Degree project in Urban Planning and Design
Second cycle 30 credits

Interdependence of resources
Re-establish the connections between local communities and local ecologies

MARIA ANDERSSON
The demand for natural resources is increasing, leading to more and more exploitations in northern Sweden. This project is situated in the region of Norrbotten, which is currently undergoing significant transformations due to the continued mining activity, energy production, and forestry. These activities are eating, destroying, and disrupting large areas in the region. In addition, little of the resources produced from these activities benefit the communities.

This project challenges the dominant narrative of ‘green development’, stating that the exploitations in the north are not sustainable or just. This project puts forward an alternative future scenario, one where Sweden is based on a distributed, decentralized structure, and the mining activity and expansion of energy production have stopped. Due to its problematic impact on ecosystems and the Sami culture and the industry’s extensive energy consumption and the implementation of a new distributed power system within the decentralized state, has further contributed to its closure. This thesis aims to provide strategies for a more self-sufficient, interdependent region where the connection between local communities and local ecologies is re-established.
The production is mostly happening in the northern Sweden whereas the consumption happens in the southern Sweden. At a regional level, almost all energy is consumed within the mining industry.

The decisions about exploiting Norrbotten are being taken from a national and global level and few national bodies are located in Norrbotten. Most of the money from exporting resources goes to the state and private companies are mostly operating from southern Sweden or elsewhere in the world and only a small portion of the extracted resources is reinvested in local communities. These extracted resources constitute a significant portion of Sweden’s economy which is based on a centralized state with a top-down, decision-making structure.
The lichen disappears

Lichen is an important plant for reindeer herding which can constitute up to 80% of the winter diet for reindeer. Reindeer herding in this region requires nature-based and not rely on supplement feeding. It's crucial for the herding industry. The 15% decline of lichen is mainly due to a decrease of > 60 year old, open pine forest. Forestry can have a significant role in reversing the trend and improving ground lichen conditions.

Large-scale logging, intensive reforestation efforts and the suppression of forest fires have resulted in a decline in lichen communities, and these successional stands to new productive sites, which are important habitats for ground lichens. Such stands have instead been replaced by dense, managed forests that favor mosses at the expense of lichens. Both temperature and precipitation have increased over the last decades and may potentially influence the abundance of ground lichens. Removal of cutting residues can have a positive effect on lichen because of reduced shading and fertilizing effects of the residues.

The impact of forestry

Lichen grows on the ground and on trees. Sparse forest where sunlight can hit the ground and the lichen can grow. One reindeer eats around 3 kg lichen/day.

Deforestation and land preparation leads to lichen ending up underground. When wood cutting occurs the lichen that grows on the trees disappears.

Removing lichen from the ground prevents sunlight from reaching the ground which prevents lichen from growing. Lichen grows 1-7 mm/year.
Local seasonal ecologies

Unpredictable climate

Norrbotten is vulnerable due to its geographical and climatic disadvantage and has resulted in that almost 83% of the food is imported from Europe and what is mainly grown in present time is grain and animal feed. Due to the emission scenario RCP4.5, with an increase in temperature and precipitation, the future climate is unpredictable and can affect which ecologies will and will not be present in the future in the region.

Many of these ecologies are found in the region right now, except for algae’s and mussels and their functions can benefit the ecosystem in the water by purifying bacteria on which they feed. The increase in temperature can benefit mussel cultivation, algae cultivation and extend the season for agriculture but the increase in temperature may disadvantage the growth of lichen.

In order to promote localized production and consumption within the Norrbotten region that is not reliant on Europe, these existing and extended ecologies have been grouped into three landscape types: water, agriculture, and forest. These ecologies exhibit distinct seasonal conditions and are widely spread out in the region, which contributes to the creation of a resilient region that is not solely dependent on one single resource. Each ecology necessitates unique management practices, influenced by both the season and specific attributes.
Pressure on the Sami landscape

1500 B.C
Wild reindeer migrated into northern Sweden
Sami began tending reindeer

800 A.D
Sami families hunted and fished within a certain area
Villages began trading with Sami

14th century
Farmer settled along the coast and traded with Sami
In 1290, the church college was built
The crown started exporting from the north
Settlers were given full ownership of land

17th century
Lapland villages moved closer to the sea
Sami received fishing and hunting rights

18th century
Mining started in Bildenen
Lapland borders are introduced to protect Sami from other industries

