Resource Atlas for the Anthropocene

Taking Measure of the Varanger Coastline

70°22'16.6"N 31°06'36.0"E

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Resource Atlas for the Anthropocene

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The course Building a Circular Resource Archive is based in the conviction that circular resource networks will and must play a seminal role in future place-based practices. It builds knowledge on both local and global cyclic systems – past, present and future. Based in theories of innovative place development the course discussed how local resources may contribute in future circular economies and practices. Resources in this context encompass found building material such as driftwood, edible plants such as berries, seaweed and herbs, landscape features and types such as river plains, heaths and arable soil.

The course takes the northern Varanger peninsula as a case, and locates, analyzes and describes found resources in the Varanger territory, littoral as well as terrestrial. Specifically, it looks at the Vardø island and the coastline between Vardø and Hamningberg to the west. The area has been mapped scientifically, based on data provided by a research project on Finnmark's primary cover, and more artistically, in a small series of photographs where the body of the researching students have been used as measures of Salix height and of the extension of the willow-forest and the crowberry-landscape. These photos playfully illustrate how we enter a territory and a cultural landscape that already exists and changes in and through infiltration with human agencies.

This atlas forms an initial and partial archive of local resources that can be of use for local entrepreneurs and the Vardø municipality for years to come. The coastline in question has been in the Arctic climate zone until 2019. A short growing season and low temperatures makes it difficult at the moment to grow other species than grass in Varanger. A continued rise in temperatures as a consequence of climate change may make it possible to grow grains and root vegetables in the future. The area has a general richness in berry resources, and the river delta plains are important grazing area for reindeer and sheep. These areas will be in need of management in order to stay productive in the way that people and grazing animals are relying on them to be productive. Still, even with contemporary and current data on some species' prolific spread, and some species' vulnerability to encroaching species, there is so much we don't know and cannot know about future changes to the territory. Proposals in this atlas, then, are speculative approaches to future scenarios, but based on available data in the present.

The course has mapped and analyzed four specific landscape zones, the Vardø island, Vardøya, and Smelror on the mainland, two delta areas, Sandfjord and Persfjord, as well as the beach zone along the coast. The four groups of students have focused on resources that are among the most prominent in their respective areas. Soil and soil preparedness became the most important resource for the island group. The Persfjord group focused on arable land and how to possibly manage and secure it for the future, while the Sandfjord group has delved into the complex relationship between crowberry (Empetrum nigrum), shrubs like gray willow (Salix glauca), dwarf birch (Betula nana) and meadowland. The beach group has focused on the occurrence of marine plastic waste, driftwood and seaweed along the beaches of northern Varanger and drawn out a system for plastic collection.

The course's ethos was to investigate which on-land resources Vardø municipality is possessing, and how to manage these for future potential. General climate projections based on a medium level of climate measures (RCP4.5), estimates that Vardø will be 3.7 degrees warmer in 2100 than today. This is as warm as Sandnes near Stavanger is today, with an average temperature of close to 14 degrees.[1] This opens several possibilities with regards to agriculture: growth and harvest of new species, and with regards to risks: increased land use for habitation and industrial development, sea-level rise, and encroachment by shrubs and other competitive on berries and grassland.

[1] https://www.nrk.no/klima/kommune/5404

Encroachment of some species upon meadowland and grazing area is already happening: The course has been lucky to have input from the research project MONEC, To Manage or Not: Assessing the benefit of managing ecosystem disservices, led by Kari Anne Bråthen at *UiT, The Arctic University of Norway*.[2] This project is a result of many years of research and starts off from the Anthropocene fact that the effects upon ecosystems by human production and consumption are inevitable. We have been used to regarding the effects of human behaviour upon the ecosystem as negative; as disruptive and degenerative influences. On the other hand, ecosystems have generally been considered to be balanced multispecies systems where species compete for habitat, but where cyclical changes in climate balances out differences. What then when a species misbehaves; when it seems to be moving away from its balanced position within an ecosystem and becomes independent, triumphantly winning the competition for habitat and area? Empetrum nigrum (krekling) is one such species, responding so well to increasing temperatures that is outplays other species, herbs and berries alike. This deteriorates foraging condition, and worse, reindeer and sheep grazing area. MONEC suggest to manage Empetrum, a native species in its native ranges, either by burning it or ripping it out, and are undertaking experiments in collaboration with reindeer herders and sheep farmers across the Finnmark territory in order to explore these strategies.

Mapping the landscape between Vardø and Hamningberg, the course was able to use base data from a series of plots established by the Finnish biologist Matti Haapasaari in 1967, and revisited by Kari Anne Bråthen and MONEC in 2020. By extrapolating the data to the surrounding areas, under Bråthen's supervision, we know that the general cover of crowberry along parts of the Vardø-Hamningberg coastline is 80-90 % in heath, some of which has likely been meadowland, meaning that the mass of this prolific plant has doubled in the last 40 years.[3]

The part of Vardøya called Skagen is almost entirely covered in Empetrum. Still a good place for cloudberries, the growth of Vaccinium vitis-idaea (tyttebær, am: lingonberry) has been halted and impaired by the extensive carpet of Empetrum. In order to supply MONEC with more data, the course was allowed by the municipality to establish a test area on the Vardø island, ripping off a corridor of approximately 8 by 1,2 meters. This site will be re-surveyed in 2021.

Field work

During a fieldtrip to Vardø 24-31 October, 2021 it was obvious that the snow had arrived before we did. After several weeks of mapping circular resources at a distance, using various online resources and scientific data, we were thus still being held at a distance from the ground that we were investigating. It was not yet frozen, but blanketed in 15 cm of snow.

During the week we performed a series of drives and walks along the road between Vardø and Hamningberg. Equipped with two shovels, a ruler, cameras and mittens, we would then explore our sites in depth by walking transects, soil sampling and photo documenting growth and soil depths, at one point also helping a local sheep farmer get the last

2 https://monec.org/om/

3 Haapasaari, M. (1988). The oligotrophic heath vegetation of northern Fennoscandia and its zonation. Acta Botanica Fennica, 135, 1–129.

two of his sheep into his van for winter refuge. The student's first experience of the crowberry heather was the feel of its bounce; the definite firm, yet, giving layer of an almost continuous carpet of Empetrum underneath the snow, almost wherever we walked. Wiping off the snow in large patches we could easily establish the uniform character of the crowberry layer – an entangled network of roots, leaves and berries, a blanket seemingly floating on top of the ground, yet infiltrating its upper layer of soil.

Walking and snow removal became our modus operandi. The snow forced us to establish procedures that we would otherwise not have established. In Sandfjord we walked a transect from the western side of the valley, through a veritable forest of shrubs along the Sandfjord river, across the river and the plain to the west of the river. In Persfjord we extracted soil samples from four locations and explored the river plain for Empetrum and shrubbery, and on the Vardø island we surveyed the coastline for seaweed, sampled the soil underneath the old fish-racks, talked with locals about the outside areas of the new greenhouse. The coastline group drone photographed and collected plastic and seaweed samples from a series of locations along the coast.

Soil in a human-nonhuman perspective

The course considers the Finnmark landscape a human product, not only by cultural practices, but also by climate changes produced by human production and consumption patterns. The fact that there is farmland in this near Arctic climate zone, is due to a 'geopolitical strategy to secure national borders and to expand a post-war welfare state', as well as 'a colonial effort to cultivate farmers in the far north', as argued by anthropologist Marianne Lien in her article 'Dreams of Prosperity – Enactments of Growth, The Rise and Fall of Farming in Varanger'.[4] The aim of the early 1900 farming policy was clear: 'to establish sound agricultural practices adapted to the climate in the region, so that the resource potential is fully utilized'.[5] One realized however early on that yield was not sufficient without a substantial use of fertilizers that quickly depleted the soil.

To counter this idea of propelled and increased yield, the course has worked from an understand of soil as a slow-forming web of life, where microorganism and biota are part of a larger food web that involves larger animals and plants. In her article 'Making Time for Soil,' Maria Puig de la Bellacasa is looking at the ethico-political, practical and affective dimension of concepts and practices of soil care in the sciences and other forms of knowledge. She argues that soil is an 'endangered living world' and that modes of soil care and soil ontology are entangled: 'what soil is thought to be affects the ways in which we care for it'.[6] Care however, requires that we humans approach soil as a web of relations that constitute the very possibility of an ecosystem, rather than as a substance to exploit for perpetually increased yield. One such approach is carefully drawn out by the island group that suggests soil renewal and composting strategies for the new greenhouse in Vardø, drawn by the AHO studio course *In Balance – Arctic Cycles I*, spring 2021.

The discussion of how to manage land area in a former Arctic climate zone in the coming decades must be complex. If agriculture in the Arctic reflected a 'southern' idea of productivity it the 20th century, it may be less intrusive in the 21th, especially in a region that will still remain at a distance from the large supply nodes in the south.

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[4] Marianne Lien, 'Dreams of Prosperity – Enactments of Growth, The Rise and Fall of Farming in Varanger', Anthropological Journal of European Cultures Volume 29, No. 1 (2020): 42-62 © The Author(s), p. 42.
doi: 10.3167/ajec.2020.290104 ISSN 1755-2923 (Print) 1755-2931 (Online)

[5] Ibid, p. 55.

[6] Marie Puig de la Bellacasa, 'Making Time for Soil: Technoscientific futurity and the pace of care', Social Studies of Science 2015. Vol. 45(5) 691-716. DOI: 10.177/03063/27/5599851, p. 692.

The course is a complementary course to the studio course *In Balance – Arctic Cycles Vardø II*, and both courses are part of the research project Circular, Balanced and Shared - Strategies for stewardship in the Norwegian Arctic.

The teachers want to thank a group of 11 national and international architecture students who enthusiastically and with great energy explored landscape and biodiversity, who eagerly delved into theoretical explorations of care and into scientific literature on ecosystems, oceans currents, and soil sciences.

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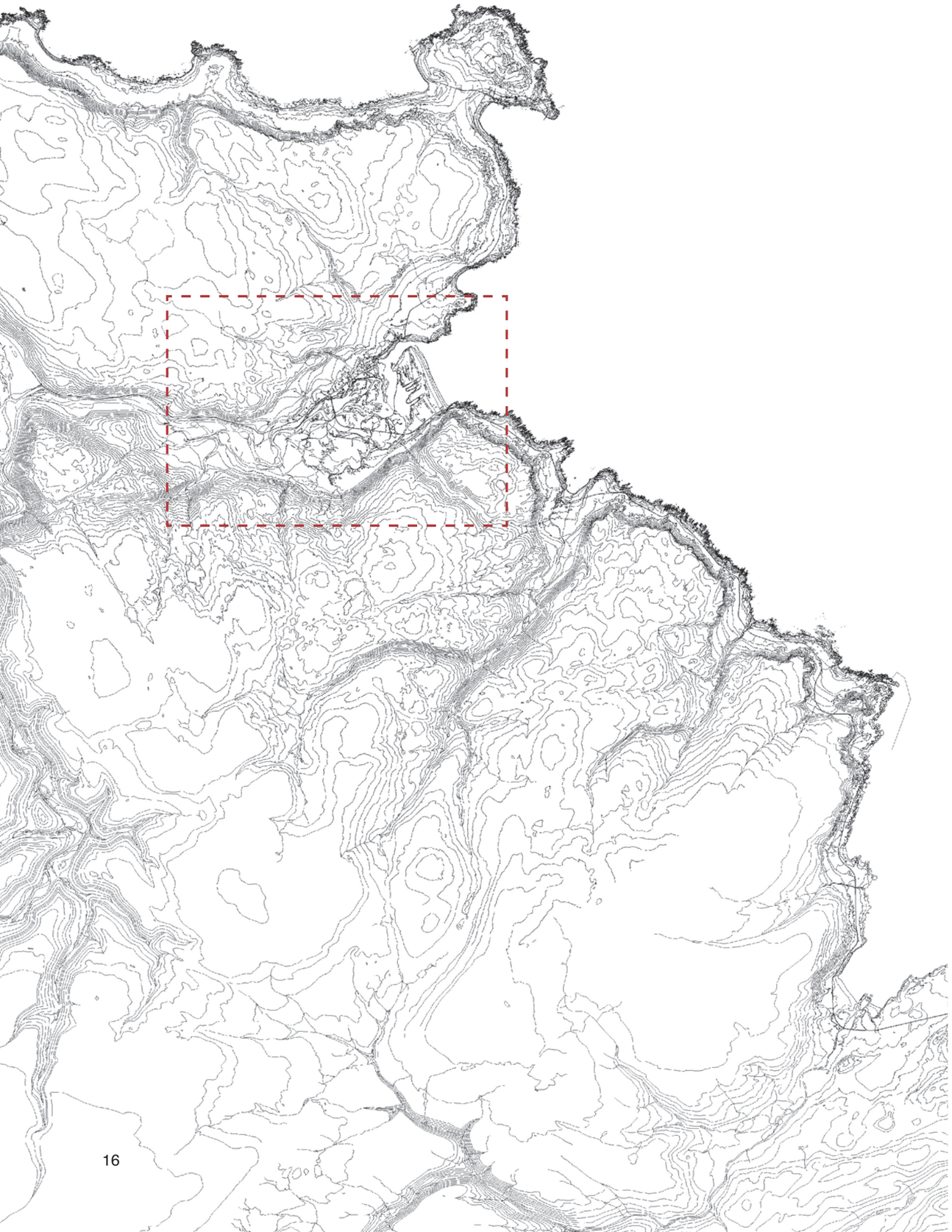

Climate impact on ecosystems

The following booklet consists of a compilation of diagrams, cartographic maps, and analytic sections that study vegetation resources, ecosystem evolution, and the interaction between the different species that co-exist in the Varanger Peninsula. This work aims to provide a comprehensive archive of local resources that can be used by local entrepreneurs and the Vardø municipality for years to come. Having access to this type of resources and databases has been proved to be especially important for communities that have been left outside of the globalized network.

Throughout the different pages concepts as evergreening, greening and circular practices will be tackled to localize, analyze and describe found resources on the coast of northern Norway. The ecosystem along Varanger's northern coastline consists of rich flora and fauna, not only inland but also its shores. The onshore part of the peninsula is largely characterized by Arctic rock desert, but river deltas contain nutrient-rich soil that attracts the widest variety of species. Meadow, grass vegetation, heath (Crowberry and dry heather), mountain birch forest, and willow thicket are representative of the area. The fauna is characterized by a rich birdlife with nesting space along the coast, grazing reindeer that are drawn to rich valley sides and bays, which also represent a core area for mountain foxes.

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2021 Autumn _ Arkitektur- og designhøgskolen i Oslo

