Tampere University of Applied Sciences

Hiilinielu I Carbon Sink (2022)

From Waste to an Environmental Friendly Artwork

Isa Kiviaho

BACHELOR'S THESIS
May 2023

Bachelor's Degree of Media & Arts
Fine Arts

ABSTRACT

Tampereen ammattikorkeakoulu
Tampere University of Applied Sciences
Degree Programme in Media and Arts
Fine Arts

KIVIAHO, ISA:
Hiilinielu I Carbon Sink (2022)
From Waste to an Environmental Friendly Artwork

Bachelor's thesis 65 pages
May 2023

This thesis and the multidimensional artwork were to examine whether it is possible to develop and create environmentally friendly art from the environmental waste. With my working group, we chose to try to convert the zero fibre of Näsijärvi in Tampere into biochar.

In the summer of 2022, we investigated the possibility of converting and pyrolyzing zero fibre into biochar as energy-efficiently as possible and further processing it into an environmental artwork for the Pispala's Contemporary Art Centre Hirvitalo's sculpture park. A large artwork complex "Hiilinielu" (Eng. Carbon Sink) was born.
The environmental artwork acts as a carbon sink from the power of zero-fiber pyrolyzed and fed biochar in the sculpture park of the contemporary art center of Pispala. The artwork includes an art video with a spell-like spoken word, a photographic work and a still life. The body of work was presented at the RAW exhibition in March 2023 at Grafiikanpaja Himmelblau.

In this thesis, we went through the pyrolysis process of zero fiber into biochar and the different stages of each work in the ensemble from the beginning to the gallery space.

Key words: environmental art, video art, biochar, environmental waste, carbon sink

CONTENTS

1 INTRODUCTION 4
2 CHANGING ENVIRONMENTAL WASTE INTO BIOCHAR 11
2.1.1 Zero fibre processing 13
2.2 Bio Carbon 14
2.2.1 Pyrolyzing zero fibre to biochar 15
2.2.2 Pyrolyzing biochar by DIY -method. 19
2.2.3 Nourishment 21
2.2.4 Proportions for the best result to create carbon sink 22
2.2.5 Nitrogen producing plant 23
3 CARBON SINK AS ENVIRONMENTAL ARTWORK 24
3.1 Beginning of the project 24
3.1.1 Planning and ideation 25
3.1.2 Soil Cultivation 26
3.1.3 Material: willow 27
3.2 Planting the seedling and finishing the work 30
4 VIDEO 33
4.1 Planning and preliminary preparation for inspiration 34
4.2 Spell as a narrative 35
4.3 Filming 38
4.2.1 Visualizing word 42
4.3 Recording voice 44
4.4 Outsourcing the recording process and editing 45
5 PLANNING AND PREMILINARY PREPARATION FOR AN EDUCATIONAL PHOTO WORK 47
5.1 The educational board as a work of art 47
6 INSTALLATION 52
6.1 Materials 52
6.2 Process of the sculpture 54
6.3 Kill your Darling at the last minute. 55
7 CONCEPTUAL AND ENVIRONMENTAL ART FOR GALLERY SPACE 58
8 DISCUSSION 61
8.1 Carbon Mouth 62
8.2 Afterwords 67
REFERENCES 69

1 INTRODUCTION

Climate anxiety is already visibly cutting the air in modern times, and the world situation is such that action is now required. Humanity's growth and ways of operating have had a direct interaction with challenging and complex phenomena such as climate change and species extinction.

The IPCC, an intergovernmental climate panel under the UN, published the sixth part of its assessment report, i.e., the summary report on the state of the climate on 20 March 2023. The IPCC report emphasizes that nature conservation and the preservation of its diversity and ecosystem functioning are of great importance. At least 30% of the earth's surface must be protected by 2030 in order to stop nature's ability to sequester carbon and the destruction of nature. Prevention of the destruction and degradation of forests, as well as large carbon sinks and ecosystem restoration are part of the solutions. The urgent transition to fossil-free forms of energy is also extremely important. We also need fast solutions and ways to remove carbon dioxide from the atmosphere. The report and press releases emphasize that solutions are available, but transitions to them must happen quickly. Climate change and loss of nature is mainly caused by human economic activity and is a political and structural problem, which should be responded to quickly at a level that changes the structures of society. However, the IPCC report now also focuses on the means of adaptation to change. (IPCC 2023.)

The State Council of Finland responded to the report in the following announcement:

"The scientific evidence is clear: climate change is a Threat to the well-being of humans and nature. In the report published today, the Intergovernmental Panel on Climate Change IPCC points out that urgent action is needed to ensure a liveable future for all. There is very little time for corrective actions, but solutions are available." - Press release of the Ministry of the Environment (Finnish Government Council 2023.)

The Minister of Environment and Climate, Maria Ohisalo, appeals in the same press release for the seriousness of science's messages. Ohisalo points out that the crises of recent years have shown that people and societies can act quickly and that this is necessary to stop climate change. Ohisalo appeals that everyone is needed for this, the government, companies, farmers, organizations and citizens. (Finnish Government Council 2023.)

Modern human activity is unsustainable and has serious effects on the state of the entire earth. The way society and people operate must change structurally in order to prevent the deterioration of the earth. Human is a part of nature, not a separate part of it. However, there is still hope. Modern human must adapt to the already irreversible changes, but there is still a chance to prevent the worsening of the climate crisis.

In her Master's thesis at Aalto University, Veera Tiainen has studied art activism in the time of the eco-crisis and already in her introduction states that the treatment of the eco-crisis in the art field in an activist form is fragmentary and mostly a side plot among other phenomena of contemporary art. Tiainen had interviewed Kiasma's amanuensis Saara Hacklin, who informed that little is known about art activism in the field of Finnish visual arts, because the art world does not yet recognize art activism as its own. The introduction already supported one's own way of thinking and emphasizes the narrative of hope in art activism. (Tiainen 2022.)