19th century
Railway to Gällivare is built
The mining develops
Agricultural border is introduced to protect Sami from other industries

20th century
Narvik - harbor and city are being built
New mining in Kiruna
The first hydropower plant and wind turbines are built
Railway between Narvik and Gällivare is built

21st century
New land drilling shows that there are other minerals and the existing mining resources are exhausted until the year 2008
New wind turbines and high-power plants are being planned
This project is situated in a scenario where Sweden is based on a distributed decentralized state which is used as a hypothesis to examine the consequences of such a scenario. By the year 2060, the mining industry has been forced to shut down due to its problematic impact on ecosystems and the Sami culture. Additionally, the industry’s extensive energy consumption and the implementation of a new distributed power system within the decentralized state, has further contributed to its closure.

These mining landscapes of 2060 have now become accessible to the public, serving as a reminder of the cities’ mining history and an essential part of their identities. These landscapes have transformed into public platforms, utilizing the physical presence of the mines as educational tools to address history and foster public discussion about land exploitation. In areas where reindeer herding takes place, efforts have been made to restore the natural environment.

Due to the closure of the mining industry, the extraction of resources like iron ore has stopped, leading to reduced production and energy consumption. Energy production is now limited and primarily produced within communities for local consumption. The main source of energy comes from bioenergy derived from residual products of local ecologies.

In terms of resource ownership, the landscapes no longer belong to the state or private companies. Instead, they are managed as commons, no ownership and instead shared by the community. The resources are managed by the commoners at the community scale, where the landscape has been distributed at the regional scale. At this level, the commoners negotiate and renegotiate rules regarding boundaries, usage forms, interaction, and penalties for breaking the rules. Each community is responsible for its own commonalities, and people voluntarily participate within the different communities. The different communities are responsible for mobility sharing, seasonal productive centers, and trade relations. Conflicts that arise is primarily handled among the different communities but can also be received at the regional level.

At the regional scale, the organization Sametinget, Sami commoners, and the politicians within the municipalities in the region represent the people and have responsibility and manage the overall landscape in the region. They make the big decisions, such as the distribution of resources among different communities and clearly defined boundaries. People can participate in this decision-making process through their respective community.

To generate a self-organized system it is important to have design principles like participation, conflict resolution and clearly defined boundaries. The project understands the practices of Sami culture and the value of local ecologies in the region to derive solutions. By building on nomadic practice and utilizing the land like the Sami community, this project generates resilient, productive landscapes.
Ecology rotation in productive centers

Temporary

The different qualities of seasons have guided Sami communities, who relocate and temporarily leave behind before the resources have been completely exploited. This approach allows the ecosystem to regenerate in cyclical manner, ensuring continued resource production from the land. To be able to generate a local production and produce the ecologies, three different productive centers are proposed based on the three different landscape types: water, agriculture, and forest.

Based on the idea of crop rotation, which is the practice of planting different crops on the same plot to enhance soil fertility, this project applies a similar principle to produce ecologies. By utilizing the same plot of land for different ecologies during a specific time periods, the extraction of resources is limited, preventing soil and ecosystem degradation. Additionally, by activating the specific ecology only during its corresponding season, other activities such as reindeer herding can utilize the same plot of land.

Water centers [W]

Activity time in center

![Water activities]

Activities

- Fishing
- Mussel farming
- Algae farming

Agriculture centers [A]

Activity time in center

![Agriculture activities]

Activities

- Reindeer herding
- Plant
- Smelt
- Harvest
- Excavating

Forest centers [F]

Activity time in center

![Forest activities]

Activities

- Wood cutting
- Bunting
- Reindeer herding
- Replant lichen
- Picking

Temporality

The different qualities of seasons have guided Sami communities, who relocate and temporarily leave behind before the resources have been completely exploited. This approach allows the ecosystem to regenerate in cyclical manner, ensuring continued resource production from the land. To be able to generate a local production and produce the ecologies, three different productive centers are proposed based on the three different landscape types: water, agriculture, and forest.

Based on the idea of crop rotation, which is the practice of planting different crops on the same plot to enhance soil fertility, this project applies a similar principle to produce ecologies. By utilizing the same plot of land for different ecologies during a specific time periods, the extraction of resources is limited, preventing soil and ecosystem degradation. Additionally, by activating the specific ecology only during its corresponding season, other activities such as reindeer herding can utilize the same plot of land.
To be able to not extract all the resources in one area, portable structures are moved around and assembled and disassembled.