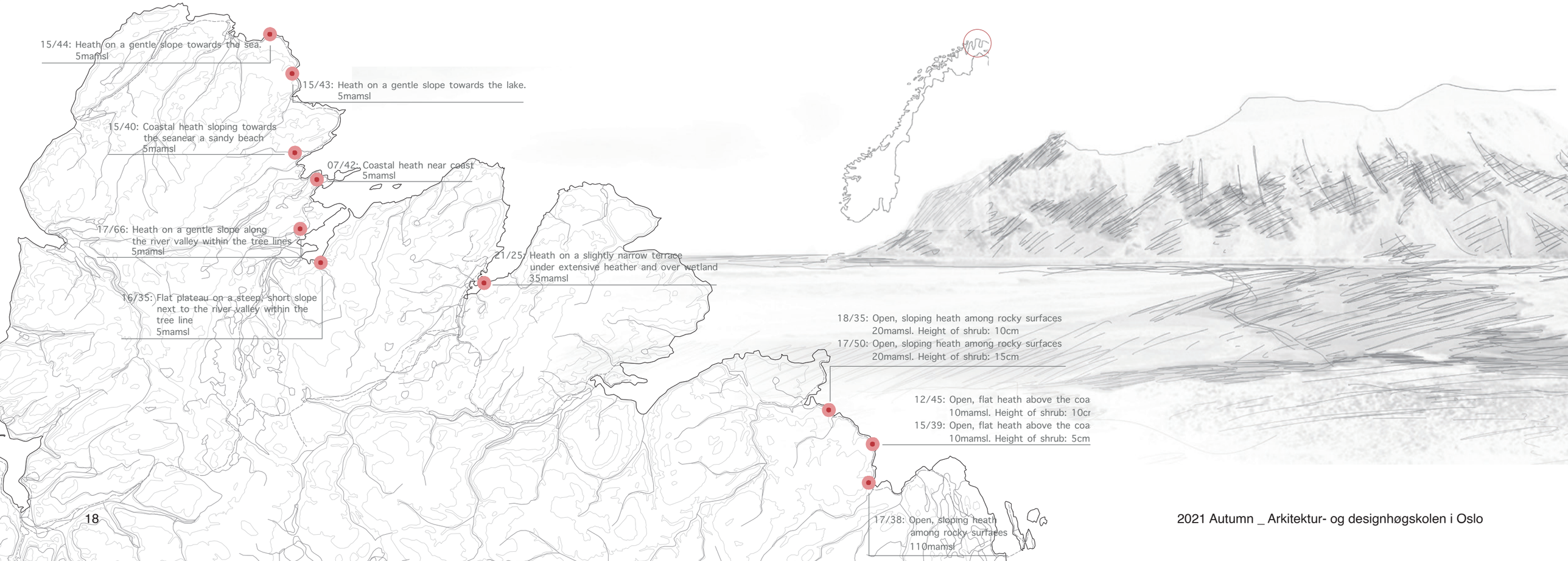
Previous research

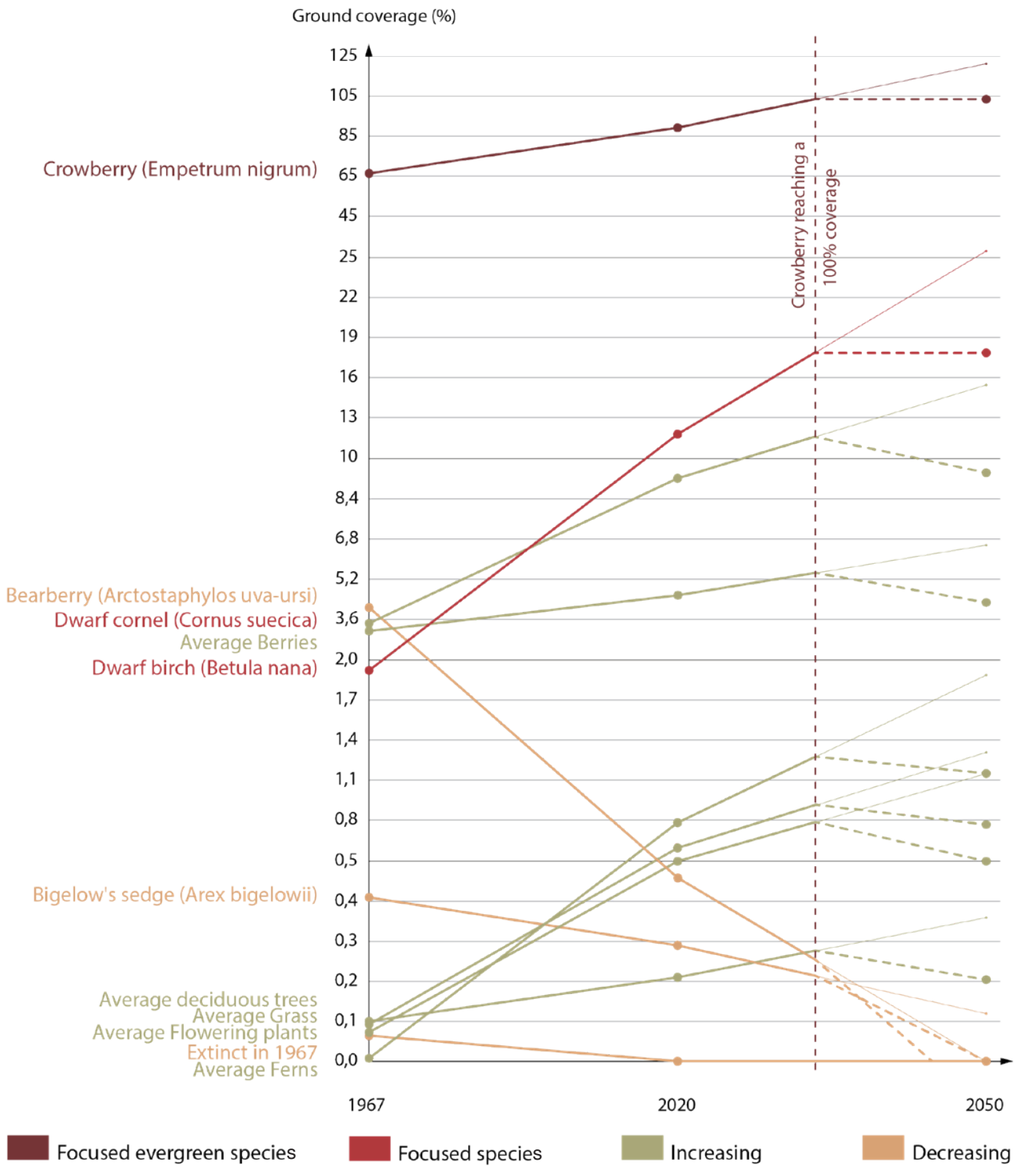
It may be possible that a multiplicity of interacting factors, more or less regulated by a law , operate in concert to form a unit, a system. The organisms, the ways of life and the interactions that take place in the biosphere in general, exhibit an extraordinarily high level of complexity. Such a complexity is difficult to imagine other than in vast systems, which explains and makes it possible to clearly take the measure of the deep human ignorance relative to the relations established within the biosphere, and consequently relative to the effects of the disturbances which the human activities can introduce into it.

The topic of our role within the ecosystem requires before anything else a reflection on how we understand ourselves as a specie. Due to our capacity for critical thinking, human beings tend to see themselves as superior to the rest of the biosphere. It is therefore necessary that first of all, we abandon the anthropocentric vision of the world around us in order to continue with the discussion. Undestanding ourselfes as part of the ecosystem will make us aware that taking care of it is selfcare.

Based on the data provided by the Finnish biologist Matti Haapasaari that compares the evolution of different vegetal species between 1970 and 2020 in 10 different spots across the northern coast of the Varanger Peninsula, we project the future evolution that these species may experience in a context of climatic change and rising temperatures. By analyzing the average growth/decrease of the main plants present in the landscape, we can provide a database to compare with our specific point of study – Sandfjord.

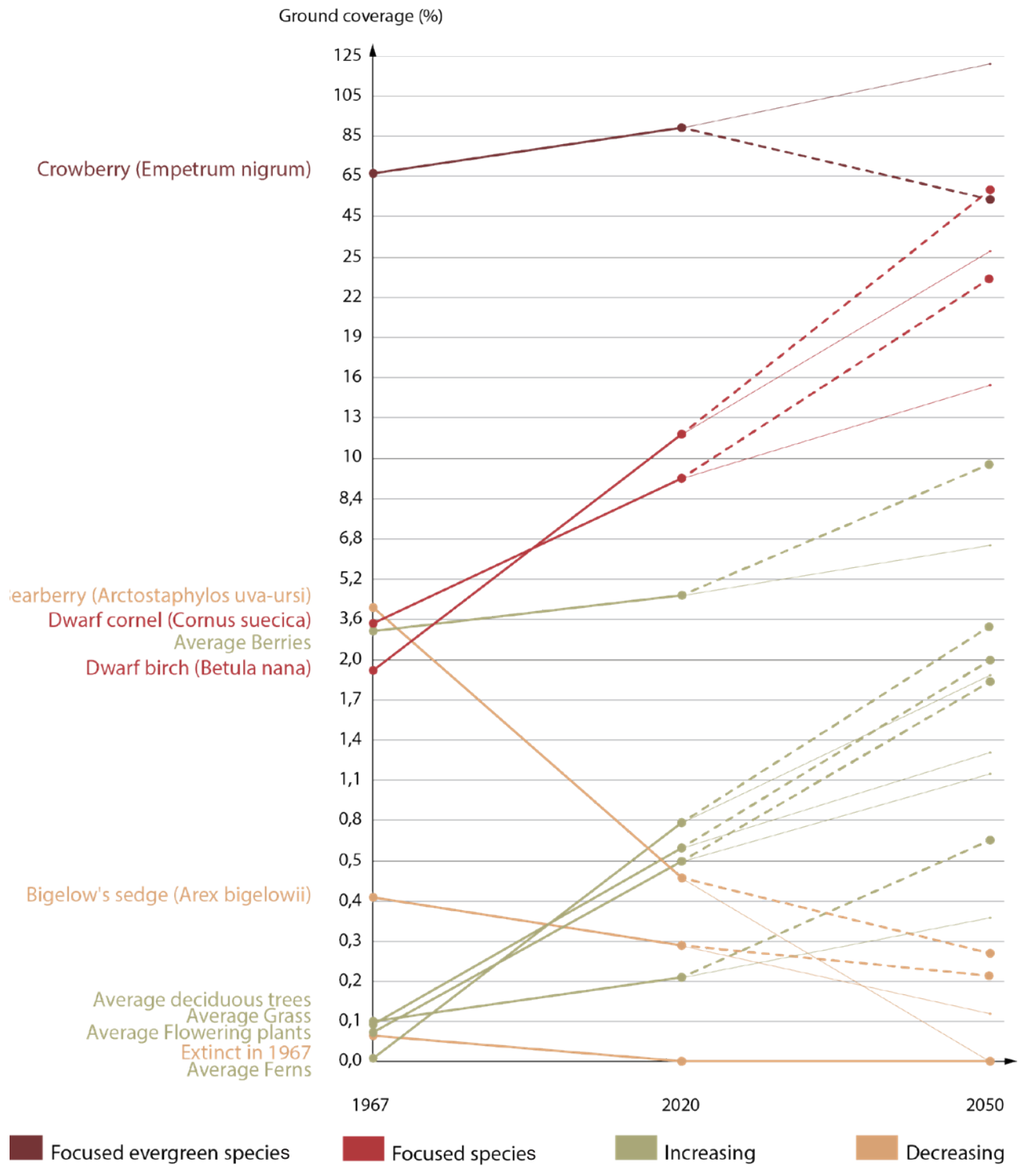
This study also puts on the table interesting questions about our right as one more species inside an already tottering ecosystem to alter it. We have to be conscient about our role as one more needle inside the chain. We sometimes forget that we are part of it, and that we need to see ourself again as part of the ecosystem. Rethink our relationship with nature and the central position we assume having, over the other species, might bring us to consider us again as being part of the ecosystem. Could we then consider interacting with the different species without having a superior position? As the previous civilisation took care of the land burning the invasive plants, we might have a role in taking care of the ecosystem. Burning is the fastest and easiest solution, but is it the best one? The entire biodiversity of the burned area will therefore be destroyed and the stored CO^2 in plants will be released in the atmosphere. The carbon footprint of such an action would be dramatic.





Future scenario 1

Comparing the data of 1970 and 2020 with the global warming situation, we projected two different scenarios for the evolution of the different species. The first scenario illustrates the evolution of the latter without any human intervention on crowberry overgrowth. We assumed that, when the crowberry will reach 100% ground coverage, it will therefore continue its expansion by slowly overtaking the other different species, altering the entire eco-system.



Future scenario 2

We consquently assumed that the crowberry represent a threat, as the human lifestyle, on the biodiversity. The second scenario consider a human interaction on crowberry, to limit its expansion, and reduce its ground coverage. The ground will therefore allow more space for the other species, and due to climate change, their expansion will get even more important, favorising diversity of species in the eco-system.

Sandfjord river delta

Sandfjord is a river base area formed by maritime sediments that, like other similar areas in the northern territories, is experiencing dramatic changes in the ecosystem. Fuelled by climatic change, disturbances in the distribution of certain species have accelerated. This is leading to imbalances in the vegetation composition, with retroactive effects on the whole system.

Between these imbalances we can highlight the crowberry resistance which squeezes out other species through toxins, resulting in a large number of plants experiencing a drastic decline (meadow plants, herbs, heather, between others). The other main process that will be deepened is the densification and overgrowth of (bush areas) that is also drastically transforming artic fluvial valleys.

Greening and evergreening

However, the entire ecosystem is undergoing two big transformations driven by milder temperatures: greening and evergreening. Greening is the process where bushes, grasses, and sedges are growing more abundant during warmer, and now more lasting, summer seasons encroaching on land that used to be Arctic desert. It is mainly characterized by fast-growing and short-livee species, which generally die in colder seasons and become fertilizer for the new generation next spring. On the other hand, evergreening is led by species that remain green and functional through more than one growing season. These are low nutrients species, which makes them less attractive for animals grazing. The main two species that fall into this category in our area of study are crowberry and lingonberry. Between these two plants, crowberry is the one threatening the ecosystem the most. Its expansion represents a high threat to meadow areas, which are considered to be the most dynamic, fertile, and biodiverse ecosystems in the area. Meadows are good indicators of arable land presence and is the main source of graze for reindeer and sheep.

The ecological consequences of evergreen plants expansion, however, are markedly different from the effects of taller, deciduous species. Here, we argue that predictions of how shrub expansion will affect tundra ecosystems based on characteristics only applicable to deciduous shrubs, hampers our understanding of the complex ecosystem feedbacks related to Arctic vegetation shifts. We are aware of several ecological differences between deciduous and evergreen shrubs and how they may affect ecosystem processes in opposing ways, and highlight the key mediating role played by herbivores and if humans could also interfere in this mediation.

Crowberry
Evergreening

Gray willow
Greening

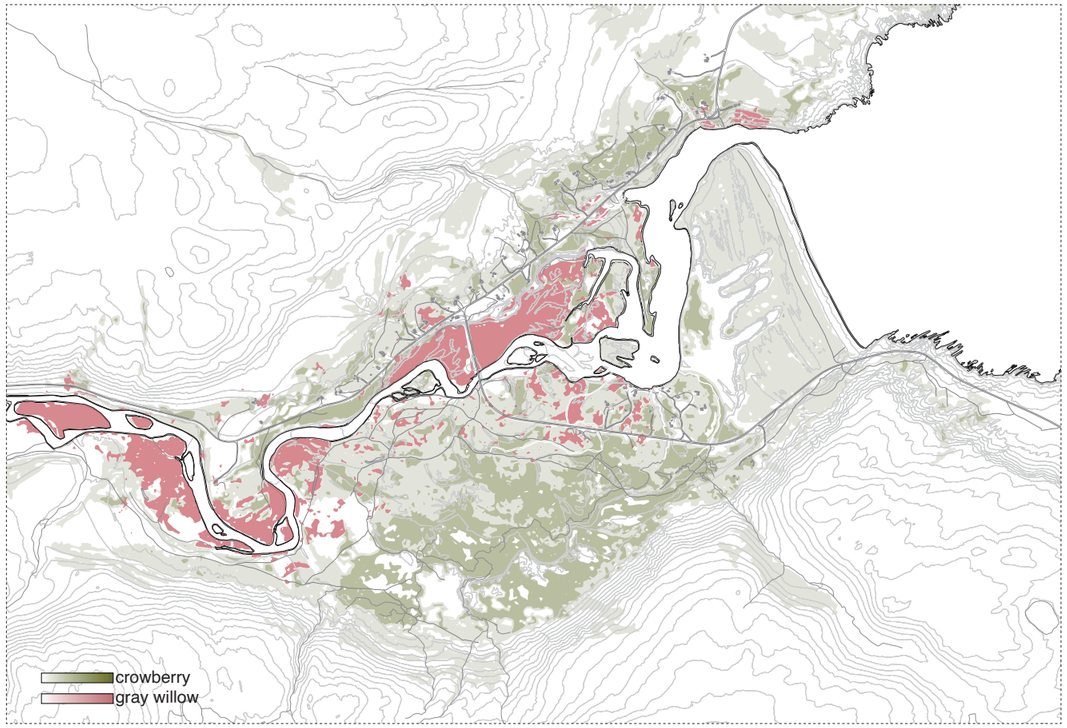
Overgrowth : present and future scenario

The maps show the density and expansion of crowberry (Empetrum nigrum) and gray willow (Salix glauca) in the Sandfjord river delta, both in present time and in the future scenario. The time reflects their expected growing dominance in the ecosystem. It is impossible to predict the future conditions, but it is important to take into consideration that they are likely to happen. Their appearance will appear as both spread out, spreading higher up in the terrain due to temperature rise, and by getting more dense in already established areas.

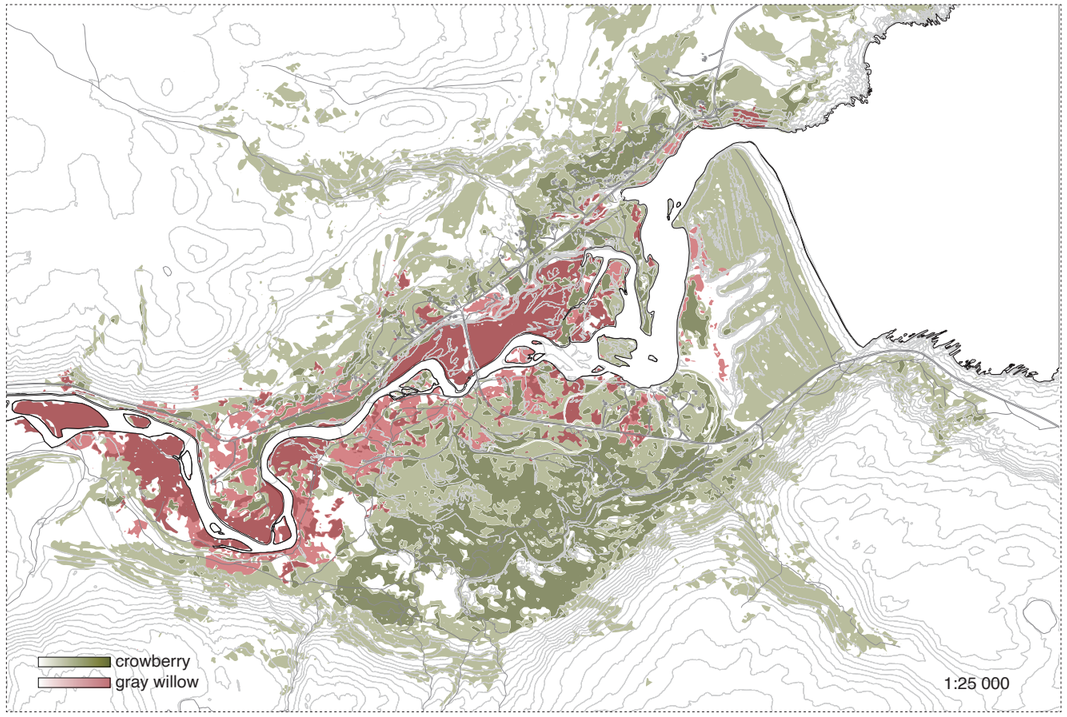
Through field observations, we found that the crowberry thrives in everything from crate soil higher up in the terrain, to sedimentary substrates near rivers and coasts. We observed that the crater, in other words, is not only higher up, but also completely down to having managed to establish itself from higher terrain with box soil and all the way down to moist maritime sediments.

Expansion and density of gray willow and crowberry

Present scenario



Future scenario



Crowberry

Crowberry (Empetrum nigrum) is an evergreen creeping dwarf shrub naturally present in tundra ecosystems and various climates, from humid coastal climates to high mountains and dry inland. The plant grows very slowly and thrives in nutrient-poor areas where it can live almost on bare stones and windswept areas. All it requires is enough sun. The berries from the crowberry are nutritious and tasty for grazing animals and birds, but there are few of them compared to the number of leaves. The leaves are only edible when very young, and therefor have a low grazing value.

Crowberry has, in recent years, been spreading through the north and now poses a threat to the tundra up-until-now balanced structure with its strong and often long-lasting influence on many of the ecosystem processes (directly to other vegetable species and undirectly to grazing animals). In short, the crowberry has no competitors. Its leaves contain small glands with toxins that drop from the leaves and onto the soil, where it come into contact with soil organisms and other plant roots. The poison accumulates in the soil, changes the soil, and creates inhospitable conditions for other plants. In the worst case, the poison can damage and cause restrictions or death in other species. Furthermore, melting snow helps to spread the poison further and into rivers. The leaves also break down so slowly that long after their death they continue to spread their venom to their surroundings. Wind and birds also help to spread the plant over larger areas and the plants are pollinated by the wind.

Crowberry is therefore responsible for reducing diversity and further ecological imbalance where it thrives. According to research from Kari Anne Bråthen professor at *UIT, The Arctic University of Norway* the presence of crowberry leads to long-term changes in the soil environment, which in turn harms the occurrence and distribution of other plants species, especially grazing plants such as herbs and grasses. The thesis also points to crowberry as a bad grazing plant. Lastly, it shows that warmer climates can be a driving force for the crowberry's advance in the Arctic.

