

Helsinki-Uusimaa Regional Council

STUDY OF WASTELANDS IN INGÅ AND HELSINKI-UUSIMAA REGION Final Report

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We are pleased that we got the chance to dive into the interesting topic of wastelands and afforestation and hope that our report will be valuable in the future.

1 INTRODUCTION

1.1. Description

This study was made under Pioneers into practice -programme by EIT Climate-KIC. Climate-KIC is a European knowledge and innovation community, and the largest European partnership programme focusing on climate change. The programme is supported by the European Institute of Innovation and Technology (EIT), which is a body of the European Union. The programme includes an Europe-wide expert exchange for climate experts (Pioneers) and learning components on systemic change, the methods and tools of which were utilised during this study. The study is an outcome of one of a series of group assignments, which form a part of the learning component. They are connected to real-life mitigation challenges, presented to the Climate-KIC Pioneers by appointed problem owners.

The study was carried out between June and November 2020 by Pioneers who have different backgrounds in topics such as sustainability and climate change. The original title of the challenge was "The question of forestation of wastelands in Helsinki-Uusimaa Region - How to increase the area of forested land to strengthen the carbon sinks of Ingå and Helsinki-Uusimaa Region?".

Our challenge owners were Elina Röman from Ingå commune and Simo Haanpää from Helsinki-Uusimaa Regional Council. Helsinki-Uusimaa-region has a target to become carbon neutral by 2035, and carbon sinks, mainly found in forests, and compensation means are important elements in reaching this target. As the current carbon sink of forests in Helsinki-Uusimaa region is found to be negligible due to extensive use of wood and a substantial amount of forest cover is lost for construction purposes, there is an interest to identify suitable areas for afforestation. Elina Röman, the then environmental chief of Ingå, as the main challenge owner wanted to find out if there are suitable wastelands in Ingå commune that could be afforested in order to increase carbon sinks in the area.

Already in the beginning, our discussions were linked to an act proposed by the Ministry of Agriculture and Forestry of Finland, for a new subsidy that a private landowner could receive for afforestation for certain types of wastelands, which are mainly land areas which have previously been used for agriculture or for peat extraction, but are currently out of use. This act was accepted on 17.12.2020 (*Laki metsityksen määräaikaisesta tukemisesta*, 1114/2020). In the first discussion Aapo Ahola, environmental inspector from Raasepori, the neighbouring commune of Ingå, was also involved to deepen the discussion on how to approach the challenge.

In this challenge we intended to study

a) what is the potential of using wastelands for increasing carbon sinks by afforestation in Ingå and Helsinki-Uusimaa region?

b) how the afforestation process works and what are the challenges related to it?

c) what other potential ways, besides afforestation, there are to increase carbon sinks in Ingå and Helsinki-Uusimaa region?

d) what other potential uses than afforestation are there for wastelands to tackle climate change and preserve biodiversity in Ingå and Helsinki-Uusimaa region?

In this task we used GIS data in order to identify the possible suitable areas for afforestation. We also contacted and interviewed stakeholders in order to understand the bigger picture and to find answers to our questions. In order to estimate the suitability of different areas for afforestation we were considering different aspects of the system, such as biodiversity of the wastelands and how the wastelands can be part of green corridors. We were also studying other possible options, besides afforestation, in order to increase the use of carbon sinks in the region and provide further knowledge on the carbon handprint potential of wastelands for e.g. city planning.

1.2. Definitions

We identified *wastelands*, *carbon sinks* and *biodiversity* as key terms in our research. Given their broad definitions, we have included in this report their definitions based on what they mean to our research and the context in which this research was developed upon.

1.2.1. Wastelands

In Finnish, the term *joutomaa*, translated usually as *wasteland*, can refer to many different kinds of areas. The most relevant definitions to this project are discussed here.

In colloquial language the term wasteland refers to unused areas, that are often in an urban environment. Many of these wastelands are ruderates or areas waiting to be built. The areas called ruderates are for example areas found in railway yards and harbours, old landfills, sandpits and areas below electric lines. They often have different herbs and graminoids (hay) growing on them. For normal citizens they often look like a wasted area, but in the light of biodiversity, they are valuable. These were not the original target of our project, but are touched upon in this report.

In the then law proposal of the Ministry of Agriculture and Forestry of Finland, from which the project started (now act 1114/2020), wastelands have a special meaning. In Finnish the term used in the act is *jouto<u>alue</u>*, not *jouto<u>maa</u>*, but both are translated as a *wasteland* in the rest of the report.

In the light of the act, only areas that would actually have potential for foresting are considered. Thus, wastelands are defined to denote only:

- Old fields that have not been farmed for at least two years meaning that they have not got any agricultural subsidies for two years
- Old peat production sites.

- In addition the area should be at least 0.5 ha.
- Traditional rural biotopes such as heaths, semi-natural and natural meadows, grazed woodlands and forests are left out due to their biodiversity value.

Ingå commune was hoping that wastelands would refer also to the term used by Forest Science, *jouto-ja kitumaa (unproductive land)*. Unfortunately for the original question, this is not the case and the subsidy is not meant for reforesting these lands.

It is important to keep in mind the difference between wastelands targeted by the afforestation subsidy act and wastelands overall.

1.2.2. Carbon sinks

A *carbon sink* can be anything that absorbs more carbon than it releases to the atmosphere. Carbon sinks are, for example, forests and vegetation overall, oceans and soils. If the balance of a carbon sink is disturbed somehow, a sink can become a carbon source, which releases more carbon to the atmosphere than sequesters it. Carbon sinks are very important because they remove huge amounts of anthropogenic emissions from the atmosphere. Globally forests' role as a carbon sink is very big (Keenan & Williams 2018). It has been estimated that 19 % of all carbon on earth has been stored by plants, including forests. Around 31% of the carbon in forests is stored on the biomass and 69 % in the soil (IPCC 2000). On the other hand, deforestation releases globally significant amounts of carbon to the atmosphere, and reduces the global carbon sink.

In Finland, the net carbon sink by forests was 25,6 million tonnes of CO₂e (carbon dioxide equivalent) in 2019 (Ministry of Agriculture and Forestry of Finland 2020b). CO₂e provides a way of measuring the warming effect of different greenhouse gases on a common scale: it expresses the warming effect of other gases as the amount of CO₂ that would warm the atmosphere as much. As a comparison, the greenhouse gas emissions in the same year were 52,8 million tonnes of CO₂e (Statistics Finland 2020).

Finland has its own National Forestry Accounting Plan, which includes forest reference level that is based on the LULUCF Regulation of the European Parliament (2018/841) (Ministry of Agriculture and Forestry & Natural Resources Institute Finland 2019). Natural Resources Institute Finland has calculated these reference levels based on projected emissions and removals from the managed forestland and harvested wood products for 2021–2025. According to the plan, the reference level should be consistent with the goal of achieving a balance between the anthropogenic emissions of greenhouse gases and their removal by sinks in the second half of this century. Forest reference level is one tool for achieving carbon neutrality.

1.2.3. Biodiversity

Biodiversity refers to the variety of life in a certain region. Biodiversity is usually considered in three different levels: the diversity of habitats, the species richness and the genetic diversity of species.

The most commonly used measure of biodiversity is the species richness. The latest assessment of threatened species in Finland, The 2019 Red List of Finnish species, was published on March 8th 2019. According to the assessment, the majority of the threatened species live in forests (31%) as well as rural biotopes and cultural habitats (24%). The biggest reason for endangerment is loss of habitats e.g. closing of open habitats such as meadows and use of forests. (Hyvärinen et al. 2019)

Thus, issues related to biodiversity are relevant in this project. The wastelands considered for afforestation are often open habitats that have had agriculture and they may have valuable biodiversity. The protection of this biodiversity may exceed the benefits gained from increasing carbon sinks.

Biodiversity should be considered also in the afforestation process. The forest can be planned to be biodiverse from the beginning. Also, the diversity in the surrounding areas should be considered and how the new forest can support biodiversity in the big picture should be examined.

