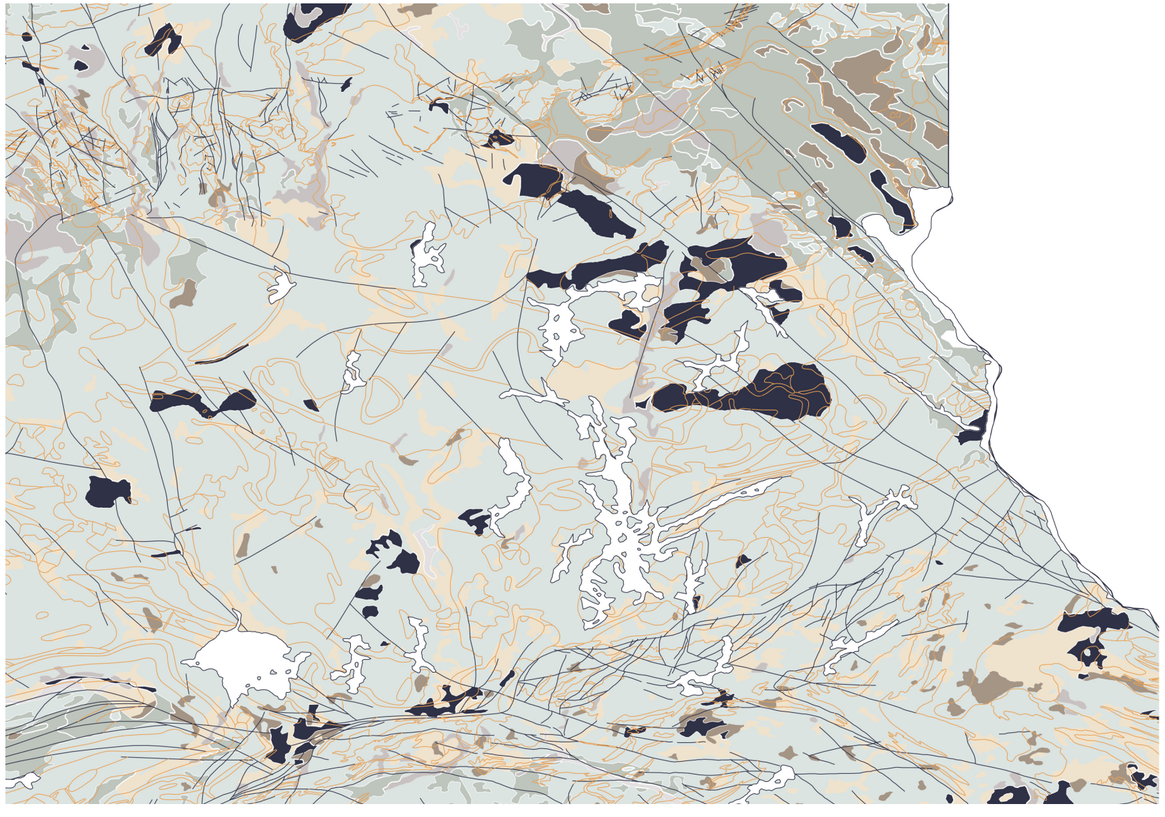


Figure 73
Structural geology.
Temagami and surrounding region.

Natural Setting: Structural Geology

Variation in geology does not go unnoticed. Curious accumulations of rounded boulders, major rock outcrops, and veins and folds, speak to a fluid, volcanic history. Clearly, bedrock and surficial geology define the configuration of the lakes and its varied landforms. "The region lies at the intersection of all three structural provinces of the Precambrian Canadian Shield: the Superior, Southern, and Grenville provinces (Burbidge 1988; Hewitt and Freeman 1978; Simony 1964). These sedimentary rocks underwent repeated folding, faulting, and metamorphosis (Hewitt and Freeman 1978)" (as cited in Gordon 2013, p.56).

Two Huronian formations outcrop within Temagami: The Lorrain and Gowganda Formations. The partially metamorphosed sedimentary rocks (mudrocks, sandstones, slates, and conglomerates) of the Gowganda Formation comprise more than half of Lake Temagami's bedrock exposures (Burbidge 1988, p.1, as cited in Gordon 2013, p.56). The Nipissing Diabase is clearly expressed through the formation of dikes and is the second most exposed bedrock type after the Gowganda Formation in Temagami. "Since the Nipissing Diabase is more resistant to erosion than the softer rocks of the Gowganda Formation, it forms most of the high land, ridges, lookouts and steep waterside cliffs" (Burbidge 1988, as cited in Gordon 2013, p.56-57). Glaciofluvial deposits, such as outwash plains and eskers, composed of sand and gravel, are present, but are found in relatively small proportions of the region among otherwise rocky shorelines (Gordon 2013, p. 57).

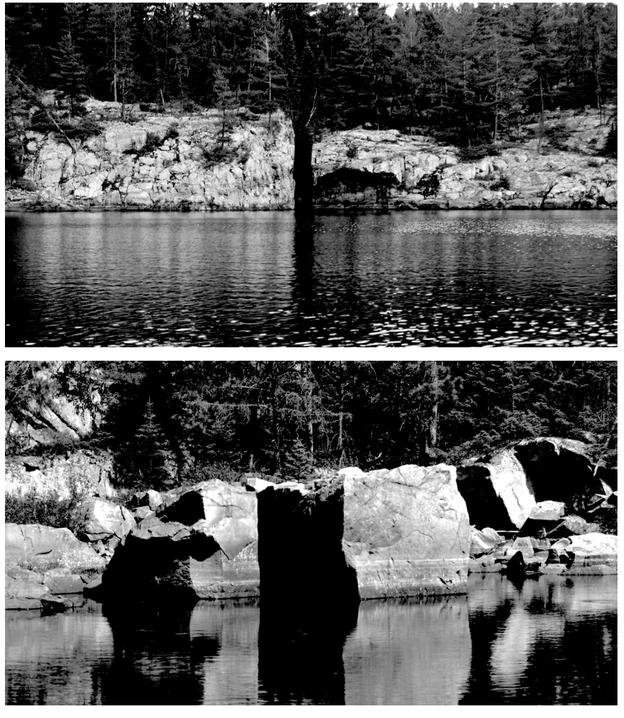


Bedrock
Fluvial deposits
Galciofluvial ice-contact deposits
Galciofluvial outwash deposits
Galciolacustrine deposits
Organic deposits
Till
Lakes
Sharp contact trend
Horizontal fault lines

10 km

Figure 74 (left)
Geology. Temagami and surrounding region.

Figures 75 (right)
Rock fault movement along the shore of Diamond Lake, Temagami



Natural Setting: Forest cover

The Lake Temagami ecoregion covers four percent (4 million hectares) of Ontario and lies 50 km south of the northern boundary between the Great Lakes–St. lawrence mixed forest and the boreal forest (OMNR 2008, p.1). Within the Lake Temagami forest ecoregion the dominant tree species are white pine (*Pinus strobus*), red pine (*Pinus resinosa*), scattered white birch (*Betula papyrifera*), and white spruce (picea glauca). Also common, but less abundant are yellow birch (*Betula alleghaniesis*), balsam fir (*Abies balsamea*), aspen (*Populus*), sugar maple (*Acer saccharum*), and red maple (*Acer rubrum*) (OMNR 2008, p.2).

In 1901, before the arrival of the railway, the province had decided to define certain areas of the region as 'Forest Reserves' to safe guard future increases in the logging of pine. In 1935, local property owners agreed with existing local pine mills to establish a 'Skyline Forest Reserve', which would protect views of the forest solely from the water and shoreline on Lake Temagami (Ottertooth, 2000-2014). However, in the 1970s, the demand for wood intensified logging operations, and the interior forest beyond the skyline reserve was extensively logged. Today, patches of young and noticeably simplified reforested areas buffer active and inactive logging roads throughout the region. Today, only a few patches of old growth white and red pine forest stands still exist, affording ecological, economic as well as educational value to the region.

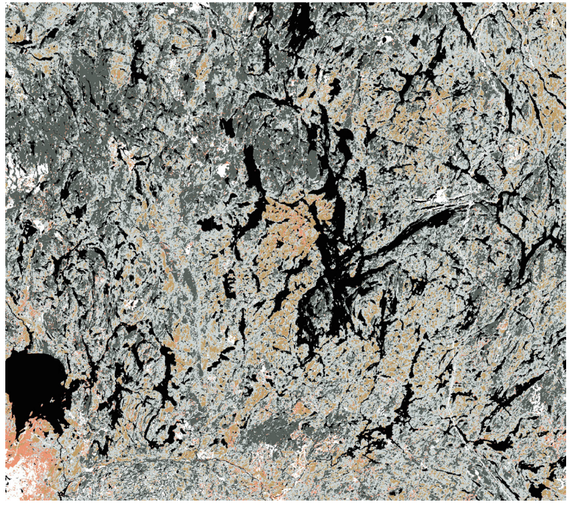
"It was not until [Peter] Quinby and the TWS [Temagami Wilderness Society] initiated the Tall Pines Project in 1988 (Quinby 1988) that anyone had attempted to identify the specific qualities of an old-growth forest in northeastern North America! (Killan 1990). During the summer of 1988 we discovered the largest remaining continuous stand of old-growth red and eastern white pine forest (Cundiff 1989) at the north end of Obabika Lake in Temagami, Ontario. During the winter of 1988-89 we also discovered that less than 2% of our old-growth white pine forests remain world-wide making them an endangered ecosystem type.... June of 1996, the Ontario Minister of Natural Resources announced that the Obabika Old-Growth Area (3,520 hectares) was officially protected as an addition to the Obabika River Provincial Park (Ontario Ministry of Natural Resources 1996)"

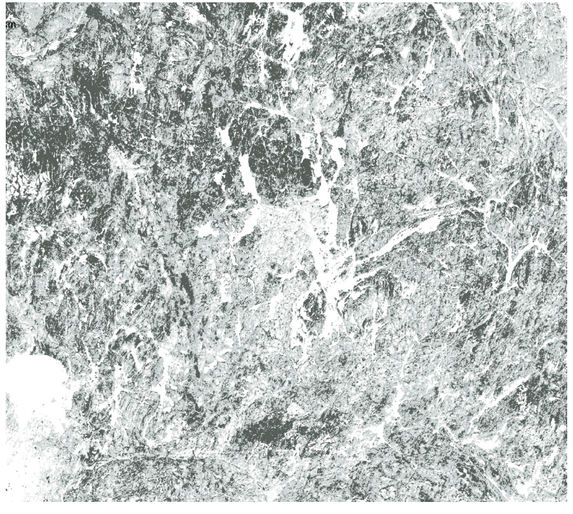
(Quinby 2000, p.2).

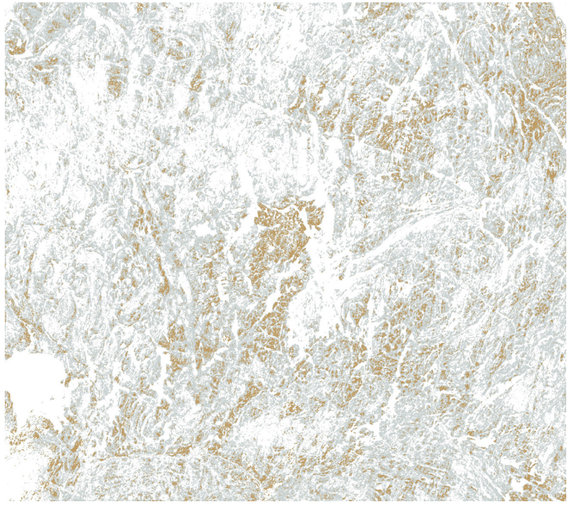
Figure 76
Percentage of Pinus vs. other species of trees in the region.

strobus

resinosa







Dense coniferous

Dense deciduous

Water (deep, clear)

Dense mixed

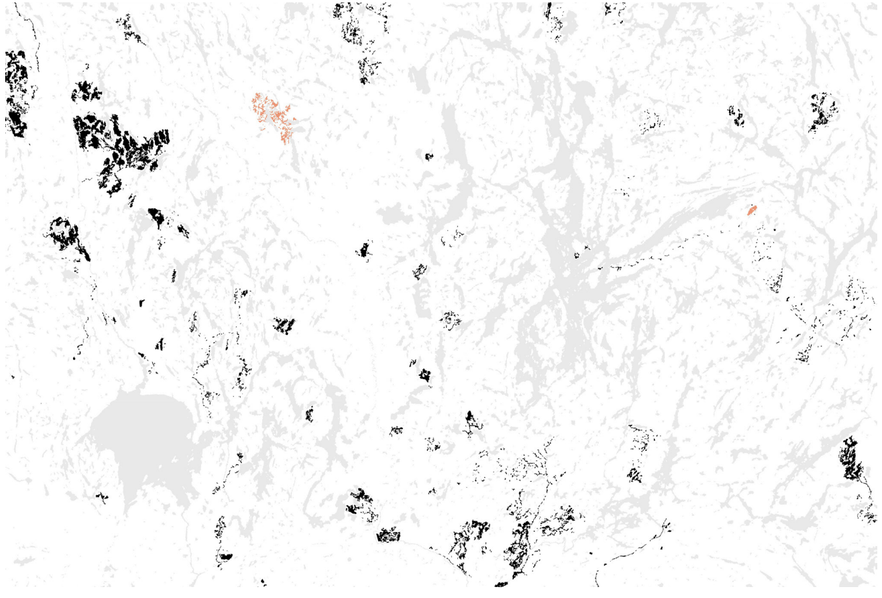
Sparse forest

10 km

Figure 77 (left)
Land cover
Temagami and surrounding region.

Figure 78 (center)
Dense coniferous and dense mixed forest

Figure 79 (right)
Dense deciduous and dense mixed forest



Water bodies

Burns

Cuts

10 km

Figure 79 (left)
Forest clear-cuts and burns estimated at more than 10 years of age.

Figure 80 (right)
Open and treed bog conditions.

open bog

Treed Bog

10 km

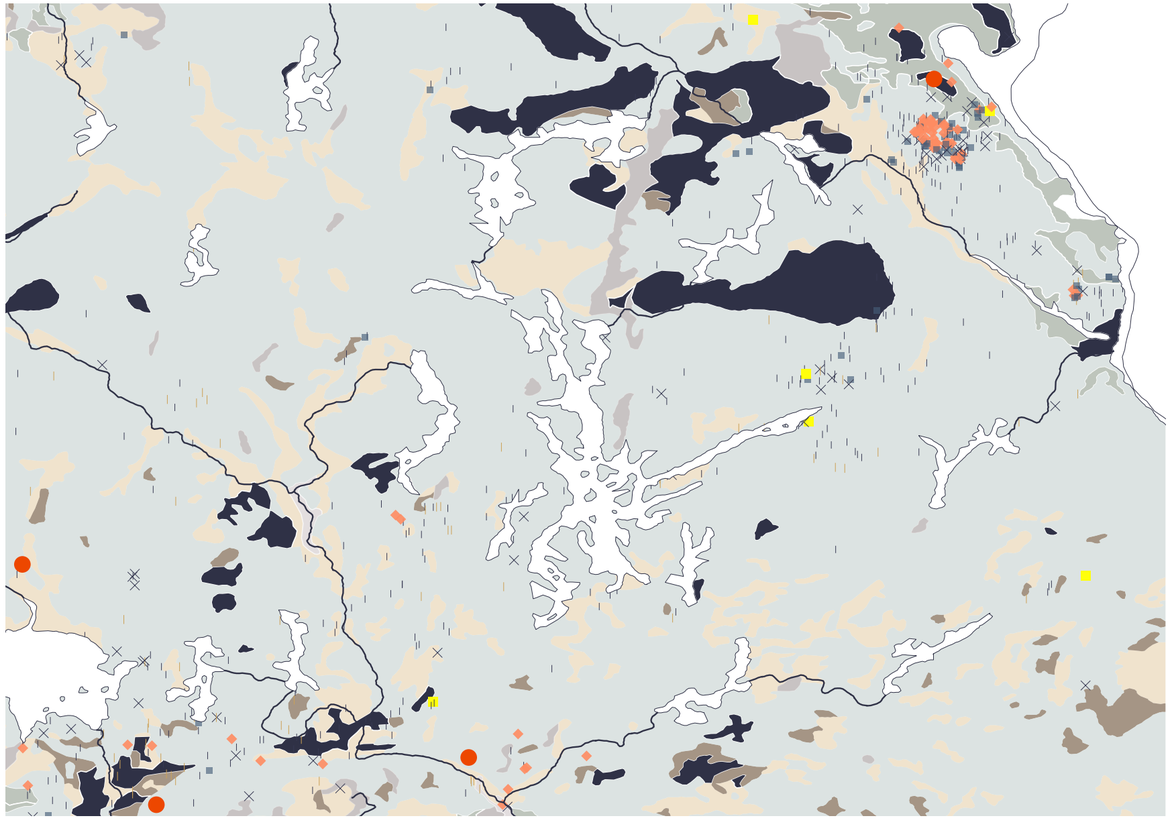


Figure 81
Mining.
Temagami and surrounding region

TEMAGAMI, ONTARIO,
Cultural Setting:
Minerals

Settlement of the area by Europeans did not take place until the early nineteenth century, as many of the main trade routes through Ontario did not cross as far north as Temagami and so remained simply a place to stop and rest. Eventually, the Hudson's Bay Company would establish a small trading post on Temagami Island, (which later relocated to Bear Island). The subsequent discovery of abundant mineral deposits within the Nipissing diabase and Temagami Greenstone belt formations in the early 1900s meant incredible opportunity for prospecting and mining within the area, and effectively accelerated the development of the region (Bennett 1978, p.65). Gold, copper, nickel, silver, iron, arsenic, molybdenum, platinum, palladium, cobalt, zinc, bismuth, uranium, pyrite, and graphite are some of the resources that were and are currently being extracted, though many mines were left abandoned after the 1960s.