Gray Willow

Gray willow (Salix glauca) is widespread throughout Finnmark, along the entire coastline of the Barents Sea, and is an important part of ecosystems along water and watercourses. The plant is highly profitable for insects and birds, and with a height up to two meters, it is not only an important food source but also a hiding place and nesting place for lots of fauna. Species such as domestic reindeer, elk, lynx, and rich species of sparrows thrive here, in addition to blue-throated divers and hawks.

In the lower layer of the vegetation in the willow shrub, grass species grow and is almost an oasis for many organisms. However, willow shrubs represent a danger for the ecosystem as it will experience a gradual “overgrowth”, resulting in a decline of other species. In the spring and summer, the river delta in Sandfjord is part of the reindeer grassing area, as it is an area with easy access to nutritious food. Reindeers eating gray willow can probably help keep the growth of willow shrubs down. However, the extent to which reindeer and other grazing animals manage to keep the number of shrubs down remains unclear and, as it looks now, grazing animals are not enough to hold back the overgrowth.

Sanfjord

B

A

Field work

During the last week of October 2021 we traveled to the work area in order check if all the approaches, reflections and material that we had collected in the classroom transferred to the reality of the place. Visiting the site allowed us to walk a transect through the river valley, taking samples and photographing the terrain every few meters. Thanks to this fieldwork we were able to conclude that the evergreening process is much more present and developed in the Sandfjord area than we had previously thought. The crowberry not only extends to the areas farthest from the river, but also reaches its very banks. The only terrain in which this species was not strongly present was on the islands of sedimentary origin created by the river itself .

Transect of the Sandfjord riverdelta in October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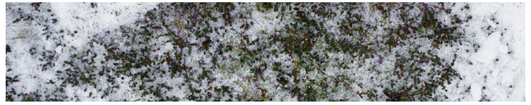
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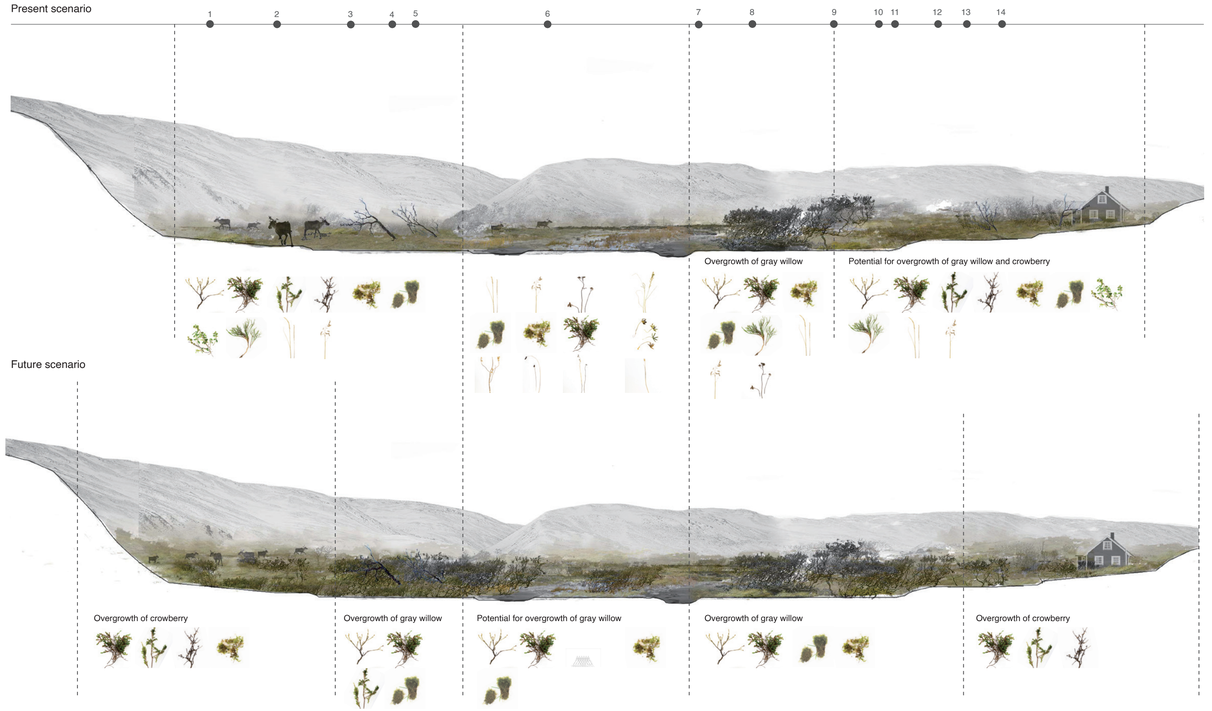


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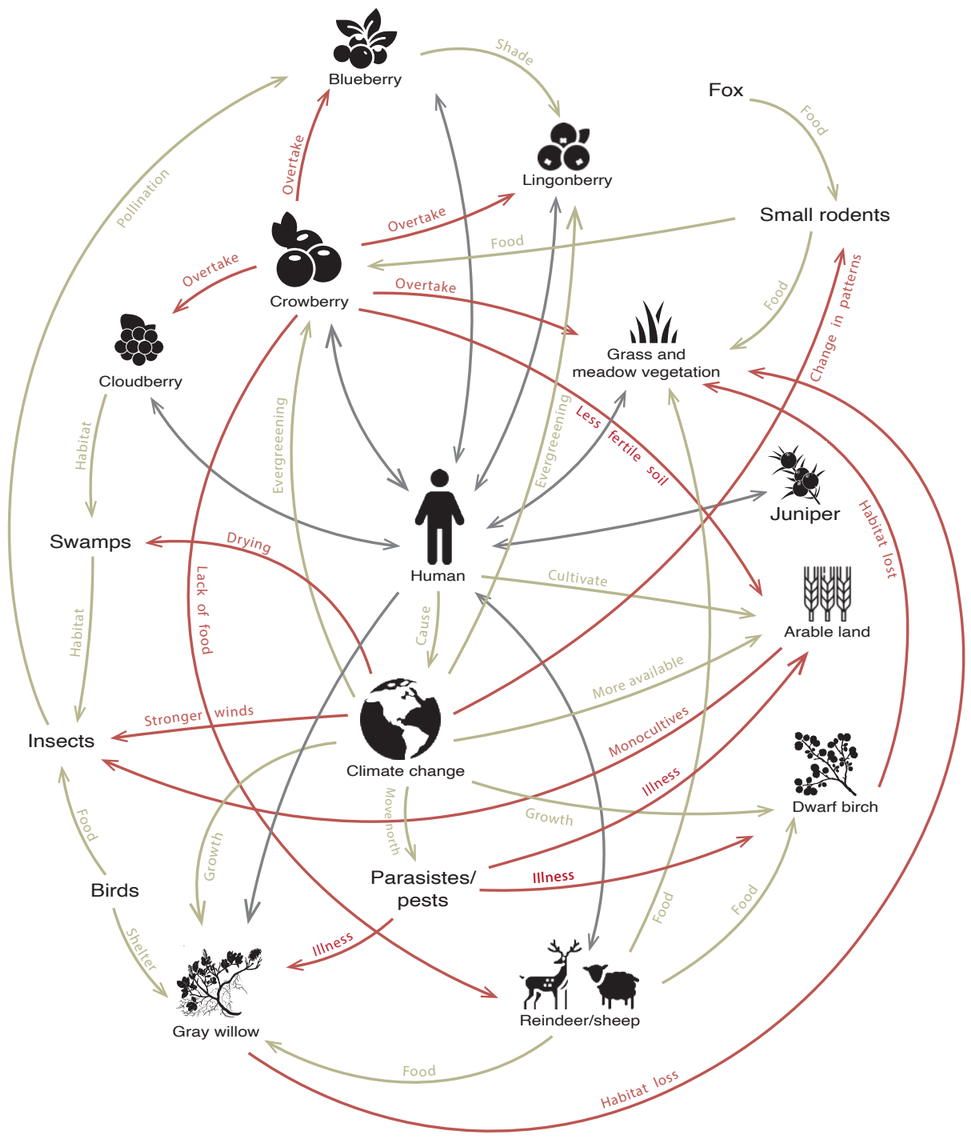
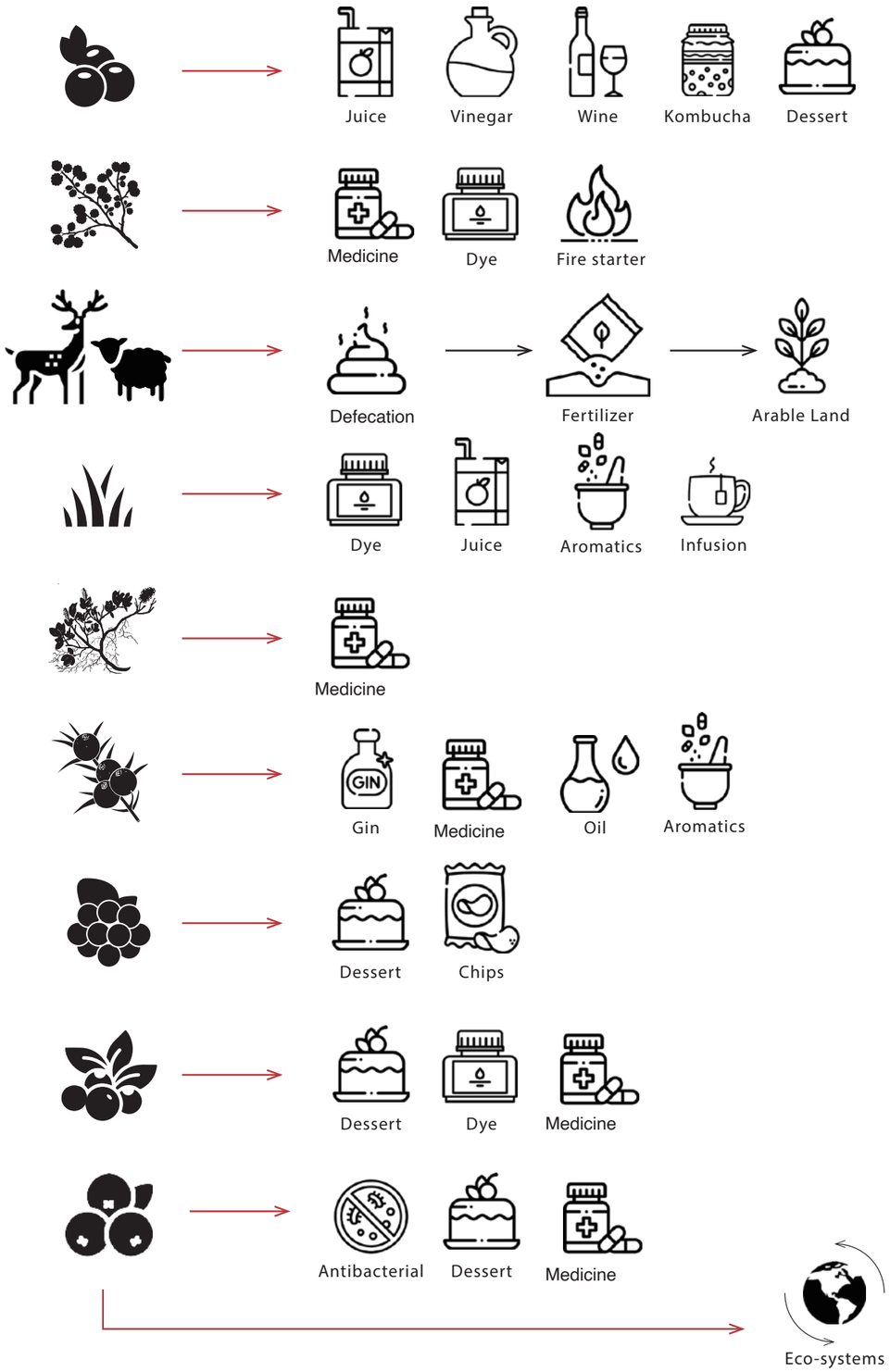


The ecosystem along the northern coast of Varanger

Together with climate change, the loss of species and habitats is considered one of today's biggest environmental challenges. Ecological balance is about how species affect each other and how our footprints and usage of resources have ripple effects down the chain. Today, the Varanger Peninsula experiences dramatic effects on the ecosystem related to climate change, especially in the distribution of certain species and imbalances in the vegetation composition, with retroactive effects on the climate system. The attached diagram shows the interrelationships inside the Sandfjord ecosystem we have become aware of. It materializes how every link in the chain not only has a direct impact on its close fellows, but can also trigger uncontrolled effects on other species that seemed independent. The study of climate change in Northern and Arctic areas represents an important field of research because they are experiencing a faster rise in temperature and thus faster change than elsewhere on the globe. If we aim to continue to utilize natural resources, we are dependent on understanding inter-relations between non-human species, essential to the ecosystem's stability. We have identified two different types of connections inside the network, impact, and threats (red arrows), and beneficial relationships (green arrows).

Although all relationships are considered to be in the same level of importance human resources (grey arrows) have been highlighted as an important outcome for the local community and have been further developed in the second diagram. Although all relationships are considered to be at the same level of importance, human ressources have been highlighted as an important outcome for the local community and have been further developed in the attached diagram.



Reference:

- MONEC, To Manage or Not: Assessing the benefit of managing ecosystem disservices, led by Kari Anne Bråthen, Maria Tuomi, Jutta Kapfer, Tuija Maliniemi
- Pilsbacher, A. K., Lindgård, B., Reiersen, R., González, V. T., & Bråthen, K. A. (2020). Interfering with neighbouring communities: Allelopathy astray in the tundra delays seedling development. Functional Ecology.
- https://www.nina.no/archive/nina/PppBasePdf/rapport/2009/436.pdf (s.15-16)
- COAT > Forskning > Lokaliteter > Varanger / Várjjat
- Klimaendringene kan skape en grønn ørken | UiT
- Varangerhalvøya nasjonalpark (norgesnasjonalparker.no)
- Kreklingkrig (forskning.no)
- Klimaendringer i norsk arktis - Konsekvenser for livet i nord (npolar.no)

1:30000

Research by

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Mehmet Deniz
Mirko De Roia

Soil

Soil is a living organism. Complex, healthy soil consist of a myriad of living organisms, from microbial and invertebrate fauna, to plants, roots and fungi. It is said that it takes a 100 years to make 1 cm of soil. Therefore, soil is not a renewable source and has to be maintained. Creating a circular soil system in a rough landscape like Vardø comes with a great challenge. Our main focus has been the research on existing soil conditions and the potential building of of soil by analyzing the useful waste and natural resources that already exist on the island of Vardø. Looking into the present industries and resources on the island, to find a way to live in symbioses rather than just taking from and depleating existing resources.

The increase of temperatures in the future in places like Vardø will make it possible for people to grow their own food and vegetables in the future. The climate change will bring challenges and opportunities. In order to be prepared to work with these challenges and turn them into benefits some ground work has to be done.

In northern islands like Vardø, that are based on a massive rock layer, there might be a possible in lack of soil. In order to understand the existing soil, it has been important to look into the historical past of Vardø. For centuries the fish and the processing of fish has been the great resource for the island. It still is, and the onland fishing infrastructure is still very visible in the urban fabric of Vardø. Our first focus was to analyze the the interesting relation between the fishing industry and soil conditions.

Previous research performed by Miles Hamaker and Brona Keenan had revealed that there would be soil to be found under the fishing racks. Until the 1970s these racks would be loaded with fish slowly drying to become stockfish. The fresh fish would drip, and the birds that tried to feed on it would drop guano. Free range livestock would be grazing on the fresh grass and further fertilize the soil for cyclic growth.

According to assumptions then, there should be a lot of good soil under the fish racks, as a lot of waste should have provided nutrition over the years. Our field investigations showed that the soil layer is not necessarily thick underneath the racks, only 5-10 cm and that a rock layer appear directly after a mossy layer of hummus. But our survey also shows that some plant species live and flourish even here, especially the salix and the betula. Research projects show that the growth power of plants in the Arctic are almost the same as in the rain forest.The growing season is short so the soil could provide a lot of nutrition for the and then build up new nutrition over the winter season. However, there are also places on the island that have built up a more massive layer of soil over decades or centuries, through processes such as the nesting of birds, the sprouting and dying of plants, the tide and

nutrients of the surrounding sea and erosion of rocks. In these areas we found an organically living earth layer approx. 15 cm thick. The new city greenhouse is also surrounded by a valuable existing layer of soil that could provide a basis for planting, possibly from earlier inhabitants using their plot for growing. This knowledge is valuable for the further process of soil reclamation.

For a city that may want to grow its own vegetables in a future warming climate, it is crucial to protects its existing soils and to potential enhance the speed of new soil formation. Composting methods, the already used method of mixing seaweed and sand, ensuring horse manure as a natural fertilizer on the island, may all play an important role for the future. We analyzed compost methods from areas with a similar climate. "Hugelkultur" could become a method for Vardø. This method could be used with the resources available on the island. By digging a hole, filling it with nutrients and covering it with soil, and letting this pile be fed with nutrients from within throughout the winter season, one could increase the amount of soil for years to come. Driftwood could be brought in for the base of the "hugel".
The greenhouse garden could be framed by a low mound. A mixture of sand and seaweed could form the second layer of the hill, which would also function as a wind barrier for the ground plants.

Talking to members of Dyrk Varanger /[Grow Varanger] that are the catalysts of the new green-house in the city, we learn what the community thinks is relevant to grow and discuss what may be grown in the future. Next to southern plants like basil or comparable herbs, we also suggest to work with historical valuable plants like rhubarb, cabbage, potatoes. The demand of plants that are harder to get in the north is large, since these have to be shipped from the south and only arrives after days of travel.

Soil condition

Skagen

Reinøya

Hamnøya

Smelrok

Bussesundet

Svartnesbukta

Vardø

1

2

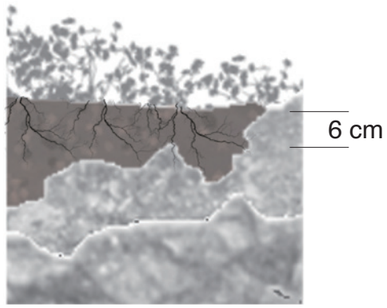
3

1:20000

- Agricultural land
- Meadows
- Thin soil
- Landfill
- Area reserved for
- leisure buildings
- Fish racks

Ref:
https://miljoatlas.miljodirektoratet.no/KlientFull.htm
Brona Ann Keenan and Miles Hamaker, Savour the Psst, Taste the Future, diploma project AHO, 2016.