2 METHODOLOGY OF DATA COLLECTION

This chapter is composed of four different sections. First, we will introduce our challenge and our main question to solve it. Second, we will introduce our process for solving this challenge, which consists of four different steps: *making sense, framing, delivering,* and *sustaining.* Third, we will introduce the tools selected which include the pentagonal diagram, actor tree, interviews, credential cards, stakeholder map, and the future radars. Lastly, we conclude the chapter by introducing the wastelands in Ingå, which was our main area of study.

2.1. Challenge

Our initial challenge was to find the most suitable wastelands for afforestation in order to strengthen the carbon sinks in the Helsinki-Uusimaa region, but during our research, we found that the potential for afforestation of wastelands was very small in this region. Therefore, we reformulated our challenge with the following question to provide our project owners with useful information for further development:

What are the core elements that define wastelands and what could be a suitable action plan for a systemic development of these wastelands in the Helsinki-Uusimaa region?

By reformulating our challenge and creating this research question, we were able to widen our understanding of the system that surrounds the use of wastelands. This way we have explored different aspects of the system such as biodiversity of the wastelands and how wastelands can be part of green corridors. We also studied other possible options besides afforestation to increase carbon sinks in the region in order to provide further knowledge on the carbon handprint potential of wastelands e.g. in city planning.

2.2. Process

As a team, we decided not to set roles, but rather encourage each other to contribute by 1) doing things that interest us and offer new learning possibilities, 2) providing support when needed, and 3) speaking up if something is not necessarily, what we wish to do.

When utilizing the tools mentioned below, we followed a process composed of four key steps defined as making sense, framing, delivering, and sustaining. They all took place in a loop-like manner as they were interdependent and influenced our systemic approach to solve our challenge. Each of these steps allowed us to learn and mature our knowledge about our challenge. First, in *"making sense"* (Part 3 in the report) we explore our challenge from a wider perspective by looking at the significance of wastelands for Finland as well as the relevant policies and projects currently in place. Second, in *"framing"* (Part 4) we go deeper into understanding these wastelands from a more local perspective using the Ingå commune and the Helsinki-Uusimaa region as our focus. During this step, different tools are utilized to better understand our main stakeholders and the existing opportunities in order to frame the core elements that conform wastelands and what could be a suitable action plan for a systemic development of these wastelands in the Helsinki-Uusimaa region. Third, in the *"delivering"* step (Part 5), we unfold our solution and possible next steps for our project owners to take the development of these wastelands further. Fourth, in *"sustaining"* (Part 6), we propose how this solution could be managed to obtain the desired systemic impact in the long run. These steps are described in depth separately in the following chapters.

2.3 Selected tool

During our field work, different tools were selected from the Climate-KIC Systems Innovation Toolkit to obtain relevant insights and guide for our research. Below are the tools and our reason behind the selection of each tool.

Pentagonal diagram: This tool was used to nail down the problem surrounding the use of wastelands for afforestation in the Helsinki-Uusimaa region, identify the different components and specific details, and get a common ground for further actions.

Actor tree: The actor tree was selected to identify and categorize all of our stakeholders. This tool allowed us to visualize who those main stakeholders are at the very beginning of our journey to include them throughout the rest of the process and activities.

Interviews: This was a key element in our research. We conducted interviews in August 2020 upon identifying a suitable sample of stakeholders. They were our main source of information to understand the context of wastelands in Ingå and the Helsinki-Uusimaa region. Our interviewees came from three different groups, which were identified as the main stakeholders:

1. Landowners:

- Nina Långstedt (Krämars gård)
- Mikael Jern (Västankvarn gård)
- Otto von Frenckell (Fagervik gård)
- Peter Siggberg (Chairman of the City Council)
- 2. Private entities (businesses):
 - Christoffer Malmberg: forest specialist, insights to forest plans for Ingå (Stora Enso)
 - Niina Partanen: environmental manager (Stora Enso)

3. Public sector:

- Susanna Kankaanpää: environmental planner, environmental services (City of Helsinki)
- Tuomas Lahti: environmental inspector, environmental services (City of Helsinki)
- Jenni Kuja-Aro: environmental inspector, environmental services (City of Helsinki)
- Anri Linden: team head, planning (City of Helsinki)
- Tiina Saukkonen: design responsible, city space and landscape (City of Helsinki)
- Riikka Äärelä: landscape architect, city space and landscape (City of Helsinki)
- Kaisa Pirkola: consulting officer (Ministry of Agriculture and Forestry)
- Pia-Maria Thomssen: project manager (Finnish Forest Center)
- Jussi Mäkinen (PhD student at University of Helsinki/ postdoctoral researcher at Yale University)

The landowners were interviewed face-to-face. Nina Långstedt was interviewed in English and others in Finnish. The interview questions were provided also in Swedish. Christoffer Malmberg and Niina Partanen were interviewed through email in Finnish. All the interviewees of the public sector were interviewed using Microsoft Teams. The interviews of City of Helsinki were done partly in English and partly in Finnish.

Credential cards: We created credential cards for each of the most relevant stakeholders to help us to see how the stakeholders were related to the project and its context.

Stakeholder mapping: After identifying all of our main stakeholders, we proceeded with the stakeholder map to visualize the differences between actors in behavior, role, and attitude to the challenge, as well as the power relationships amongst them. These approaches provided us with different engagement strategies to apply depending on the specific stakeholder.

Future radars: We selected this backcasting tool for co-creating a future vision and potential set of experiments with our project owner. By applying this tool we were able to plan actions equipped with a global overview of the milestones to achieve, coupled with their feasibility and the influence needed for them to happen. Given the complexity of our challenge and potential for the occurrence of unforeseen events in the future, this tool allowed us to create a pathway of milestones to make our plan more reliable.

2.4. Wastelands in Ingå - Area of study

In the process of preparing the afforestation subsidy, the Ministry of Agriculture and Forestry ordered an estimation of the potential wastelands from Tapio Oy in spring 2020. We ordered the GIS data from Tapio Oy for the Helsinki-Uusimaa region. This was paid by Helsinki-Uusimaa Regional Council, who also received a copy of the data for future use. We visualised the data using QGIS 3.10. We used the maps as a visual tool in our interviews to ask the landowners if any of the identified wastelands where within the land they own.



Figure 1. Map of the wastelands identified by Tapio Oy in Ingå. The northern parts of Ingå commune missing on the map did not contain any wastelands targeted by this study.

When constructing the dataset of potential wastelands the following type of lands were excluded (Tapio Oy, 2020):

- Land on forestland, poorly productive land (*kitumaa*) and unproductive land (*joutomaa*)
- Agricultural land covered by the agricultural support scheme for which area payments have been paid after 2014
- Nature protection areas
- Urban areas (*taajama*)
- Private yards
- Seashores
- Valuable traditional biotopes on private and public land
- Sites adjacent to water that are on important national valuable landscape areas
- The surrounding environments of the National Board of Antiquities' sites

• The vicinity of the sites of endangered species

According to Tapio Oy's estimation there are approximately 118 000 hectares of potential wastelands. The biggest potential is in northern and eastern Finland (Lappi, Kainuu and Pohjois-Karjala). The majority of the wastelands recognised in the GIS analysis are old fields. Of the old fields approximately ¾ are on mineral land and ¼ on peatland.

We combined our visit to Ingå with the interviews to the landowners and a meeting with our project owner, Elina Röman, to wrap up our main findings and overall experience during our visit. This visit was very valuable in our research as we got to experience at first hand the different sizes of these lands, grab a sense of the people living there and their values, the economic value of these lands for landowners as well as realistic solutions or future steps that could be developed further.

3 MAKING SENSE

This chapter encloses our initial steps to obtain a better understanding of our challenge. The "making sense" -step is all about familiarising ourselves with the topic at hand and obtaining a wider picture of the complexity of the challenge and its context. First, we will discuss the significance of the carbon sinks for Finland and cover the strategic recognition of carbon sinks and wastelands as a subsection. Second, relevant policies and projects about afforestation will be covered separately.

3.1. Significance of the carbon sinks for Finland

To pursue the Paris Agreement objective to keep the global temperature increase to 1.5°C, the EU aims for carbon neutrality by 2050 (EU 2019/2020). In Finland, the government builds climate actions so that carbon neutrality can be achieved earlier. This means tightening the existing obligation to emission reduction national level. Thus, Finland will fasten the emission reduction actions and strengthen the carbon sinks so that Finland reaches carbon neutrality by 2035 and becomes carbon negative soon after. Regarding land use, the government will create a sectoral climate plan on how to reduce emissions and strengthen the carbon sinks, and aim for increasing the net sink. (Programme of Government 2019.)