The only fixed structure in the seasonal productive centers is the underground storage. The temperature underground means that the fridge does not need energy and the freezer is cooled by ice collected from the sea.

Transport of ecologies

**Seasonal productive centers**

**Water centers [W]**
- Summer/Fall
  - Mussels must be transported on ice
  - Dried algae
  - Dried fish needs cold
  - Butchered moose and reindeer

**Agricultural centers [A]**
- Winter/Spring
  - Cultivated fruits and vegetables
  - Pickled berries and mushrooms
  - Firewood and wood

**Forest centers [F]**
- Any year
  - Dried algae
  - Dried fish
  - Butchered moose and reindeer
Network of productive centers

Legend

The ecological forest is the forest within reindeer winter grazing land. To be able to favor the ecosystem in the forest, which, among other things, is the lichen, these forest areas are only thinned out of young trees that prevents sunlight from hitting the ground. For the network of productive centers to work, productive forest is planted within the city. This resource is important to produce portable structures and energy.

The seasonal productive centers don’t function by themselves, within the city there is functions with fixed structures like bioenergy plant, recycling station, composting, storage, cooling and sailing market, prepare and package and manufacturing. These structures are mostly using existing buildings in the cities.

Circular recycling system

This project focusing on going from global productive landscapes to local productive landscapes by changing the flow of resources to benefit local communities, and to generate that on a regional scale, the seasonal seasonal centers are distributed based on the location of the city within three distinct landscapes. The railway system functions as a transition for these ecologies and other services as a place for exchange. Stations along the railway are strategically placed according to the specific landscape they are situated in. This network facilitates the trade of resources as it is based on the principles of commons and resource sharing. Based on the modes of transportation, a 30 kilometer radius from the city and station indicates where the production could possibly happen.

Distance from city

Modes of transport

Summer/Fall

Winter/Spring
Productive centers in cities

Local distribution of seasonal centers - agriculture & water

Existing
- Agricultural land
- Reindeer winter grazing land/forest
- Water
- Primary roads (bus, bike, squad bike)
- Snowmobile trail

Proposed
- Agricultural land
- Station
- Seasonal centres
- Structures for seasonal centres

Local distribution of seasonal centers - forest & water

Existing
- Rainbow groving land/forest
- Important pasture land
- Rut land
- Water
- Primary roads (bus, bike, squad bike)

Proposed
- Station
- Seasonal centres
- Structures for seasonal centres
- Production forest
- Restore nature for reindeer herding

Co-production in Spring

1. Seasonal center water
2. Seasonal center agriculture
3. Station and transportation rental
4. Recycling station
5. Bioenergy plant
6. Cooking and eating market
7. Prepare and package ecologies
8. Storage
9. Manufacturing

Co-production in Fall

1. Seasonal center forest
2. Cooking and eating market
3. Station and transportation rental
4. Recycling station
5. Manufacturing
6. Bioenergy plant
7. Prepare and package ecologies
8. Storage
9. Production forest

Co-production in Winter

1. Seasonal center forest
2. Seasonal center water
3. Station and transportation rental
4. Recycling station
5. Storage
6. Cooking and eating market
7. Prepare and package ecologies
8. Manufacturing
9. Production forest

Existing
- Reindeer winter grazing land/forest
- Important pasture land
- Rut land
- Water
- Primary roads (bus, bike, squad bike)
- Snowmobile trail

Proposed
- Station
- Seasonal centres
- Structures for seasonal centres
- Production forest
- Restore nature for reindeer herding

Acknowledge the city’s mining history and let nature take over
Initial title: **Self-sufficient Norrbotten**

The impact of green development on Norrbotten and exploration of an alternative future scenario

Degree project Booklet

Maria Andersson
Degree project in Urban Planning and Design
Master’s Programme Sustainable Urban Planning and Design
KTH School of Architecture and Built Environment
January 2023
Introduction

Northern Scandinavia was for several thousand years sparsely populated and had limited contact with the southern parts of Scandinavia. The Sami community was a majority, but in the 14th century, the crown claimed rights to areas north of Hälsingland. Colonization increased due to the extraction of natural resources, including silver, iron ore, hydropower, and forest. The land-use change, through natural resource extraction, has had significant ecological, social and cultural impacts on indigenous communities. Indigenous rights, cultural practices, and identities are strongly intertwined with traditional lands. The cumulative effects of natural resource extraction are especially problematic for Sámi reindeer herding.