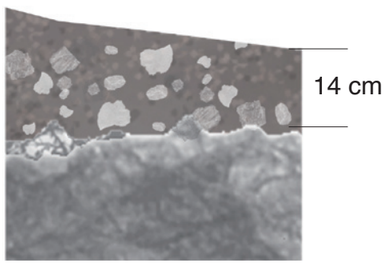
4



1

Thin and rocky soil layer under the fish racks

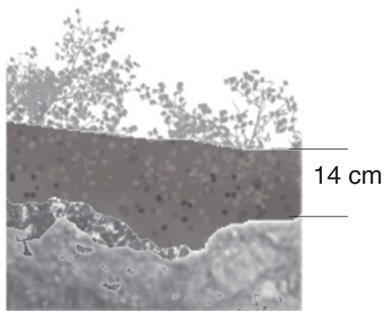
5



2

Rocks are pressed up over winter and enters the thick and dense soil layer

6



3

Thick and dense soil layer near the ocean. Grass and herbs grow here, and earthworms are found

7

Weeds and grass prove that there are nutrients in the soil

8

Here "krekling" grows on rocky terrain with a thin soil layer. They could effect the quality of the soil in the area.

9

Some species can grow fairly large from nutrients found in a thin layer of soil. This soil can be very nutritious.

Example section

Waste for soil making

There are horses living on the island today. These already produce a valuable potential source for soil creation and fertilizer. Most of the feces found is already dried, therefore can be used as found.

Horse feces

The food waste we create everyday contains valuable bacteria for soil creation. Today compost goes to Tana and further on to Båtsfjord, which is a long travel for a valuable resource for Vardø.

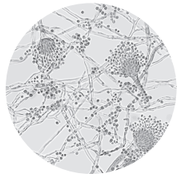
Compost

The seaweed is led inland with the tide, and is left laying on the shore many places around Vardø. Many of these are already dry or the salt is washed out, and can be picked and mixed with soil or used as fertalizer straight away.

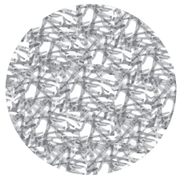
Seaweed

Recipe

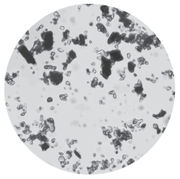
Preparing of the soil is the starting point for a florishing garden. In order to have the nutritious booster and food for the SOIL BIOTA living in between it is important to add the right amount of spices. The right mixture is key in preparing a good tasting soil.



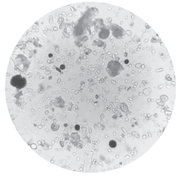
Fungi



Algae



Bacteria



Bacteria

35 %

existing soil (preferably from Vardo)

25 %

dry horse poop/seaweed (optional)

25 %

fine sand and bigger rocks

15 %

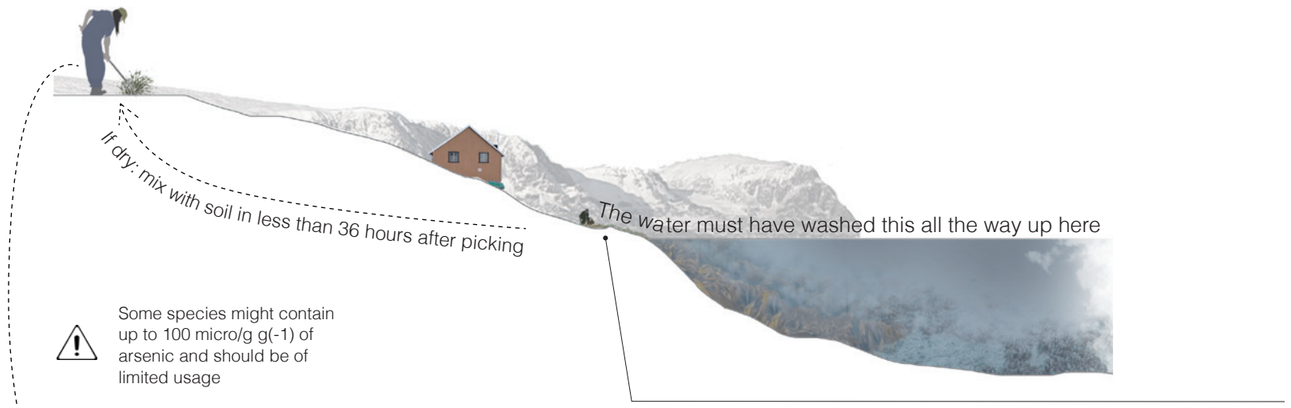
water

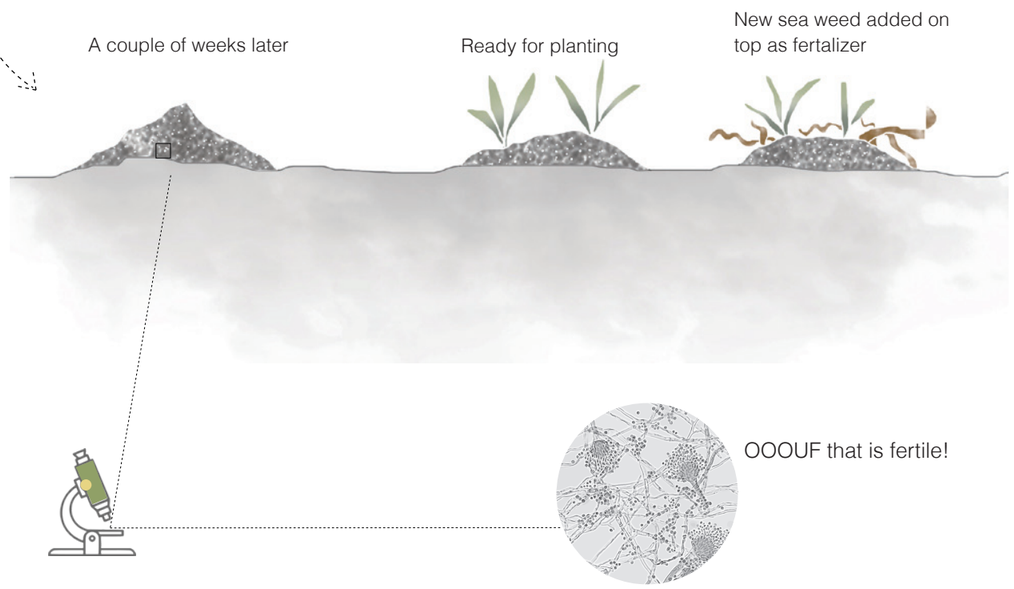
Preparation for growing season for one medium sized planting box

1. Dry horse feces over the winter season (Fresh horse poop could burn seedlings)
2. Apply feces to the existing soil in the spring. Don‘t dig it to deep so the air can help activate it
3. Wait for a few rainless days to apply the fertilizer on slack soil
4. Add fine sand to the mixture to improve the airyness of the existing soil (beneficial for plants like potatoes, raddish..)
5. Add water and mix up everything
6. Let it work for a few days
7. Plant seedlings

Mixing seaweed with soil

In southern parts of Norway seaweed has traditionally been used in agriculture for soil making and fertilizing. With the arctic areas getting warmer in the future, the southern techniques can be useful and applied in the arctic.

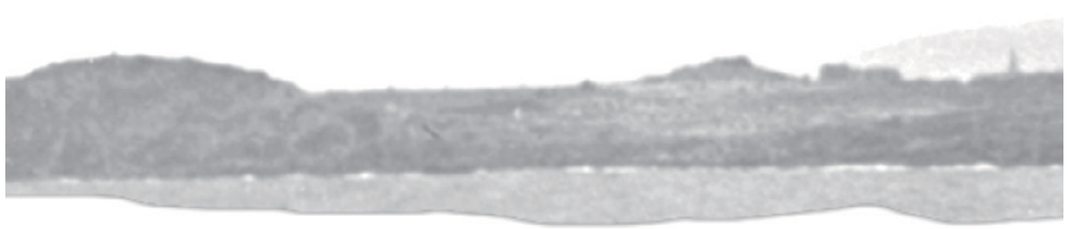




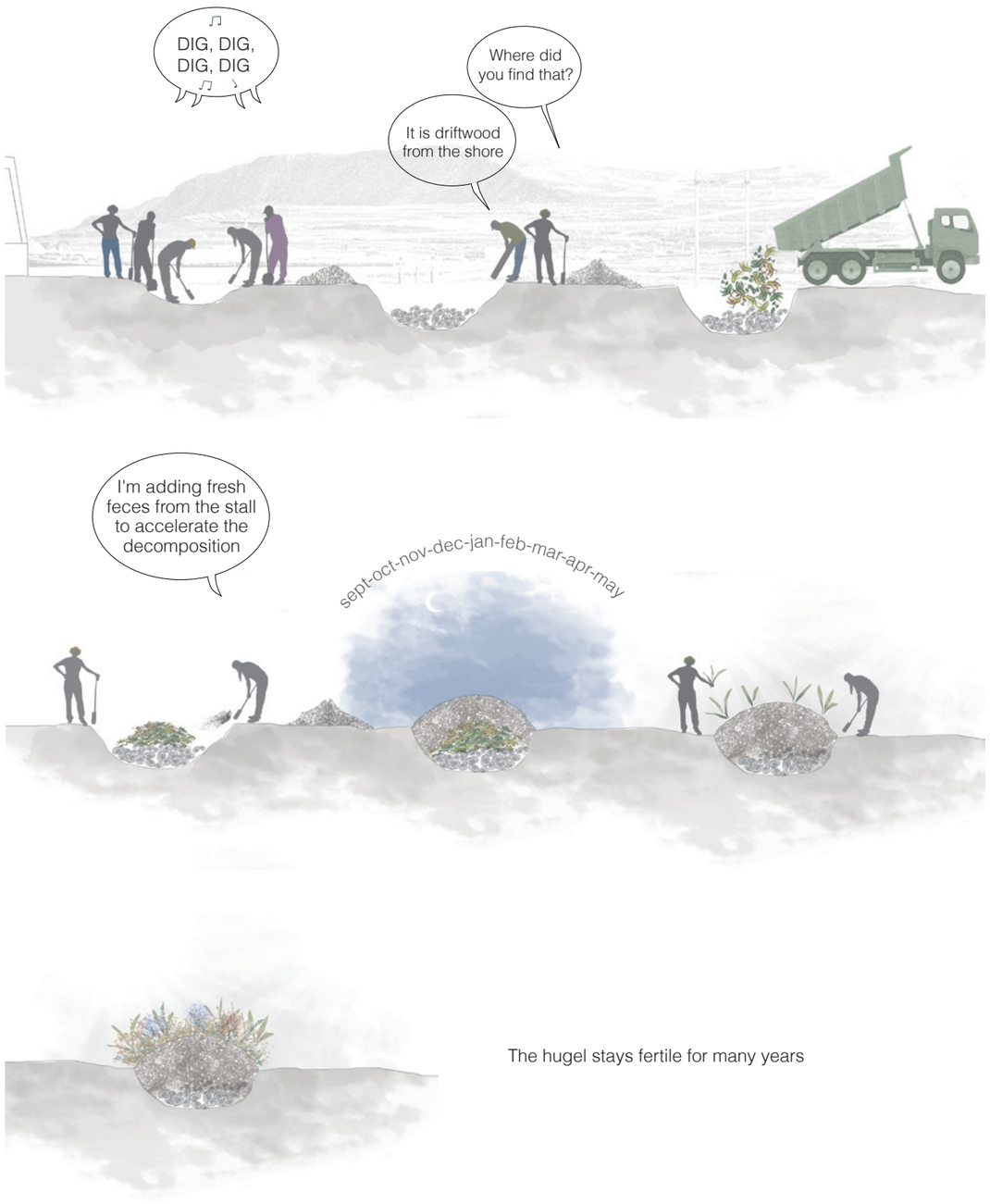
Horse feces

12

Looking into natural resources for soil making, we learnt that farmers in Kiberg might have dried sheep feces stored. With horses already living on the Vardø island there is a valuable resource for this already excisting on the island. Seaweed could also be introduced into this process. In some areas of the world, seaweed is used as bedding in stalls. The seaweed acts as a disinfectant for the horse feet and immediately mix with the horce feces to create a fertilizing booster for the Soil.



Hugelkulture with compost



"[Soil is] kind of like thinking about a brick house, you can't build a house out of sand and straw. You've got to glue them together somehow. You have to bring them together into the smallest building block for brick house, which of course is a brick. So that smallest unit of structure in a brick house, that's what a micro aggregate is.

So it's the bacteria that provide the glue to hold that brick together. Well, you're not making a brick house with bricks alone. You've got to have something to glue those bricks together and start building the walls. You have to leave holes for the windows, for the doors. You got to put a ceiling, you got to put a roof on that house.

You got to have floors. Who is it that's going to build those structures for you in the brick house structure and your soil. Those are going to be the fungi. The fungi builds our strands, our filaments, and they're going to take those micro aggregates and pull together a whole bunch of those. So we're starting to build the walls.

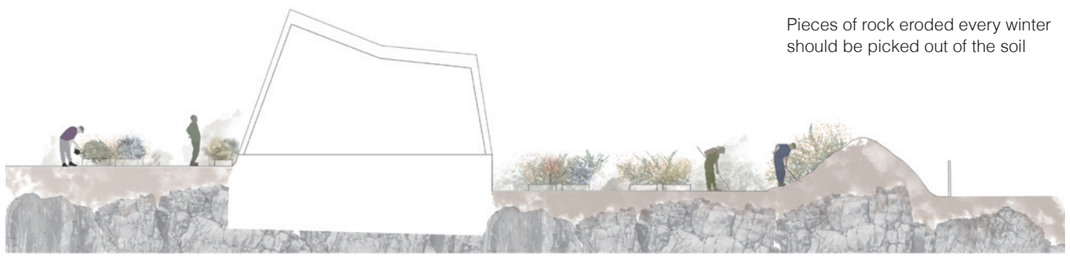
We're building the doors, the ceilings, the floors of the structure in our soil. And as we start to build these structures, you can see where we're pulling things together. And now we have space for oxygen and water, and a roof."

- Elaine Ingham (speech)
/transcribed by the team









Section A-A

Grow in the greenhouse

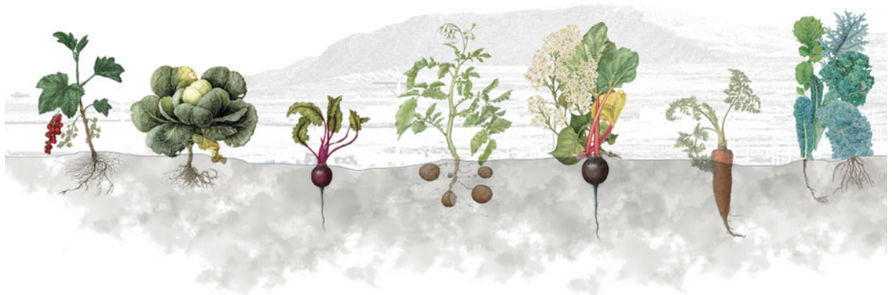
INSIDE

Basil travels ca 10 000 km to get to vardø, and is only available once a week

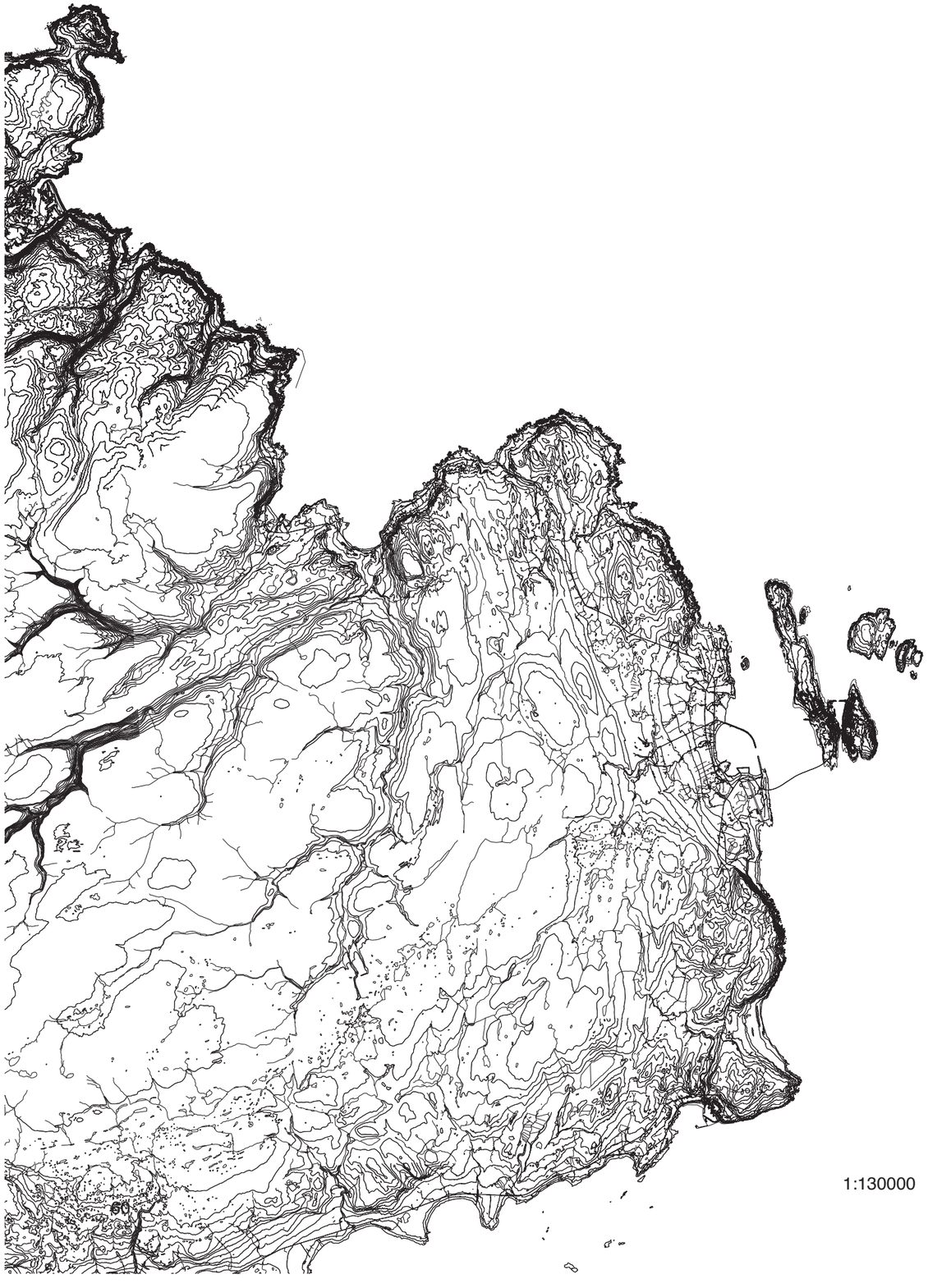
Because of the long sun hours, strawberries and tomatoes become more tasteful in the north

Cucumber Tomato Basil Strawberries Chives Salad Green peas Parsley

OUTSIDE



Red currant Cabbage Beet Potato Mangold Carrot Kale



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Seaweed, plastic and drift wood

As a result of climate change and human footprint, we find more and more plastic waste on the beaches around the world, also in northern Norway. Although some local societies along the coast have developed systems to clean their coastlines, fewer have thought about beach waste and making something out of it; to turn it into a circular resource. This work is focusing both on the plastic waste and its possibility of becoming a resource, on driftwood as an existing resource, and on the seaweed, a possible future resource that exists in abundance along the Varanger coast.