Visual artist Teemu Mäki raises in his essay "What is climate change from the perspective of art?" art's responsiveness to climate change. Mäki raises the power of art to help people take climate change seriously and bring information that can be experienced so strongly that it can decisively change our experience of existence and our behaviour. And also, that art is able to experiment with old values and create new ones. Art can encourage and suggest new values. Unlike science, art creates ideal images and mental landscapes of lifestyles and the environment, and art can create a new relationship with the world view and the experience of beauty. (Mäki 2017.)

In the field of Finnish contemporary art, there is room for climate activism and climate-themed art. The great meaning and value of art is to raise and stimulate discussion and represent the image of the times. Art has opportunities to influence and stimulate thinking and create images that ultimately can create change at best. Artists have an important role in society in creating images and works depicting change in the time of the climate crisis.

The situation in the field of contemporary art is not empty. On the contrary. Climate change and environmental issues have been discussed in the field of art for a long time. Finnish cultural identity is strongly associated with the forest and the environment and inspired by nature. Especially in the 21st century, environmental and climate related works have increased, and artists have become more and more aware. Based on my own search for artists on their own websites can show as an examples of artists in Finland who work on the environment due to climate, nature, environment and human, IC-98's Patrik Söderlund and Visa Suonpää (AV-Arkki n.d), nabbteeri's Janne Nabb and Maria Teeri (Finnish Painters n.d), Antti Laitinen (Wihurin Rahasto n.d), Tuija Kokkonen (Kokkonen, T. n.d) and Nastja Säde Rönkkö (Rönkkö, N. n.d) can be mentioned. Each of the above-mentioned artists has focused on the climate, climate change and human effects on the environment in the field of contemporary art.

Climate change and the eco-crisis is the sum of many parts, which is very difficult to describe in one way. Art is a key factor in slowing down the eco-crisis because they can help internalize knowledge, feelings and moral value. However, according to studies, a large part of the arts dealing with the eco-crisis depict certain phenomena more than others, so the image of a multi-level phenomenon is distorted into distant and detached images, rather than depicting connections between things. Also, many approach the subject with blame or scary and oppressive works, which can cause a backlash in viewers. (Tiainen 2023.)

It has been found that instead of threatening images, it is more important to show empathy in art and rather to build hope for change. In the field of contemporary art, this has been well-awakened, and artists show an interest in showing the side of things and building a hopeful future. A good example is Puistokatu 4, which

was founded and opened in Helsinki as a joint project of the Tiina and Antti Herlins and Maj and Tor Nesslings foundations, which is a house of science and art whose mission is to promote rapid cultural change in an ecological crisis. (Mistä kyse… n.d.) The house offers contemporary art of sustainable development and spaces for the builders of an ecologically sustainable future of art and science. The works of the opening exhibition were thematically full of hope and empathy in the face of climate change and environmental issues. Combining art and science in a common mission is welcome.

Tampere has its own history when the Lielahti sulphite pulp mill started its pulp production on the shore of Lake Näsijärvi in 1914, and the mill's wastewater was directed directly into the lake until the 1960s. (Palmroth 2019.) Over the course of history, more than 1.5 million cubic meters of zero fibre, a by-product of the wood industry, have fallen to the bottom of Lake Näsijärvi. In Tampere, the solution and handling of the environmental problem is timely, because a new residential area is being built in the area where zero-fibre is the most frequent. The city of Tampere has been experimenting and researching for years the beneficial use of zero fibre for, for example, biogas production.

In January 2022, agreed with the artist Pietari Hyvärinen and Contemporary Art Center Hirvitalo that we can implement an environmental work in the contemporary art centre’s sculpture park. We reflected on the structure and elements of our environmental work and, as artists in the time of the eco-crisis, we thought about whether we could benefit from using environmental waste as a material, which would be shaped into a work of art. Pietari Hyvärinen proposed the use of Näsijärvi zero fibre due to its local and large-scale waste problem. We wanted to take a stand locally and highlight the damage caused by factory production to the environment.

In environmental art, meaning arises in relation to the space and nature surrounding the work. The work is not just an art object placed outside, but it gets its meaning through its environment, and it creates the character of the environment itself. (Huhmarniemi & Jokela 2018.) Regarding the use of environmental waste as material for an environmental work, I thought that it would be more suitable for the environment if the waste could be developed to be environmentally friendly.

I set out to find out if we can convert zero fibre into biochar from biochar experts Anna-Kaisa Elo and Jarkko Nummela. The situation was that pyrolyzing Näsijärvi zero fibre into biochar was theoretically possible. Before there had been a few experiments done in the scientific world. Biochar has been used for thousands of years to nourish the soil and is itself a carbon sequester from the atmosphere.

While writing this thesis, the Ministry of the Environment and the Ministry of Agriculture and Forestry have also clarified the rules of the game for voluntary emission compensations in their project. Experts and ministry officials confirm that if biochar is used for soil improvement or carbon dioxide is captured from the atmosphere and stored, biochar is currently the only available method for making a valid compensation claim in Finland. (Ministry of Agriculture and Forestry, Ministry of the Environment 2023.)

In the theory of zero fibre, possible pyrolysis into biochar opened the possibility for us to create a real carbon sink as a work of environmental art. For example, artist Agnes Denes' Tree Mountain itself as a work has a positive effect on its surroundings. The zero fibre material as the material of the sculpture transformed into a more abstract and invisible form, so the external form of the environmental work had to be developed into a physical form in some other way. I felt that the physical form lacked playfulness and adventure, delightful ejaculation. I strive to build a physical environmental work with as natural materials as possible, in the manner characteristic of environmental art.

Ideally, over time, the physical work naturally settles down, but the carbon sequestration ability remains in place. Hanna Johansson states in her Earth and environmental art recording project that the documentation of the art of our time has changed. Recording has come to be seen as a necessity, as the works themselves are increasingly lost, changed and moved to new situations. (Erkkilä, Haapala, Johansson & Sakari 1999.) While constructing my own piece in my mind, I realized that the process of my project is more interesting and important than the final physical sculpture itself. For example, English based art philosopher land artist and photographer Andy Goldsworthy's work with natural moment-built and disappearing beauty with leaves and stones in the environment. Photography

for documentation is needed in this kind of work for bringing these acts to audience.