In 1905, The Temiskaming and Northern Ontario Railway (now Ontario Northland) came through Temagami and created opportunity for tourism and greater efficiency of resource extraction. Prospector Dan O'Conner founded the town of Temagami, and in 1903, formed a steamship company on the lake and established the first store on the future town site. By 1906, three hotels on Lake Temagami had been built, followed by the Ferguson Highway (now Highway 11), which was completed between Temagami and North Bay in 1927 (Ottertooth 2000-2016). Today, Temagami can be found most lively during the summer months when cottage owners and adventure seekers rush to the lakes. The Temagami area is perhaps most renowned as a fantastic canoe destination both nationally and internationally. Various recreational activities are easily accessible due to seasonal outfitters and lodges, which provide gear rentals and often guided excursions throughout the lakes. There are numerous campsites within designated provincial parks from which to explore on one's own, and the many youth summer camps keep the waters and shores of Temagami continuously navigated.

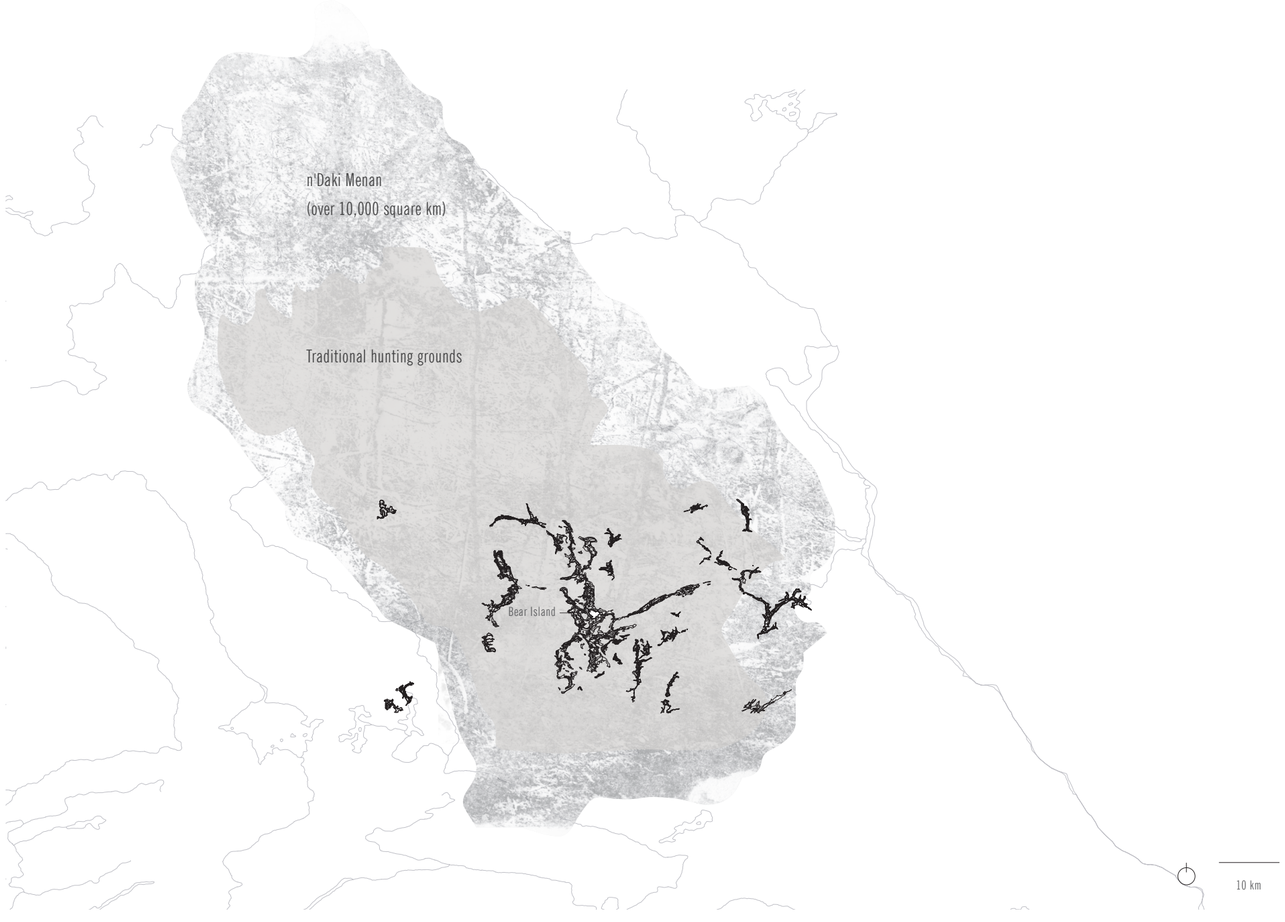


Figure 82
Extent of n'Daki Menan and ancestral hunting grounds

Cultural Setting: n'Daki Menan

The incredible presence of old growth pine forests had initially drawn my attention to this region of Ontario. Yet, as my knowledge of this place deepened, I began to understand that one of the most important realities about the Temagami territory is the history of the original people connected to the landscape. The Teme-Augauma Anishnabe have lived on their land – n'Daki Menan – for upwards of 10,000 years. And, although most Canadians recognize the Temagami wilderness as "... a popular destination for campers and canoe trippers since the turn of the twentieth century" (Thorpe 2011, Introduction) it is indeed much, much more. As it exists today, n'Daki Menan has been reduced to the area of Bear Island, a 1 km^2 island at the center of Lake Temagami. Bear Island was purchased by the Department of Indian Affairs from the Province of Ontario in 1943 to be designated as a permanent reserve. Despite the refusal from the Teme-Augama Anishnabai community to accept this for many reasons, but also because an official treaty had never been signed – the official reserve status was still granted in 1971 (Thorpe 2011, p?)

In the profoundly important publication entitled 'Temagami's Tangled Wild' (2011), author Jocelyn Thorpe explains how n'Daki Menan was 'discovered' and re-interpreted as an untouched Canadian wilderness, even as the Teme-Augama Anishnabai continuously asserted their rights and responsibilities toward a very differently understood territory (Wynn in Thorpe 2011, foreword). Her main argument throughout the book is that "Temagami has been made –imaginatively and materially – as a site of wild Canadian nature. Its appearance as naturally wild and Canadian is the result of historical processes and relationships of power that disguised themselves as natural and worked to dispossess the Teme-Augama Anishnabai of their territory" (Thorpe 2011, Introduction). The environmental activism that has manifested in Temagami began with the desire to draw attention to destructive logging practices, but as Thorpe suggests, this type of environmentalism: "also helped to mask contemporary Aboriginal claims to land, thus making the forest appear unproblematically a part of the Canadian wilderness" (2011, p.16-17).

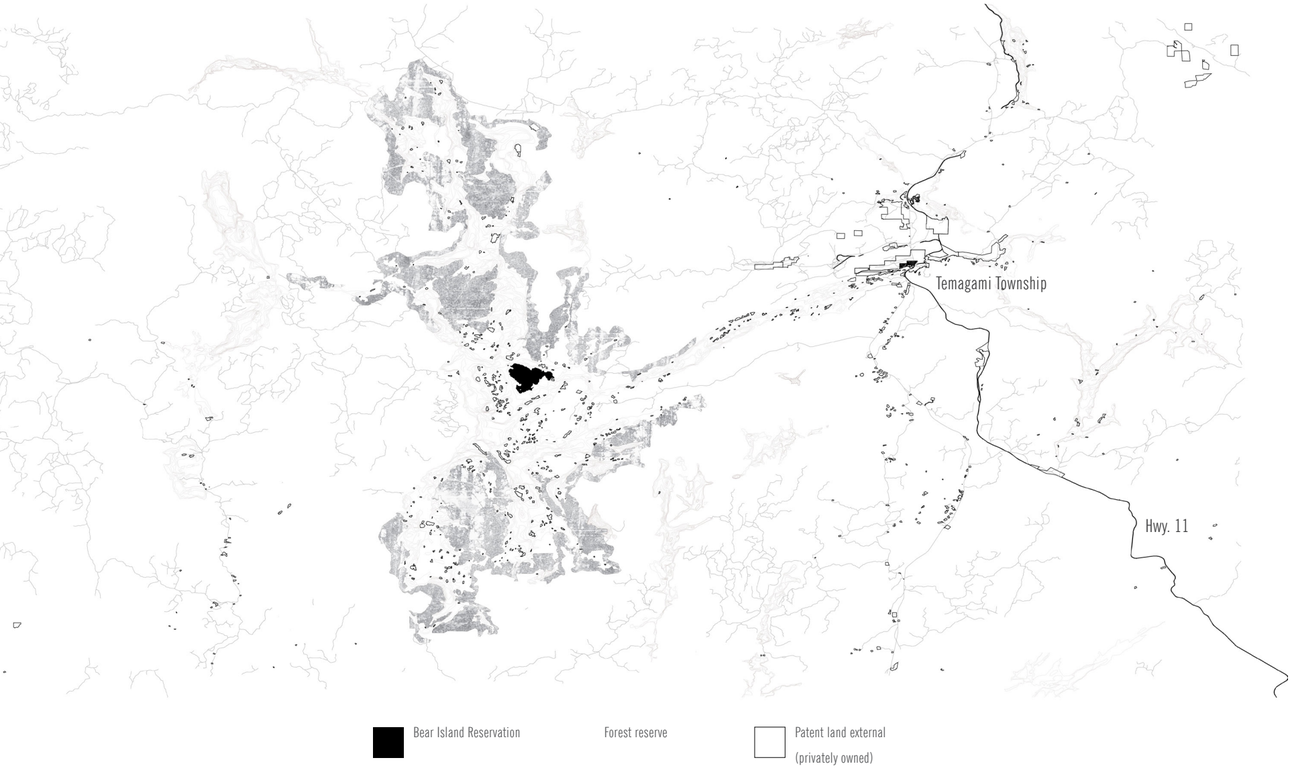


Figure 83
Current extent of n'Daki Menan
(limited to Bear Island), and privately
owned land and protected land.

"For many generations, the First Nation governed the use of n'Daki Menan according to a system of family hunting territories, where each family had a responsibility to steward its two- to three-hundred-square-mile area in a way that ensured the continuity of the species upon which the nation depended for survival.[2] As non-Aboriginal people began to encroach in growing numbers upon n'Daki Menan in the late nineteenth and early twentieth centuries, the Teme-Augama Anishnabai found their ways of life and relationships with n'Daki Menan disrupted. Over the ensuing years, they became increasingly excluded from their lands until, with the creation of a reserve in 1971, the federal and provincial governments officially recognized them as having claim to only one square mile of the four thousand comprising n'Daki Menan. Since then, the Teme-Augama Anishnabai have taken legal and direct action to assert control over n'Daki Menan, but according to Canadian law and popular imagination, the region exists, with the exception of the one-square-mile reserve [Bear Island], as part of Ontario. [3]"

(Thorpe 2011, Introduction)

Figure 84
Location of the Temagami region within the context of Ontario, and main route from Toronto, Ontario via Hwy 11.

FIELD NOTES

Temagami, Ontario
July 24th- 3th, 2016.

During the later end of July, 2016 I took a brief summer trip to visit the Temagami region in Ontario to finally experience the infamous old growth pine forests. As the most efficient way to travel throughout the region is on water, it was obvious that we (my partner and I) would be traveling by canoe. Among the extensive network of canoe routes, there was one loop in particular that passed through significant old growth. This route was also of interest since it convened with sites of paleo-ethnographic and spiritual significance to the Teme-augama Anishnabae. The route is called the *'Obabika Loop'* and it is one of the most popular routes to take on the lakes.

The drive from Toronto to Temagami is nearly a straight line north on highway ON-11 for 454 km (approximately 5 hours). For travel on the lakes, we adhered primarily to 'The adventure map' by Chrismar Mapping services, Lake Temagami – Temagami 2, 1:80,000, Obabika River Provincial Park.

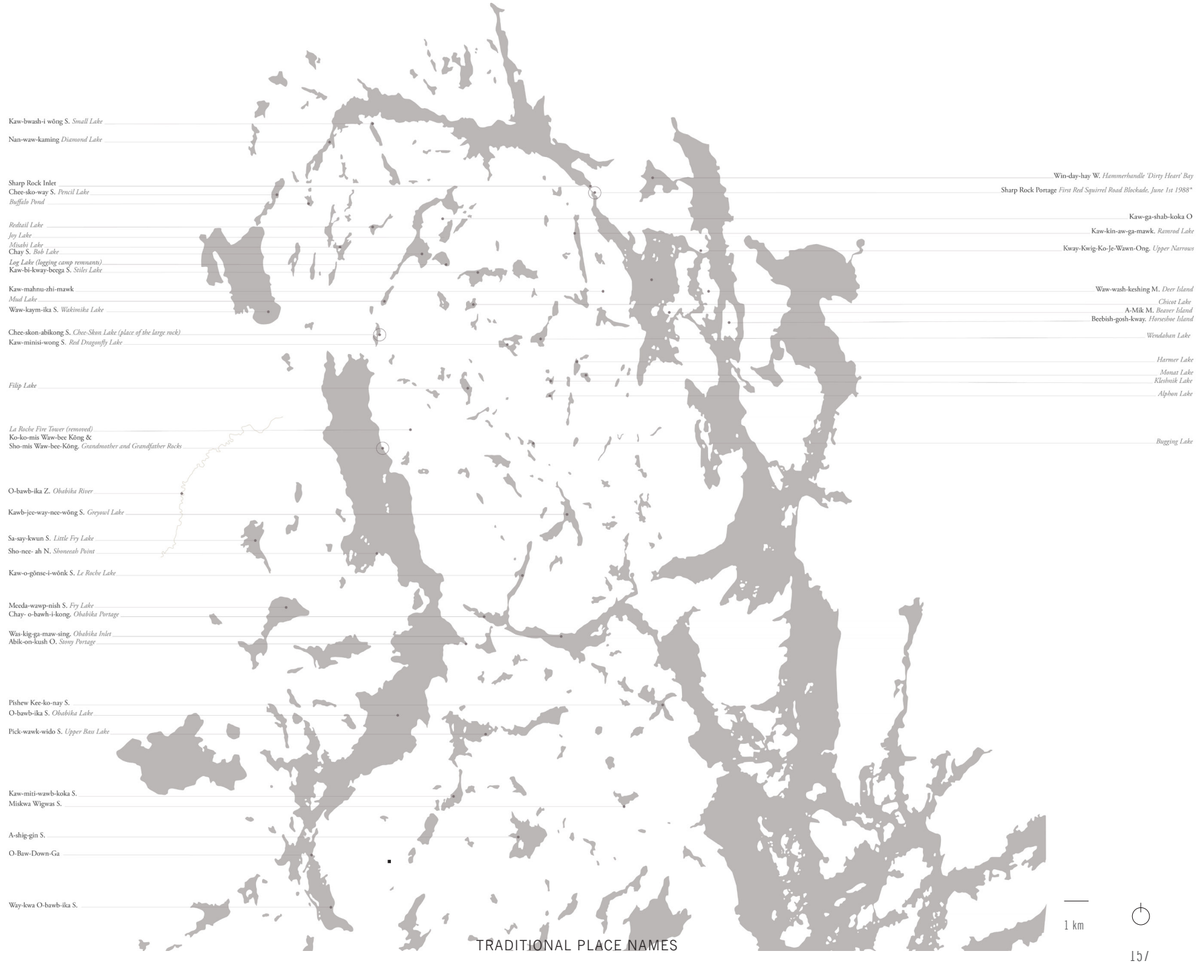
1 km

Average Temperatures and precipitation for July, 2016:

Precipitation : 66 mm
Mean daily max: 25 °C
Hot days: 31 °C
Mean daily minimum: 14°C
Cold nights: 7°C
Prevailing wind: South-southwest

Figure 85 (left)
Map showing distribution of Temagami's interconnected and outreaching system of lakes and streams

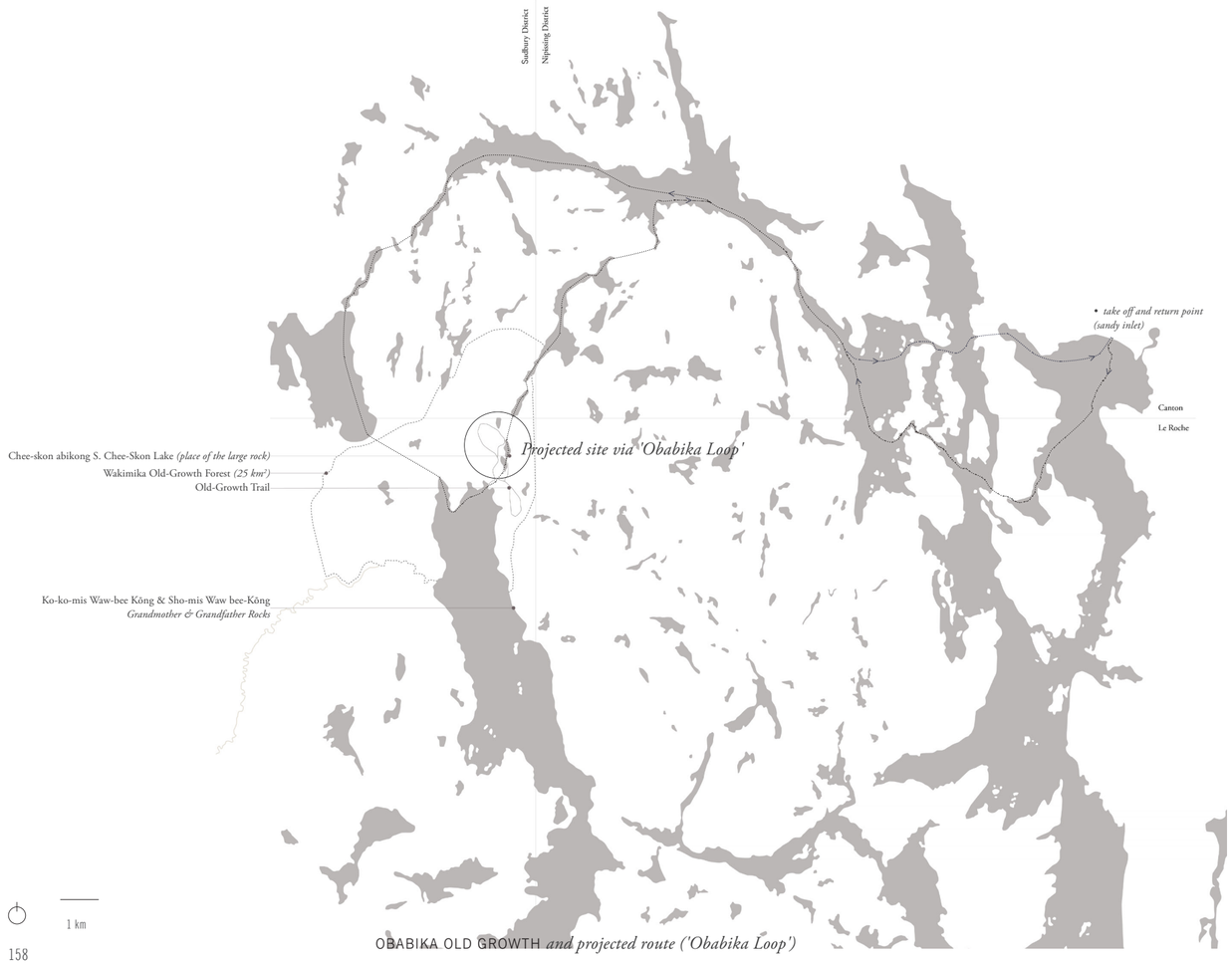
Figure 86 (right)
Map of traditional place names,adapted from Craig A. Macdonald's map of traditional routes and travel before the 1900s.



1 km

STUDY AREA *Northwest Temagami*

TRADITIONAL PLACE NAMES

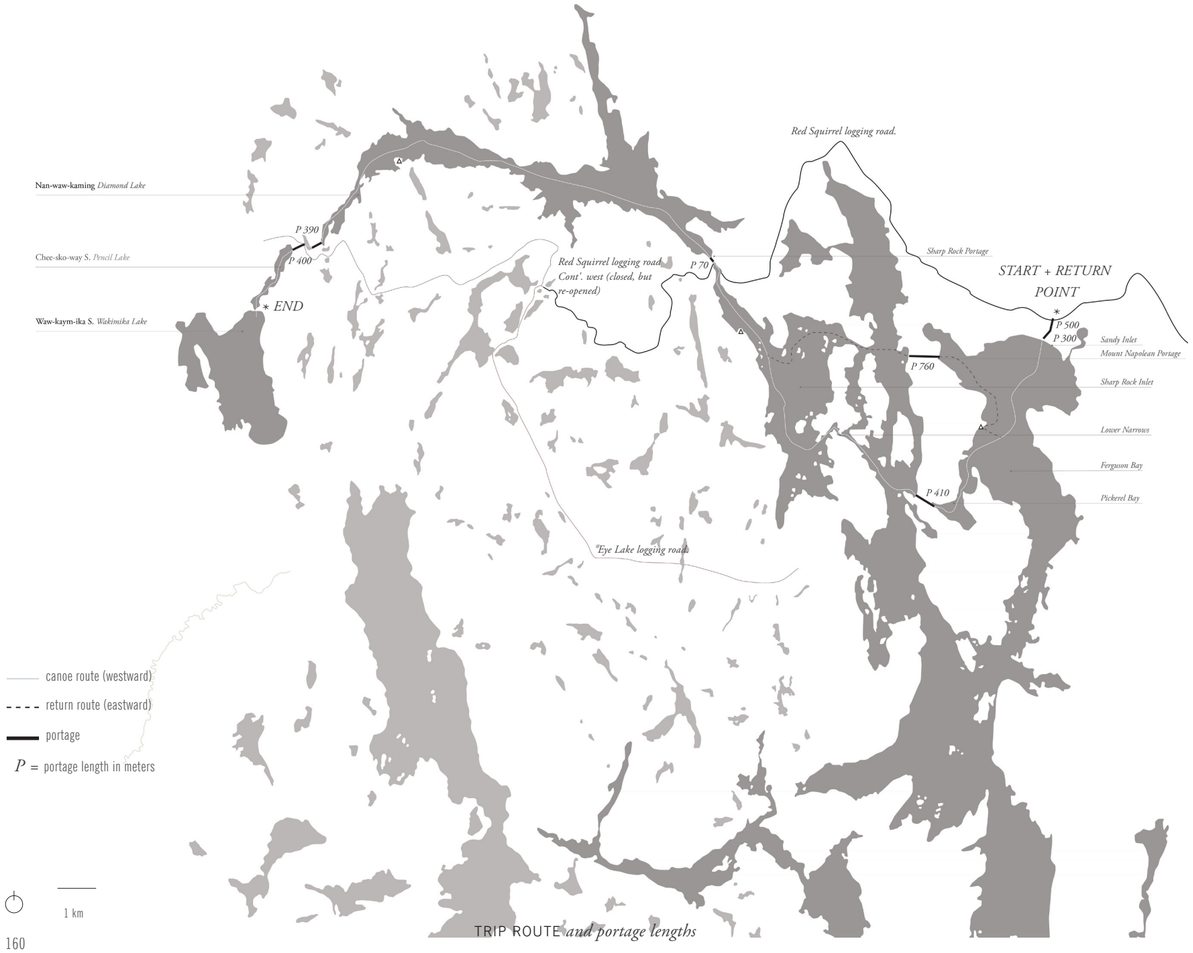


OBABIKA OLD GROWTH *and projected route ('Obabika Loop')*

Figure 87
Location of Obabika Old Growth forest and projected route before arriving in Temagami ('Obabika Loop')

Figure 88
Nastawgan
The routes of travel on land and water.

NASTAWGAN *Routes of travel on land and water*



TRIP ROUTE *and portage lengths*

Figure 89
Trip route (east - west)
Total portage distance: 39.3 km
Total canoe distance: 59 km

Day 1

The day began with a winding drive along the Red Squirrel logging road, heading west toward our take off point from the beach (Sandy Inlet) at Ferguson Bay. Despite its tangled history, and continued use for logging - moving along the Red Squirrel road was actually quite a memorable experience. The shoulders were spilling over with late summer wildflowers and every so often a quick glimpse of an adjacent water body dotted with lillies and the odd pitched tent along the shore came into view. We parked our vehicle, but still needed to complete a 300-m portage through mud holes (as described on a map srawled by our outfitter) and finally another 200-m would have us at the shoreline.

As we take off from Sandy Inlet, a light rain starts to fall. Winds are from thes south, so the air is warm through Ferguson Bay. As we turn into Pickerel Bay, Fog or low-lying clouds plume from the trees along the shoreline. It is extremely sheltered and calm here. We cross Pickerel Bay portage westward, (410 m). The trail is marked by a narrow path of fallen trees and sharp, slippery rocks. Joe got a pine needle in the eye.

We continue northwest through the Lower Narrows near Beaver Island, then north through Sharp Rock Inlet towards Sharp Rock Portage. We stop to set up camp overnight on an island just a short distance from Sharp Rock Portage. A seemingly domesticated chipmunk stole our parmesan during dinner.
It rained all night. Incredible lightning. The forest floor was extremely soft, moist, and completely saturated where we slept – pillow-y, but thankfully dampness did not enter the tent. We depended hugely on our tarp, which was fastened to three narrow pines to keep our goods dry.

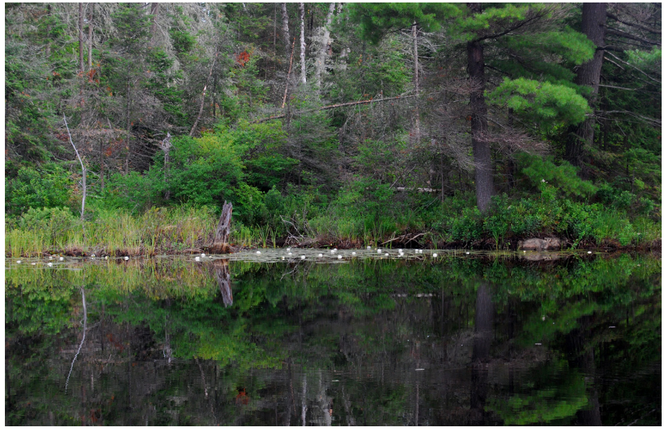


Figure 90 (left)
White water lilies,
off Red Squirrel road,
Temagami, Ontario.

Figure 91 (right)
Sudden rain,
Diamond Lake,
Temagami, Ontario.

Figure 92
Line of rocks,
Diamond Lake,
Temagami, Ontario

Day 2

The morning is already hot – the sun is drying our wet backs as we start a short paddle to Sharp Rock Portage. We encounter a minor step-up over a beaver dam. The beginning of Sharp Rock portage is bisected by a logging road. Although the length of the portage is quite short, the name does ring true.

Now, we are headed west on Diamond Lake. The winds seem to shift. Heavy west headwinds keep us almost at a stand-still. Sheets of falling water are indicators in the distance of approaching rain. The weather is nearly impossible to read.

Slight turn southward down Diamond Lake. The rain begins to fall very heavily, but we could still make out a very peculiar accumulation of rocks, which peeked above the water and curved down the center of the lake between the east and west shorelines.

We set up camp across from this line of rocks. The evening is dry, but unpredictable clouds to the south make us nervous.

Figure 93
Heading south.
Portage between
Diamond Lake and Lain Lake,
Temagami, Ontario.

Day 3

A slight shift in plans for the day's travel. Due to lost time because of heavy winds, we decide to visit the Obabika old growth trails as a day trip and stay one more night on Diamond Lake
We move southward on Diamond Lake toward the first portage. Shallow, swampy waters and enormous fallen and shattered rocks are arranged like a maze on the surface of the water. We scramble onto shore trying to avoid sliding a toe into the muddy waters. Enormous boulders mark the portage terrain (390m). It is close to noon and the sun is beaming and winds are very calm. Sweat accumulates quickly. We emerge onto a small water body. It is fresh and aqua-marine. We paddle swiftly across. The second portage (400 m) is much wider, less vegetated and smoothed by rock outcrop We cross an abandoned logging road where in 1989 a historic blockade by the Teme-Augama Anishnabai and conservation activists took place.

We experience very calm winds down Pencil Lake – cedars and large deciduous trees reach over the shoreline. At the southern end, the lake pinches and opens out onto the peninsula/beach at Wakimika Lake. The view from the beach is a beautifully expansive body of water dotted with islands in the distance. We lounge in a natural enclave within the cedars. There is something lush and almost tropical about this beach forest. A beach day feels like a dream. We rest and swim and eat. Alas,we decide not to journey toward the Wakimika old growth trails since it would take another two hours, plus the time it would take to explore the trails… and then the journey home. We would be portaging back to camp in the dark. So, instead we return to camp from Wakimika beach the same way we came. We are much stronger, however the heat has intensified. An unbelievable crack in the rock face along the shore catches our attention. The shorelines are so unique: spotted with smooth round rocks etched with the residue of water levels. Incredible evening to make dinner.

Figure 94
Portage access at north end of Pencil Lake, Temagami, Ontario.

Figure 95
View along the beach Obabika Lake, Temagami, Ontario.

Figure 96
Terrain,
Diamond Lake,
Temagami Ontario.

Day 4

Today is a full day of travel to return to Sandy Inlet. We depart at 7:00 am. The heat is extreme even in the morning. Our route east through Diamond Lake offers a new perspective. No wind. The water is still and appears thick like oil, yet still so clear. Travel is incredibly quick. 3 hours brings us to Sharp Rock portage. We stop at an island covered with cedars again in Sharp Rock Inlet for lunch. The clouds are blanketing the sun from time to time - the air is comfortable. We keep north through the Upper Narrows and across the North Arm of Lake Temagami toward the mount Napoleon Portage (760 m). Very difficult and varied terrain. The mosquitoes prevented any sort of enjoyment on the trek. Emerging back onto Sandy Inlet at Ferguson Bay around 5 pm. We paddle southward to final camping destination. The sky turned a blush pink that night and so did the water. As we dried our clothing for the last time and began to prepare supper, sounds of the celebratory shouts indicating the end of a long canoe trip could be heard from the opposite shoreline at camp Wanapitei.

Figure 97
Red Squirrel road.
July/August.
Temagami, Ontario.