We drove along the coast of northern Varanger, stopping in almost every beach, gathering information and pictures of what we found, in order to further analyze and propose possibilities of future use for the community. Our main investigation area is Hamningberg, mainly the western beach, where we found the highest amount of accumulation of our three main categories.

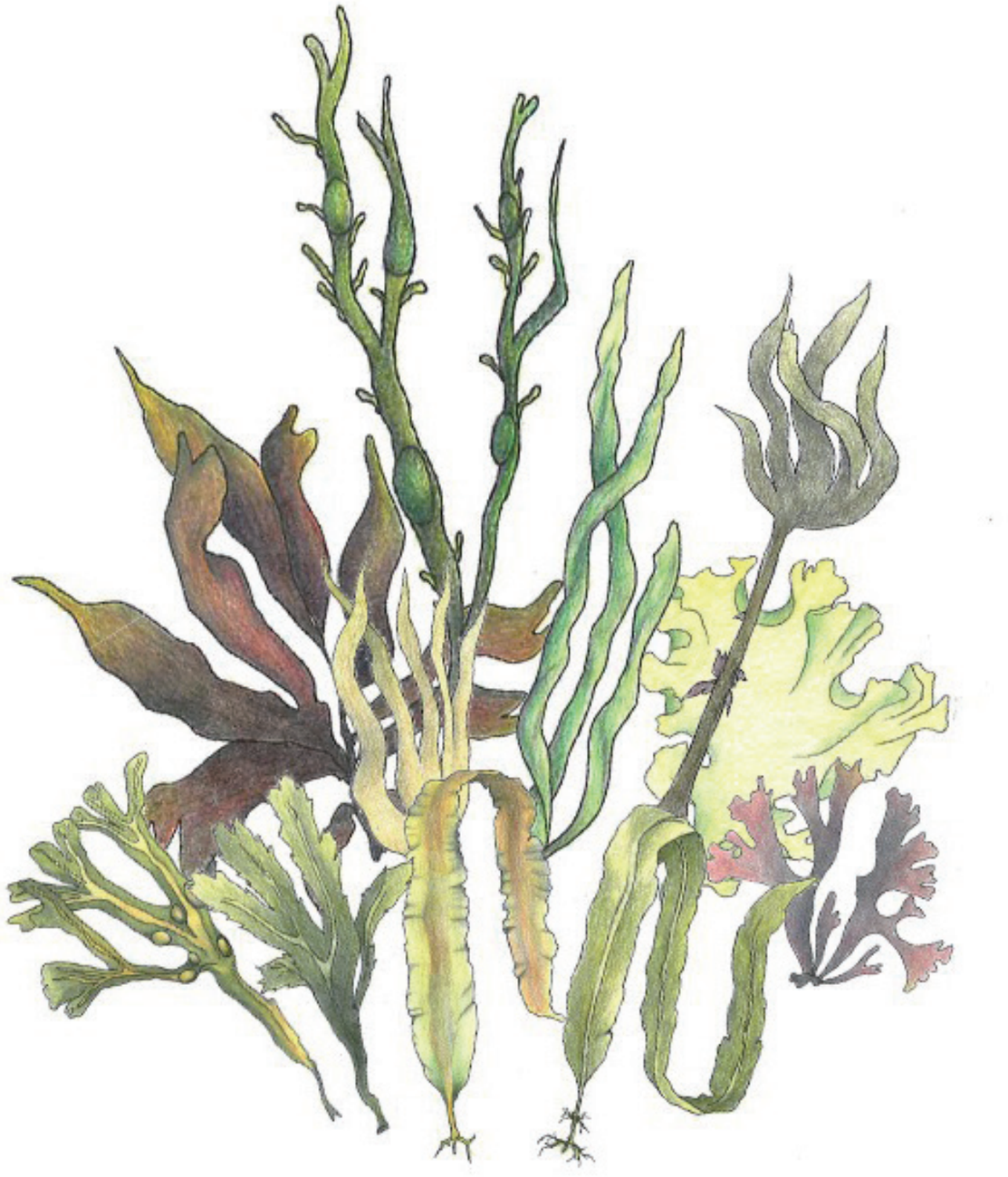
Research by

David Pedersen
Paula Costa Sot
Tu Uyen Phan-Nguyen

2021 Autumn _ Arkitektur- og designhøgskolen i Oslo

Photo: David Pedersen

Illustration: David Pedersen



Seaweed

There is a lot of natural resources hidden underneath the cold water of the Barents Sea. Our research aims to give inhabitants of the northern Varanger region knowledge of where they can find different kinds of seaweed species, how to identify them, and what they can be used for.

Seaweed, also called benthic marine algae, is a group of plants that can be found near the coastline, or further out on the ocean floor. We can classify seaweed intro three main groups, green (Chlorophyta), brown (Phaeophyta), and red (Rhodophyta).

Many species are known to grow really fast. During the summer time with a lot of sun hours they can grow up to 30cm each day. Especially where there are strong currents and the nutrient flow contribute to faster growth.

From what we have learned about the conditions in and around Hamningberg, we established that there is larger accumulation of different species of seaweed on the western beach of Hamningberg (See page 26). Large amounts of driftwood also accumulate in this bay due to the currents they drift on. That same currents combined with strong winds and large waves gives perfect conditions for seaweed growth in this specific area.

Seaweed is a resource that is not utilized well enough in our daily life. In this chapter, we will share some information that can help increase the competence related to the various algae that can be found along the coastline of Varanger. Our goal is to make it easier for people to include seaweed in their daily diet.

Seaweed species

An overview of the different seaweed species you can find along the Norwegian coastline. The description related to the pictures aims to inform about where the different species can be found in the sea, which parts of them are edible, and which parts should be left for further growth.

Illustrations: David Pedersen

WHAT: STORTARE (Laminaria hyperborea)

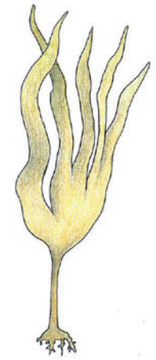
WHERE: The kelp plant thrives at a depth of 20m. Grows on rocky soils, and preferably in areas exposed to waves.

HOW: The stem and first part of the leaf are not used and should be left for further growth.

WHAT: GRISETANG (Ascophyllum nodosum)
30cm - 2m

WHERE: Grows at the top of the shore along the entire Norwegian coast.

HOW: This is seaweed and thus grows from the top. New shoots are being used in cooking.



WHAT: FINGERTARE (Laminaria digitata)
Up to 2.5m

WHERE: Located along the entire Norwegian coast between the coastal zone and the sea zone. Grows from the bottom in the transition between stem and leaf.

HOW: The stem and first part of the leaf are not used and should be left for further growth.

WHAT: SUKKERTARE (Saccharina latissima)
Up to 3m and more.

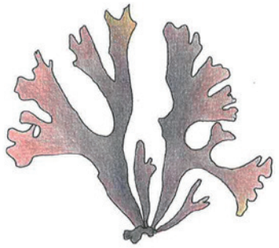
WHERE: Can be found along the entire Norwegian coast in sheltered waters. Grows from the bottom in the transition between stem and leaf.

HOW: The tip of last year`s leaves in the tip are often frayed and worn with a lot of growths on and this part should be cut away.

WHAT: BLÆRETANG (Fucus vesiculosus)

WHERE: Grows at the top of the shore along the entire Norwegian coast. Has midrib, is olive green and has paired blisters, one on each side of the midrib, but may lack these.

HOW: The new shoots can be used for cooking.



WHAT: KRUSFLIK (Chondrus crispus)
2 - 15cm

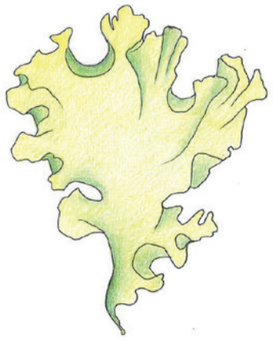
WHERE: A red algae species found along the entire Norwegian coast. Often grows on rocky bottoms in shallow water.

HOW: Grows from the top. Some of the algae should be left for further growth.

WHAT: SØL (Palmaria palmata)
5 - 20cm

WHERE: Found along the entire Norwegian coast in the spring zone, exposed waters. Often grows on the algae such as on the stalk of large kelp and mussels.

HOW: Grows from the base of the leaf and the whole algae can be used. Some of the algae should be left for further growth.



WHAT: HAVSALAT (Ulva lactusa)
Up to 20cm

WHERE: Can be found along the entire Norwegian coast.

HOW: Green algae is best used fresh. The whole leaf can be used for cooking.

WHAT: BUTARE (Alaria esculenta)
20 - 30 cm wide and several meters long.

WHERE: Grows most often a few meters down, but can be collected with rubber boots where shore is wide.

HOW: It is the middle field that is used, the one that is outermost and worn is cut away. The bottom part should be left for regrowth.

WHAT: TARMGRØNSKE (Enteromorpha)
Varies from 10 - 40cm

WHERE: Can be found along the entire Norwegian coast. Grows most often in puddles on boulders, but grows also directly on other species at the top of the shore.

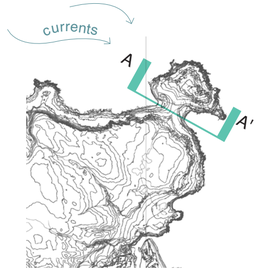
HOW: Everything.

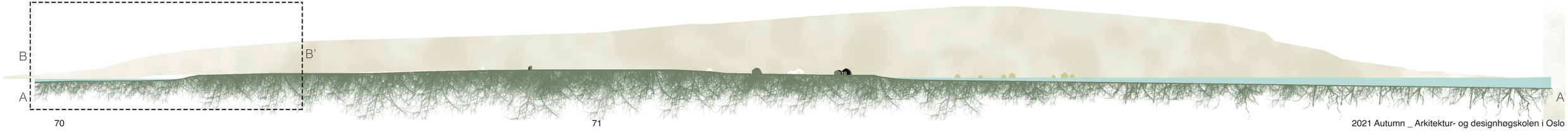
WHAT: SAGTANG (Fucus serratus)

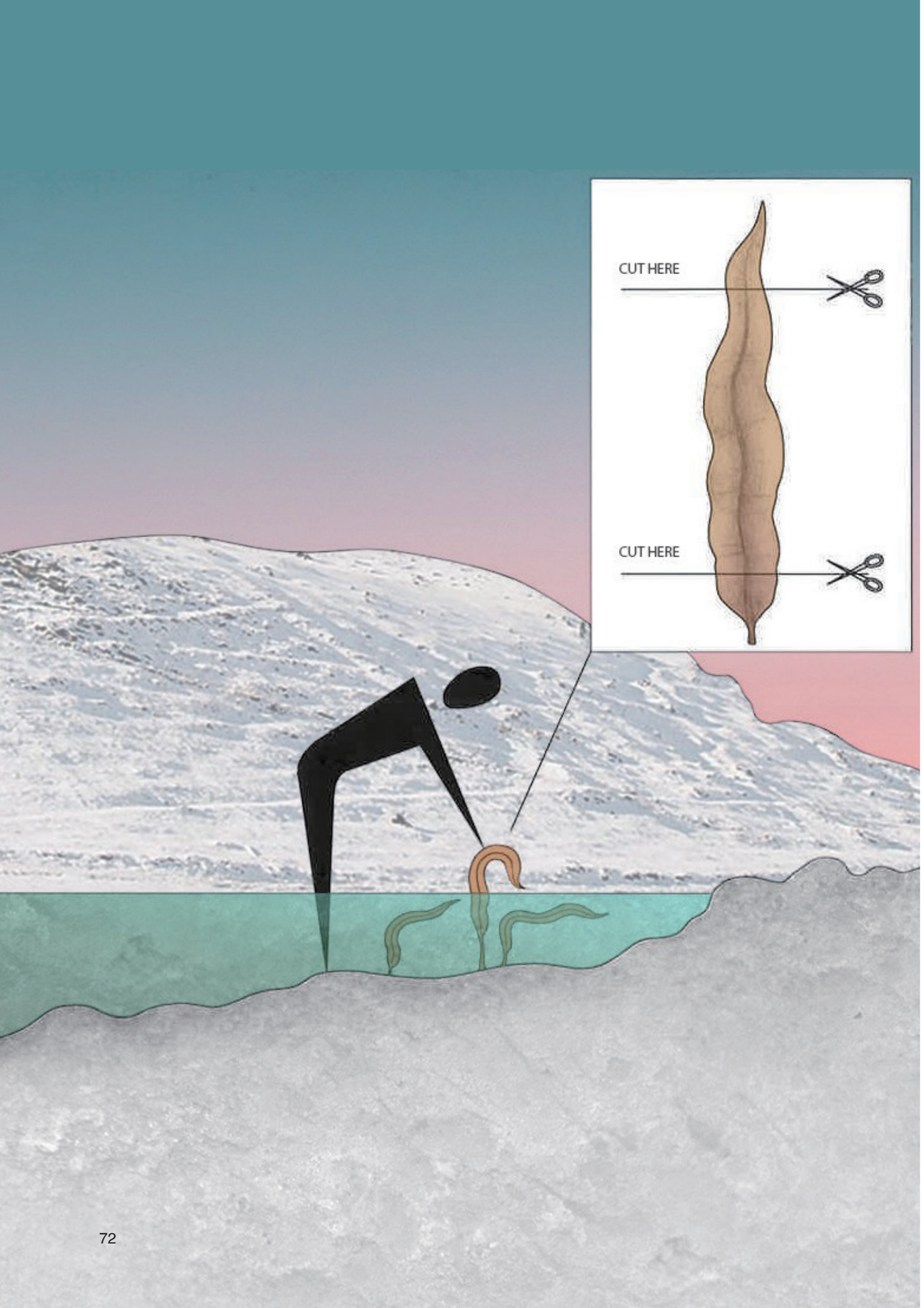
WHERE: Grows at the top of the shore along the entire Norwegian coast.

HOW: These are the new shoots at the far end and approx. 3-5cm down on the blade that can be used for cooking.

Beach section, Hamningberg



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CUT HERE

Seaweed - Kitchen

Seaweed is a natural and forgotten vegetable that is not often used for cooking, but which is suitable for it. You can find it along the entire Norwegian coastline and harvest it by yourself!

Seaweed can be prepared and used in many different ways. As a spice, salat or simply a decoration on your dish. You can even find species that taste like truffle. That's why there is a lot of potential in this amazing resource that is not yet seen that often in a typical household kitchen. It could be a good contributor to include more nutrients into our diet. There is a few companies, like Lofoten Seaweed, that promotes it and sells different kinds of products made of seaweed. Perhaps their Pasta Carbonara with truffle seaweed or vegan burger could be on your plate in the near future?

SIMPLY SEAWEED RISBURGER

Ingredients:

4 tablespoons Simply Seaweed +
8 tablespoons water
2 tablespoons ground flaxseed +
6 tablespoons water
2 dl boiled rice
1 onion
3 garlic cloves
1 carrot
0.5 dl oatmeal / ground oats
2 tbsp soy sauce
1 tbsp lemon juice
1 dl sunflower seeds
olive oil
a pinch of smoked paprika spice
salt and pepper

TRUFFLE SEAWEED - CARBONARA

Ingredients:

500 g Tagliatelle with seaweed
2 tbsp oil
2 eggs and 2 egg yolks
50 g grated parmesan
1 tablespoon truffle seaweed salt
1 teaspoon pepper

Photo and illustration: David Pedersen

Care for the plastic

Our focal point has surrounded the edge of land and sea, mainly the coastal line. Specifically, we investigated parts of the drift material that our ocean washes back ashore. We received information that occurrences of driftwood were quite common on the beaches in our research area. As a circular resource, the potential of driftwood is easier to imagine. But our first investigations showed us that plastic is one of the main products arriving to the northern beaches, guided by the sea currents going north.

The research project Unruly Heritage: An Archaeology of the Anthropocene refers to contemporary waste as the 'material legacies of the Anthropocene', pointing out the unmanaged chaos that continues to strangle the lives of the ocean.[1] Through this project Þóra Pétursdóttir and Bjørnar Olsen criticizes what we as a society perceive and cherish as cultural heritage and what we easily exclude despite UNESCO's inclusive definition of heritage: 'our legacy from the past, what we live with today, and what we pass on to future generations'. For a long time, we, as a society, have dealt with unwanted byproducts with an attitude of 'out of sight, out of mind'. What we are witnessing today is our material past returning, haunting the landscape, harming nature and disrupting ecologies.[2] It would be ignorant to discard these man-made 'archipelagos of sea-borne debris', so strongly claiming presence, occupying physical space, demanding our attention, in fact are products of our culture, our modern society, indeed our 'legacy from the past'. And they are in need of care. Care is the keyword of how we deem what is valuable to pass on or to leave out - we need to care.