Having grown up in the digital era, video and photography naturally came into the process. I thought about documenting the process and it grew into my own video piece to describe the art process. Instead of just documenting, I decided to try to make a video work that describes the process and contemporary climate anxiety but is full of hope. The building of Outi Heiskanen's Majan rakennus (1990–1992) describes well the effect of the video and the example of making. In the video, we see when Heiskanen builds a hut for herself with the elements she finds in nature and her surroundings. Maja has disappeared, but the video work continues its own life. (Erkkilä, Haapala, Johansson, Sakari 1999.)

The video piece can describe process, journey and climate anxiety and the power of change with its reflection. And the photo can bring out the work itself to the viewer, and the photo's educational board-like form reminds us of learning, and the educational detail of the work enables the possibility of change.

Hiilinielu I The Carbon Sink art project is an artistic and scientific study as well as a multidimensional body of work. It covers an environmental work, a spoken word video work, a work representing the aesthetics of an old educational board, and a layout that brings to the viewer the invisible zero fibre under water and the pyrolyzed biochar.

In this thesis, I open the structure of works and entities step by step. In the first part, the pyrolysis of zero fibre into biochar is investigated with the help of the biocarbon expert, CTO of PUHI Oy Jarkko Nummela, and independently with homemade methods. After that, I open the parts of my artistic process one by one from the beginning to the gallery space for the art community to see.

I approach the issue primarily as a contemporary artist. The work exudes strong features of art activism, however, my intention for my work is an inspiring manifestation and influence through my own example.

In this thesis I ask how to transform the by-product of factory production into an environmentally friendly element and utilize it in an ecologically sustainable artistic process that would also inspire change for the benefit of the climate?

2 CHANGING ENVIRONMENTAL WASTE INTO BIOCHAR

2.1 Beginning

The development process of the artistic entity of the Carbon Sink -project was fast-paced and lively. In January 2022, we discussed with visual artist Pietari Hyvärinen about the creation of an environmental work in the Hirvitalo sculpture park of Pispala Contemporary Art Center. We were involved in the activities of the contemporary art center and we received positive reception for the development of the work. We were both united by an interest in environmental art and an appreciation for the work of Teemu Lehmusruusu (Bioart society n.d) and Antti Laitinen (Wihurin Rahasto n.d), which combines media and installation art as well as bio and natural arts.

Pietari brought up Tampere's local environmental problem in the discussion and showed his interest and the question of whether it would be possible to create an installation using Näsijärvi's environmental waste with zero fibre. I got inspired about the idea and thought about whether environmental waste could be turned into climate action. My close circle includes biochar experts Anna-Kaisa Elo and Jarkko Nummela. Through them I had learned about biochar and its environmental effects, so I immediately connected the organic nature of zero fibre with the possibility of pyrolyzing biochar.

Due to the organic nature of zero fibre, it is theoretically possible to dry distil it into biochar. Biochar can be used, among other things, for soil improvement, carbon compensation, cleaning of polluted land and water, composting, construction and many other possibilities, from technical applications to cosmetics (Elo, Nummela & Kymäläinen 2021). Biochar is effective in sequestering carbon from the soil and atmosphere and nourishing the soil. All elements enable the creation of a proper carbon sink.

We planned a long performance video, where Hyvärinen would collect zero fibre in a sack and carry it from Hiedanranta over Pispalanharju to Hirvitalo and I would film the entire journey, and we would have done the sculpture separately.

However, the work faced its first setback when I asked from marketing and communications manager of Hiedanrannan Kehitys Oy Matti Huhta for permission to collect some zero fibre from the construction area of Hiedanranta. Turned out, It is not possible to collect zero fibre, because it is more than 4 meters deep and there is so much dirt that even with a gauze a citizen can't get it. However, with the help of Huhta, we received zero fibre from Pimara Oy as a donation for our work.

2.2 A zero fibre by product of the wood industry

There were no environmental laws yet when factory was build and it was only in the 1960s that due to the negative public debate attention was paid to wastewater emissions from factories. In the 1980s, the activated sludge process was started to be used in wastewater treatment, thanks to which the proportion of wastewater in the 1990s was already less than a tenth of its highest point in the 1970s. These days factories follow environmental management systems. (Palmorth 2019.)

Zero fibre is a wood-based organic fibre sludge that was created as a side stream of paper and pulp mills and ended up in the lake Näsijärvi along with wastewater. Over time, the zero fibre has sedimented, i.e., sunk to the bottom and compacted. (Lahtinen 2016.) Wastewater from the Lielahti factory was mainly diverted directly from Hiedanranta untreated until the 1960s, which is why it is estimated that 1.5m3 of zero fibre has ended in the Hiedanranta area. The thickness of the mass at the bottom of the lake varies in the area from two to eleven meters. (Palmroth 2019.)

Zero fibre located in Lielahti has been studied to be mainly wood-based material. The pulp contains long and short fibres, hemicellulose, cellulose, lignin and bark pulp in the surface parts (Palmroth 2019). The composition and colour of zero fibre changes depending on how deep the zero fibre originates. The zero fibre located deeper has been sedimented for up to a hundred years, so it has a darker colour and a felt-like texture and is tougher. Towards the surface, the colour lightens towards brown, and the structure becomes more fibrous. (Lahtinen 2016.) Pimara Oy donated zero fibre excavated from Näsijärvi for this work, and

the zero fibre used for the work was most likely closer to the surface, due to its brown tone and clear fibrous structure.

Due to the strong chemical treatments, especially in the deeper bottom, zero fibre sediment can be harmful to the water ecosystem. Näsijärvi zero fibre has been measured to contain, among other things, nitrogen, phosphorus, sulphur and other metals. When they dissolve, they cause a loss of oxygen in the lake, and when the sediment mixes with the water, harmful substances can travel 33 kilometres, endangering aquatic organisms. (Palmroth 2019.)