Presently, Sweden is one of the leading producers of ores and metals in the European Union. Ninety percent of all iron ore mined within the EU comes from Sweden. The industry provides employment for many people and is one of the main industries in some towns, such as Luleå, Kiruna and Gällivare. The steel industry employs 2.8% of the workforce in Luleå, 18% in Kiruna and 13% in Gällivare.

Over the past centuries, the pursuit of materials has shaped cities, landscapes, and modern lifestyles, regulating the way people live in both helpful and hazardous ways. The exploitation of raw materials have permanently shifted the earth. In Sweden, there are ongoing debates about new mining sites, as the demand is increasing, but also about the expansion of existing. The North of Sweden is undergoing a “green revolution”, characterized by new exploitations taking place.

Site

The three major cities in the region of Norrbotten, Luleå, Gällivare and Kiruna, have been built to generate the large-scale exploitation. This project focuses on these cities but with a holistic approach for the whole region.

Luleå, with a population of 78,000 people, is one of northern Sweden’s industrial cities. It thrived in the 1880s due to the steel and shipping industries, which have significantly shaped the city. During that time, a railway system was built to connect the mining operations in Kiruna and Gällivare, enabling the transportation of iron ore to Luleå for steel production and subsequent export.

Gällivare has a history dating back to the 1690s when the first iron ore discovery was made. In 1735, the first test drilling took place, and the area was primarily inhabited by the Sámi community. In the 1880s, the railway system was extended to Gällivare, leading to the city’s growth. Today, approximately 17,000 people live there. Due to the expansion of mining activities, certain parts of the city have been relocated.

Kiruna has been home to Sami communities for a significant period. The first miners arrived in the early 17th century, marking the beginning of the first mining era. However, it was not until the mid-1880s that the first test drilling occurred and the first ore train departed from the city. Presently, iron ore mining continues, resulting in the ongoing relocation of the city. Moreover, recent discoveries of rare metals have been made. The current population of Kiruna is 22,000 people.
Globally, iron ore is the most extracted natural resource, and the demand continues to increase. Iron ore is used to produce steel which is mainly used for buildings, vehicles, and infrastructure. However, the ongoing extraction of iron ore affects and disrupts the ecology, industry, and systems consisting within Indigenous communities. The industry releases carbon dioxide emissions, mainly from steel production. Additionally, both mining and processing of minerals release chemicals into the environment, posing a risk of leaching pollution into both lakes and groundwater.

It is important to assess whether the mining landscape is developing sustainably, considering both natural and social ecologies, along with economic systems. Will there be an end to resource extraction, or will it continue at the expense of what?

From a green growth perspective, continued economic growth is often presented as a prerequisite for sustainable development. Growth is seen as a premise for being able to engage in sustainability, either in terms of tax revenue in municipalities, or profits for businesses to be able to research and develop new approaches and be incentivized to innovate (Hagbert et al. 2020; Hagbert et al. 2021).

Hybrit is a new industrial facility, going to be situated in Gällivare, that aims to produce steel without coal, reducing carbon dioxide emissions and aligning with the principles of green growth. However, this facility still requires iron ore and electricity for production. Are there alternative futures for these cities that do not rely on growth and resource extraction?

Today, some industrial cities are facing the challenge of transformation. The northern Sweden, rich with mining and metals, but geographically and climatically disadvantaged, is particularly struggling with such transformation. How could a transformation without steel industry look like in this region?

I’m challenging the current model of urbanization which is dependent on globalization. My standpoint for sustainability is based on a degrowth society which means downscaling of production and consumption that increases human well-being and enhances ecological conditions at the local and global level, in the short and long term (Xue 2021). From this standpoint the project should result in a strategy that is more connected to the local territories with new forms of production and consumption.

The project takes place in a post-mining era where I assume that Hybrit has been developed and is in use until the year 2040. Between 2040 and 2050 steel is being phased out and instead recycled and reused. In the year 2050 I assume that there are no more extraction of iron ore and production of steel, but the existing material is being recycled and reused.

What could a future sustainable society that is not based on economic growth be like?

How can a more localized and circular urban transformation take place in traditional industrial cities in a post-mining era?

How could Norrbotten become a self-sufficient region without global export and colonialization of the north?