According to Pétursdóttir and Olsen, this implies a rethinking of care as a concept that exceeds human acts and extends to a meaning of 'capacity' to be 'realized within actual material ecologies'.[3] Meaning to include how objects, environments, people and animals meet and co-inhabit a shared world. Heritage is commonly understood as a 'past cared for and consciously addressed'. Maybe lifting drift material and waste in the discussion of heritage could inspire an alternate, more careful approach.

Photo: Mehmet Deniz

1 Pétursdóttir, Þ. & Olsen, B. (2016, November) Unruly Heritage: An Archaeology of the Anthropocene.

2 Ibid., p. 41

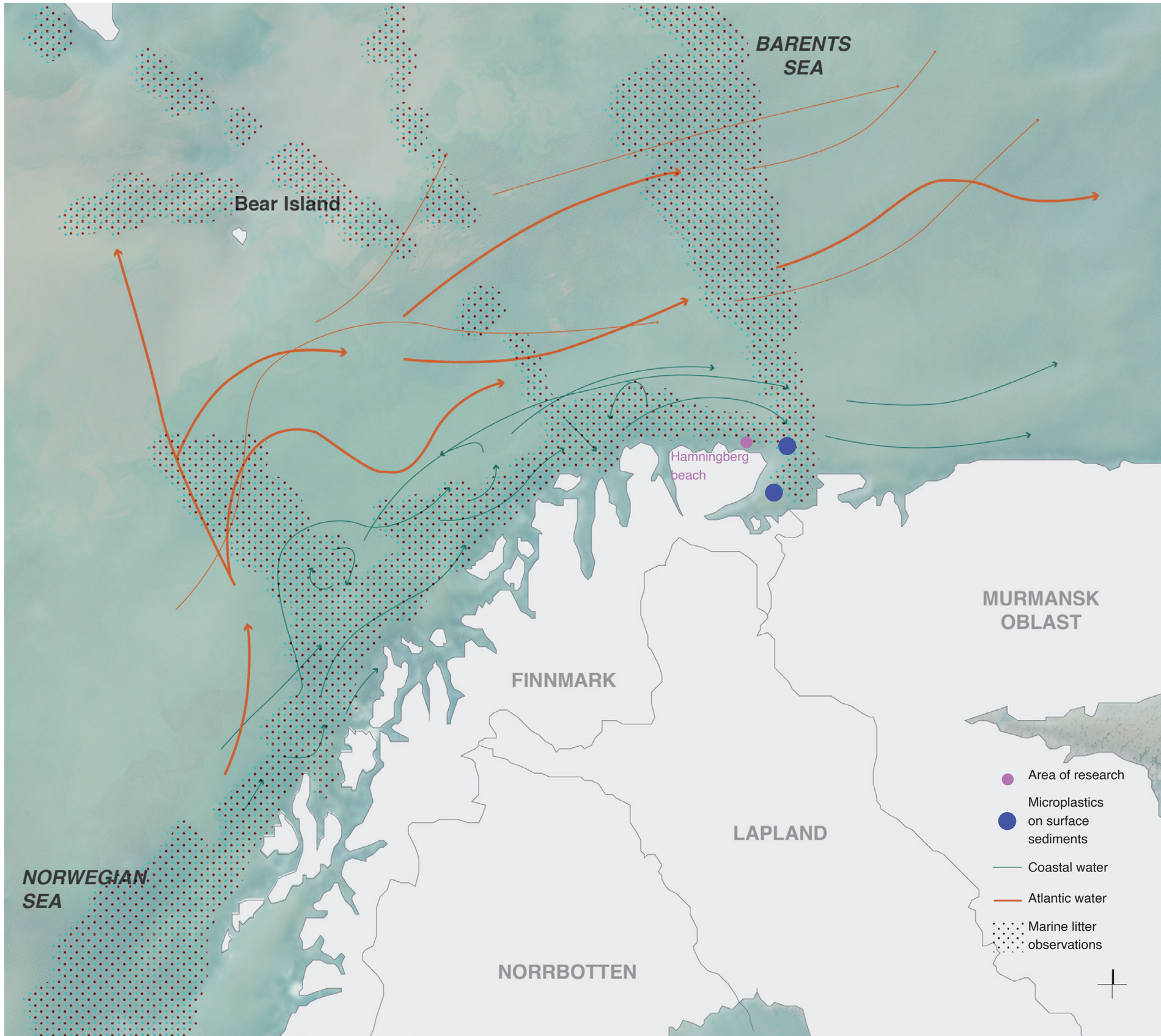
3 Ibid., p. 41

Plastic pathways

To get a better understanding of how plastic gets transported, we looked at maps for ocean currents. We also wished to understand where the materials come from, where it accumulates and what types of plastic travels with the currents.

From the MAREANO database, an online map compiled by a research group from the Norwegian Institute of Marine Research, we gathered data of observed marine litter, mainly plastic.[1]

Two dots on the map signifies areas near our research site, where researchers recently found the amount of microplastic to be 26-50 granulars/particles per kilo of sediment dry weight.[2] Not surprisingly the ocean and air currents carry microplastic to the arctic regions.



1 http://mareano.no/kart/mareano.html#maps/6133 (10.11.21)

2 https://mareano.no/nyheter/nyheter_2020/nye-kart-over-forurensing-og-mikroplast (10.11.21)

1. Hamningberg
2. Sandfjordneset
3. Frøkenhollbukta & Persfjorden
4. Næringsbukta
5. Vesterbarbika
6. Sandvika, Vardøya
7. Laukvika
8. Skinnstakkvika
9. Molvika

Areas of accumulation

Speaking to Frank Cato Lahti, a local plastic entrepreneur, and Varangerfjæras Venneforening (VFVF), a non-profit organization consisting of people from the Varanger area, we gathered information on where the highest accumulation of marine litter, including plastic and driftwood, occurs. There are organizations such as Rydd Norge and Nordic Ocean Watch that organize huge cleaning 'dugnad', that usually happens once or twice a year, often late spring and early autumn.[1]During these sessions massive containers are temporarily placed on targeted places to gather all the trash collected. After a cleaning session, the container is transported to a recycling station. As we understood, everything is put into one big container.

According to a spokesperson of VFVF, much of the marine litter is in bad condition, only if lucky will one find some reusable metal. We have found Sandfjordneset and Molvika to be two of the beaches where Rydd Norge organizes cleaning dugnad. Molvika is the beach where most of the usable driftwood was collected.

Hamningberg is one of the beaches with high accumulation of litter. During our field trip to the beach, an open box was already placed for people to collect whatever marine litter they could find. Even though the beaches most likely have already been cleaned, the box was overfilled.

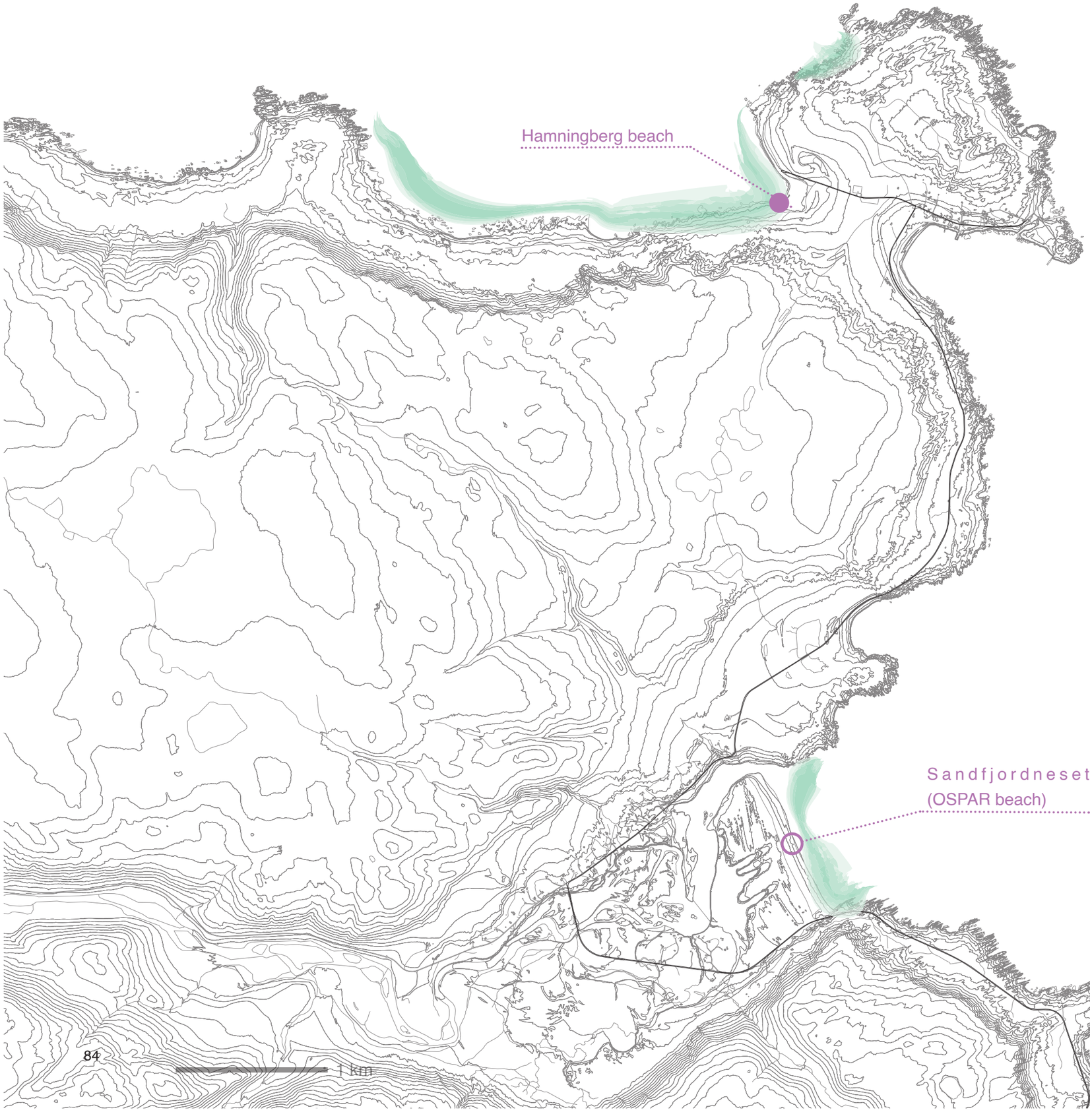
1. Persfjorden-Syltefjorden
2. Barvikmyran & Blodskytodden
3. Vardøya
4. Recycling station

Information gathered from Frank Cato Lahti and Varangerfjæras Venneforening

1:10000

10 km

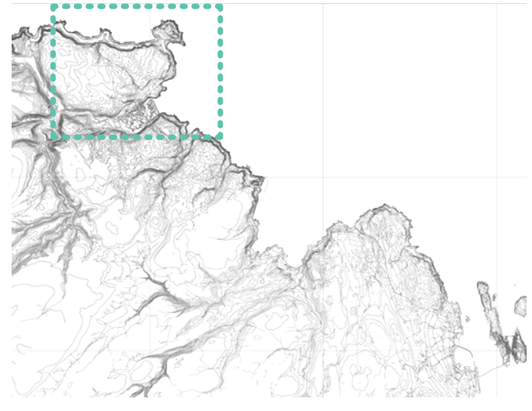
1 https://ryddenorge.no/aksjon/37322 (10.11.21)1 https://ryddenorge.no/aksjon/37322 (10.11.21)



In the period from 2010 to 2016 the Norwegian-Russian ecosystem surveys (a collaboration project between the Norwegian Institute of Marine Research and the Knipovich Polar Research Institute of Marine Fisheries and Oceanography), have been monitoring marine litter in the Barents Sea showing a dominance of plastic waste.[2] The Oslo/Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) recorded that nearly 90% of the litter on the beaches are plastic. Accordingly, most of the plastic originates from the fishing industry. [3]

[2] Strand et al. ,"Potential sources of marine plastic from survey beaches in the Arctic and Northeast Atlantic", p. 2

[3] Ibid.

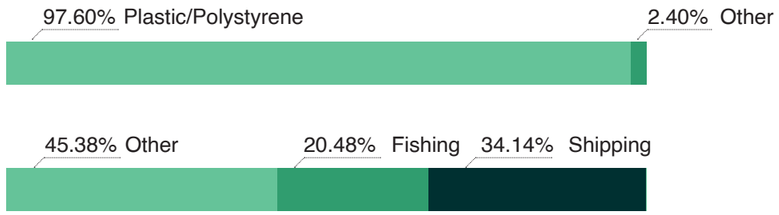


OSPAR registers the marine litter using different categories, including sub-categories: Plastic & polystyrene, metal, wood (machined), rubber and cloth. Only from 2012 to 2014 the number of items nearly doubled:

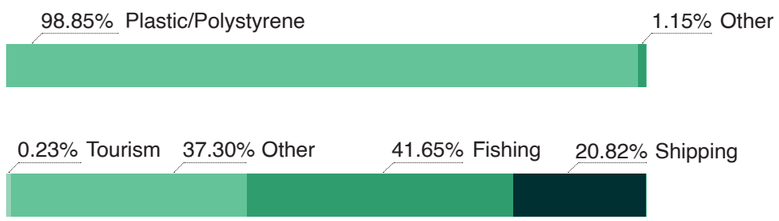
We understand from these charts (2012 and 2014) that the amount of plastic deriving from fishing has more than doubled. [4]Tourism also entered the statistics.

[4] https://beachlitter.ospar.org/beach/sandfjordneset/survey/1km/2012-10-02/summary (11.11.21)

Sandfjordneset 1 km, 2012
No. of items: 249



Sandfjordneset 1 km, 2014
No. of items: 437



Information gathered from OSPAR

Photo: Tu-Uyen Phan-Nguyen

Photo: Tu-Uyen Phan-Nguyen

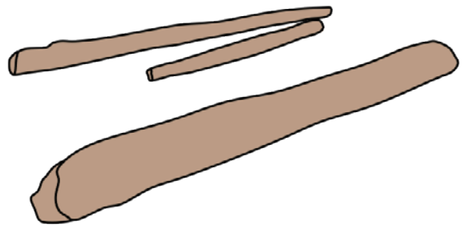
Suggestions for future scenarios

As a result of our investigations, we came up with suggestions of what to do with the resources found on the northern coastline and beaches, one for driftwood, one for plastic and one for seaweed.

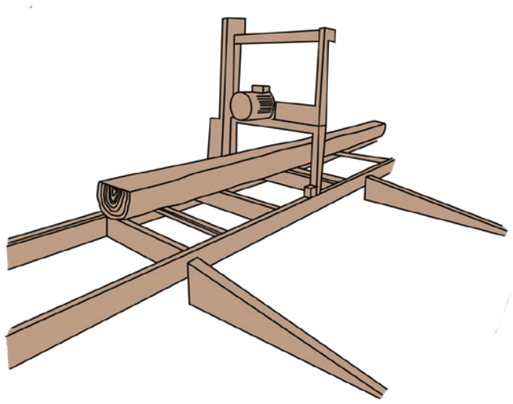
Driftwood on the beach. Photo: Tine Hegli

Driftwood process

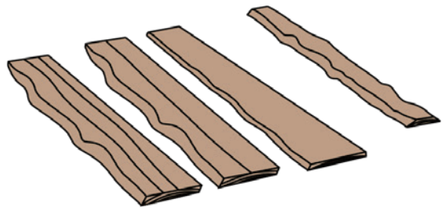
A possible future use of driftwood could be small architectural structures such as Hjellen, a shelter designed by the AHO architecture studio course *In Balance – Arctic Cycles II* for Vardø hockey club, from source to final product.Credit: In Balance studio, Tine Hegli, autumn 2021



1. Driftwood collected from the beach. Can be used both as construction and cladding material.



2. Material production on the sawmill.

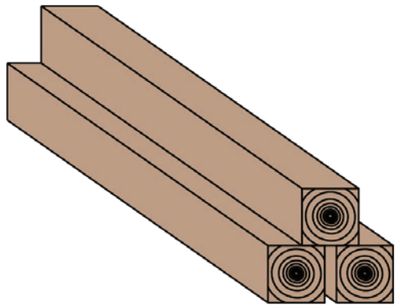


3. Cladding made of 'leftovers' from the sawing process of construction parts.

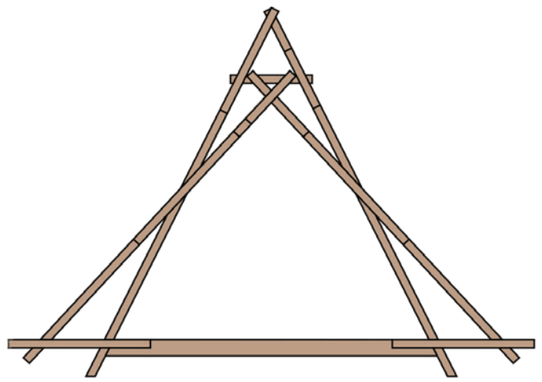
a.

b.

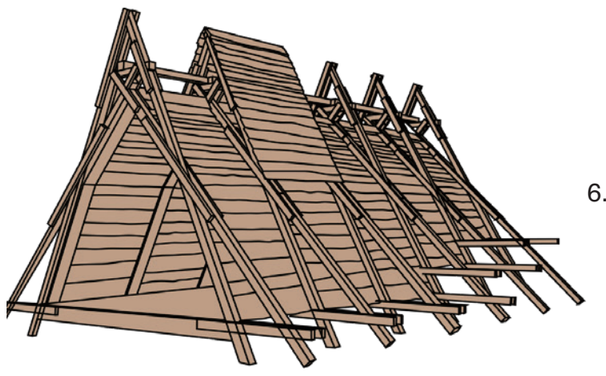
c.



4. The core of the timber which is the strongest part of it can be used for construction.



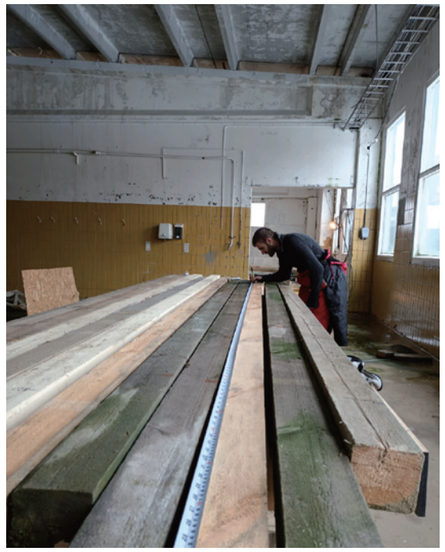
5. Example of a frame built of driftwood.