Various studies are being carried out for zero fibre and different processing options are being tested constantly by the city of Tampere and companies in various fields, what could be done for zero fibre. According to the goals of the city of Tampere, the solution should be sustainable, and economically realistic. As bio-waste, zero fibre sets limitations for the beneficial use of the material, but because of the nutrients it should be used in energy production. For example, the important nutrients of zero fibre such as nitrogen and phosphorus could be utilized to support the circular economy. In his thesis, Palmroth shows that biogas production is also suitable for utilizing zero fibre. (Palmroth 2019.) Biochar is a theoretically possible solution for the utilization of zero fibre in a way that supports sustainable development but falls outside the volume desired by the city of Tampere and the economically realistic limitations.

2.1.1 Zero fibre processing

I received half a garbage bag of wet zero fibre from Pimara Oy from foreman Antti Ukonjärvi. The purpose of the project was to implement biochar as energy efficiently as possible, so the drying took place in sunlight, laid out on the ground. The biomass to be pyrolyzed must be solid and dry in order to be able to produce biochar. The paper pulp-like zero fibre took a week to dry completely. As the water evaporated, the mass became lighter. Wet zero fibre had a strong characteristic smell. But as it dried, the smell subsided. I squeezed the excess water out of the mass with my hands and at the same time formed solid pieces.

PICTURE 1. Drying zero fibre in the light of the sun. 25.06.2022. Photo by Alisa Elo.

2.2 Bio Carbon

Biochar is a carbonized organic main by-product, which is produced during pyrolysis, i.e., dry distillation of biomass in oxygen-poor conditions at sufficiently hot temperatures. Biochar has been created naturally in forest fires when wood burns in oxygen-poor conditions throughout the world's history. And when humans started using fire, biochar was created as a by-product and remained to enliven the soil. Later, this has been done on purpose, for example by cascading. Due to the diverse and useful structure of biochar, its applications are very versatile.

The most common applications of biochar are improving the soil, creating a carbon sink, cleaning contaminated soil and water, and using it as a growing medium. The versatility also covers cosmetics and medicine as a raw material, as well as livestock production as a bedding and manure enhancer. (Nummela 2017.)

In my process, I have familiarized myself with the biochar teaching material of Annakaisa Elo, Ph.D., adjunct professor and LAB University of Applied Sciences' leading expert. And it appears from the material that, the rate of climate warming and the amount of carbon dioxide in the atmosphere is at the point where simply giving up fossil energy and using renewable energy is no longer enough. We need to develop solutions for sequestering climate carbon from the atmosphere as well. Biochar is a long-term carbon sink. Biochar does not decompose biologically and can remain in the soil for 300–20,000 years. Its carbon content is high, and the nutrients bind to the structures well. Biochar enhances the growth of microbes and has excellent moisture retention. Biochar in the soil binds carbon from the air and nourishes the soil.

2.2.1 Pyrolyzing zero fibre to biochar

We pyrolyzed twice in the project; the first time with expert Jarkko Nummela in Sahalahti on 8.7.2022 with Nummela's homemade pyrolysis. We tested if it’s possible to pyrolyze zero fibre and Nummela introduced me the process. The second time we pyrolyzed independently with Pietari Hyvärinen in the courtyard of Hirvitalo at the Pispalas’ Contemporary Art Centre on 19.7.2022.

The pyrolysis process is in theory a simple method. The organic raw material is heated in oxygen-poor conditions and at a sufficiently high temperature. It also appears from Elo's teaching materials that the goal is to preserve the solid carbon-containing substance of the original organic material, i.e., the cell walls. This forms a very porous structure typical of biochar.

In addition to zero fibre, we filled the pyrolysis with wood chips as a component that forms warm gas and mass (Nummela 2022). Zero fibre as a material is not a solid uniform raw material, such as for example wood, but it is a fine particle that has been compressed to size. Wood chips also protect that fine zero fibre from below does not block the gas outlet during pyrolyzing.

PICTURE 2. Setting dry zero fibre in pyrolysis. 8.7.2022. Photo by Isa Kiviaho.

PICTURE 3. Pyrolysis in progress. In Jarkko Nummela's self-built pyrolysis. Photo by Isa Kiviaho.

PICTURE 4. Pyrolysis in progress. Photo by Isa Kiviaho.

While pyrolysis is running from the pipe from below, pyrolysis emits gases containing methane, hydrogen, carbon monoxide, as well as water vapor and carbon dioxide. When the gas supply has stopped. Pyrolyzing has occurred.
The temperature must be high above 350-800°C. (Nummela 2022.)
When pyrolysis exceeds 800 degrees, it heats heavy metals from organic matter.

During pyrolysis, we smelled and observed that zero fibre also emitted sulfuric acid during pyrolysis. This is a sign of the rustling of history, because the old chemical sulphite cooking method of wood processing plants used a calcium bisulphite solution containing sulfuric dioxide. Studies have found, among other things, mercury, copper, sulfuric, nitrogen and phosphorus in Näsijärvi's zero fibre. The concentrations of substances are low in zero fibre, but due to the large amount, there are many harmful substances in the lake. (Palmroth 2019.)

PICTURE 5. Temperature record in pyrolysis. Photo by Isa Kiviaho.

PICTURE 6. Successful biochar with Jarkko Nummela. Photo by Isa Kiviaho.

The first experiment with expert Jarkko Nummela proved successful. And we made the first batch of biochar from zero fibre in Lake Näsijärvi. The theory came true, and we had created environmentally friendly biochar from environmental waste.

PICTURE 7. Piece of zero fibre and pyrolyzed biochar. Photo by Isa Kiviaho.

2.2.2 Pyrolyzing biochar by DIY -method.

With Jarkko Nummela's instructions we decided to try pyrolyzing biochar ourselves with Pietari Hyvärinen. Originally, the intention was to pyrolyze biochar in the community sauna of the Pispalas' Contemporary Art Centre Hirvitalo, so that we would have utilised the thermal energy we used for pyrolyzing at the same time. The sauna could not be used, so we ended up in a large cauldron in the yard.