3.1.1. Strategic recognition of carbon sinks and wastelands

Carbon neutrality is usually defined as an 80 percent emission reduction from standard year (eg. 1990, 2007). The remaining 20 percent of the emissions are being sequestrated to regional carbon sinks, removed from the atmosphere by technological means or compensated. Besides the government, cities, municipalities and regions have important roles in implementing climate actions, and a growing

amount of them have made their own commitments towards carbon neutrality. One acceleration for commitments has been the Hinku network (Towards carbon neutral municipality, *Kohti hiilineutraalia kuntaa*) that shares knowledge of best practices for climate change mitigation, supports climate work of municipalities and creates demand for climate-friendly products and services. Now over 70 municipalities and 5 regions have committed for 80 percent of emission savings by 2030 from the level of 2007. (Carbon neutral Finland 2020a.) Finnish Environment Institute created the network in 2008 and due to successful work, Hinku network continues to work to reduce climate impact, promote local wellbeing and better functionality of municipalities' economy. From 2018 the network has been supported by EU Life funded Canemure-project (Towards Carbon neutral municipalities and regions, *Kohti hiilineutraaleja kuntia ja maakuntia*). (Riekkinen et al. 2020.)

As a partner of Canemure-project, Helsinki-Uusimaa Regional Council has committed to promote regional cooperation and in 2020 created a roadmap for carbon neutral Uusimaa 2035 to achieve national climate targets (Helsinki-Uusimaa Regional Council 2020a). The creation of the roadmap started in spring 2019 and municipalities of Helsinki-Uusimaa have participated in the work eg. in regional workshops. The roadmap has six key point areas. One of them addresses the strengthening of the carbon sinks and compensating the emissions, while it aims to support recreational use and biological diversity, too. The area has four targets: 1. Maintain and strengthen the carbon sinks and storages in forest areas 2. Promote the carbon sequestration of farm lands and pastures. 3. Identify compensation methods and options and to 4. Increase the knowledge of carbon sinks and emission sources. (Helsinki-Uusimaa Regional Council 2020b.)

Our challenge topic, wastelands, seem to be still rarely specifically addressed in climate action plans. City of Lahti from the Päijät-Häme region has created an action plan of sustainable energy and climate change to reach carbon neutrality by 2025. Action plan includes two actions concerning the afforesting of wastelands to increase carbon sinks that are being addressed from the views of land use and climate change adaptation. Actions aims for increasing carbon sequestration but instructs to keep fields that are central for landscape open. Progress of these actions, as well as other 98 actions, are updated to an online tool, where anyone interested can follow the climate work of Lahti. (Ympäristövahti 2020a; Ympäristövahti 2020b.)

3.2. Relevant policies and projects about afforestation

This section provides a brief view at the current state of afforestation policies and projects in Finland that are relevant when concerning our challenge. The topics covered in this section include the afforestation subsidy proposal of the Ministry and relevant projects for climate-wise foresting and biodiversity preservation.

3.2.1. The afforestation subsidy act

The Government Programme has defined that there should be created new ways to coordinate for strengthening the carbon sinks and storages of forests and soil (Programme of Goverment 2019). To understand the potential for new carbon sinks, the Ministry of Agriculture and Forestry has estimated that there exist around 118 000 hectares of wastelands that could be forested. Around 9 000 hectares are areas that have been released from peat production and rest are fields that are outside of food production. To help the decision to forest these unused areas, the ministry prepared an act for afforesting subsidy. (Ministry of Agriculture and Forestry 2020a.)

The subsidy will not affect now in-use food production fields and the valid subsidy can be admitted only for an area that is not in active farm-use and has not received agricultural subsidies since 2019. In addition, biodiversity values, cultural landscapes, water economy and plan restrictions will be taken into account, before admitting the subsidy. The subsidy will not be admitted to areas that are significant by their environmental or nature values such as meadows (*niitty*), glades (*aho*), dry meadows (*keto*) or wood-pastures (*hakamaa*). The area to be afforested should be at least 0,5 hectares and approximately at least 20 meters wide. The subsidy will be limited for private landowners to encourage them to plant a forest to an area that has not been in use with compensation amount and reward in management. (Ministry of agriculture and forestry 2020a.)

In government's law proposal for the parliament, there are available estimations of the emission, carbon storage, water system and some other environmental impacts of the afforestation. Regarding the carbon sinks, the biggest potential for afforestation is located in the regions of Lapland, Kainuu and North-Karelia. Best benefits for climate would be achieved by foresting the peat-based fields and previous peat production areas. Now addressed subsidy will be a continuum for previous foresting subsidy systems. (Ministry of agriculture and forestry 2020a.) In Finland, old agriculture fields have been forested with governmental support from the end of the 1960s until today almost 300 000 hectares. Main subsidy for this was a Financing law for sustainable forestry (Kemera, abbreviation for <u>Kestävän metsätalouden rahoituslaki</u>). According to the proposal, in 2020, there is no existing governmental funding for foresting, since the previous subsidy law was annulled in 2015 and last payments were made at the end of 2019.

3.2.2. Relevant projects of climate-wise foresting and biodiversity preservation

Understandably, the act does not define how or what kind of forest should be forested for the subsidy, but the process aims to direct that biodiversity and diversity in tree species are promoted in forested areas. For more practical guidance, Finnish Forest Centre is coordinating two helpful projects that are Climate-wise forest owners and Unused fields and swamps to carbon sinks by foresting.

The Climate-wise forest owners -project (*Ilmastoviisas metsänomistaja*) aims to share topical and independent information about forests as carbon sinks, what are the influencing factors and how

increasing the forest areas will support national climate goals (Finnish Forest Centre 2020a). The other project Unused fields and swamps to carbon sinks by foresting (*Peltoheitot ja suonpohjat metsittämällä hiilinieluiksi*) aims more directly to support the foresting of the old agricultural fields and peat production swamps aka wastelands. Project also produces information material and organizes events about how to better the forest growth and optimize the carbon storages while taking forest owners' own economic targets into account. (Finnish Forest Centre 2020b.) Together these projects are coordinating webinars and one theme is foresting wastelands to carbon sinks.

At the latter project, Finnish Forest Centre and Finnish Natural Resources Institute have made their own estimation about wastelands that are suitable for foresting in Finland. The Estimate includes about 99 000 hectares, which is very close to the estimation of the Ministry of Agriculture and Forestry. Project's result is that potential forested wastelands in Helsinki-Uusimaa are mostly old agricultural fields. Most of them are located in Kirkkonummi (403 hectares), Vihti (441 hectares), Raasepori (554 hectares) and Lohja (647 hectares). For comparison, Ingå has only 157 hectares of old agricultural fields. (Isoniemi 29.10.2020.)

Project manager Mira Isoniemi of Unused fields and swamps to carbon sinks by foresting indicates following factors that limit foresting of old agricultural fields:

- Traditional biotope in 100 metres radiance of the target
- Urban housing areas
- Coastal beach meadows that are in 50 metres from sea shore
- Conservation areas
- Built cultural environments
- Areas that have been already been forested with Kemera-subsidy
- Areas bordering national landscape flow waters.

From the biodiversity aspect, another interesting program is the Helmi habitats programme (*Helmi-elinympäristöohjelma*) by the Ministry of Environment. Program aims to strengthen the biodiversity of Finland and secure vital ecosystem services that are provided by nature. With these actions, the programme supports climate change mitigation and adaptation. The program is based on voluntary participation of landowners. In addition, during 2020 Helmi granted approximately three million euros to municipalities for the biodiversity promoting work in habitats of Helmi-program (Ministry of Environment 2020a.)

One of the Helmi-program's targets is to rehabilitate 15 000 hectares of traditional biotopes by the end of 2023. These rehabilitated traditional biotopes are aimed to be mainly in scope of environmental compensation of EU agricultural subsidies, but there's an intention to create a system for a national subsidy, too. (Ministry of Environment 2020b.) During the program, the potential of wastelands have been recognized that some of these might be rehabilitated or developed as biodiversity areas (Keskinen 2020).