Day 5:

Our last paddle back to the beach at Sand Inlet. A group of teens greet us as they finish a 20-day canoe trip from James Bay. We walk again past the mud holes – our final portage and say goodbye. The drive back down Red Squirrel road was again, very pleasant. Wildflowers, campers... scenic views of adjacent lakes.

The Red Squirrel logging road

The Red Squirrel road was actually abandoned west of Sharp Rock Portage in 1989 – (although it was illegally cleared in 1984 by MNR), but re-opened (quietly) in 2001 by Liskeard Lumber workers of New Liskeard. New Liskeard, however, does not operate a mill, so all of the lumber is exported out of Temagami Large logging machines were often visible, parked on the side of the road, half submerged in the forest. Areas of reforestation are every so often marked off of Red Squirrel Rd. The new growth is composed of narrow pines with a homogeneous and young under-story of ferns and small shrubby plants.

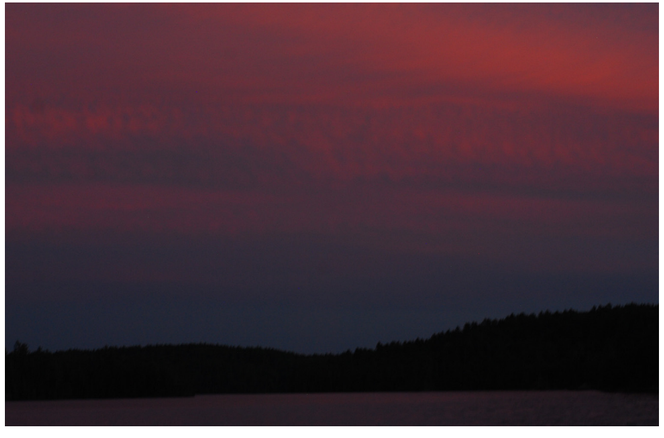


Figure 98
The last night's sky,
Ferguson Bay,
Temagami, Ontario.

General Weather

The weather was very inconsistent. The clouds generally emerged with immense energy and colouration: Deep blues and grays and sometimes greens. Sheets of rain were often seen in the near distance. On the water the view of the sky is very open– You can see the development and approach of these micro storms. This type of weather was, thankfully, balanced with days of intensely bright and sunny skies. The dichotomy was intense. We were incredibly dependent on the weather without any ability to predict it without cell phones or data connection. It is funny, this dependency on weather forecasts. They provide a great level of comfort - telling us how to react to the atmosphere. Do you stay in or do you go to the beach? Thankfully for us the beach came to us.

The Wind

The July wind in Temagami is acute. Before leaving on this trip I recall reading something about how the sound of the pines in the wind is like a whisper. And it is – in the way that it builds and makes its way toward you. Since the presence of wind seemed to often come as gusts, you could hear the approach by the sound of pine needles buzzing. The buzz is very distinctive from the rustling of deciduous leaves in the wind– it builds audibly like a crescendo until you feel it on your skin. Abrupt changes in air pressure would explain the gusts. Is this a result of the surrounding landscape/landforms, I wonder?

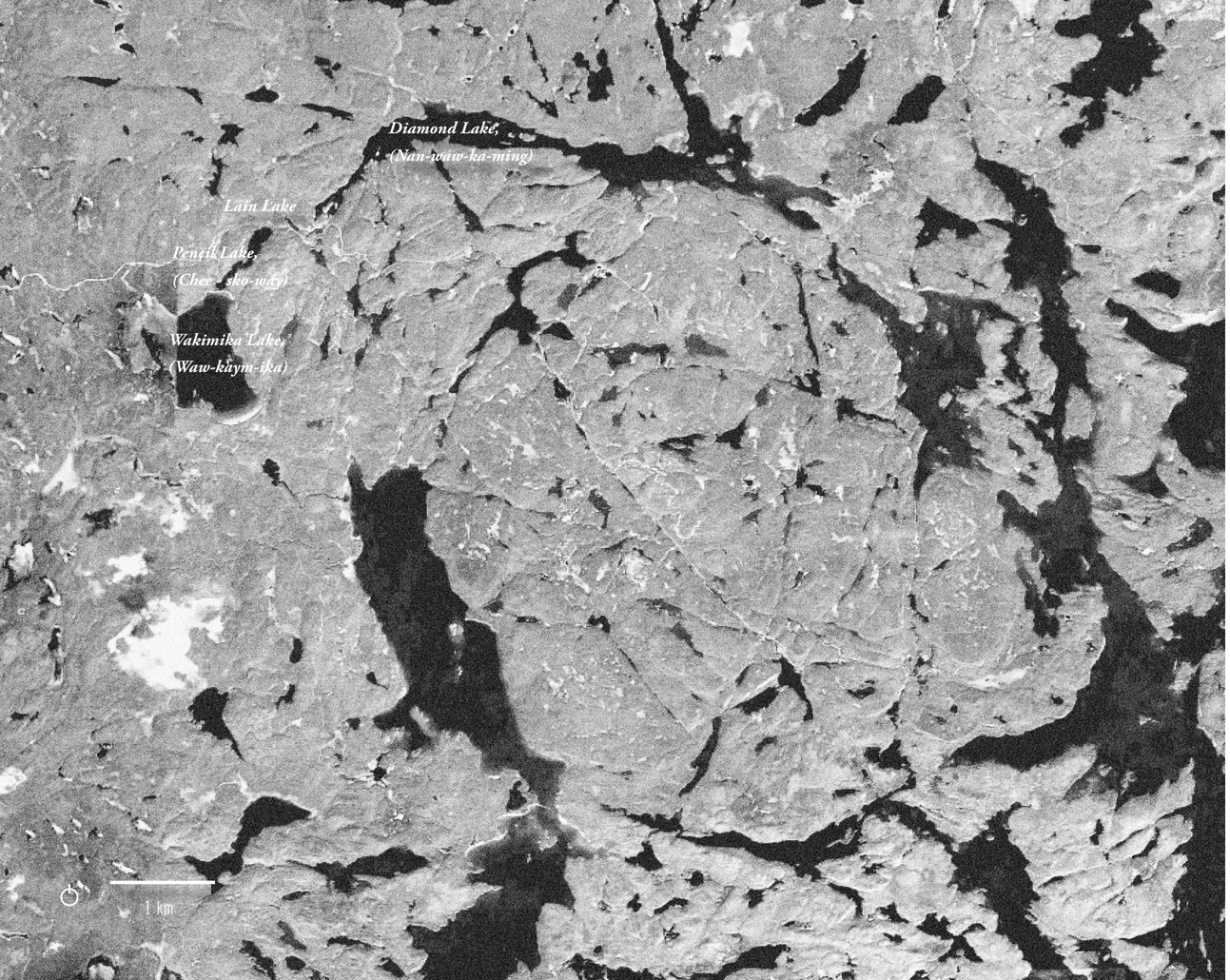
Figure 99
Ground cover.
Diamond Lake,
Temagami, Ontario.

Distilling a Site

Returning to Toronto from Temagami after a long, final day, I was faced with choosing a particular site within the old growth forest in Temagami, for which I would propose a design. I had embarked on this trip with a particular focus for a site, but as it happened, we did not make it far enough. I began to wonder, having not experienced that 'preconceived' place, how would I be able to understand its nuances, its ambiance, and its atmosphere? Although this was frustrating in the moment, ultimately it allowed for a renewed freedom in my imaginings for other sites along the path that I truly experienced in an intimate way. Distilling the Temagami region was a rather general process since it fit certain criteria within the framework of this research, but it was necessary that when it came to the design work, the site would need to be experienced.

This is imperative for all landscape architecture. In order to design for a place, you must know it in a haptic sense, even if the practical world of design might tell us otherwise: that we should be prepared to design and make decisions for and from remote locales. I understand that this is often an inevitability of the profession, but I have a difficult time imagining how beautiful, insightful design that might truly touch the people who dwell there and do possess an understanding that particular place, might result from this process.

Throughout the five days spent in Temagami, it became clear that the place I came to know quite well through bodily and emotional engagement was Diamond Lake.



The affective atmosphere of Diamond Lake was one of calmness and gentleness. I am basing this on a mere two days in this part of the landscape, so perhaps it is not accurate. Yet, there is something about the lake's orientation – the narrowing of the shoreline to the south that creates beautifully focused views as well as such a purely serene feeling both in the way that the atmosphere is felt (the weather, mainly the wind) and its presence as an atmospheric totality.

Drawing inspiration from the simple yet considerate landscape architectural details of Teresa Moller and from the ethos of Nordic nationalism and further from the beautiful connection that the boreal forest expresses with the atmosphere, I began to develop a plan for an unexpected experience through the Temagami wild.

Figure 100
Satellite image
over northeastern Temagami, and
contextual focus for a landscape
intervention.

"It is obvious that multiple factors contribute to the creation of atmosphere, among them, forms and their geometries, the dimensions and proportions so familiar to architects. But equally and often more important are colours and textures of surfaces, the weight and origin of materials, the care or lack of detailed execution, and the characteristics of varying sorts of light: their evenness or flickering quality, relative permanence, or rate and nature of change. The qualities of diverse sounds, acoustic reverberation or absorbency, olfactory qualities and their combinations, and so on contribute just as much to the creation of atmospheres. The difficulty is that while it is easy to generate a list such as this, and some of these characteristics are relatively easy to control through instrumental design operations, our embodied experience where meaning actually appears is always primarily synesthetic and enactive"

(Pèrez-Gomez 2016, p.31).

PART 5

UNVEILING ATMOSPHERE

Figure 102
A natural path revealed
Diamond Lake
Temagami, Ontario

Design Proposal

This proposal explores how a forest field station might be organized in Canada as a contribution to the research being accomplished at the SMEAR II station in Finland, but approached with a different spatial and aesthetic language that speaks honestly to the Temagami region. The spatial design is articulated very minimally as a series of pathways, walkways, and stairways, which are rendered elementally with in-situ stone, wood and native flora, traversing 6.7 km through a section of the Temagami forest.

Located between Diamond Lake and the northern beach at Lake Wakimika in Obabika River Provincial Park, these surfaces form the spatial organization and circulation of a field station concerned with forest – atmosphere relations. Moments along the path reveal delicate instruments, which measure the fluctuation of forest emissions and other influential atmospheric behaviors. The desire is to draw attention to the sensible forest atmosphere and to the process of cloud seeding as a way to cultivate unexpected interpretations of an existing wilderness landscape.

Levels of Forest Atmosphere

The experience of moving through the landscape follows a vertical transition through four levels/heights of the forest, which trace the measurement interfaces established within the Hyytiälä forest. These are: *water, the forest floor, mid-canopy, and above canopy height.* Each intervention follows the most natural line of movement through the forest, tracing the sweep of the eye - a break or an undulation in the land. Here the experience of the forest's atmosphere is enhanced by the arrangement of existing natural features through which the forest can more safely and peacefully be experienced. Indications of the path from the shoreline offer subtle cues into the forest, enticing exploration beyond the common perspective from a canoe on the water, drawing people's eyes and minds deeper into the forest. Those passing by and who decide not to venture toward the trail might ponder the forest and, in turn, pay more attention to the shoreline as they continue their journey.

To move through the Temagami region means to engage all of ones senses. Most movement on land is very difficult. The forest creates a clear sense of enclosure, like a room with doorways, walls, a ceiling, and windows – a space with distinct edges and openings, but where one can easily get lost in between. When traversing a difficult portage, the desire to reach the other side is overwhelming, but the feeling of looking out over to the next body of water and gliding effortlessly in a canoe is incredibly satisfying. So, this would indicate that any comfortable motion through the space of a forest is unencumbered. Full balance and mobility is imperative. As many canoe trips go, any attention to the landscape occurs usually from the shoreline or from the middle of an expansive body of water. The portage on land is an 'in and out' experience. So, as a way to balance this, the design intention is to create a way of moving through the forest that is a much more light, effortless and playful.

Figure 103
Site plan

MOVEMENTS:

1. Jetty Pool

2. Little beach and wildflower logging road

3. Broken Nastawgan (metigo-mikana)

4. Intersecting stone path

5. Rooms of forest atmosphere (measurement facilities)

6. Forest pool

7. Grand staircase

8. Little clearings

9. Stair between the rocks

** Rest / look-out point toward the water*

^ Existing campsite

NOTE: (South portion of plan continues on next page)

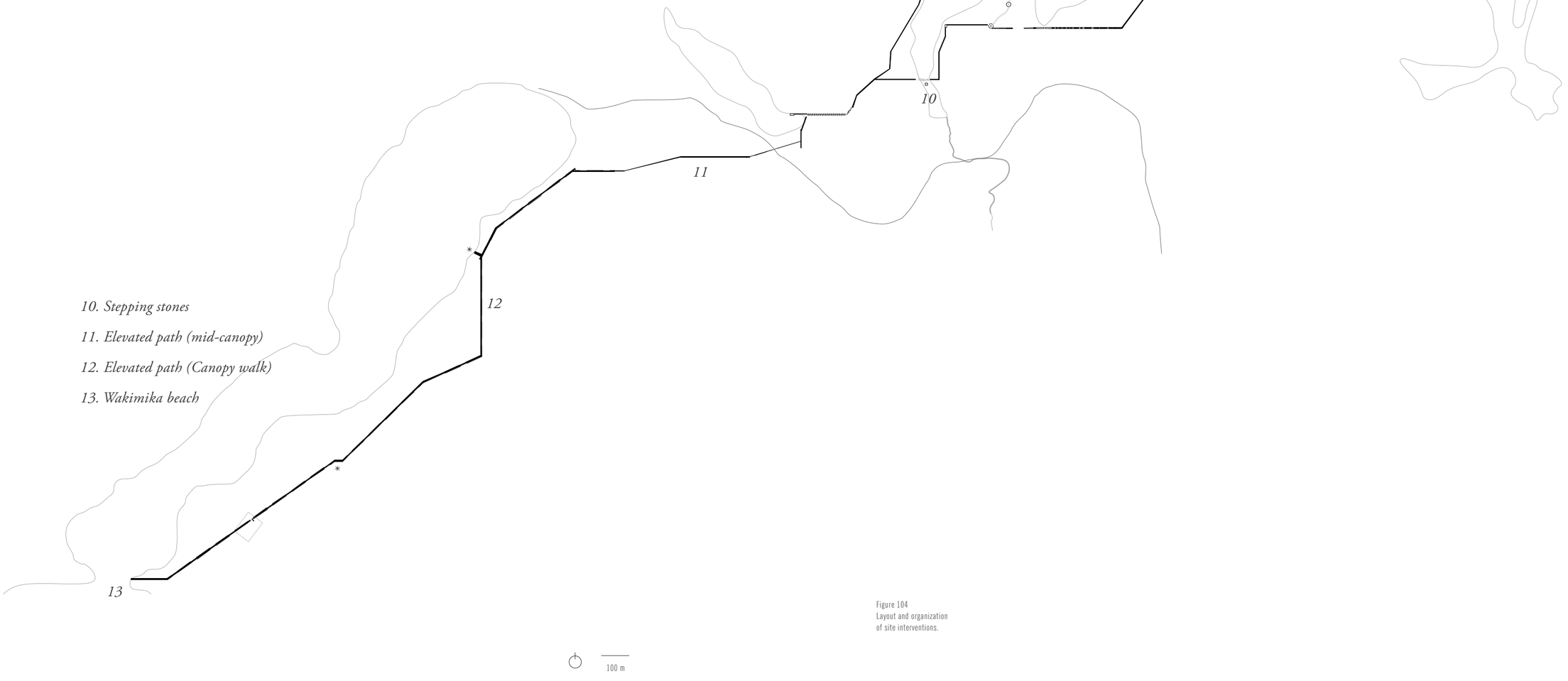
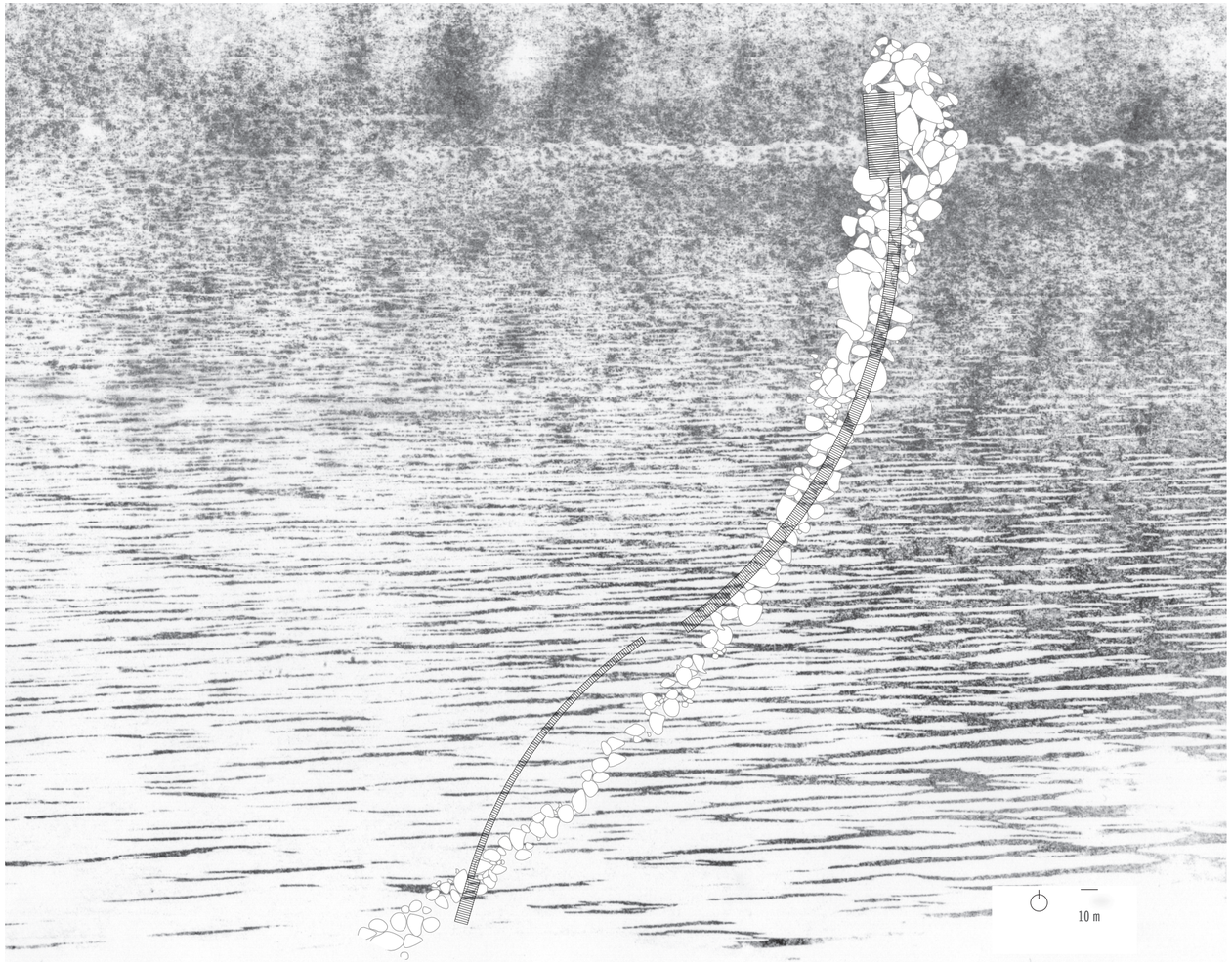
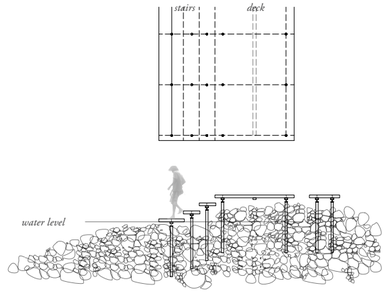