PICTURE 8. Isa Kiviaho and Pietari Hyvärinen pyrolyzing in the Pispala's Contemporary Art Centre 19.7.2022. Photo by Isa Kiviaho

We placed zero fibre and wood chips in a metal tight-fitting old coffee jar that was tied around with iron wires to make sure it stayed closed. We nailed a hole in the lid with about an 8mm nail, the gas that comes in the process of pyrolyzing gets out. The jar was placed in a large cast iron cauldron, and we gathered a campfire from the trees evenly around and on top of the jar. Pyrolysis is known to be complete when the gas no longer manifests itself in the hole as a transparent oscillating stream of air, a burning flame, or a slightly cloudy smoke.

PICTURE 9. Initiation of pyrolysis 19.7.2022. Photo by Isa Kiviaho.

Holes appeared in the metal jar in the middle of pyrolysis, so success was uncertain, but it took about two hours to pyrolyze about a litre jar. The jar was immersed in cold water and sprayed water over the coals so that oxygen does not react and burn coal. We had succeeded in our experiment and created environmentally friendly biochar from environmental waste ourselves.

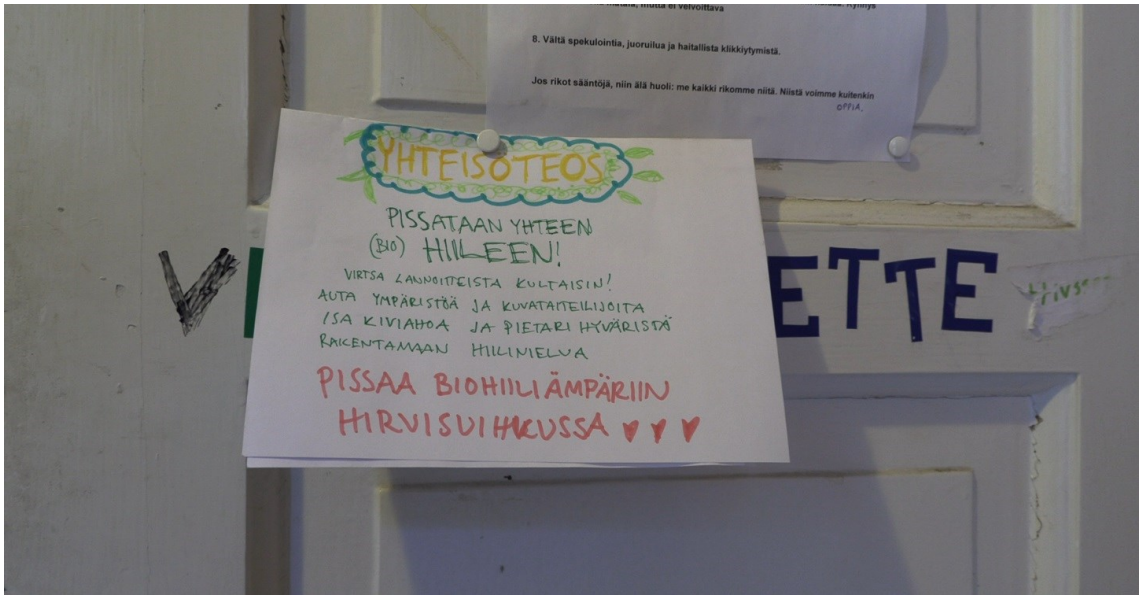
PICTURE 10. Isa Kiviaho with a successful homemade biochar made from zero fibre in Lake Näsijärvi 19.7.2022. Photo by Isa Kiviaho.

2.2.3 Nourishment

Biochar itself is not yet a component that nourishes the soil. It must be nourished to be as effective as possible to improve the binding of nutrients and moisture to the soil, to promote the formation of vegetation and micro-organisms, and to act as a carbon sequestrator, i.e., a carbon sink.

The simplest and natural fertiliser is urine, about 9 parts of water and one part of urine is an effective means of fertilizing the garden, plants and the ground. Urine contains nitrogen and phosphorus, which nourish plants, as well as salts and micronutrients. For example, zinc, selenium, iron, manganese, sodium, magnesium and calcium (Malila, Viskari & Kallio 2019).

To nourish the biochar, I organized a community artwork where visitors to the Pispala's Contemporary Art Centre could participate by peeing in a bucket to nourish nature and a carbon sink for a work of art. 1.5 liters of urea can be used to fertilize approximately one square meter of farmland per year. The amount is the average amount of urine produced by one person per day. (Malila, Viskari & Kallio 2019.) There was enough participation, and the community work was successful.



PICTURE 11. “Community work. Let's pee on one (bio)coal! Urine from fertilizers the most golden! Help the environment and visual artists Isa Kiviaho and Pietari Hyvärinen to build a carbon sink. Pee in a bucket of biochar in a deer shower.” Photo by Isa Kiviaho.

2.2.4 Proportions for the best result to create carbon sink

For the efficiency of the carbon sink of the work and the nourishment of the soil to be at its best possible, the proportions of soil and biochar must be 90 % and 10 %, respectively according to expert Jarkko Nummela. The soil fraction of this tea is 100 litres of mold, so there must be 10 litres of biocarbon.

Biocarbon must be 10% of the total amount to be the most effective. Five 20-liter soil bags were used in the work, i.e., a total of 100 litres of mulch. Calculated from this, 10% is 10l.

PICTURE 11. Siberian pea bush and biochar in the finished work. Photo by Isa Kiviaho.

2.2.5 Nitrogen producing plant

The Siberian pea bush also produces nitrogen. Nitrogen is important component of leafy greenery, in which photosynthesis occurs.
Adequate nitrogen fertilization increases the contacting leaf area.
Leguminous plants like The Siberian pea bush, have a biological ability to fix nitrogen with the help of root nodule bacteria of the genus Rhizobium living in their root system. The bacteria create nodules on the plant's roots, which bind nitrogen and produce oxygen in the soil. Nitrogen fixation is a necessary process for photosynthesis. (Seuri, 2018.)