4 FRAMING

In this chapter we will describe the main actions taken to verify our initial assumptions on the topic and gather new insights that could eventually be formulated into a potential solution. Our "framing"-phase is composed of the pentagonal diagram, the actor tree, the credential cards, the stakeholder map and most importantly our interviews. Below we will describe the main findings/insights from each of these tools.

Our main objective in this phase of the research was to narrow down our research to answer the following questions:

- 1. What is the potential of using wastelands/wastelands for increasing carbon sinks by afforestation in Ingå and Helsinki-Uusimaa region?
- 2. How the afforestation process works and what are the challenges related to it?
- 3. What other potential ways than afforestation are there to increase carbon sinks in Ingå and Helsinki-Uusimaa region?
- 4. What other potential uses than afforestation are there for wastelands to tackle climate change and preserve biodiversity in Ingå and Helsinki-Uusimaa region?

4.1 Pentagonal diagram

Pentagonal diagram -tool (Fig 2) was utilized to obtain a better understanding of the Ingå commune and most importantly our main problem. By defining the problem statement, resource gaps, climate change challenges, societal challenges, and technical challenges we were able to focus our research on the core elements that conform wastelands and what could be a suitable action plan for a systemic development of these wastelands in the Helsinki-Uusimaa region.



Figure 2. Pentagonal Problem

4.2 Actor tree

Actor tree -tool (Fig 3) was very valuable for our research as we were able to identify our main stakeholders, the main challenge and its context. In terms of our stakeholders, we found out that the core stakeholders were the municipalities (most importantly those within the Helsinki-Uusimaa region), companies or NGOs working for the forestry industry (e.g. Stora Enso, Metsä Group, Carbon Action, etc.), and private landowners. In terms of our challenge and its context, we found out how complex it is to work with projects related to land use and more so those that deal with the use of wastelands as many factors come into play such as inhabitants/citizens, EU and national targets, land history, and planning done by municipalities which takes many years.



Figure 3. Actor Tree

4.3 Credential cards

These credential cards (Fig 4, Fig 5 and Fig 6) were created to analyze more carefully our main stakeholders. For our project, we identified three main stakeholders: private landowners, public sector, and private companies working in forestry. These stakeholders possess great power to influence decisions (especially private landowners), they all have a high degree of interest on wastelands and each holds different levels of adaptability when required to make any decisions on these wastelands.

Credential cards

The Canvas



Figure 4. Credential card for landowners

ine canvas



Figure 5. Credential card for City of Helsinki (Public Sector)



Figure 6. Credential card for companies and organizations

4.4 Stakeholder universe

Stakeholder universe -tool (Fig 7) was very useful for our group to visualize the interest and adaptability of our three main stakeholders and the connection they hold with other secondary stakeholders for the systemic development of wastelands.



Figure 7. Stakeholder universe

4.5 Future Radars

The Future Radars (Fig 8) was used for co-creating a future vision and potential set of experiments with our project owner. Insights of using this back-casting tool are presented in Part 6.



Figure 8. Future radar tool, which was used to raise conversation about the envisioned future. Some of the post-its did not find a good place on the axis.

4.6 Interviews

The interviews were carried out with our main stakeholders. These interviews were a crucial addition to our research as they provided us with a wider picture on the topic since they all had different viewpoints on the topic. We clustered the main insights from these interviews into different topics which will be covered in the following sections. Figure 9 summarizes the main insights.

KEY INSIGHTS FROM INTERVIEWS



Figure 9. Main insights from interviews

4.6.1 Afforestation potential of wastelands in Ingå and the Helsinki-Uusimaa region

We found out that the current potential of foresting the wastelands, which were identified through the Tapio data in Ingå and in Helsinki-Uusimaa in general, is quite small. The biggest potential, according to our interviewees, is located in the Eastern and Northern Finland, where there are big, united land areas which are currently out of proper use. In the Southern part of the country, most of the land areas are already very efficiently in use. Landowners from Ingå and interviewees from the forest company Stora Enso said that these wastelands in Ingå, found by Tapio, are mainly cultivated land, old crofts or frontman's houses and pastures for animals. So most of these land areas already have a purpose. However, they mentioned that the atmosphere in the Ingå commune has become more climate-friendly during the past years and people have become more interested in doing climate-friendly actions. They told, e.g. that a wetland area in Ingå was renewed by WWF a couple years ago and that citizens were pleased about this.

We found out also by interviewing the environmental experts of the city of Helsinki that in Helsinki the areas identified in the Tapio data are not actual wastelands, which could fit with the afforestation subsidy act's definition. The city of Helsinki shares the concern about carbon sinks and carbon sequestration, but sees that foresting to increase carbon sinks is not a possibility in a dense area as Helsinki. But this could be a better option in the rural areas. In Helsinki there are some areas, which are currently out of use. Some of them are waiting to be constructed and others are open areas such as managed meadows that have high biodiversity values. The environmental experts mentioned also that Ingå commune has lots of significant cultural landscapes and thus, the decisions about land use changes, and about which areas are kept as such and which should be used for other purposes, should be done carefully.

On the other hand, landowners think that the idea of using afforestation as a way to increase carbon sinks in Finland is good and there is a lot of potential. Interviewees from Stora Enso confirmed this, but added that the commitment of landowners is important in the success of the afforestation project. One of the landowners, who practices organic farming, pointed out that the use of wastelands should be holistic by always taking into account the biodiversity.

4.6.2. Challenges and possibilities related to afforestation

Interviewed landowners have not been planning to increase the forested land area in their own lands in the near future. However, all of them had experiences about forest regeneration and planting forest to a new land area. They also recognized some problems with afforestation. It can change the landscape dramatically when, e.g., an open landscape becomes a very dense spruce forest. They mentioned that important things to consider in planting new forest areas are, e.g., the previous use of forest, game management and risks for damage (e.g. danger of moles). Subsidies are important for many land owners. According to the landowners, the afforestation of not very productive land is not very popular at the moment, as far as they know. By cultivating the land, the land owner can get the financial support for the cultivation. While planting a new forest can take years before the land becomes profitable. Interviewees from Stora Enso also mentioned that money is a challenge in foresting wasteland, as, e.g., if the forest needs to be left to grow, there will be no money from the logging. Thus, financial help is needed. One landowner mentioned that programmes such as METSO-programme, Forest Biodiversity Programme for Southern Finland, (*Etelä-Suomen metsien monimuotoisuuden toimintaohjelma 2014–2025*) are great incentives for landowners and it is important to promote them. Two landowners said that compensation as a method to strengthen carbon sinks is a good way, and compensation will probably increase in the future. One of the mentioned that a beef cattle farm compensated their emissions by planting trees in Raasepori. Some of the landowners were familiar with available and planned subsidies for landowners for afforestation and some were not. This view was supported also by Pia-Maria Thomssen from Finnish Forest Center, who mentioned that Kemera-subsidy (see Part 5.1.5) is not used as much as it should be.

An afforestation project can have many valuable goals. The interviewed landowners were asked to describe an ideal forest project. Recreational values and diverse forest structure, achieved by planting different tree species, came up in these discussions. Also, it is important that forest grows well, it is natural and site conditions are taken into account. Pia-Maria Thomssen from Finnish Forest Center said that in order to achieve a successful afforestation project, expert opinions and vision should be included. She also emphasized that areas should be chosen with care. Areas where the growing forest would need a lot of care, the costs and emissions coming from maintaining the new forest could exceed the benefits and afforestation would not be beneficial.

4.6.3. Social aspects in afforestation of wastelands

All interviewed landowners were positive about involving other people in afforesting actions and they had some previous experience about it. However, it was mentioned that involving other people might also cause some hassle, if these people do not have previous experience about the planting process. One landowner mentioned that digital platforms such as Workaway are useful tools to generate interest on managing lands by inviting people to volunteer or do internships. Also, interviewees from Stora Enso were interested in cooperation with locals and had previous experience about it.