Figure 104
Layout and organization
of site interventions.





MOVEMENTS

1. Jetty pool:

The site is best experienced as a day trip.

Both approaches whether coming from the north at Diamond Lake or from the South up through Wakimika Lake, begin and end with the water as the visual focus – as the horizon. If moving east (via canoe) from Sharp Rock Inlet, the first approach to the site begins at the southwest bend of Diamond Lake. A peculiar fine horizontal landmass appears just above the water's surface. It widens as you approach and see that it is similar to a jetty, composed of smooth, rounded boulders. A narrow cedarwood platform is visible upon the rocks, suggesting an ideal moment to rest. The deck continues and sweeps out onto the lake toward the tapered end of the 'jetty' forming a natural pool enclosure: a protected pool, stepped to provide an easy way into the water and enjoy the warm southwest wind that breathes up the lake during the summer months. Toward the southern end of the landform, a small, boxy instrument sits nestled within the rocks. Its purpose is to measure wind speed through the scattering of sound waves by atmospheric turbulence at various heights (Sonic Detection and Ranging, also known as SODAR) within the lower layer of the atmosphere (up to 800 meters) (Wikipedia, 2016).

Figure 105 (left)
Jetty pool - plan

Figure 106 (right)
Dock, plan and sections - cross (top), lengthwise (bottom)
1:150

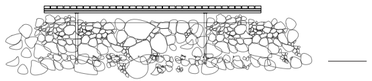


Figure 107
Jetty Pool Perspective

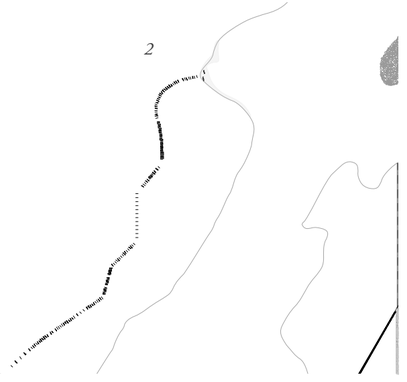
Wildflowers in forested habitats

Cyp Barboleta^ ripedium acuale (Moccasis flower/Lady's slipper - Late Spring*)*
Erythronium albidum (Trout lily - Spring*)*
Lysinachia borealis (Starflower/borage - Summer to early Autumn*)*
Caltha palustris (Marsh-marigold - Spring + Summer*)*
Vaccinium angustifolium (Low-bush blueberry - Late Spring to early Autumn*)*
Aquilegia canadensis (Canadian columbine - Late Spring - Early Summer*)*

Wildflowers in wet habitats (marshes and fens)

Pogonia ophioglossoides (Rose pogonia - Summer*)*
Sarracenia purpurea (Northern pitcher plant - Summer*)*
Nymphaea odorata (Fragrant white water lily - Summer*)*

Figure 107
Wildflower logging road section(s)- 1:50



2. Little Beach & Wildflower Road

From the jetty pool, one might glance curiously toward a lovely small beach just visible on the southwest shoreline. This little beach is an old access point to a logging camp that was decommissioned in the late 1960s. Remnants of machine relics are found half-submerged within the forest and an old logging road is barely still present, succeeded with native flowering plants. Seating on the beach and a new path surface has been defined, and follows the pre-existing roadway, articulated by 4 x 0.5 m slabs of inlaid polished basalt stone. The wildflowers are enhanced through careful seeding between the glossy stone. The path opens out onto Diamond Lake and continues to connect southward toward Lain Lake. This path that defines the western shore is not dotted by measurement instruments, rather it is simply meant to provide a gentle articulation in the land, guiding the way through the forest and engaging what is already there.

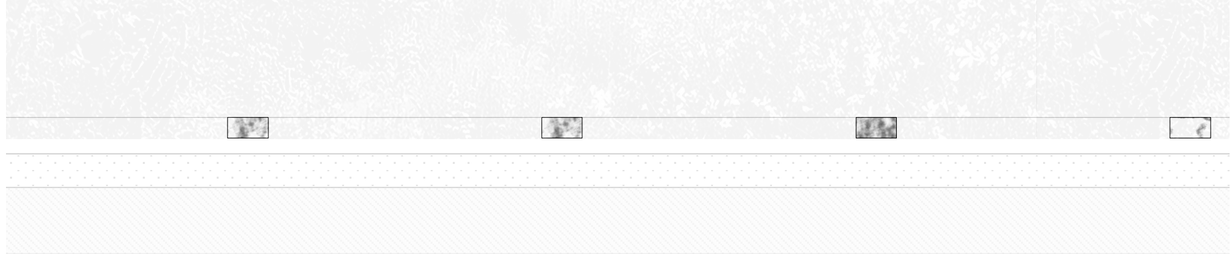
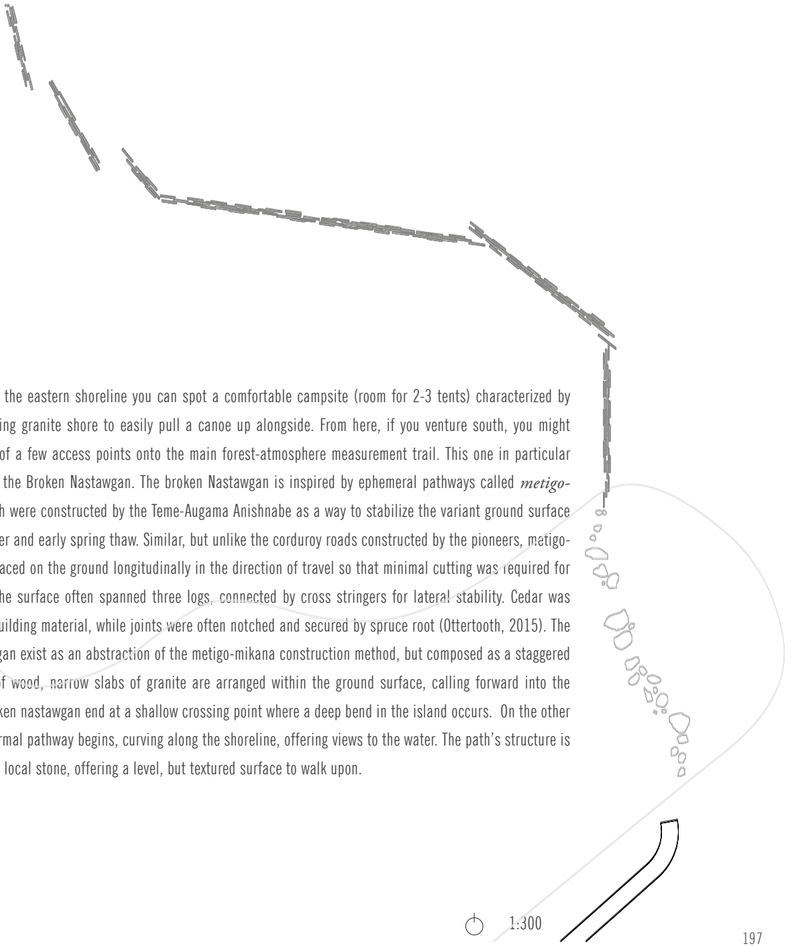


Figure 108 (left)
Broken Nastawgan - 1:25

3. Broken Nastawgan
(Metigo-mikana)

Looking toward the eastern shoreline you can spot a comfortable campsite (room for 2-3 tents) characterized by a smooth, sloping granite shore to easily pull a canoe up alongside. From here, if you venture south, you might encounter one of a few access points onto the main forest-atmosphere measurement trail. This one in particular is indicated by the Broken Nastawgan. The broken Nastawgan is inspired by ephemeral pathways called *metigo-mikana*, which were constructed by the Teme-Augama Anishnabe as a way to stabilize the variant ground surface during the winter and early spring thaw. Similar, but unlike the corduroy roads constructed by the pioneers, metigo-mikana were placed on the ground longitudinally in the direction of travel so that minimal cutting was required for construction. The surface often spanned three logs, connected by cross stringers for lateral stability. Cedar was the preferred building material, while joints were often notched and secured by spruce root (Ottertooth, 2015). The Broken Nastawgan exist as an abstraction of the metigo-mikana construction method, but composed as a staggered path. Instead of wood, narrow slabs of granite are arranged within the ground surface, calling forward into the woods. The broken nastawgan end at a shallow crossing point where a deep bend in the island occurs. On the other side, a more formal pathway begins, curving along the shoreline, offering views to the water. The path's structure is assembled with local stone, offering a level, but textured surface to walk upon.



1:300

Figure 109

Intersecting stone and wooden path -1:75

4. Intersecting paths

The intersecting path connects and offers a way into the forest from a second campsite located on the eastern shore of Diamond Lake. These campsites are marked within the Obabika River Park, but do not offer any amenities – they are simply characterized by level ground ideal for sleeping, cooking launching a canoe, and relaxing. The path intersects with a slightly elevated wooden path, which leads westward, or one may continue south to a narrow stream, where water catchment instrumentation is implemented. The Exchange of NO, NOx, O3, CO_2, and H_2O are measured through the soil at various depths in response to rainfall, snowfall, and temperature fluctuations.

The wooden path, which extends as a continuous diagonal line along the forest floor, draws the journey toward the 'Rooms of Forest Atmosphere'. Every the path ends for short a distance as important features in the land intersect the path's trajectory. Here, you may need to hop over an ancient fallen log or perhaps stumble upon a network of fine tubes (trace gas analyzers) woven into the forest floor, which measure aerosol emissions from ground level vegetation, before stepping back on the path again. As the path ends, one emerges onto gently sloping terraces that descend to overlook a dramatic drop at the edge of the land - a moment of rest.

Figure 110

Stone and wooden paths through the forest

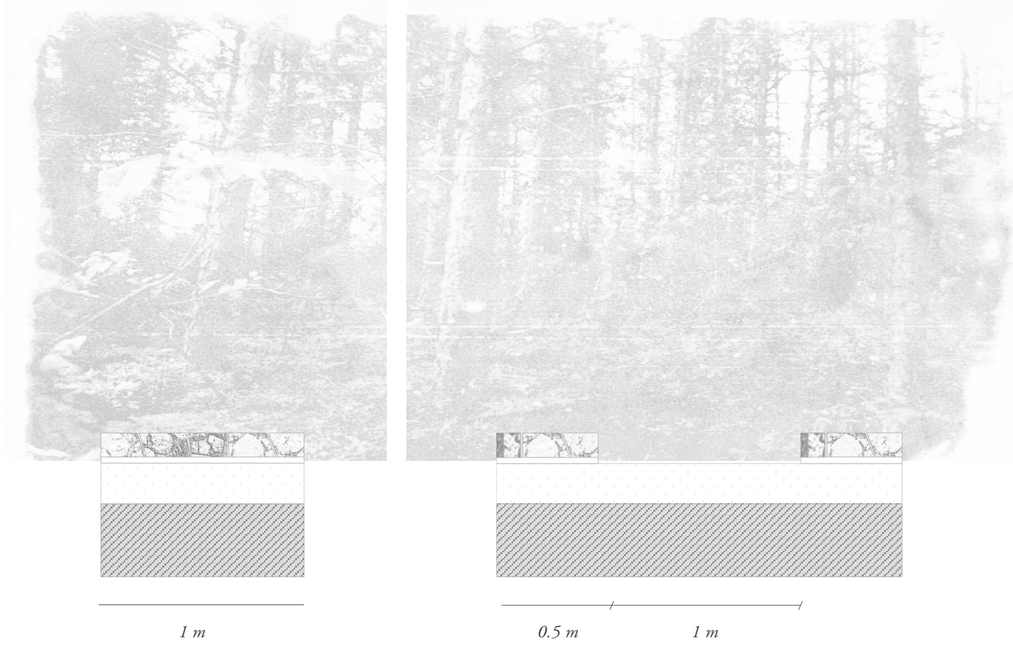
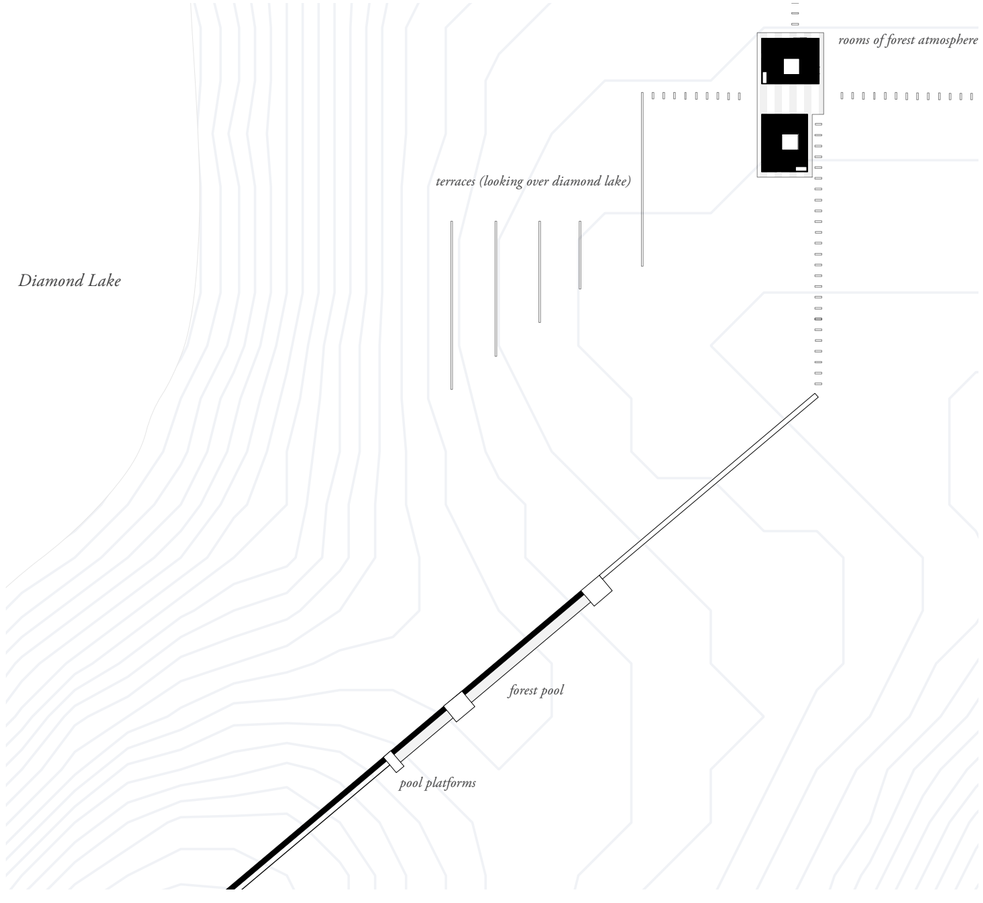