3 CARBON SINK AS ENVIRONMENTAL ARTWORK

The concept of environmental art covers works in outdoor spaces, which in terms of form fit or are defined by their place. An environmental artwork can also be built from materials specific to the site, such as soil, stones, plants, snow and so on. In environmental art, meaning arises from the relationship with the space surrounding the work. (Huhmarniemi & Jokela, 2018.)

Ecologist Hanna Östman developed the concept of restorative environmental art in 2015 in her research on ecologically restorative environmental art. She refers to the concept of environmental art, whose primary goal is to restore its ecosystem. This is where the Carbon Sink environmental work fits in, by improving the land around it and acting as a carbon sink. In her research, Östman has taken artist Agnes Denes's Tree Mountain from 1996 and artist Jackie Brookner's work “The magic of Water”, 2007-2010. According to Östman's research, these works are the only restorative environmental works found in Finland. Brookner's work "The Magic of Water" had a significant impact on the birds of the area. The artificial islands included in the work enabled peaceful nesting places for local birds. And Agnes Denes's Puuvuori in Pinsiö would prevent possible environmental harm in the Ylöjärvi groundwater area. (Östman, 2015.)

3.1 Beginning of the project

I greatly admire sculpture parks built by artist Veijo Rönkkönen and artist Ossi Somma, and I also love the Botanical Gardens. I had just seen the 7 meter the Earth Goddess sculpture created by Mosaïcultures Internationales de Montréal at the Atlanta Botanical Garden. A magnificently gigantic fully green and blooming human figure rises from the ground in the middle of the garden. I played with the word carbon sink and how in Finnish it is a part of the mouth. As a flash in my mind, I clearly visualized a large mouth opening from the ground, that would be at the same time a carbon sink.

I am inspired also by the artworks of Agnes Denes and Olafur Eliasson and Andy Goldsworthy. Eliasson's work for the climate as an artist is very impressive. I admire Michael Pinsky's Pollution Pods, 2017. Pinsky also combined art and science in his four-year project, where he studied the causes and consequences of pollution. He illustrated and imitated the air quality of different cities for the viewers in large greenhouse-like domes.

3.1.1 Planning and ideation

The design process of my landscape artwork was a lively meta-level chain of events. The planning was made easier by the pre-arranged location in the Hirvitalo sculpture park and the familiarity of the area. Due to the nature of the finished public placement and its definitively tied nature, my work can be defined as a place-bound land artwork (Johansson 2004).

The sculpture park is a sheltered open space surrounded by dense trees. A clear plan before the shape of the sculpture was its function as a carbon sink. I had in mind an imaginative and playful character portraying greenery. My mind was spinning with faces, sleeping creatures and fairy tale creatures rising from the ground. My agenda was to play freely with the artistic imagination and bring the whimsy to biology, natural laws and science. This was my way of dealing with climate anxiety concretely by doing something through art.

I played with the Finnish word hiilinielu, which means carbon sink but literally it is carbon mouth. I saw our environmental artwork as a powerful living vision emerged where there is the mouth with the tree growing in the middle. The decision was strongly intuitive. The mouth took shape and my mind flashed through various options for forming lips and a large tongue. The idea was to create a permanent perennial growing sculpture, which is green in the spring and creates a snow sculpture-like shape in the winter. It changed when Pietari and I both became interested in willow as a sculpture material, so we ended up braiding the shapes of the lips and tongue.

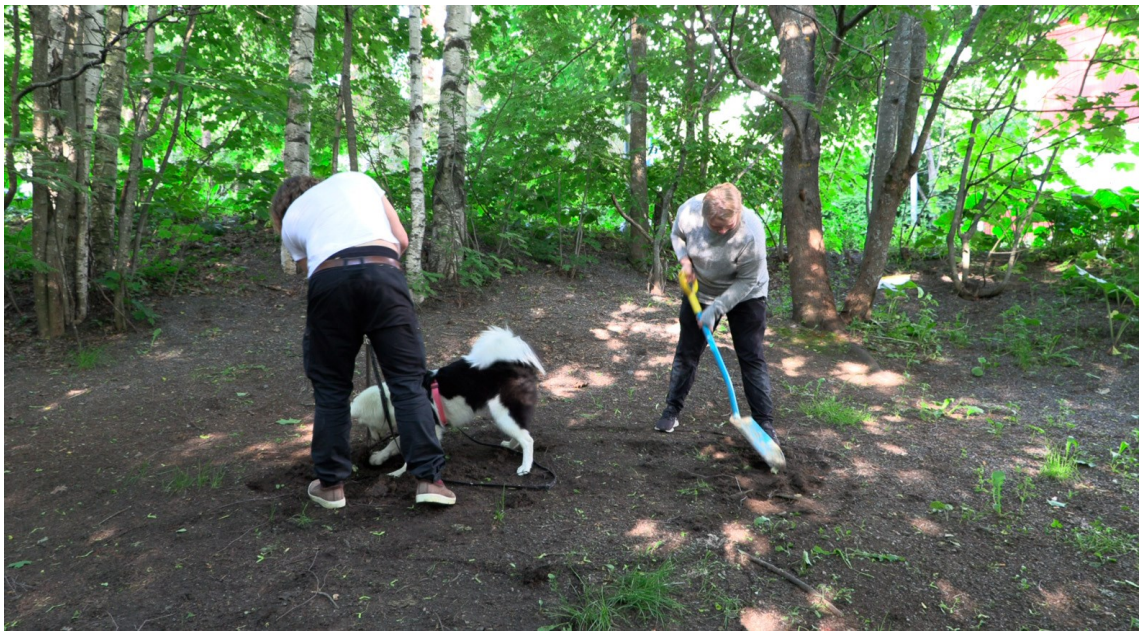
PICTURE 12. Original first sketches of Carbon Sink – land art. Photo by Isa Kiviaho.