What does a post-mining era mean for these cities and the people living there?
Method

Research

Literature Review: Continue read the articles to understand urbanization and the green revolution. Continue accumulate a theoretical standpoint so that I could use it as my main approach for my project.

Site visit: Visit Kiruna, Gällivare, and Luleå to understand the regional territory and to map a selection of elements in the region.

Historical research (timeline): To understand how this region has developed over time and how these cities has developed and changed over time.

Extract tools from literature and reference projects: By reading articles and study reference projects I will extract tools which I can use for my concept and strategy.

Analysis

Mapping 1 Large scale: The whole region - Industries, infrastructure, food production, economy of forest, hydropower, quarries, building and natural environments.

Mapping 2 Medium scale: Each of these cities in a city scale including urban patterns and collective spaces and compare historical maps.

Mapping 3 Small scale: Each of these cities, map places, people, lifestyles, and activities.

Actors: Map important actors in each of these cities (organizations, associations, workplaces, Sámi communities)

Data collection: population, income, education, export and import, employment etc.

Design

Concepts: Based on research and analysis develop a concept.

Strategy: Deriving from the concept define a strategy for the design part.

Three main steps for my project

• Analyse the existing physical, social, and economic characteristics of Kiruna, Gällivare, and Luleå and question the current model of urbanization which is dependent on globalization.

• Using contemporary urban theories as my standpoint for sustainability.

• Propose alternate strategies for a localized horizontal relation among territories and people in Norrbotten.

Timeline

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Site visit</td>
<td>Literature Review</td>
<td>Site Analysis</td>
<td>Concept &amp; strategies</td>
<td>Design Ideas</td>
<td>Design Development</td>
<td>Drawing Development</td>
<td>Final Drawings</td>
<td>Presentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Projects

Industrial linear city N.A. Milyutin

A model of a uniform spatial network of settling that would provide the most favorable living conditions in any cell regardless of its location. It was a response to the problem of inequality of centre–periphery relations inherent to the urbanized world. The model is based on parallel strips of industry, transportation, and residence, separated by buffer zones of vegetation. Schools and public buildings would be in the residential zone. From this model, I will extract applicable tools for my concept and strategy.

Shougang Industrial Regeneration Project, Beijing

A regeneration project of a heavy steel industry. The project is a balance between the retention of collective memories of the site’s old function and the reinvigoration of the site in response to contemporary demands. I will use this reference to extract applicable tools on how to use old industrial facilities and land to keep the identity and the memories of the place.

Of Public Interest (OPI), Gällivare

A project situated in Gällivare, where they investigate the notion of soil and the different conflicts that arise around soil. They specifically focus on the landscapes of mining extraction and how these landscapes play a role in the society. From this project, I will extract ideas and tools in which I can use for my concept.

The Sámi Architecture Library, Girjegumpi, Joar Nango

Girjegumpi is a nomadic, living design project that highlights the importance of indigenous knowledge in today’s conversation about architecture. Working collaboratively, building techniques, the use of natural resources in a rapidly parental climate, the use of local materials in the process and a respectful approach to the landscape and nature. From this project, I will get inspiration for the concept of nomadic life.

Literature

The horizontal Metropolis, Paola Viganò 2015

This book serves as a methodology for my analysis. The horizontal metropolis includes mapping a selection of elements through the concept of horizontality. The themes that this model includes are urbanization, mobility, water, production, and ecology. The mapping is constituted in three different scales. The first scale includes the landscape and large-scale systems, and the second scale includes the city, urban patterns, and collective spaces, and the ability to compare historical maps. The third scale includes mapping places, people, and lifestyles.

Futures Beyond GDP Growth, Hagbert et al. 2019

This report is questioning economic growth and investigates how different future scenarios could reach sustainability goals. One of the scenarios is called Local self-sufficiency which I could use as a tool for my strategy.

The Urban Commons Cookbook, Mary Dellenbaugh-Losse et al. 2020

This book is mainly about strategies for creating and maintaining Urban Commons. Use this book to get inspiration from the concept of urban commons.

Other literature


Bibliography from the panels


Sametinget (2022) kartor som underlag för planer. https://www.sametinget.se/underlag

Samer (n.d) Historia. https://www.samer.se/historia


SCB (n.d) Statistikdatabasen. https://www.statistikdatabasen.scb.se/pxweb/sv/ssd/START__EN__EN0203


Footnotes from the panels


Site visit photos