Figure 111

Stone path variations - Section(s) -1:25



1:200

Figure 112 (left)
Rooms of forest atmosphere and Forest pool

5. Rooms of Forest Atmosphere

The 'Rooms of Forest Atmosphere' are the only enclosed structures integrated into the forest sequence. Their function is two-fold: They act as the forest field station's main facilities, which accommodate field data collection, computation and analysis, as well as provide spaces for offices, small bedrooms, a kitchen, and showers and toilets for researchers on site. The spaces are organized around two central atriums, which open to the forest interior, but which also act as large scale trace gas analyzers, measuring gas exchanges within a much broader cubic area of forest air. Measurements are taken as small dynamic apertures within the ceiling structure open and close to allow air to escape or to be retained. When not actively measuring, the captured atmosphere of the forest interior within the atrium can be entered and sensed – an interior space, within the interior of the forest, which study the interior behaviors of the forest.

6. Forest pool

To the south lies a cool shallow forest pool, carved within the exposed rock surface. The terrain naturally slopes toward a depression in the land, and gathers water during periods of rain, providing a moment to refresh, have a quick picnic on the little stone platforms that extend over the narrow pool or dip your toes before continuing along the path.

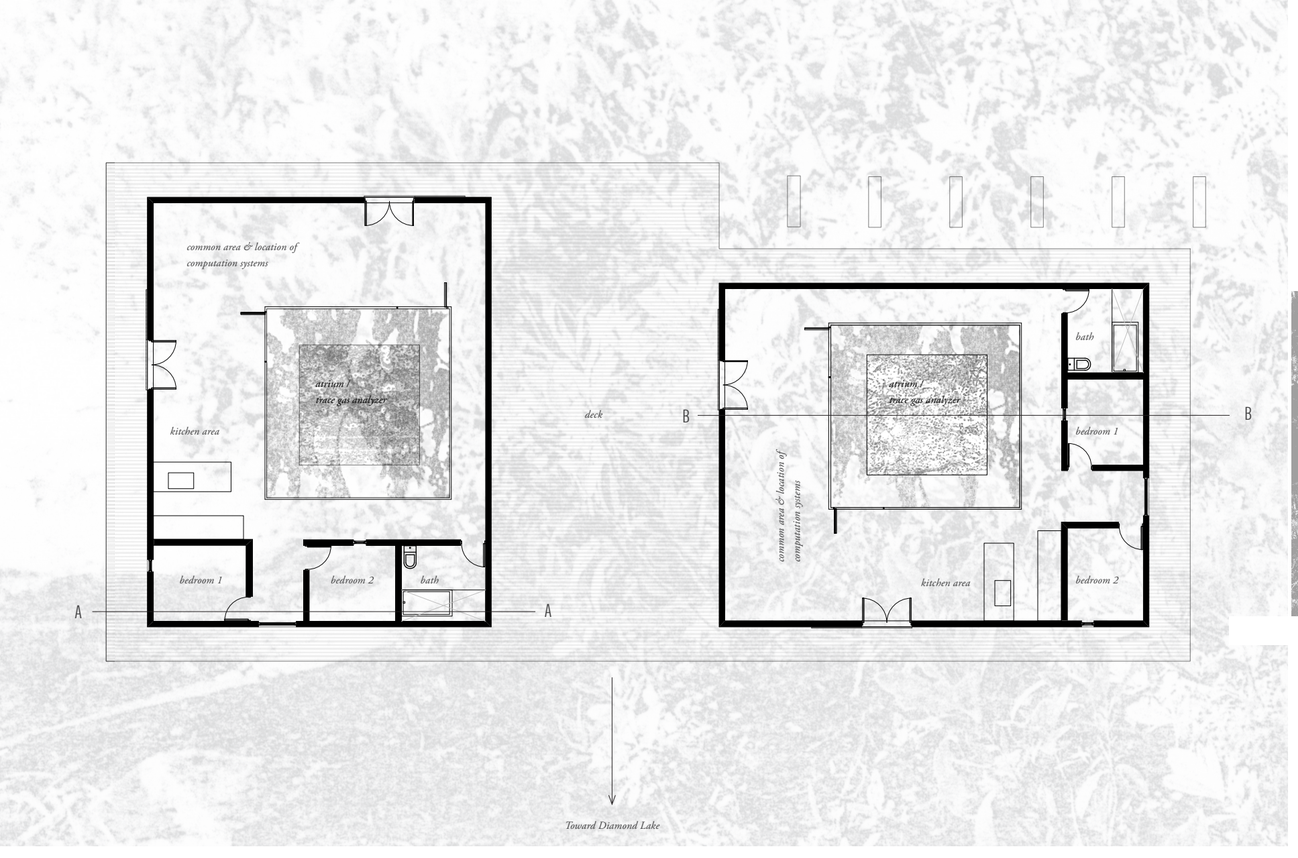
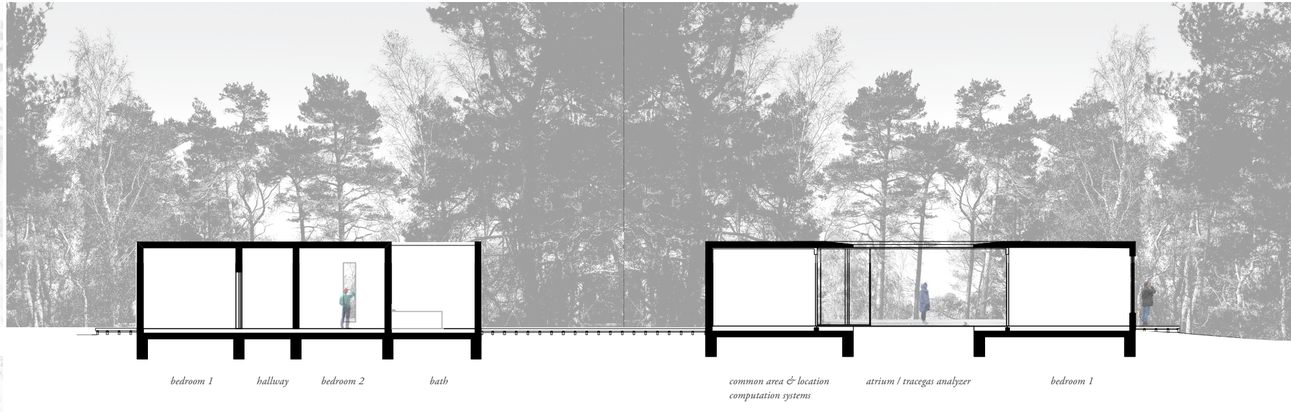


Figure 113
Rooms of Forest Atmosphere - Floor plan 1:200



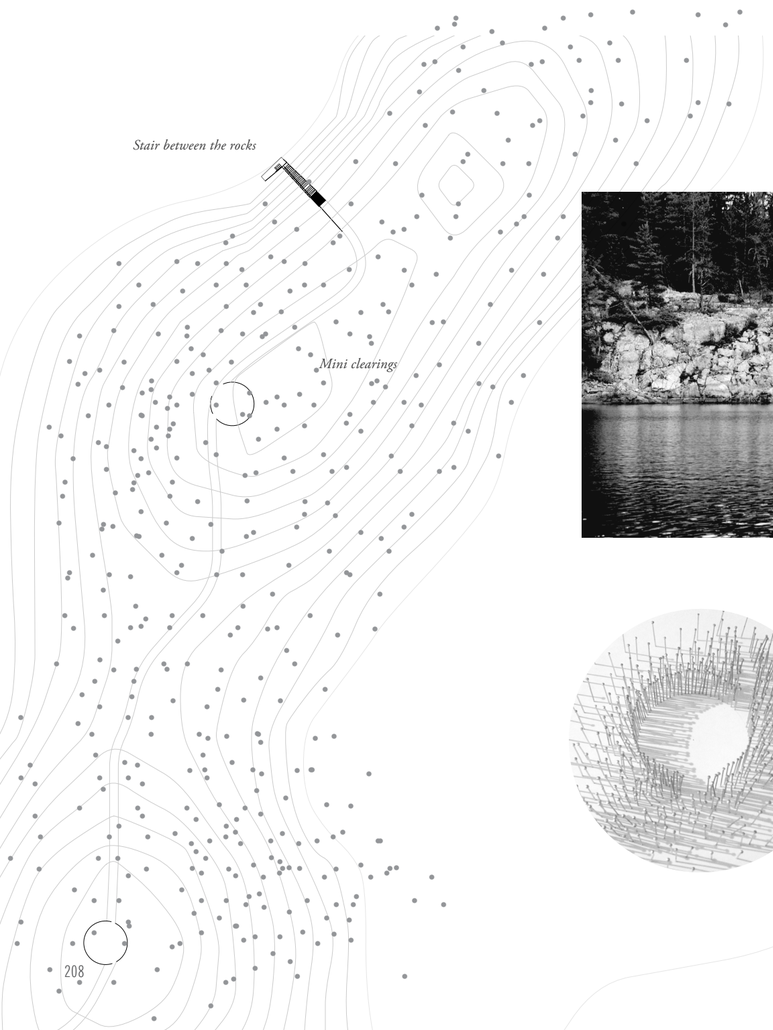
Section A-A 1:200

Section B-B 1:200

Figure 114
Rooms of forest atmosphere - Section(s)

Figure 115

Shallow forest pool. Section - 1:1000



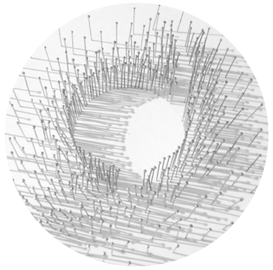
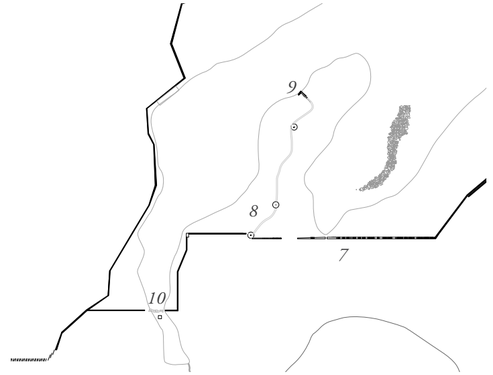


Figure 116
Mini clearings and Stair between the rocks. Plan - 1:200



7. The grand staircase

The grand staircase sweeps east to west along the site, extending a total length of (150 m) . Like the pool, the steps are carved out of the ground surface and built using cut stone found on site.

8. Mini clearings

Nearing the final steps of the staircase, a subtle path carved through the brush redirects northward - it opens onto an ordered clearing with a distinct perimeter outlined by smooth, natural wooden posts, which have retained indications of their branching structure. They form a penetrable screen that focuses the eye on an instrument that measures rain intensity. A carpet of rose pogonias (*Pogonia ophioglossoides)* speckles the clearing ground surface in pale pink throughout the summer.

9. Stairs between the rocks

Connected to this same path is the access to a hidden stair within the rocks – a natural separation in the cliff face at the shoreline. A narrow stair within the 1-meter wide space leads to a small platform on the surface of the water.

10. Stepping stones

Moving eastward, the path crosses the south end of Diamond Lake where the lake tapers into a marsh. The water is interspersed with large, dramatic boulders. For ease of crossing on foot, existing boulders have been rearranged and the surfaces have been minimally planed and textured to provide an obvious level path of stepping stones. This guides you across an existing portage trail that leads to crystal-clear Lain Lake. A small platform becomes a perfect place for a quick swim.

Figure 117
Separated rock,
South Diamond Lake
Temagami, Ontario
Figure 118
Mini clearings
and Pogonia ophioglossoid

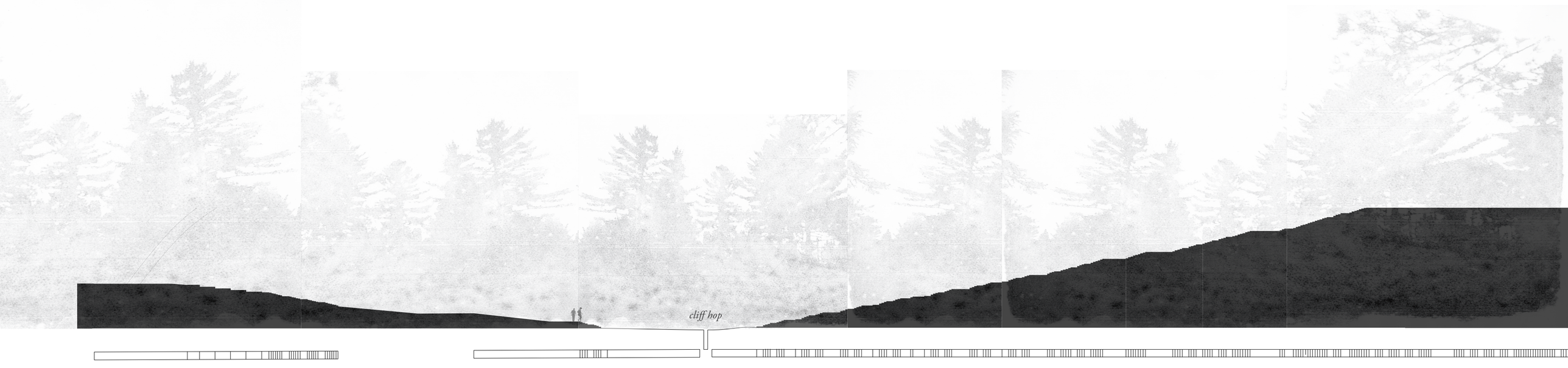


Figure 119

The Grand Stair Section - 1:600

Figure 120
Stepping stones and swimming platform at
Lain Lake Plan - 1:1200

Figure 121 (top right)
Marsh rocks,
Temagami, Ontario

Figure 122 (bottom right)
Carved Stones

12. Elevated path - Mid-canopy

The path that accesses the forest's mid canopy is constructed entirely of pine wood, and rises slightly (3 meters) above the forest floor. The materiality of the path moves away from the predominately rocky ground surface toward a much more wood-focused construction, as a conversation with the tree trunks and canopy as they begin to form the entirety of the space around the body.