PICTURE 13. The first draft of the work at the location. Photo by Isa Kiviaho.

3.1.2 Soil Cultivation

I started implementing the project with Pietari on June 20, 2022. Due to the hard and sandy soil of sculpture parks land, the first phase of our work was tillage and priming. In practice, we started by digging a 1 m x 1.5 m pit. The soil was compact,

hard in nature and full of large and tenacious roots. Our first stage took 3 hours, and the rain finally ended our work for the day.



PICTURE 14. Isa Kiviaho and Pietari Hyvärinen in the tillage work with Lumo the dog on June 20, 2022. Photo by Isa Kiviaho.

The next day we went to buy three 20-liter bags of mulch only to find out we needed two more. After the amount of soil and the final size of the work, I was able to calculate the amount of biochar and nutrients according to Nummela's instructions, which is defined above. Pure forgetfulness and damage have occurred while making the work. The Siberian pea bush enjoys the combination of soil and sand and I completely forgot about the sand. It may be very possible that this affects the growth and survival of the pea bush.

3.1.3 Material: willow

Our work with the willow took a total of four days in June 2022. We were able to collect most of the willow from Nummela's plot in Sahalahti, where there was certainly plenty of willow growing. We spent whole day in Sahalahti and collected as much willow as possible, wherever we could find it. A bright sunny summer day brought its own challenges, and the collection was slower due to the heat.

PICTURE 15. Isa Kiviaho and Pietari Hyvärinen collecting willow in Sahalahti on June 23, 2022. Photo by Isa Kiviaho.

PICTURE 16. Collected willow in Sahalahti on June 23, 2022. Photo by Isa Kiviaho.

Willow as a natural material is interesting. When fresh, it is pliable and malleable, and when it dries, it becomes hard and pliable. Precisely because of the changing nature of willow, we transported the material to Hirvitalo and immediately worked on the shape of the mouth. We wanted a possible natural and grounding result, so we used grounding jute thread and willow's own branches as a design aid.

Due to our choice of materials, our work will, in environmental art, be grounded and shaped by its environment over time.

PICTURE 17. Pietari Hyvärinen working with willow for an environmental work. Photo by Isa Kiviaho.

It took two days to work on the mouth. The amount of willow we calculated was not enough and we had to make a decision that affected the result of the work and left out the large tongue. Time and resources failed in an instant, and I felt that the tongue would also be extra for the work and the work would be more interesting without it. Due to ambitious schedule and lack of experience, getting to know willow properly remained unfulfilled. As a material willow was interesting, but we were still able to create a lip-like shape.

PICTURE 18. Isa Kiviaho working on the Carbon sink land art on June 24, 2022. Photo by Isa Kiviaho.

3.2 Planting the seedling and finishing the work

In July 2022, the only available Siberian pea bush seedling in Tampere was planted in our work. We encountered a drama of excitement on the planting day, when the garden shops and gardens in the Tampere area had sold all the bushes. In the end, after many phone calls and investigations, one small seedling was found at the Pinsiö Garden. The original plan was to plant a larger specimen to improve survival rates, but we got the last specimen.

PICTURE 19. Isa Kiviaho with the Siberian pea bush. Photo by Pietari Hyvärinen.

At the same time, we had worked on the art video part of the project, which I had planned to include the seedling planting as well. We filmed the planting of a seedling, in which our actor Oiva Suonio lays out willows, Pietari puts biochar in the soil, and I plant a bush in the work. The video work ends with this video material we shot. The environmental part of the project ends with the planting of the sapling.

PICTURE 20. Isa Kiviaho planting the sapling. Screenshot from Carbon Sink -video. Photo by Isa Kiviaho.

PICTURE 21. Isa Kiviaho and Pietari Hyvärinen watering the finished artwork. Photo by Isa Kiviaho.

PICTURE 22. Hiilinielu (eng. Carbon Sink) from above. Photo by Isa Kiviaho.

4 VIDEO

The video for my artwork is a three-minute narrative description of our process with a spell-like narrative. The omniscient poetic narrative embodies climate anxiety and, together with the image of the journey, it becomes unified with the human journey. A multi-faceted person has awakened to the world situation and strives for change. The video follows the human with many faces on its journey from the lake to the yard in its own change-making activity.

The story of the video begins at the lake, where a multi-faced person has a look full of hatred and a thought about the problem that lies beneath the surface. The video follows the tearing of a muddy element from the bottom and stuffing it into a sack from the lake, as well as the person being in his thoughts. The spell-like narrative leads forward and visualises a person's own imagination about the change of primaeval forest to commercial forests, demonstrations and politicians, clocks and desert.

In the video, a person meets two uphills, where at the top, he still looks back at the lake, where he started, and which keeps getting further away. The journey consists of getting there and putting down the sack next to the big cauldron in the domestic courtyard. A person lights a fire around the jar and watches the flame. The story culminates and ends in the garden with making a piece, counting the contents of the jar and planting a tree.

4.1 Planning and preliminary preparation for inspiration

I greatly admire film director Dwayne Logan's work "Black Thoughts" (2021), where a man tells the experience of living in America as a black man with a powerful spoken word narrative. The words have been created to build mental images and to follow the words with a moving image and narrative. Video artist Eija-Liisa Ahtila's work on authentic pictorial narration, where fantasy is mixed with realistic pictorial narration, can also be seen in the video work. Ahtila has talked about the concept of ecological drama in the Puhetta Nykytaiteesta podcast, which is well suited to describe the Carbon Sink video work.

The style of the video is documentary and authentic, with very little image processing. However, the video is a fantasy, because the original performance was also cancelled due to the impossibility of collecting zero fibre. The footage of the video is composed of real-life situations as well as staged and acted parts. The task of the video is to create an inspiring seed of change through an example and to embody the phenomenon of climate anxiety. The video work is built around the free spell I wrote, and the narration strongly follows the words, so in an artistic context my video work can be defined as a poetry video (Polamo 2016).