An example of an afforestation project with a large social impact is Rakkauden metsä (*Love Forest*) in Vuosaari, Helsinki. The idea of the Rakkauden metsä -project was to spread love as well as plant new and protect old forest, and by this support the carbon sinks and the preservation of biodiversity for future generations (Rakkauden metsä 2020). During the event in August 2020 people planted 280 seedlings of 11 different tree species that were chosen to be suitable for the soil. The trees to be planted were reserved in less than 24 hours, which gives the impression that people are willing to join in this kind of initiative. (Rakkauden metsä 2020.)

Some of the landowners felt that using people with no background in forestry for afforestation is inefficient. However participating in the afforestation process can increase the interest and involvement of local people to the new forests. Thus, we believe there could be a place for this kind of afforestation initiatives as well. It is still a good reminder that in Helsinki finding a suitable area for Rakkauden metsä was a hard job, because of the lack of available areas. Besides finding the area, the process demanded quite a lot of preliminary back work such as plan checking, species selection and other arrangements, before the planting event could be conducted.

In addition, as came out from the interviews of the landowners, educating people about forest and land use at schools and through workshops is very important. Also using private owned land in cooperation with landowner for events or commercial purposes (e.g. cafe) can be a gateway for educating others and creating awareness about nature.

4.6.4 Forest management as a practice to increase carbon sinks

Interviewees from Stora Enso pointed out that taking good care of forests is also a good way to increase carbon sinks. It is possible to include both biodiversity and economy in balance. They said that private landowners are nowadays more and more interested in taking care of their forests. Taking good care of forests was also emphasized in the interviews with the City of Helsinki and was recommended as a significant factor in strengthening and maintaining carbon sinks.

Pia-Maria Thomssen from Finnish Forest Center said that Finnish forest owners form a big and diverse group of, at least, 600 000 people. This diverse group includes, e.g. people for whom the forest is economically very important, farmers who own a bit of forest and people who have inherited forest and it can have mainly other than economical value. The interviewee pointed out that one should also think if it is right to pile a lot of climate responsibility on forest owners' shoulders. Like mentioned for many forest owners, forests have a significant financial role.

Pia-Maria Thomssen stressed that important things in forest management and afforestation are securing the growth of the forest, taking care of the seedlings on time, not making unnecessary ditches, understanding the meaning of decaying trees for the biodiversity and understanding of forest ecology. If one does not understand the processes, then it is difficult to understand the significance of one's own actions. There are many ways in forestry how we can positively affect biodiversity and carbon sinks, such as lengthening the rotation cycle, taking better care of the forest, creating more mixed forests, leaving more deadwood and using ash fertilization.

We were interested to understand better the possibilities of the forest owner to have a climate friendly forest plan. Forest plans are often based on mainly economical values, like in the case of the landowners we interviewed - but some of them also mentioned biodiversity, sustainability and climatic values, which were taken into consideration in their forest plans. One of the landowners mentioned that new methods in forestry can be challenging to put into practice. The interview with Stora Enso revealed that

the company offers the possibility to stress climate in a forest plan, but as the interview had to be done by email, we did not have a chance to ask about it more. It would be valuable to look more into how forest companies offer climate-wise forest plans or plans that enhance biodiversity and how can these be combined. Interviewees from Stora Enso also mentioned that municipality owned forests have similar plans like the privately owned.

4.6.5 Companies and organisations working in afforestation projects

Regarding other financial instruments for foresting, the Ministry of Agriculture and Forestry has identified approximately 10-20 companies that provide compensation services in Finland (Yle 2020a). According to Kaisa Pirkola, such organizations include Taimiteko by 4H-association, Ilmastoapu, CO₂ Compensate Finland Oy and Puuni Oy.

For example, Puuni is a start-up, whose business idea aims for increasing carbon sinks at wastelands of municipalities and offers emission compensation to the private and public sector. The company works with municipalities to search potential wasteland for foresting and makes an agreement with them about the permanence of the carbon sink for one hundred years (Yle 2020b).

Example of a recent customer of Puuni is Tampere Hall, who provides business customers an opportunity to compensate the emissions of their organized events at the venue. For Tampere Hall, it was very important that the carbon sink planted using the customer's compensations would be a near location to make the impact more easily addressable. The convenient place for the carbon sink, size of two hectares, was found at the close-by municipality of Lempäälä. Lempäälä plays a key role as a location, but also as manager of the new carbon sink. Altogether 3670 sprouts of black alders, pines and silver birches will create a carbon sink that is estimated to sequestrate approximately 1 000 tonnes CO₂ during the next 100 years. To verify the right amount of the compensation, Tampere Hall has informed that the calculation of the event's carbon footprint will be conducted in a sustainable and transparent way by using the model of Finnish Natural Resources Institute. (Tampere Hall 2020.)

Another interesting compensation service is offered by 4H-association's Taimiteko. The idea of the project, too, originates from the model of emission compensation for the private and public sector, but focused on employing youth. Taimiteko started in 2019 with Youth in climate work –project (*Nuoret ilmastotöissä -hanke*) and during summer 2019 3,6 hectares of forest was planted. The target of Taimiteko is to plant 10 000 hectares of new forest by 2030. Project also uses the calculations done by Finnish Natural Resources Institute, who has also developed a carbon sink calculator that turns tCO_2 to the right amount of sprouts and indicates working hours that youth will be working. (Anttonen 29.10.2020.)

4.6.6 Increasing carbon sinks with agriculture

Already in the beginning of our project we recognized the importance of climate-friendly actions in agriculture in order to increase carbon sinks. Interviewed landowners were experienced in climate-

friendly actions in agriculture. They mentioned that land use can also be diverse. For example one of them had a mix of fruit trees with some open areas for grass and herbs. Regenerative farming was also brought up in the interviews. It is a method that considers biodiversity, ecosystem services, soil regeneration and climate change resilience, and can offer many opportunities to the use of wastelands and normal farming land.

The ways to increase carbon sinks by agriculture has been studied in Finland. One example is Carbon Action -project by Finnish Baltic Sea Action –group, which started in 2017. It contains many research projects and the goal is to provide scientific information about how carbon sequestration can be enhanced with regenerative agricultural practices. Research projects are conducted in pilot farms. The target is to improve yields, biodiversity and resilience, climate change mitigation and to reduce emissions from the fields to the water bodies by regenerative farming methods (Carbon Action 2020).

4.6.7. Perspectives on land use in the Helsinki-Uusimaa region

Regarding the land use of the Helsinki-Uusimaa region, we interviewed specialists from the City of Helsinki to understand better, how land use planning can be used for strengthening carbon sinks. Although Helsinki and our challenge owner Ingå commune differ from each other, adjustable practices for benchmark may arise.

For example, the City of Helsinki has high targets for urban environment development and building construction. New housing areas are being developed, old buildings are facing renovations and infrastructure has to be supportive as Helsinki's target is to become the most functional city in the world. In the land use sector of City of Helsinki, a group of professionals was formed to discuss how urban planning can be directed towards climate-wise and adaptive solutions. Specialists aim for emission reduction, but also consider how existing and new carbon sinks can be taken into account. Helsinki sees it very important not to fall for green washing and aims for solutions that have real significant impact. To understand better the impacts of the solutions in land use planning, Helsinki has, for example, recently conducted a life cycle cost and carbon calculations in Vuosaari area planning.

Regarding carbon sinks, space creates limitations in Helsinki and Helsinki addresses the issue on how to "green" and create adaptive urban areas. For new housing areas, Helsinki is using green multiplier as a requirement to secure a certain amount of green in the plot. The carbon sinks are also considered in building materials, and for example, Helsinki is promoting wood construction in some new housing areas, such as Kuninkaantammi. Likewise, interviewees from Stora Enso reminded that wood products and buildings work as carbon sinks, especially when compared to manufacturing from non-renewable sources. Helsinki sees it important that cut wood remains a long-term carbon sink, when used in construction. There have also been discussions that could Helsinki compensate somehow for the carbon sinks removed in construction.

4.6.8. Other potential uses of wastelands

Although foresting might seem to be the logical way to use the wastelands for strengthening carbon sinks, we wanted to research and hear about other potential uses for these areas and overall consider could there be a better solution when addressing biodiversity preservation.