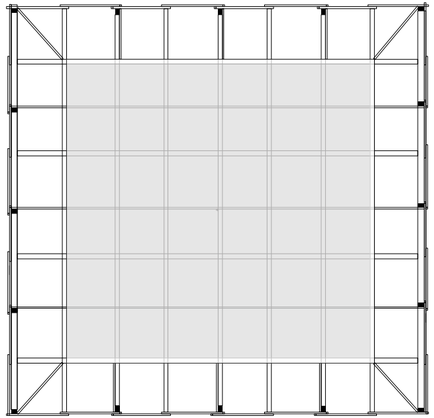
13. Elevated path - Canopy Walk

The path continues to reach upward to a maximum height of 9 m above the ground's surface, extending a significant distance south along the east edge of Pencil Lake, toward the beach at the mouth of Lake Wakimika.

Along the path, at eye level, the branches of the pine trees sparkle with small glass measuring devices - pine shoot cuvettes - which measure ambient temperature, sap flow, and the exchange of gases by pine shoots. These instruments are delicately encased around the branch tips; and each is lit with a small solar light that gently dances in the breeze. The tree tower - a scaffolding structure that measures aerosol formation high above the canopy is situated just east off the elevated walkway, standing 130 m tall.

Figure 123

Elevated path section - elevation 1:50



path width: 3 m

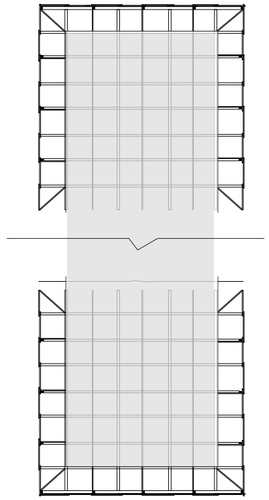


Figure 124

Plan - 1:50

Figure 125

Plan - 1:100

14. Wakimika Beach

This is the end and the beginning of the journey. The cedar lined, horseshoe -shaped beach acts as a peaceful threshold between the great, wide waters of Wakimika Lake and the narrow, gently curving shores of Pencil Lake. The canoe softly grazes the sandy bottom as you reach the north side of the beach. The shoreline is punctuated with natural enclaves within the cedars - some outfitted with conveniently arranged drift wood and carved stone seats, which provide a perfect place to lounge, have a snack, and listen to the calming buzz of the pines in the wind.

Figure 126
Looking south,
Wakimika beach,
Temagami, Ontario

Measurement Sites

1. Sonic Detection and Ranging
2. Water catchment area instrumentation
3. Trace gas sampling tubes
4. Trace gas analyzer and atrium
5. Rain intensity monitor
6. Pine shoot cuvettes
7. Tree tower

Figure 127 (right)
Measurement sites

Concluding thoughts

This project started as a response to Peter Zumthor's conception and description of architectural atmospheres. "What do we mean when we speak of architectural quality?" What do we mean when we speak to "the collective impression of physical and sensorial qualities" he asks.

Now, reflecting upon the work that has unfolded, I feel that the process of recognizing atmosphere from a landscape architectural lens does vary, but only slightly, from a purely architectural point of view. To the list of qualities that Zumthor has assembled *(The Body of Architecture, The Magic of the Real, Material Compatibility, The Sound of Space, The Temperature of a Space, Surrounding Objects, Between Composure and Seduction, Tension Between Interior and Exterior, Levels of Intimacy, The Light on Things, Architecture as Surroundings, Coherence, and The Beautiful Form),* I feel it is important to add a few subsequent categories, which are deserving of, but not exclusive to landscape and exterior environments. The ideas embedded in the added categories are not novel, but are actually beautifully engaged by many who practice landscape architecture. I would simply like to highlight approaches and conditions of thinking and seeing that make a landscape project so successful within the discussion of atmospheres.

I call the first *Phenomena and Event.* This category encourages a playful engagement and curiosity in natural phenomena on the part of the designer, as a way to guide the creation of spatial form and experience. This implies that form is created or influenced, to some degree, by natural processes. Atmosphere is addressed in this practicum through a response to the Temagami region of Ontario, and through the subtle suggestion of movements as a way to experience the phenomenon of cloud seeding by coniferous forests. The goal is not to make the participant completely aware of the intricacies of the phenomenon, but instead to help frame unexpected experiences and perspectives of the landscape, leaving room for ones own interpretations.

The second, *Rhythm and Repetition* is related to *Phenomenon and Event* but speaks more explicitly to cycles and patterns of movement. This is not limited to the movement and rhythms of the body in space, but considers how design might respond to the natural movements of the land caused by in the Earth's axis and relation to the sun, its rate of rotation and atmosphere – grand shifts such as the transition from night to day; season to season; the rolling-in and clearing of a storm. *Rhythms and Repetition* also acknowledges the deliberate repetition of elements, chosen materials, and curated sequences of movement through unbound space. In this way, designed features can be made legible across expansive scales. The application of repetition is (almost) necessary at the scale of a forest. Repetition cultivates familiarity, harmony and union between the participant, the constructed landscape and the natural landscape.

The third, *Aromatics and Space* is especially relevant to this work and fits nicely within the sensual categories highlighted by Zumthor (*The Sound of Space* and *The Temperature of Space)*. As mentioned in *Part 3: Atmospheres*, it has been scientifically acknowledged that certain organic aromatic compounds stimulate a physiological and emotive response in our brains. The scent of a pine forest is bound to our understanding of its space and atmosphere.

One last realization that I have taken away from this work, which has truly influenced my reading and making of landscape experiences – is an awareness of one's subconscious behavior in response to atmospheric settings. This asks that a designer addresses atmosphere through a hinting toward existing environmental features. Those who consider the science and affect of atmosphere in landscape architecture embrace the unpredictability of exterior settings and do not prescribe, but hint at opportunities for human action. Thus, a push toward choice and autonomy in the situations and moods we create is essential. This is simply asking the designer to listen to the body's inclinations, to sense the activity and variability of the world around us, and to express and enhance the sensible, yet unseen qualities of our environments through spatial intervention.

TEXT REFERENCES

Anderson, B 2009, 'Affective atmospheres', *Emotion, Space and Society*, vol. 2 no. 7781.

Baker, M.B & Peter, T 2008, 'Small-scale cloud processes and climate', *Nature Publishing Group*, vol.45, no. 7176, pp. 299-300. [3 April, 2015].

Benedito, S 2014, '*On landscape and atmosphere'*, GSD 02450 Course Outline Spring 2014, landscape architecture department, Harvard University, Cambridge, Massachusetts.

Bille, M., et al., 2014, 'Staging atmospheres: Materiality, culture, and the texture of the in-between', *Emotion, Space and Society*. Available from: <http://dx.doi.org/10.1016/j.emospa.2014.11.002>. [3 December, 2015].

Böhme G, 2013, *The art of the stage set as a paradigm for an aesthetics of atmosphere*. Available from: <http://ambiances.revues.org/315>. [4 February, 2015]

Böhme, G 2000, 'Atmosphere as the subject matter of architecture' in *Herzog & de Meuron: Natural history*, Lars Müller Publishers, pp. 398-407.

Böhme, G 1993, 'Atmosphere as the Fundamental Concept of a New Aesthetic'', *Thesis Eleven*, 36, pp. 113-114.

Bonan, G.B, Pollard, D., & Thompson, S.L 1992, 'Effects of boreal forest vegetation on global climate', *Nature*, vol. 359, pp. 716-718. Available from: <doi:10.1038/359716a0>. [1 November, 2015].

Borch, Christian (ed); Pallasmaa, Juhani; Elìasson, Òlafu; Walter de Gruyter & Co) 2015. *Architectural Atmospheres: On the experience and politics of architecture*, Birkhauser: Basel

Brandt, J.P 2009, 'The extent of the North American boreal zone', *Environmental Reviews*, vol.17, pp. 101–161 NRC Research Press doi:10.1139/A09-004.

Deming, E.M, Swaffield, S 2011, *Landscape architecture research: Inquiry, strategy, design*. John Wiley & Sons Inc, New Jersey.

Capsula [art, science, nature], 2014, available from: <https://00capsula00.wordpress.com/>. [2 February 2015]

Corajoud, M 2010, Le paysage, c'est l'endroit où le ciel et la terre se touchent, in '*Mort du paysage ? Philosophie et esthétique du paysage',* actes du colloque de Lyon, décembre 1981.

Dal Maso M et al. 2007, 'Aerosol size distribution measurements at four Nordic field stations: identification, analysis and trajectory analysis of new particle formation bursts', *Tellus B*, Journal Compilation C, vol.59, no.3, pp.350-361. European Supersites for Atmospheric Aerosol Research, date unknown, description of the SMEAR II field station in Hyytiälä, Finland. Available from: <http://www.eusaar.net/upload/SMEAR2.pdf>. [Accessed 15 June 2015].

Dettelbach, M 1999, 'The face of nature: Precise measurement, mapping, and sensibility in the work of Alexander von Humboldt', *Studies in History and Philosophy of Biological and Biomedical Sciences*, vol. 30, no. 4, pp. 473–504.

Endesor, T 2010, *Aurora Landscapes: Affective Atmospheres of Light and Dark*, UNSPECIFIED Ashgate Publishing. ISBN 978-1-4094-0186-5

Griffero, T 2014, *Atmospheres: Aesthetics of emotional spaces*, Ashgate Publishing, Burlington.

Hellström Reimer, M 2010, 'Unsettling eco-scapes: aesthetic performances for sustainable futures', *Journal of Landscape Architecture*, vol. 5, no. 1, pp. 24-37 DOI: 10.1080/18626033.2010.9723428.

Hill, J 2012, *Weather architecture*, Routledge, London and New York..

Ingold, T 2011 'Landscape or Weather-world', in *Being alive: Essays on movement, knowledge and description*, pp. 126-135. Available from: Taylor & Francis e-Library, Routledge, New York.

Intergovernmental Panel on Climate change 2016, Available from: <https://www.ipcc.ch/ipccreports/tar/wg1/172.htm>. [10 October 2015].

Juurola E et al. 2014, Knowledge transfer of climate-ecosystem-interactions between science and society – Introducing the climate whirl concept, *Boreal Environment Research*, vol. 19 (suppl. B), pp. 406-411. ISSN 1797- 2469

Kant, I 1781, *Critique of pure reason*, trans. J.M.D. Meiklejohn, The University of Adelaide, South Australia. Available from: eBooks@Adelaide, <http://ebooks.adelaide.edu.au/k/kant/immanuel/k16p/complete.html#section1>. [30 April, 2016]

Kulmala et al. 2000, 'Biogenic aerosol formation in the boreal forest', *Boreal Environment Research*, vol. 5, pp.281-297. [5 June, 2015].

Kulmala et al. 2001, 'Overview of the international project on biogenic aerosol formation in the boreal forest (BIOFOR)', *Tellus B*, vol. 53, pp. 324-343. [16 June, 2015].

Latour, B & Serres, M (eds) 1995, *Conversations on science, culture, and time*, trans. R. Lapidus, University of Michigan Press, Ann Arbor.

Lewis, S & Deavere S.A, 2014. LIVE from the New York Public Library, March 26th. Available from: <www.nypl.org/live Celeste Bartos Forum>. [15 August, 2015].

Menin S 2001, 'Fragments from the forest: Alto's requisitioning of forest place and matter', *The Journal of Architecture*, vol. 6, no. 3, pp. 279-305. Available from doi: 10.1080/13602360110061235. [10 June, 2016].

Miller Lane, B 2000, *National romanticism and modern architecture in Germany and the Scandinavian countries*, Cambridge University Press, United Kingdom.

Norberg-Schultz, C 1980, *Genius Loci. Towards a phenomenology of architecture*, Rizzoli International Publications Inc, New York.

Norberg-Schultz, C 1996, *Nightlands. Nordic building*, The MIT Press, Cambridge, Massachusetts.

O'Dowd C.D et al. 2002, 'Aerosol formation: Atmospheric particles from organic vapours', *Nature*, vol. 416. Available from: <www.nature.com> doi: 10.1038/416497a. [10 June 2015].

Pallasmaa, J, 2012. *Encounters 2, Architectural essays*. Ed. Peter MacKeith, Rakennustieto Publishing, Estonia.

Papova, M, 'Gaston Bachelard on the meditative magic of housework and how it increases the human dignity of everyday objects', 6 January, 2015, *Brainpickings: Blog*. Available from: <https://www.brainpickings.org/2015/06/01/gaston-bachelard-the-poetics-of-space-housework/>.[8 January, 2015].

Park BJ et al. 2010, 'The physiological effects of Shinrin-yoku (taking in the forest atmosphere or forest bathing): evidence from field experiments in 24 forests across Japan', *Environmental Health and Preventative Medicine*, vol. 15, pp. 18-26. Published online 2 May 2009. [14 May, 2016].

Parshall, L 2003, 'Motion and emotion in C.C.L. Hirschfeld's theory of garden art', in *Landscape design and the experience of motion*, ed. M Conan. Research Library and Collection Dumbarton Oaks, Washington, D.C, pp.35-51. [23 March 2016].

Perez-Gomez, A 1983, *Architecture and the crisis of modern science*, The MIT Press, Cambridge, Massachusetts & London, England.

Pèrez-Gomez, A 2016, *Attunment: Architectural meaning after the crisis of modern science*, MIT Press: Cambridge, Massachusetts; London, England.

Pierotti, R 2001, *Indigenous knowledge, ecology, and evolutionary biology*, Routledge: New York, London

Schultz, N 1996, *Nightlands: Nordic building*, The MIT Press, Cambridge, Massachusetts.

Quine, W.V.O, 1951, 'Two dogmas of empiricism', *The Philosophical Review*, vol.60, pp.20–43. Available from: <doi:10.2307/2181906>. [6 May, 2015]

Rannik, Ü et al. 2002, ;'Fluxes of carbon dioxide and water vapour over scots pine forest and clearing', *Agricultural and Forest Meteorology, vol.* 111, pp. 187–202. Available from doi: 10.1016/S0168-1923(02)00022-9.[15 June, 2015].

Reynolds, S 2007, 'A Goethean approach to science education', *Journal of curriculum and pedagogy*, vol. 4, no. 1, pp. 160-171. Available from: <doi:http://dx.doi.org/10.1080/15505170.2007.10411632>. [3 February 2014].

Seamon, D & Zajonc, A (eds) 1998, 'Goethe's way of science: A phenomenology of nature', in *Environmental and architectural phenomenology*, State University of New York Press, Albany, pp. 1-14. [3 February 2014].

Spracklen DV, Bonn B, & Carslaw KS 2008, 'Boreal forests, aerosols and the impacts on clouds and climate', *Philosophical Transactions of the Royal Society A*, vol. 366, pp. 4613-4626. Available from: http://rsta.royalsocietypublishing.org. [20 February, 2015].

Thomas, L 1983, *Late night thoughts on listening to Mahler's ninth symphony*, The Viking Press, New York.

United States Environmental Protection Agency 2016, Secondary organic aerosol (SOAs) research. Available from: <https://www.epa.gov/air-research/secondary-organic-aerosol-soas-research>. [10 October 2015].

University of British Columbia 2015, *Department of Atmospheric Science*, available from: <https://www.eoas.ubc.ca/academic/careers/atmospheric.html> Feb.23, 2016)

Treib, M, 2012, Reviewed Work: The manmade environment: Nya Nordiska landskap (New Nordic), *Journal of the society of architectural historians*, Vol. 71, No. 1, March 2012, pp. 127-129, University of California Press on behalf of the Society of Architectural Historians University of California Press. Available from: <http://www.jstor.org/stable/10.1525/jsah.2012.71.1.127>. [13 June, 2016]

Wilson, WA 1973, 'Herder, folklore and romantic nationalism', *Journal of popular culture*, vol. 6, no. 4, pp. 819– 835. Available from: <doi: 10.1111/j.0022-3840.1973.00819.x>. [10 June, 2016].

World weather and climate information 2016, Bordeaux, France. Available from: https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine [5 June 2016] .