6. The end result. The project aims to show how to utilize local resources. In this case driftwood that ends up along the beaches along the Norwegian coast.

e.

d.



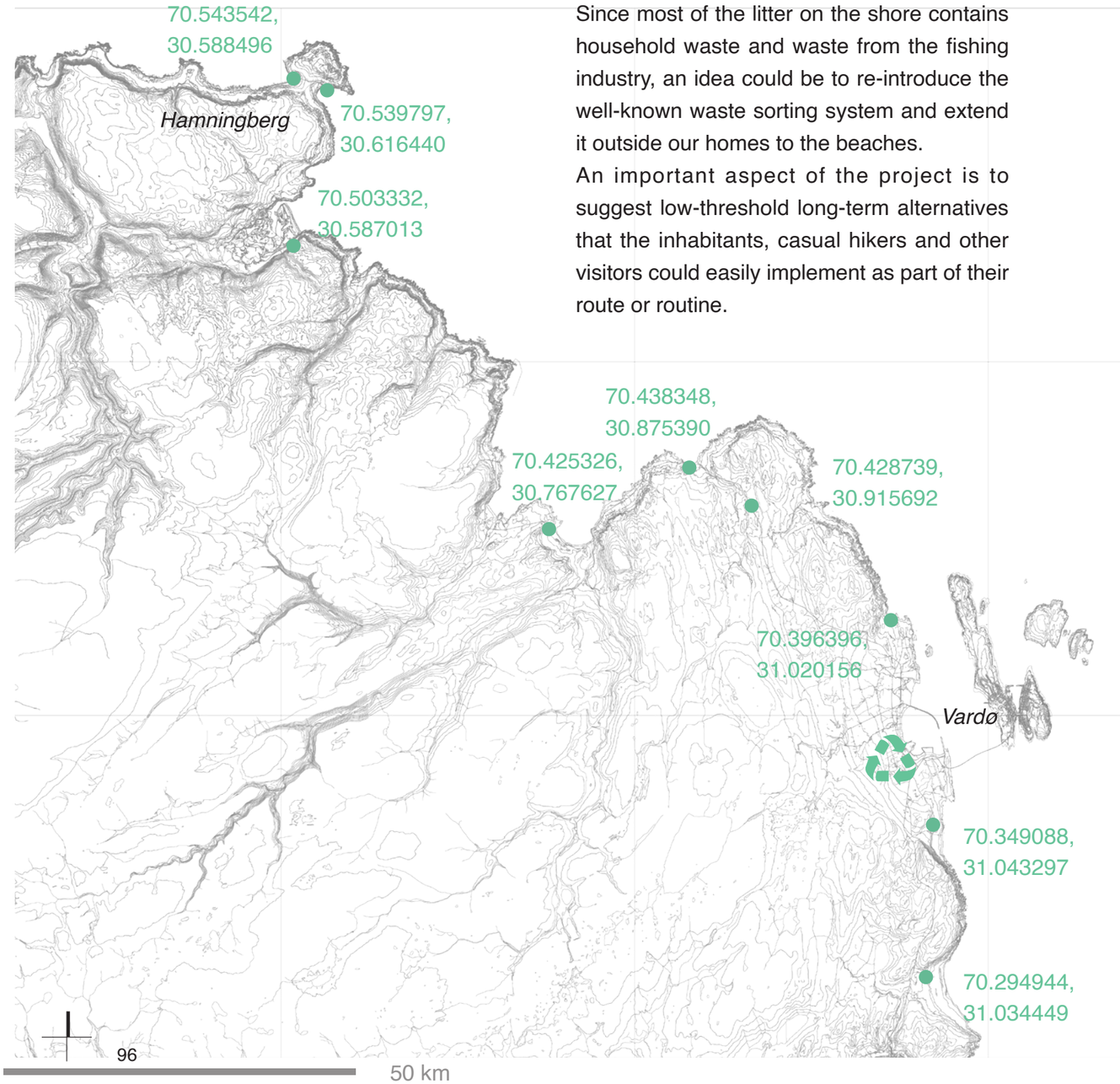
f.

Photos:
a. Hanna Lie Bakken
b. David Pedersen
c. David Pedersen
d. Paula Costa Sot
e. Paula Costa Sot
f. David Pedersen

Plastic collection system

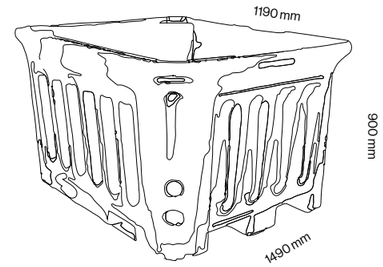
With an ambition to highlight the circular potential in plastic waste, we want to stress the importance of sorting the waste collected from the beaches as much as possible. Since most of the litter on the shore contains household waste and waste from the fishing industry, an idea could be to re-introduce the well-known waste sorting system and extend it outside our homes to the beaches.

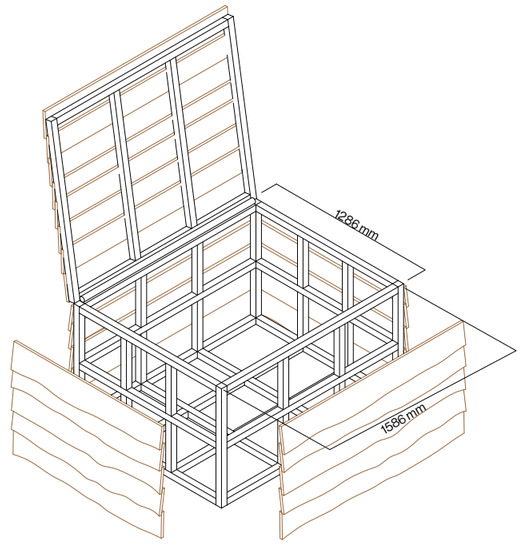
An important aspect of the project is to suggest low-threshold long-term alternatives that the inhabitants, casual hikers and other visitors could easily implement as part of their route or routine.

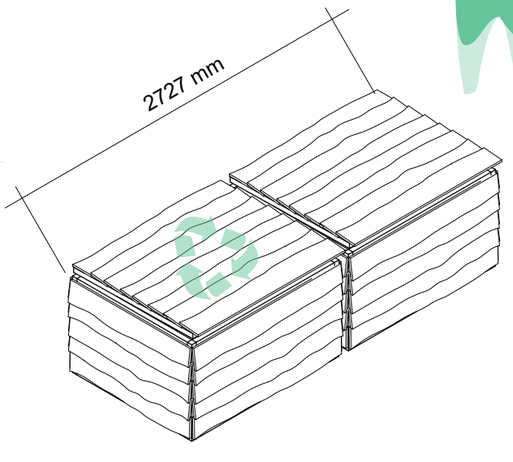


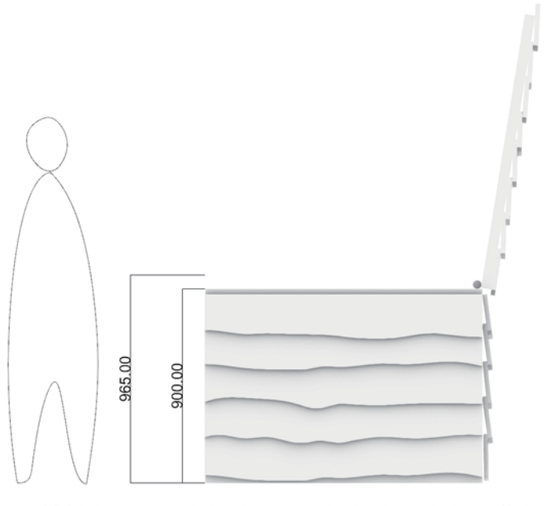
A suggestion is to strategically set out 1m3 boxes with a simple sorting system: household waste and waste from the fishing industry. The modularity of the design allows for multiple boxes if needed. The dimensions of the boxes are determined by the common fishing box of 1m3. The boxes are then protected with a structure made from driftwood. When emptying, the internal container can be lifted from its shell, and be replaced or put back when emptied.

The strategy implies using the existing roads as the main access route to the boxes. Most of the placements are near a main road for easy access. Suggested placements are indicated by the green dots and fixed with coordinates.

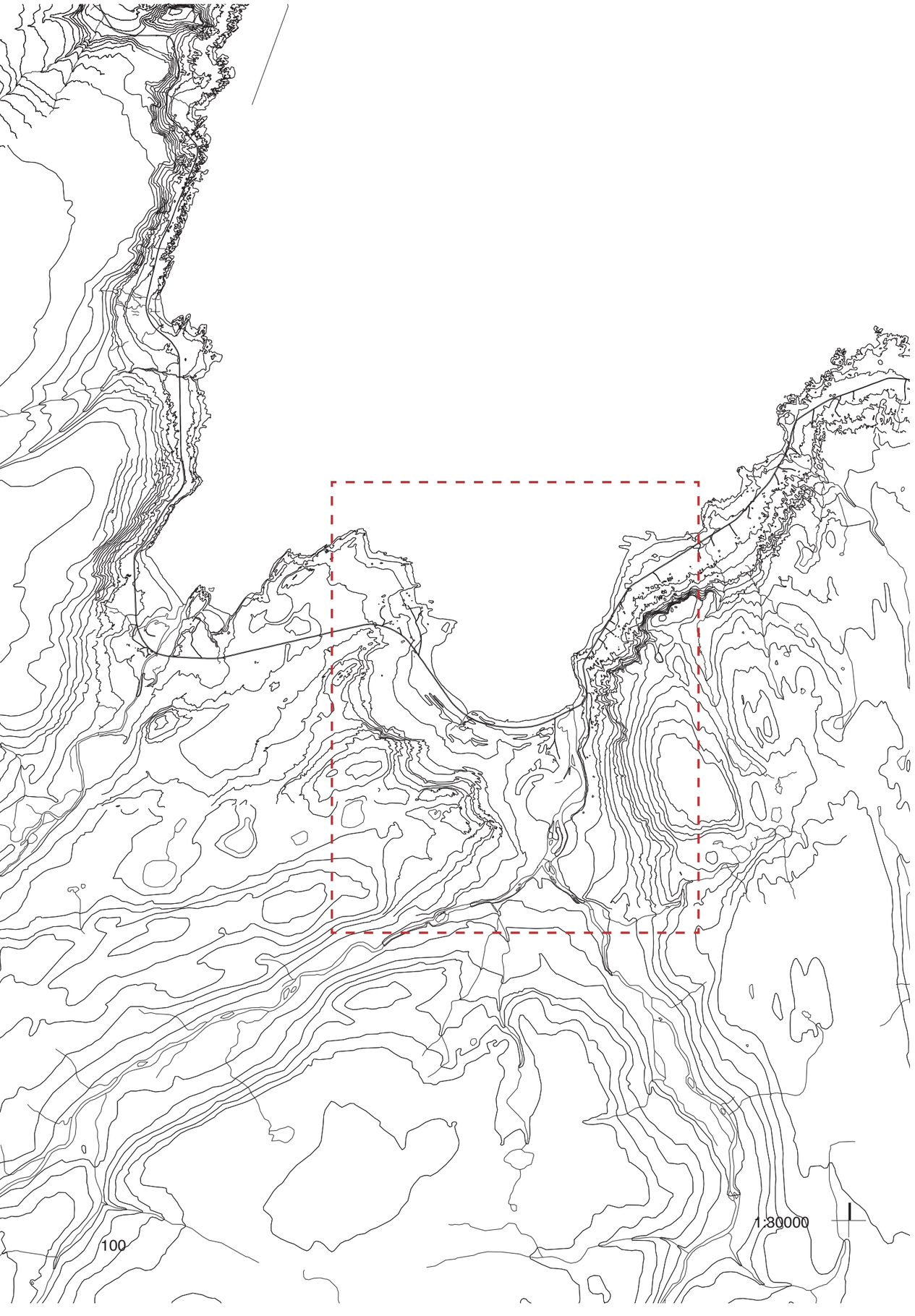








Photos: David Pedersen



Persfjord

Most of Persfjord is a landscape conservation area (landskapsvernområde) established in 2006 in order to protect a unique and arctic natural and cultural landscape together with the landscape's biological diversity. The settled parts of the area have not been included in the conservation area.

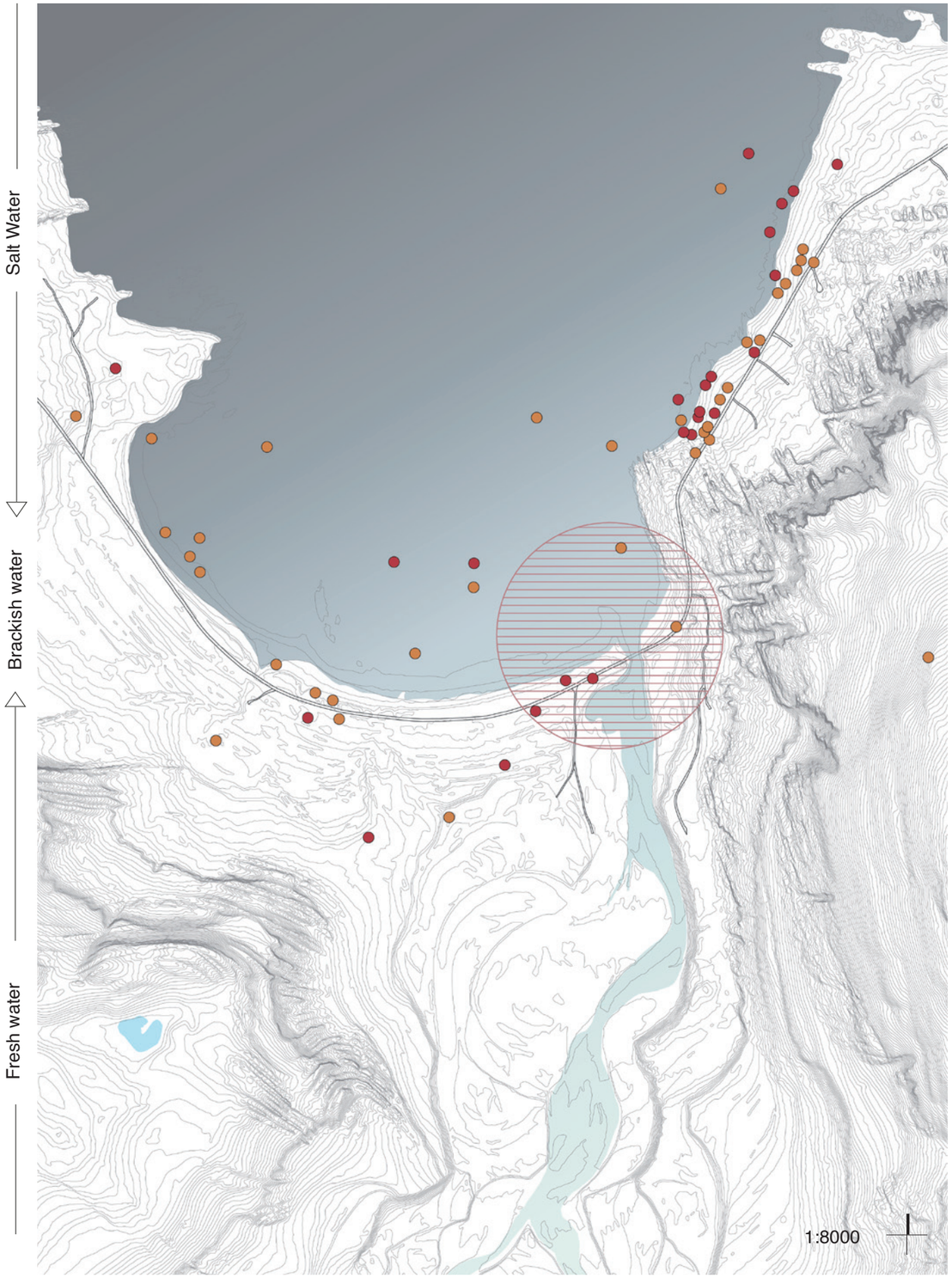
Persfjord is a lush valley surrounded by hills. The river Austadelva flows through the valley and ends up in Persfjorden. This creates a brackish water delta which is rich in biodiversity and important for several species in the area. The movement of the river has over the years created a meandering pattern of older river courses throughout the valley and also a coherent layer of soil (river and creek deposits) that can be up to 10 meters thick. A long beach runs along the alluvial plain, and the remainder of the coastline here has the characteristic vertical rugged rocks of the area and a long sandy beach.
There have been settlements in Persfjord since ------, and some of the soil surrounding the existing cabins and houses has been cultivated to make grass/animal feed since then and until the mid 1980's. Our research of Persfjord has revealed that the brackish water delta, although omitted from the conservation area, is an important nature type to take care of.

We will make some suggestions for how to deal with the previously cultivated areas whilst considering future scenarios like sea level rise and higher temperatures. Based on a mapping of the different soil types in Persfjord we will make suggestions for cultivation and what to grow in the future.

Research by

Hanna Lie Bakken
Helene Sellevoll Karlsen

2021 Autumn _ Arkitektur- og designhøgskolen i Oslo



Endangered species Birds Plants Brackish water

Delta

On the eastern side of Persfjord, Austadelva runs into the fjord and the ocean. Fresh water meets salt water and a brackish delta is formed. Deltas are typically threatened by development as these areas also attract humans. Because of this the Brackish water delta as a type, depending on the level of interventions already done, is protected.

“Brackish water deltas are often "high productive" wetfields/floodfields and therefore of great importance for birds, especially when they are migrating. Rare types of nature and species (birds and plants) often thrive here.”

From the maps of Artsdatabanken and a registration sheet from Bioforsk about the birds of Persfjord we know that quite a few rare and endangered species of both plants and birds gather here. (Sjøorre, Gulnebblom, Havelle, Kalkarve, Finnmarkssvineblom) The river outlets are specifically pointed out as spots to look for birds. So even though the delta is not a part of the landscape conservation area we consider it an important area to protect and maintain. Shrubs are a specific threat for the delta as they thrive close to water and in areas protected from wind. The landscape conservation area in Persfjord is important to protect. Our mapping suggests however, that if in a future scenario one is in dire need of more arable land it is worth considering repealing the zone in some places. For this scenario, we studied the zones outside the conservation area.