4.6.8.1. Renewable energy sources instead of carbon sinks

In our first discussions, the solar panel fields came up as an option for afforestation, although in the case presented below the area was already planted with young forest. The municipality of Raasepori had investigated if a solar plant could be a cost-efficient and create more carbon emission savings than keeping the area as a pine forest (estimated 45-80 years). Together with Raaseporin Energia and Karjaan Puhelin, Raasepori wishes to answer the increasing demand for renewable energy and especially solar energy. All three organizations share the interest for sustainable development and aim to reduce their climate impact. Raasepori is also part of the Hinku-network, and the municipality sees both climate and economic benefits from this investment. The collaboration continues to plan the investment of over 3000 solar panels in about two hectares area. Solar plant's planned efficiency would be around 1 MW and the annual production would equate to the annual electricity consumption of 500 blocks of flats. The construction permit was given in summer 2020, but the project still waits for national investment support to continue. (Raaseporin energia 2020.)

In the estimation, the ground modification impact on carbon sinks (change in soil and trees) was defined to be the worst-case scenario meaning clear cut and removal of stumps. The loss of carbon sinks and impact of immediate clear-cut in two hectares area was estimated to be -716 tonnes CO₂e. Despite this, the positive climate impact of the solar plant was estimated to be triple compared to the impact of existing forest as a carbon sink (Municipality of Raasepori 2019). In 15 years, the solar plant would reduce carbon emissions 3 313 tonnes CO₂e (Pöyry 2019a). The carbon footprint of solar plant constructions is 790 tonnes CO₂e, and the significant climate impact, almost 98 % of the carbon footprint, will be from the solar panel manufacturing (779 tonnes CO₂e) (Pöyry 2019b).

To understand the area's biodiversity and assess environmental impacts, Raasepori also conducted a nature survey. The survey implied that the removal of the trees and inserting the solar panels would create a sunny open environment that could favour some endangered species such as *Psophus stridulus* and *Cicadetta montana*, but also some Papilionoidea-butterflies and Hymenopterans. With solar panels, the area would remain open and would not risk growing shut. The soil of the area is sand that keeps warmth well. Besides the pine trees, the area includes a small open wasteland that has already started to grow shut. Nature survey estimated the area as regular, which does not include such nature values that should be protected or spared from the change. There is a possibility that as a sunny open environment the area would become an ecological pathway. It is also pointed that special care must be taken during construction, since the area has potential for invasive alien species (Luontotieto Keiron Oy 2019.)

4.6.8.2. Supporting biodiversity with meadows

It should also be considered that wastelands could be developed into biodiversity habitats or rare biotopes. Most unused areas that can be defined as wastelands are quite small and when thinking about biodiversity protection, even the smallest wastelands should be kept in mind. Areas such as the narrow areas close to roads which could be really valuable habitats for species adapted to sunny and warm habitats. It is interesting to think about what kinds of measures it would take to adjust and maintain them towards richer biodiversity.

Recently, Finnish people have been reminded of biodiversity related grass root actions for example through the big Pelasta Pörriäinen -campaign by Yle (the Finnish Broadcasting Company). People are encouraged to help pollinators and protect biodiversity for example by establishing flowering meadows on their yards for pollinators (Yle 2020c). Creating these traditional meadows is considered as a cultural and environmental act. 4H-association of Finland has encouraged youth and children for environmental action with different kinds of tasks of which one is about creating flower meadows. Task guides youth to seek dry, sunny and sandy wastelands such as sides of the parking area, building or road and plant meadow flower seeds. (4H 2020.) To maintain these small meadows, the area should be kept open and bushes removed (Yle 2020c).

During our interview with the City of Helsinki, environmental experts mentioned that some wastelands in the Helsinki-Uusimaa region have been transformed into managed meadows, but they are very few. They also confirmed that there is a plan in Helsinki to create more meadows. The connectivity of meadow patches is expected to improve in the coming years, since the City of Helsinki has just started a new developing program to clarify the whole network of meadows. One example of a managed meadow in Helsinki are the old pasture areas of Skata Farm. These lands in Uutela in Eastern Helsinki have great historic significance and have been maintained as open meadow sites.

Wild Zone NGO (*Villi Vyöhyke ry*) is a non-governmental organization that has participated in various meadow projects as well as n nature restoration projects. One of their agendas is to protect biodiversity along with producing ecosystem services and nature experience to people. They have participated for example in landscaping the grounds of the University of Tampere and schools as well as several gravel pits with building material producer Rudus Oy. They started a community forest garden in Tesoma, Tampere. Municipalities of Helsinki-Uusimaa could consider investing in landscaping projects, where the biodiversity and sense of community is stressed by NGO such as Wild Zone NGO and their cooperation partners. (Villi vyöhyke ry 2020.)

In addition to the biodiversity work done with Wild Zone NGO, Rudus Oy has experimented with other biodiversity actions on their sandpits and also considered how they could use the old sandpits in climate work. In some cases, for example lupine has taken over areas. Alien species like lupines are hard to get rid of so that the areas could be used for meadows and they have considered using these areas more for carbon sinks, but keeping biodiversity in mind as well. (Rudus Oy 2020.)

5 DELIVERING

In this chapter different ideas for social experiments will be delivered. They emerged as a result of the tools that we selected during the "framing" phase and they are meant to guide future actions if the project continues beyond the scope of this work.

Based on our initial research and findings/insights obtained in the previous phase, we found out that a solution cannot be simply established at this stage. The use and study of wastelands are extremely complex and require years of discussions, planning, execution, and management. Therefore, here we present the core elements conforming wastelands, the level of influence of the main stakeholders as well as some recommendations as next steps and different ideas that could serve as a pathway for further research in the form of social experiments.



Figure 10. The complex system of wastelands and potential recommendations and ideas for social experiments.

5.1. Recommendations and ideas for social experiments in Ingå and Helsinki-Uusimaa Regional Council

In this section the recommendations and ideas that could be used as social experiments are explained. These two recommendations could open up new insights and strengthen the initial information obtained in this research. The two main recommendations are:

- Continuing to process the GIS-data from Tapio (section 5.1.1)
- Selecting the areas that are potential for afforestation and for other purposes (section 5.1.2)

In terms of our ideas for social experiments, we identified the following:

- Ideas for sustainable foresting and biodiversity conservation (section 5.1.3)
- Ideas for social impact (section 5.1.4)
- Ideas for incentives (section 5.1.5)
- Other ideas about the carbon sinks (section 5.1.6)

Our main objective with these recommendations and ideas is to offer a pathway for further research on the topic of wastelands and provide solid data that could be used as reference for opening up the discussion of their use and importance in the municipalities.

5.1.1. Continuing to process the GIS-data from Tapio

Because of the tight schedule, we had only time to visually explore the wasteland data provided in QGIS 3.10, interview the landowners about the predicted wastelands on their lands and drive past few of the wastelands on our trip to Ingå. With more time, we would have compared the wasteland data with the nature survey GIS data of Ingå. In addition, we could have calculated the wastelands in Ingå that were found in Tapio data to concentrically see the situation and the potential of the wastelands. These are some steps that could be done in future for example by a thesis worker.

Interview with Jussi Mäkinen reminded us that the starting point for afforesting should be to safeguard species richness in afforestation on wastelands. To understand the impact it will be important to clarify wasteland types and what species they are limited to. Soil characteristics are one of the most important drivers defining the vegetation composition that develops in a new afforested area. Moreover, vegetation along with soil characteristics affects the composition of other species groups. We would suggest that Ingå commune and/or Helsinki-Uusimaa regional council could employ a thesis worker to continue analyzing the GIS-data to evaluate types of wastelands and their expected plant and animal species composition by areas' physical characteristics, such as soil properties and hydrological conditions. Another quick and easy step with GIS-data is to point to the wastelands that are close to the old and existing forests, since those areas provide best opportunities for species individuals to move between their suitable habitats and thus increase the expected utility of afforested areas to the species according to our interview with Jussi Mäkinen.

The GIS data could possibly be used also along with an analysis tool called Zonation according to the interview with Jussi Mäkinen. Zonation is developed by the University of Helsinki and the purpose of the tool is to make biodiversity protection efficient. Zonation is used to find the sites where protection and care give the biggest benefit for biodiversity. Using open source GIS data in the analysis it is possible to look at the sites' nature protection values as well as connectivity to protected areas. It can be used to implement biodiversity values to decision making in land use planning. The tool has been used for example in METSO and Helmi-programmes (Metsähallitus 2020.) With Zonation, the Tapio GIS-data could be analyzed to determine would afforesting wasteland affect, how different species are moving in the area and would the afforestation of the area improve the living conditions of these species.