Zumthor, P 2006, *Atmospheres*, Birkhauser, Basel, Switzerland.

FILM REFERENCES

An Architect in the Landscape 2009, (DVD) C-Side Productions, Geneva.

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Processed at The Belmonte Lab, Department of Biological Sciences, Faculty of Science, University of Manitoba

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Figure 47 , page 110 View above the canopy exhibiting a distinct haze. SMEAR II forest field station, Hyytiälä, Finland, summer.

Photograph by Juho Aalto, post-doctoral researcher. Hyytiälä Forestry Field Station/SMEAR II, University of Helsinki, Department of Physics.

Figure 48 , page 111 View above the canopy. Low winter clouds hover over the forest. SMEAR II forest field station, Hyytiälä, Finland, winter.

Photograph by Juho Aalto, post-doctoral researcher, Hyytiälä Forestry Field Station/SMEAR II, University of Helsinki, Department of Physics.

Figure 49 , page 112 Aerial image. Location of SMEAR II Forest Field Station, Hyytiälä, Finland
Google earth V 7.1.5.1557. (August, 4 2014). Hyytiälä, Finland. 61° 50' 43.62" N 24° 17' 49.01" E, Eye alt 3.93 km. Landsat/Copernicus 2016. http://www.earth.google.com [Accessed June 15, 2016]

Figure 50 , page 113 Figure ground map of cultural, educational and lodging facilities. SMEAR II Forest Field Station, Hyytiälä, Finland.
Adapted from: *Hyytiälä Guide Map*. http://www.helsinki.fi/hyytiala/EN%20buildings%20and%20roads.pdf. Available at: http://www.helsinki.fi/hyytiala/english/eng_aluekartta.html. [Accessed: April 2015].

All photographs of the II Forest Field Station site are taken by Juho Aalto, post-doctoral researcher, Hyytiälä Forestry Field Station/SMEAR II, University of Helsinki, Department of Physics, and are used with permission.

Figure 51 , page 114 Understory vegetation, SMEAR II forest field station, Hyytiälä, Finland.

Figure 52, page 114 Ground floor vegetation, SMEAR II forest field station, Hyytiälä, Finland

Figure 53 , page 115 ARG100 tipping bucket

Figure 54 , page 116 Soil Chamber

Figure 55 , page 116 Trace gas sampling tubes

Figure 56 , page 116 Hitu-Cottage / Aerosol Cottage

Figure 57 , page 117 Shoot Chamber

Figure 58, page 117 Tree Tower

Figure 59 , page 117 Eddy Covariance & Irradiance Tower

Figure 60 , page 117 Mast

Figure 61, page 118 Indications of elevated wooden pathways through the forest.

Figure 62 , page 118 Location of cultural spaces, lodging and educational facilities.

Figure 63 , page 120 Marsh and Fen landscapes near SMEAR II station.

Figure 64 , page 121 Measurements taken on the surface of a nearby lake.

Figure 65 , page 122 Measurement interfaces at the SMEAR II field station.[Diagram]. Created using Adobe Photoshop.
Postl, J., 2011, *Scots Pine, Helsinki, Finland.* [Photograph].

Figure 66 , page 124 Climatic feedback effects (including particle nucleation) between the boreal forest and the atmosphere. [Diagram]. Created in Adobe Illustrator.

Figure 67, page 126 Tealemetree. Art work by Agnes Meyer - Brandis in the Forest Field Station, Hyytiälä, Finland. [Photograph].
Meyer-Brandis, A., 2014. *Tea cup tools.* Available from Flickr Creative commons, https://www.flickr.com/photos/arselectronica/20116145751/. [Accessed June 2016].

Figure 68 , page 130 Circumpolar boreal forest region and arctic zone. [Map]. Created in QGIS.
GIS files: NAboreal (Natural Resources Canada. Canadian Forest Services), NCSDv2_circumpolar_WGS84 (Bolin Centre Database), gpr_oooalla_e (Boline Centre Database), cp_biozone_la_shp (Bolin Centre Database)

Figure 69, page 132 Circumpolar region and distribution of podzol soils in Canada (an indication of coniferous forest). [Map]. Created in QGIS and Adobe Illustrator.

GIS Files: ggd602_soils_canada (Land Information Ontario - OMNR), NCSCOv2_circumpolar_WGS84 (Bolin Centre Database), gpr_oooalla_e (Bolin Centre Database).

Figure 70, page 133 Distribution of *Pinus resinosa* and *Pinus strobus* within the North American boreal zone. [Map]. Created in QGIS and Adobe Illustrator.

GIS Files: prov_bound_ll, lakes_ll (CanVec. Ontario Geological Survey. Ontario Ministry of Northern Development and Mines Ontario Geological Survey), NAboreal (Natural Resources Canada. Canadian Forest Services), pinusresi (U.S. Geological Survey), pinustrb (U.S Geological Survey).

Figure 71 , page 134-135 Satellite image of northeastern Ontario (Temagami Lake region)

Nasa Worldview satellite. (April 25th, 2015) Ontario, Canada. 46.90550°, 80.0857°. Eye alt: 20 km. https://worldview.earthdata.nasa.gov/. [Accessed July 2016].

Figure 72, page 136 Temagami region watershed. [Map]. Created in QGIS and Adobe Illustrator

GIS Files: cdsm_dem_161017_233609 (Digital Elevation Model), drainage_ll, lakes_ll (Ontario Geological Survey. Ontario Ministry of Northern Development and Mines Ontario Geological Survey).

Figure 73, page 138 Stuctural Geology. Temagami and surrounding region. [Map]. Created in QGIS.

GIS Files: cdsm_dem_16107_233609 (Digital Elevation Model), lakes_ll, Dikes, Clines (Ontario Geological Survey. Ontario Ministry of Northern Development and Mines Ontario Geological Survey).

Figure 74 , page 140 Geology. Temagami and surrounding region. [Map]. Created in QGIS and Adobe Illustrator.

GIS Files: Lakes_ll, lines_ll, geology_ll (Ontario Geological Survey. Geological Compilation Series, Map 2443. http://www.geologyontario.mndmf.gov.on.ca/mndmfiles/pub/data/imaging/M2443/M2443.pdf. [Accessed May 2016].

Figures 75 , page 141 Intense rock fault movement along the shore of Diamond Lake, Temagami. [Photographs]

Figure 76, page 143 Land cover. Temagami and surrounding region. [Map]. Created in QGIS and Adobe Illustrator.

GIS File: z17-27class (Ontario Land Cover Database (2000), Ontario Ministry of Natural Resources). Available at: Spectranalysis Inc. 2004. Introduction to the Ontario Land Cover Data Base, Second Edition (2000): Outline of Production Methodology and Description of 27 Land Cover Classes.pdf. [Accessed May 2016].

Figure 77 , page 144 Dense coniferous and dense mixed forest. [Map]. Created in QGIS and Adobe Illustrator.

GIS File: z17-27class (Ontario Land Cover Database (2000), Ontario Ministry of Natural Resources). Available at: Spectranalysis Inc. 2004. Introduction to the Ontario Land Cover Data Base, Second Edition (2000): Outline of Production Methodology and Description of 27 Land Cover Classes.pdf. [Accessed May 2016].

Figure 78 , page 145 Dense deciduous and dense mixed forest. [Map]. Created in QGIS and Adobe Illustrator.

GIS File: z17-27class (Ontario Land Cover Database (2000), Ontario Ministry of Natural Resources). Available at: Spectranalysis Inc. 2004. Introduction to the Ontario Land Cover Data Base, Second Edition (2000): Outline of Production Methodology and Description of 27 Land Cover Classes.pdf. [Accessed May 2016].

Figure 79 , page 145 Forest clear-cuts and burns estimated at more than 10 years of age. [Map]. Created in QGIS and Adobe Illustrator.

GIS File: z17-27class (Ontario Land Cover Database (2000), Ontario Ministry of Natural Resources). Available at: Spectranalysis Inc. 2004. Introduction to the Ontario Land Cover Data Base, Second Edition (2000): Outline of Production Methodology and Description of 27 Land Cover Classes.pdf. [Accessed May 2016].

Figure 80 , page 146 Open and treed bog conditions. [Map]. Created in QGIS and Adobe Illustrator.

GIS File: z17-27class (Ontario Land Cover Database (2000), Ontario Ministry of Natural Resources). Available at: Spectranalysis Inc. 2004. Introduction to the Ontario Land Cover Data Base, Second Edition (2000): Outline of Production Methodology and Description of 27 Land Cover Classes.pdf. [Accessed May 2016].

Figure 81 , page 149 Mining. Temagami and surrounding region. [Map]. Created in QGIS and Adobe Illustrator.

GIS Files: geology_ll (Ontario Geological Survey. Ontario Ministry of Northern Development and Mines Ontario Geological Survey), MDI_2016_02_02 (Ontario Geological Survey 2016. Mineral Deposit Inventory; Ontario Geological Survey, Mineral Deposit Inventory (February 2016 update), online database. [Accessed May 2016]

Figure 82 , page 150 Extent of n'Daki Menan and ancestral hunting grounds. [Map]. Created in QGIS and Adobe Illustrator.

GIS Files: Lakes_ll, Drainage_ll ((Ontario Geological Survey. Ontario Ministry of Northern Development and Mines Ontario Geological Survey)

Adapted from: Speck, F.G. 1913. *Hunting Territories of Timagami band as described by second Chief of Timagami band Aleck Paul.* Available at: http://temagami.nativeweb.org/map-hunting-grounds.shtml. [Accessed February 2016].

Figure 83 , page 152 Current extent of n'Daki Menan (limited to Bear Island), and privately owned land and protected land. [Map]. Created in QGIS and Adobe Illustrator.
GIS Files: AL_TA_ON_2_65_eng (EPSG Geodetic Parameter Dataset), MNFR_ROAD_SEGMENT (Land Information Ontario, OMNR), NATURAL_HERITAGE_AREA (Land Information Ontario, OMNR), PATENT_LAND_EXTERNAL (Land Information Ontario, OMNR). [Accessed February 2016].

Figure 84, page 154 Location of the Temagami region within the context of Ontario and main route from Toronto, toward Temagami via Highway 11. [Map]. Created in QGIS and Adobe Illustrator.
GIS Files: ROADS600K, MAJORLAKES (Ontario Geological Survey. Ontario Ministry of Northern Development and Mines Ontario Geological Survey). [Accessed May 2016].
Vector map of Ontario. File: CA-ON-EPS-01-0001. Available at http://freevectormaps.com. [Accessed October 2015].

Figure 85 , page 156 Map showing distribution of Temagami's interconnected and outreaching system of lakes and streams. [Map]. Created in Adobe Illustrator.
Adapted from Google earth V 7.1.5.1557 image. Temagami, Ontario. Available at: http://www.earth.google.com. [Accessed June 15, 2016].

Figure 86, page 157 Map of traditional place names, adapted from Craig A. Macdonald's map of traditional routes and travel before the 1900s.
Macdonald, C., 1993. *Historical map of Temagami.* Available at http://www.ottertooth.com/Temagami/Maps/nastawgan/intro-nastaw.htm. [Accessed April 2016].

Figure 87, page 158 Location of the Obabika old growth forest and projected route before arriving in Temagami ('Obabika Loop'). [Map]. Created in Adobe Illustrator.

Figure 88 , page 159 The routes of travel on land and water adapted from Craig A. Macdonald's map of traditional routes and travel before the 1900s. [Map]. Created in Adobe Illustrator.
Macdonald, C., 1993. *Historical map of Temagami.* Available at http://www.ottertooth.com/Temagami/Maps/nastawgan/intro-nastaw.htm. [Accessed April 2016].

Figure 89, page 160 Map indicating the completed east-west trip route and portage lengths. [Created in Adobe Illustrator].

Figure 90 , page 162 White water lilies, Red Squirrel road, Temagami, Ontario. [Photograph].

Figure 91 , page 163 Sudden rain, Diamond Lake, Temagami, Ontario. [Photograph].

Figure 92, page 164 Line of rocks, Diamond Lake,Temagami, Ontario. [Photograph].

Figure 93, page 166 Heading south. Portage between Diamond Lake and Lain Lake, Temagami, Ontario. [Photograph].

Figure 94, page 168 Portage access at north end of Pencil Lake, Temagami, Ontario. [Photograph].

Figure 95 , page 169 View along the beach at the north edge of Obabika Lake, Temagami, Ontario. [Photograph].

Figure 96, page 170 Terrain, Diamond Lake, Temagami Ontario. [Photograph].

Figure 97, page 172 Looking west down Red Squirrel road July/August, Temagami, Ontario. [Photograph].

Figure 98, page 174 The last night's sky, Ferguson Bay, Temagami, Ontario. [Photograph].

Figure 99, page 176 Ground cover, Diamond Lake, Temagami, Ontario. [Photograph].

Figure 100, page 178 Satellite image over northeastern Temagami, and contextual focus for a landscape intervention. [Map]. [Created in Adobe Illustrator and Adobe Photoshop].
Google earth V 7.1.5.1557.(August 16, 2003) Temagami, Ontario. 47°09'30.09" N, 80°14'01.97" W, Eye alt. 18.3 km.Digital Globe, Cnes/Spot Image 2016. Available at: http://www.earth.google.com [Accessed June 18, 2016]

Figure 102, page 182 A natural path revealed, Diamond Lake, Temagami, Ontario. [Acetone transfer of photograph].

Figure 103, page 185 Site plan indicating extent of the path through the forest. [Map]. Created in Vectorworks and Adobe Photoshop.

Figure 104, page 186-189 Site plan indicating location of 'movements' along the path. [Map]. Created in Vectorworks

Figure 105 , page 190 Plan projection of the Broken Nastawgan. Created in Vectorworks and Adobe Photoshop.

Figure 106 , page 191 Dock, plan and section. Created in Vectorworks.

Figure 106 , page 192-193 Jetty Pool perspective. Created in Vectorworks and Adobe Photoshop.

Figure 107, page 194-195 Plan projection of Intersecting stone and wood paths. Created in Vectorworks and Adobe Photoshop.

Figure 108, page 196-197 Broken Nastawgan plan 1:25 and 1:300. Created in Vectorworks and Adobe Photoshop.

Figure 109, page 198 Intersecting stone and wood path. Created in Vectorworks and Adobe Photoshop.

Figure 110 , page 200 Stone and wood paths through the forest perspective. Created in Adobe Photoshop.

Figure 111, page 201 Sections of Stone path variations. Created in Vectorworks and Adobe Photoshop.

Figure 112, page 202 Plan projection of Rooms of forest atmosphere and Forest pool. Created in Vectorworks and Adobe Photoshop.

Figure 113 , page 204 Floor plan of Rooms of forest atmosphere. Created in Vectorworks and Adobe Photoshop.

Figure 114, page 205 Sections of Rooms of forest atmosphere. Created in Vectorworks and Adobe Photoshop.

Figure 115 , page 206 Section of Shallow forest pool. Created in Vectorworks and Adobe Photoshop.

Figure 116 , page 208 Plan of Mini clearings and Stair between the rocks.

Figure 117, page 209 Separated rock, South Diamond Lake. Temagami, Ontario. [Photograph].

Figure 118, page 209 Mini clearings and Pogonia *ophioglossoid*. Created in Adobe Photoshop.

Figure 119 , page 210 The grand stair section. Created in Vectorworks and Adobe Photoshop.

Figure 120 , page 212 Stepping stones and swimming platform at Lain Lake Plan. Created in Vectorworks.

Figure 121, page 213 Marsh rocks, Temagami, Ontario. [Photograph].

Figure 122, page 213 Carved Stones. [Photograph].
Humphreys, C., & Moller, T., 2014, *Unveiling the landscape*, Hatje Cantz.

Figure 123, page 214 Elevated path section - elevation. Created in Vectorworks and Adobe Photoshop.

Figure 124 , page 215 Plan projection of Elevated path - 1:50. Created in Vectorworks.

Figure 125, page 215 Plan projection of Elevated path 1:100. Created in Vectorworks.

Figure 126 , page 216 Looking south, Wakimika beach, Temagami, Ontario. [Photography].

Figure 127 , page 217 Measurement sites - plan. Created in Vectorworks and Adobe InDesign.