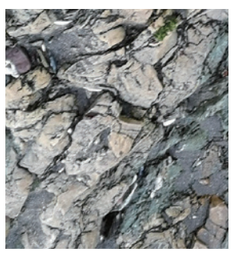
David Pedersen

Soil

There are four soil types present in Persfjord, bare rock, marine beach deposits, creek deposits and wind deposits. It is the creek deposit soil that is best suited for creating more arable land. This soil has more humus than the other types which have more sand and stone. Humus is a decomposed organic matter that improves the soil's pH stability and improves the condition of the soil. The river also brings minerals, further enriching the nutritious soil in the delta area.

Miljødirektoratet's maps tell us that the already developed and cultivated areas in Persfjord have been omitted from the protected landscape conservation area. This means that the existing arable areas, former outfields around houses, also lie outside the protected area. We propose to keep and maintain the existing arable areas. If they are not maintained we fear they might be overtaken by shrubs or crowberries.

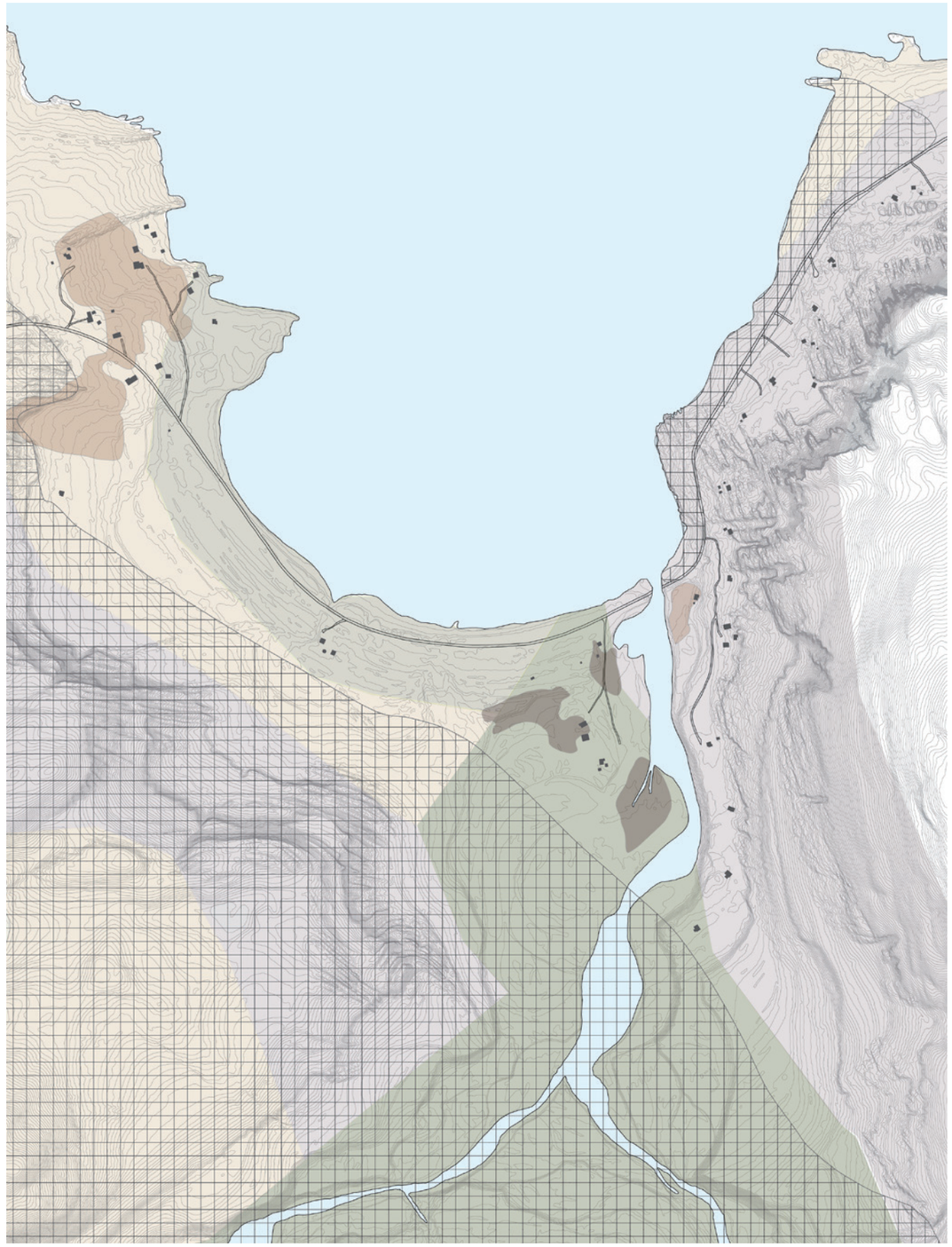
Bare rock



Marine beach deposits

River and creek deposits

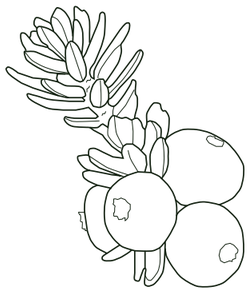
Wind deposits



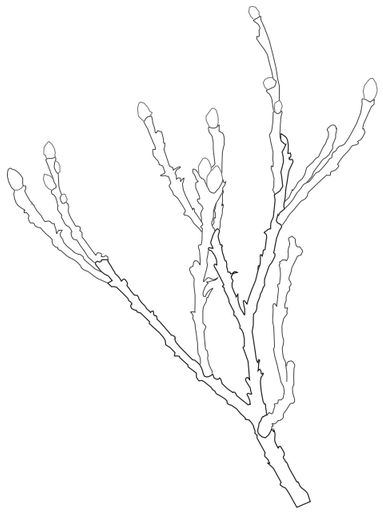
Arctic climate zone?

The coastline between Vardø and Hamningberg has been lying within the Arctic climate zone until very recently. Arable soil is scarce in the Arctic, and it takes a long time to build. If one wants to have the opportunity to grow in this area in the warming future, we may have to take some measures today. We have observed a rich carpet of Empetrum (krøkebærlyng) at the outskirts of the grasslands. Crowberry and shrubs are a threat for Persfjord's biodiversity if they are allowed to grow undisturbed.

Shrubs thrive in wet areas and can overtake large areas of land. Shrubs are already spreading on the east side of the river and if we look to Sandfjord and Sandfjordelva we can make assumptions that the shrubs will start spreading along Austerelva in Persfjord as well. Another threat for Persfjord's biodiversity is crowberries. Crowberries are a threat to the biodiversity of the tundra because of their high adaptability and the unfertile soil they leave behind when removed. It is important to find a way to prevent the spreading of these species in order to preserve the arable land, grazing areas, existing landscape and biodiversity.

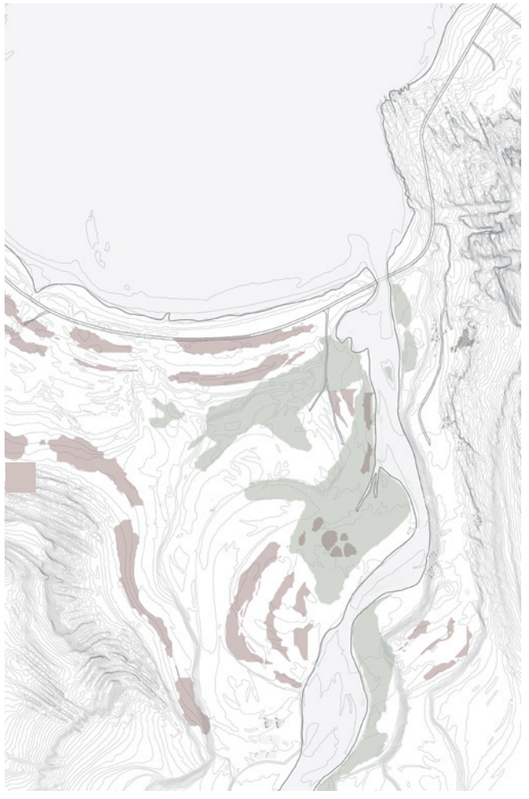


Crowberries

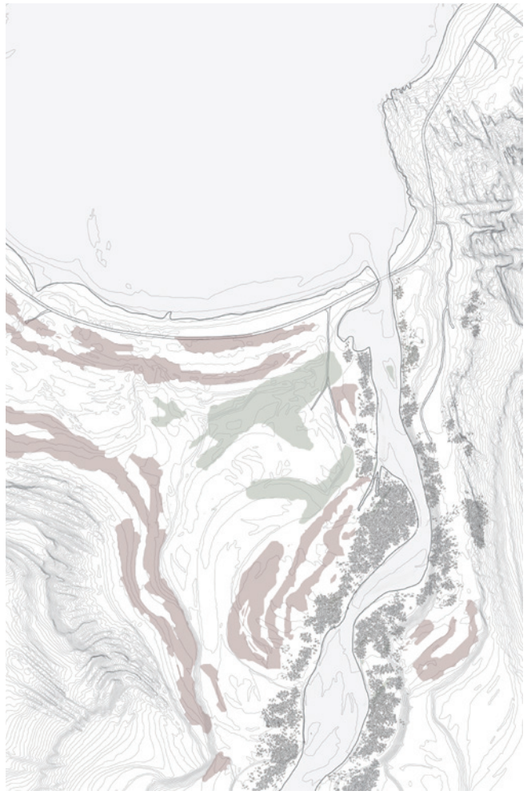


Shrubs

Present situation



Future scenario (2070)



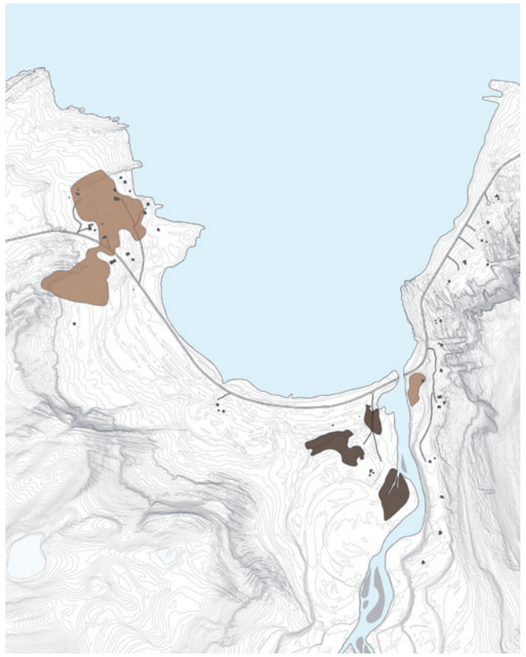
Crowberry Grass Shrubs

Cultivate the delta

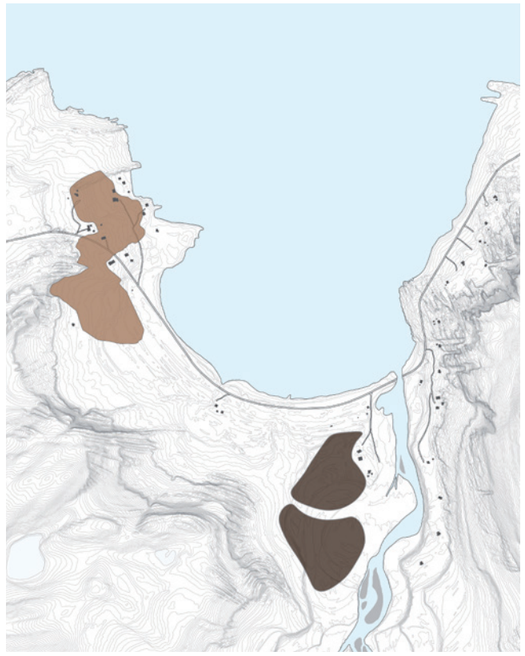
A way to prevent the unwanted species from spreading is to cultivate soil and control the growth. Persfjord has a history of growing and harvesting grass. The grass was used to feed animals (we know Persfjord has had sheep, cows, pigs, horses and chickens) and the surplus was sold to farmers in Kiberg and Kramvik. The last grass was harvested in 1985, and many of the farmers moved to Vadsø. Since then, the farms have been used as cabins and Persfjord is now a place for recreation where birdwatching and hiking are the main activities. If property owners were to start cultivating grass and soil again and expand the current registered arable land, this could provide great benefits for the Persfjord's biodiversity. This would keep the unwanted species away while also utilizing the fertile soil.

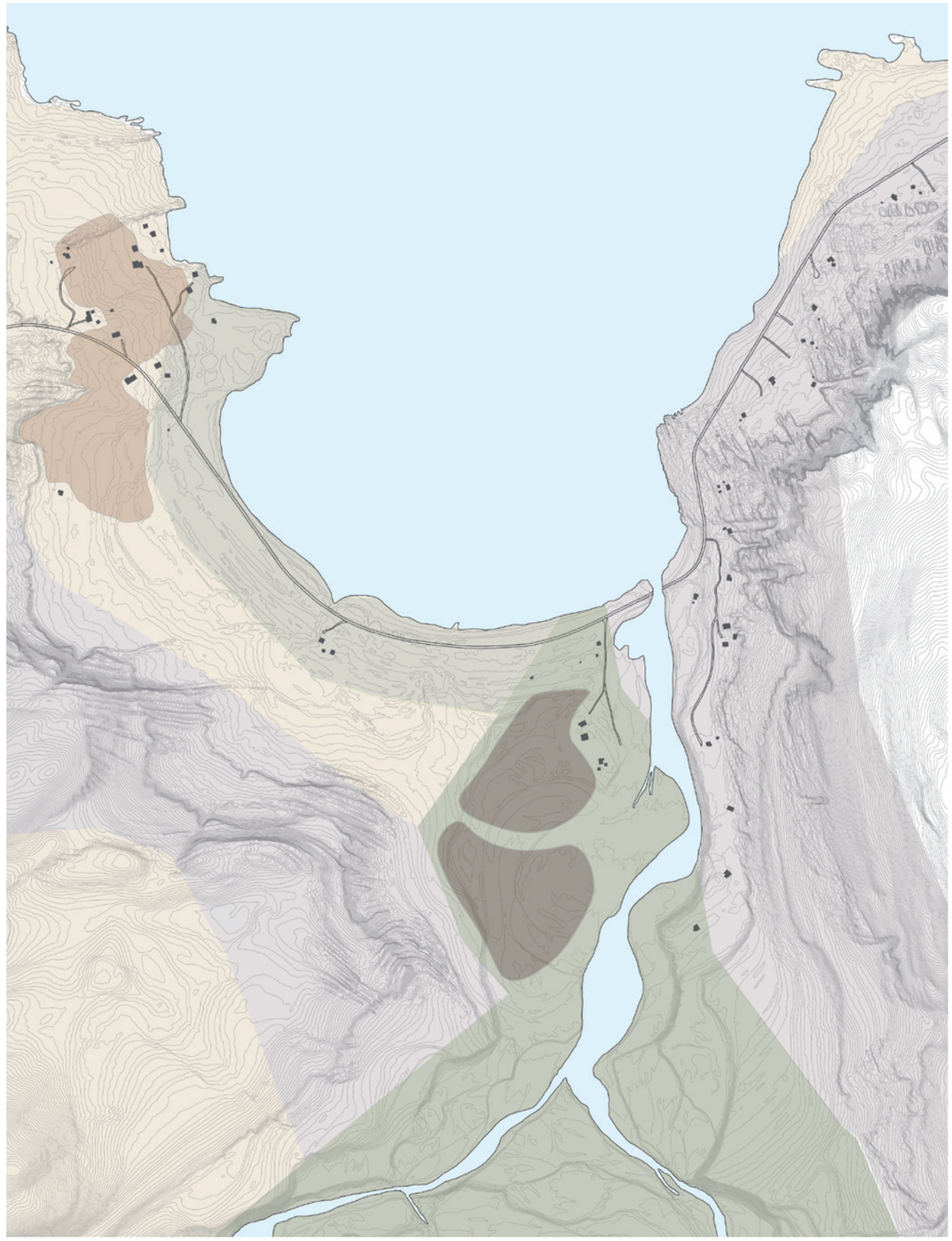
During the past years we have heard more stories of reindeer starving to death, and one of the main reasons for this is the warmer and more unstable winter climate. When snow melts and then freezes, ice is formed on the ground and then the reindeer can't get to their food. Because of this we also consider the possible growing of grass in Persfjord as an emergency supply for starving reindeer.

Cultivated soil today



Cultivated soil future



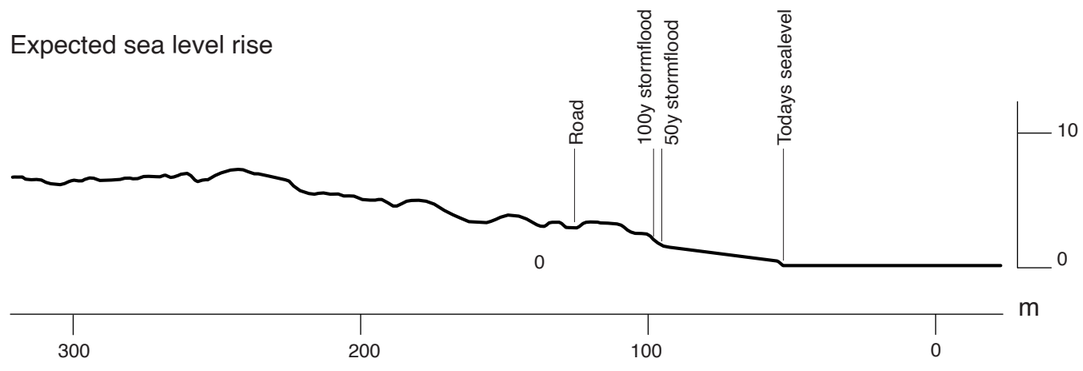


Flooding

Photo : Janike Kampevold Larsen

A prerequisite for having areas with arable soil in the future is that the area lies higher than the predicted height for sea level rise. The road running along the Persfjord beach varies in MASL (MOH in Norwegian) from approximately 4 to 6 MASL, but as we can see from the picture (above) water has already made patterns in the sand quite close to the road. The expected sea level rise with a storm flood in a hundred years is 3 meters, but we can expect the waves to be higher and wash over the road.

Hence, cultivated soil needs to be above the road and towards the south, slightly up the valley (see section) the valley. Flooding from the river is also a challenge when cultivating in the delta. It may be important not to plow the soil in order to make sure that the soil has roots that hold it in case of flooding.



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