5.1.2. Selecting the areas that are potential for afforestation and for other purposes

In several interviews, it was emphasized that if the foresting decision is made, it should be made in those areas where the trees can grow for a very long time. For carbon sequestration, a few decades might be somewhat enough, but in terms of responsible afforestation and biodiversity, the real benefits will come from long-term commitment (over hundred years).

During interviews, it became clear that it is central to use consulting of biologists and other experts in assessing how foresting would impact an area's biodiversity. Thus, we suggest a nature survey by experts to ensure more knowledge about the environmental impact and area's nature values.

Other direct solutions for areas to tackle climate change and preserve biodiversity included producing renewable energy sources (solar, wind) and managed meadows and traditional landscapes. In addition, recreational values and ecosystem services for citizens are good to keep in mind. Classifying the rest of the wastelands from these perspectives could be the next step and give the citizens an opportunity to participate e.g. by voting which solutions will be the one to follow. Again an expert's review on environmental impact is in place and when constructing, it shall be good to have the lifecycle cost and emissions calculations to make the climate and money-wise solution.

5.1.3. Ideas/suggestions for sustainable foresting and biodiversity conservation

To retain the idea of safeguarding species richness and increasing carbon sinks, it will be important to plan the afforestation to be as sustainable as the area's features make it possible. Sustainable forestry promotes methods that conserve the forest biodiversity and secure the sustainable production of timber. Different practices, such as growing uneven-aged forest with continuous cover forestry - method and prolonging the rotation length and leaving more retention trees and deadwood in the forest with even-aged forestry -methods are examples of these methods. Deadwood is a very important resource for many Finnish forest species as around 25% of them are dependent on deadwood. However, in efficiently managed forests it is in short supply. So, leaving more deadwood, planting uneven-aged forests with different tree species would be good sustainable manners in forestry.

Mazziotta et al. (2015) showed in their simulation study that carbon sequestration and carbon storage in a forest could be increased by changing only a little currently the most common practices with relatively small economic investments. For example, by leaving the trees to grow 10-30 years more would have positive effects on carbon sequestration. Naturally, also by leaving the forest as it is, without cutting it, also has a positive effect. But this is not, of course, profitable for a forest owner who needs to get income from the forest.

Some studies provide information about the potential for carbon sequestration of different tree species and their ecosystems (e.g. Shanin, Komarov & Mäkipää 2013). However, we did not study this option in depth, but rather discussed it openly with the interviewees when talking about the wastelands, their impact, and their potential uses. A further look into this topic could provide clear recommendations on which species should be planted or if there are significant differences that should be taken into account. However, our recommendation is that carbon sequestration is not the only thing considered, but the biodiversity aspect is carried along all the time. A multi-species forest will have richer biodiversity and will have better recreational values.

Lastly, our interviews and desktop research showed that when studying different tree species, the possible effects of afforestation projects should be considered as they might have a big impact on biodiversity. Biodiversity-wise it is more important to plant several species that are suitable for the location, rather than monoculture stands.

When the City of Helsinki was designing the Rakkauden metsä forest, the tree species were carefully selected and the management plan designed. When thinking long term, it will be important that these areas have their own forest management plan that guides for sustainable management. Overall, the forests of the City of Helsinki can work as a good benchmark of sustainable natural forests that has been stated in many surveys. In Helsinki, the forests are diverse and have uneven-aged and mixed species. According to specialists of Helsinki, a survey of Aku Korhonen stated that some of the forests in Helsinki are even more diverse than in some preserved areas. The policies and targets for nature management are open to all and can be found at the city's website (City of Helsinki 2020a). Some ideas can also be taken, how Helsinki has created guidance for urban planning to take the forest and wooden network into account (City of Helsinki 2020b). The development project for meadow network has just started, but this is something to keep in mind.

5.1.4. Ideas/suggestions for social impact

In an interview with specialists from the City of Helsinki, the recreational benefits of forests was pointed as a keyword. It is true that ecosystem services of forests and green areas hold so many values such as health, esthetical and recreational values. During interviews, the strictness and steep boundary between nature conservation area and human activity in zoning regulations also came to discussion. Strictness is understandable, but in some cases, small human-made adjustments might help people to find benefits of ecosystem services more easily.

It will take years before forested areas look like real forests. However, with careful planning the areas could have recreational values from the beginning. Perhaps there could be a nature trail with educational signs telling about that particular old wasteland, what has been planted and what is the importance of planting forest to mention a few ideas.

When planning afforestation close to housing, imagination in planning is welcome. The forest created by afforestation does not need to be "just a forest", but it could have other values as well. Fruit trees and berry bushes suitable for the climate could be planted along making the forest a forest garden for the people living close by.

Rakkauden metsä in Helsinki has been a success so far. Like mentioned before the trees to be planted were reserved in less than 24 hours, which implies that people are willing to participate in a programme where one can have a personal relationship to the tree planted (Rakkauden metsä 2020). This kind of project could be done in Ingå as well. Maybe Ingå could rent the land from a private landowner.

Lassila & Tikanoja have a project called Pantit Puiksi *(Deposits to trees)*. In the project, people can give the money they get from bottle deposits for planting a tree. The project is piloted in K-Market Hertta in Helsinki during 2020. In 141 days, they had collected the money for planting 3297 trees (situation on 26.10.2020). In their case, the forests are planted in Madagascar but the forest could also be planted in the municipality. (Lassila & Tikanoja 2020.) Maybe it could be combined with other money collection incentives such as Taksvärkki.

Overall, it is emphasized that it would be important to get the locals to see the benefits of afforestation. When locals are engaged in the area, it is more likely that the forest is not cut down later and thus, the biodiversity benefits will eventually be realized.

5.1.5. Ideas for incentives

If a municipality owns wastelands, good examples for afforestation resources include the cooperation with compensation entities, such as e.g. earlier mentioned Puuni that offers compensation possibilities to companies and organisations and 4H-taimiteko that also employs youth for climate actions. In addition, the social concept of Rakkauden metsä in Helsinki is giving a nice option for community participation for an area that is easily accessible.

For private landowners it is important that they get knowledge and support about climate-friendly actions in forestry. Knowledge and support exist, such as by Climate-smart forestowner -project but it seems that it does not reach all landowners. Our interviews revealed that there is a lot of interest among landowners to do sustainable and climate-friendly actions in their own lands. In addition, increasing

collaboration between different stakeholders - landowners, municipality, companies, citizens, NGO's, could in a positive way bring them closer to each other and open the discussion. Besides support and education, very important is to provide economic incentives to make afforestation a more profitable option and raise its popularity.

Many of the private landowners had some fields that are in natural condition that are in the domain of agriculture subsidies. The law proposal for afforestation concerns only areas that have not received agricultural subsidies since 2019 and thus, it should be good to check and innovate for other incentives.

There are also other subsidies related to the topic. Kemera-subsidy, that was also mentioned earlier in this report, is now waiting for the decision for continuation until 2023. Kemera-subsidy can be applied for a number of management actions related to supporting the growth of young forest. It is meant for private landowners for e.g. tending of seedling stand. According to the interview with Finnish Forest Centre (Pia-Maria Thomssen) the subsidy is not applied for in its total potential. Thus, the question is, how to motivate people to apply for the afforestation subsidy for increasing carbon sinks.

The subsidies for keeping land as farming land came up in the conversation a few times. We got the impression that it is often profitable to keep land as a field (registered as field in *peltorekisteri*) as then one gets an agricultural subsidy. Some of the landowners pointed out that it can be a financial problem for a landowner to take these lands out of the register.

In our interview with specialists from the City of Helsinki, it also came up that in Kuusamo, Northern Finland, there has been development of market-orientated approaches to foster landscape and recreational values in forest management. The incentive idea is that the tourists and tourism entrepreneurs together fund for conservation of landscape and biodiversity values, and landowners are compensated for the loss of forest income during 10 years' agreement (Tyrväinen 2020).

The approach is piloted during autumn 2020. The selected forests have to be reform-mature, private owned and central for tourism including landscape and biodiversity values. During the time, they are also carbon sinks, even though forests are not entirely without cuts, since some collecting and small open cuts can be done depending on the agreement's subject. (Tyrväinen 2020.) Pilot is part of Sincere-project that aims for developing and promoting innovative mechanisms to produce forest ecosystem services. Project is accomplished by Finnish Natural Resources Institute, Finnish Forestry Centre and local actors.

Although the current Covid-19 situation has impacted dramatically on international tourism, the recreational areas are in high use. Maybe similar incentive collaboration could be created in Helsinki-Uusimaa region for areas that are privately owned, but have a potential for recreational use and shared ecosystem services.

5.1.6. Other ideas about the carbon sinks

As our discussions pointed out, carbon sinks can be strengthened in other ways, too, although forests remain as the most significant solution. Benchmarking to other municipalities can give more insights to Ingå on how to promote wooden constructions and take care of carbon sinks in city planning. In general a set of tools and best practices about climate-proof planning and implementing adaptation activities were created during Climate-Proof City (*Ilmastonkestävä kaupunki, ILKKA*) -project 2012-2014, which included among others a check-up list to increase carbon sinks in city planning (see Climate-Proof City 2014).

Regarding the carbon neutrality targets of municipalities, the compensating is discussed side by side with strengthening the carbon sinks with ways to address the last 20 percent of the emissions. Although compensating is not that strongly promoted because of its indirect impact, it is most likely necessary and should be done so that the emission savings are provable.

When discussing with specialists from the City of Helsinki, the idea of a joint compensation fund for the Helsinki-Uusimaa region was presented. With space limitations, the potential of increasing carbon sinks in Helsinki is minimal and there has already been some discussions on compensating possibilities of the change in land use. One suggestion is that joint compensation would be directed to increasing and securing the carbon sinks by afforestation and agroforestry programs in the developing countries, where the forest loss is more evident. Collaboration ideas sound very intriguing, but to be successful, it shall be important to design and enforce them properly.

A recent study revealed a loss of biologically valuable natural forests and only small carbon sequestration in Chile, where the government has been given subsidies for foresting during 1974-2012. The program increased the area of trees, but largely planting of commercially valuable tree plantations (Heilmayr et al. 2020.) Even though the question was not about the compensation programs, it will be important to check the benefits for carbon sinks are real, verified, permanent and creating something additional.

The emission compensation can be done through a variety of emission reduction projects, but also increasing the carbon sinks. Several organizations are offering these kinds of projects that have been certified for example by Verified Carbon Standard or Gold Standard. (Wall 29.10.2020.) Gold standard certified projects are recommended by WWF, since Gold standard enables these projects to actualize and without support these projects would not happen (WWF's Climate Calculator 2020). To be able to compensate the emission, it is of course necessary to first estimate and verify the amount of emissions that aims to be compensated (Wall 29.10.2020)

6 SUSTAINING

In this chapter, we will introduce our main findings from the workshop we carried out with our challenge owners. For this workshop, we utilized the Future Radars -tool in order to envision the future changes and actions that must take place in the coming years to generate the expected impact with the existing wastelands in the Helsinki-Uusimaa region. In the first section, we will describe our main findings from the workshop and in the second section, a few notes about monitoring and managing are shared.

6.1. Envisioning future changes and actions

We invited our case owners to use the Future radars -tool with us to find out changes that should happen to reach the envisioned future. The future we envisioned is that all wastelands are in sensible use by 2050.

First, we had a brainstorming session during which everyone thought about the changes that should happen to reach the envisioned future. We started from the year 2050 and imagined backwards towards the present time. It was hard to imagine changes close to 2050. The changes that we came up with were not temporary linear, but they could happen at the same time as the actors behind the different changes are different. The changes were also ordered according to the amount of control Helsinki-Uusimaa Regional Council or Ingå commune has on the change and the feasibility of the change.

In the next step, we looked forward from present to future and looked at the actions that should be done. They were ordered in temporal order as well as according to their impact and the effort required. Again, we noticed that most of the actions were close to the present time.

One of the first changes that was envisioned to happen is that the wastelands would be mapped and their status recorded. The Tapio GIS data has the subsidy-competent wastelands mapped, but other wastelands are understandably not in this data.

The next step after mapping the wastelands and when deciding about the future use of the wasteland is to do nature surveys where needed. Nature surveys help in deciding if the area would be more suitable for biodiversity protection through meadows or for forestation as a carbon sink or to be used for renewable energy protection. Related to this it was recognised that there might be competition about wastelands in the future. In the future companies might be increasingly interested in wastelands for compensation manners.

A wish for a digitalising project of old nature surveys came up as well. We discussed that there could be a need for developing the regional GIS data overall. For example if all spatial information from nature surveys in Helsinki-Uusimaa would be as QGIS-compatible files, it would make this kind of project easier.

The changes listed included increasing awareness on different levels. It was recognised that telling about good practices that have been implemented could be done with rather small effort by municipalities. Knowing about these practices could inspire people to search for more information and take similar action on their own land as well. Municipalities' webpages and social media channels can be used for dissemination, too. In addition, local newspapers are often happy to publish news about local success stories.

There is also a need for more guidance about subsidies. Ways to ensure that private forest owners get information about the available subsidies easily are needed. Small municipalities might have only one or few people working in the environmental sector so well-designed guidance from other relevant actors would most likely be very welcomed.

Finally, education about sustainable practices is needed in the future. There are hopefully valuable results coming from Climate-wise forestowner -project of Finnish Forest Centre.

6.2. Group notes about monitoring and managing

Without knowing well about the resources of Ingå or other municipalities of Helsinki-Uusimaa, we do not feel confident giving strict advice on monitoring and managing. Few things we want to stress are as follows:

- a) Professional advice could be used in choosing the best use of wastelands.
- b) Climate-wise forest practices should be used increasingly in forest management also in already existing forests. The afforested wastelands should have a climate-wise forest plan as well. When afforesting new wastelands effort needs to be put in taking care of young forest, so that the seedlings will grow well.
- c) If wastelands are made into meadows or other open landscapes, the management needs to planned well.
- d) Municipalities could consider communicating about the afforested areas in their webpages, social media or local newspapers to commit locals.

7 CONCLUSION

This project offered us a great opportunity to learn in more depth about wastelands in Ingå and the Helsinki-Uusimaa region, while collaborating closely with our challenge owners Elina Röman from Ingå commune and Simo Haanpää from Helsinki-Helsinki-Uusimaa Regional Council. It also served as a great platform to apply our learnings from the Pioneers into Practice and obtain industry experience in the field of systems innovation. From our research, we have gathered some key takeaways which are presented below as conclusions:

- Afforestation of wastelands is a complex issue, which benefits from systemic thinking.
- There are various stakeholders included in the system: landowners, municipalities' and region's decision makers, governmental bodies, forest companies, NGOs and businesses and people living close to the wastelands.
- Afforestation is not the only good option for wastelands. The care should be taken, when considering different options of use on each wasteland. Increasing managed meadows and renewable energy production are valuable options to consider. It should also be looked into how to combine different uses to achieve the greatest benefit.
- Wastelands offer a good ground for addressing biodiversity loss along with climate targets. If a wasteland is forested, biodiversity can be protected with a careful and varied choice of trees used. In addition, the ecosystems close by should be recognised to see if the new forest could help protect the existing species.
- The afforestation subsidy is available for private landowners for the first 10 years. Another incentive for climate-wise forest management could be considered. Compensation should also be considered as a way to finance afforestation. In addition, some of the subsidies promote other efficient use of wastelands and this should be looked into.
- The way the forest is managed is very important as it affects how good of a carbon sink the forest is, and how rich in biodiversity it is. It should be kept in mind, what happens after the forest is planted, not only that it needs to be planted. Sustainability should be addressed in forest plans by changing and diversifying the current forest practices.
- Education about climate-wise forest management and climate issues related to forests could increase the urge to use wastelands for common good and commitment for it.
- People should be involved in planning the new use of wasteland close to them. This would probably make them more committed to support the new use of the areas. There are various examples of afforestation, biodiversity protection and renewable energy production that can be used to inspire people. Involving people could also help to imagine how the wastelands can have recreational values that people will appreciate.

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