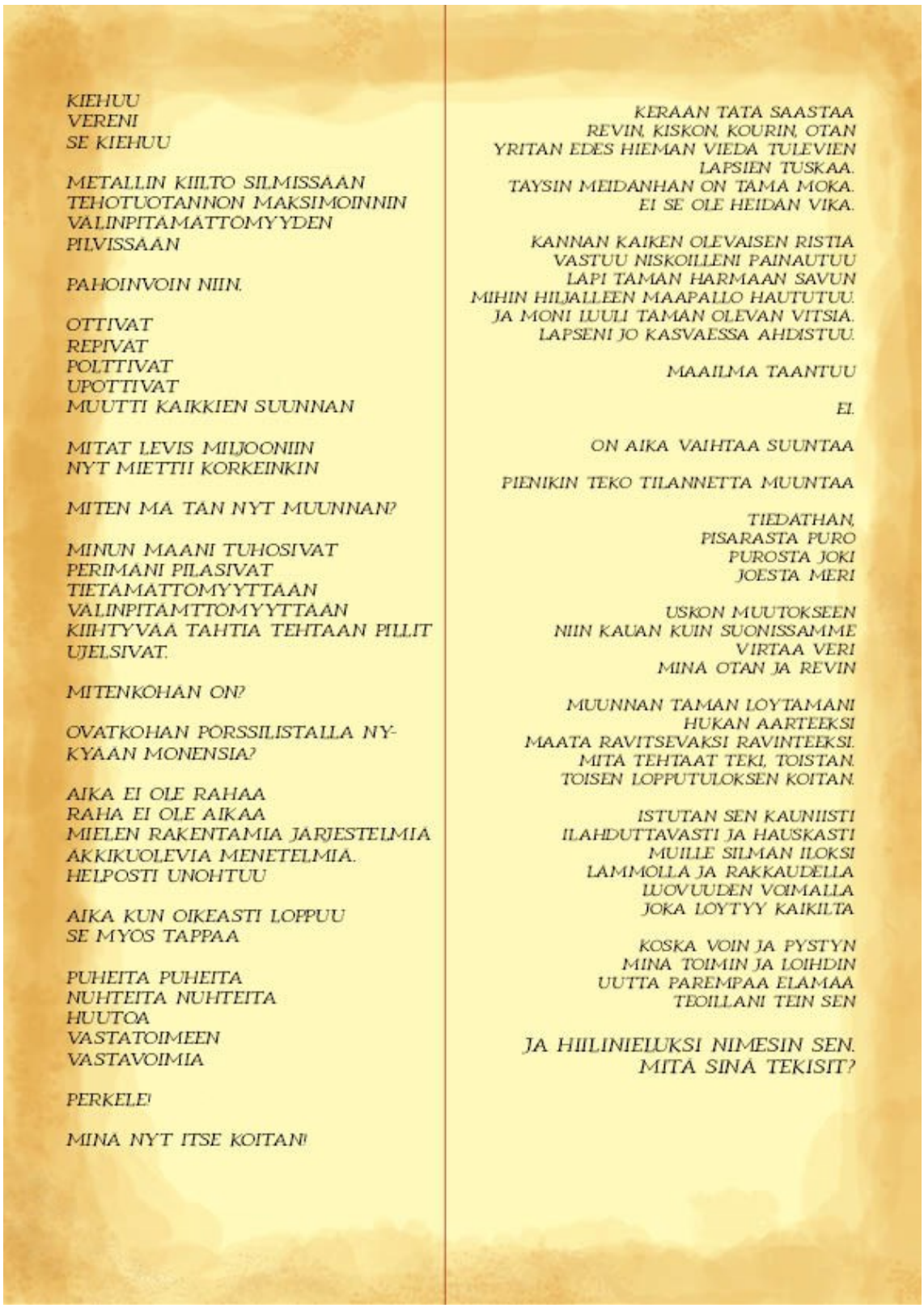
I shot almost the entire video with a Canon x203 movie camera I borrowed from school. Footage has also been filmed with a GoPro, for underwater images. I used a tripod and a hand grip to create the effects: zoom in and zoom out and upward camera movements.

4.2 Spell as a narrative

My video work follows a spell-like free word art in its script. A spell is a tool for influencing the world, which is built from linguistic symbols and is based on the mythology, religion, tradition, world system and symbolic world of a certain community. The spell is related to the everyday language of communities in the sense that both are means of communication. The goals of everyday communication and a spell differ in that one is a means of communication and the other a means of influence. (Patrykiejew 2003.)

I've chosen the incantation over the typical poem form because of its freedom. Spell-like narration gives the freedom to build word choices purely according to one's own natural and free rhythm and pace. The agenda of my purely flamboyant word art is to simultaneously deal with and express today's climate anxiety and influence the viewer to change direction. As a Finnish woman, it was natural to use my own native language. The Finnish language is beautifully and strongly sonorous, and it is easier and wider to play with metaphors in one's own mother tongue.

The rhythm of my statement is an important element, and the video is rhythmic to my voice and words. Because of that, this could be called a poetry video. However, I have not followed poetic measures and rules, studied poetics, so you can call this a poem or poetics. I don't pronounce poetically correctly, because in Finnish pronunciation the emphasis is always on the first syllable, which I don't do at some points.



KIEHUU
VERENI
SE KIEHUU

METALLIN KIILTO SILMISSÄÄN
TEHOTUOTANNON MAKSIMOINNIN
VALINPITAMATTOMYYDEN
PILVISSÄÄN

PAHOINVOIN NIIN.

OTTIVAT
REPIVAT
POLTTIVAT
UPOTTIVAT
MUUTTI KAIKKIEN SUUNNAN

MITAT LEVIS MILJOONIIN
NYT MIETTII KORKEINKIN

MITEN MÄ TÄN NYT MUUNNAN?

MINUN MAANI TUHOSIVAT
PERIMÄNI PILASIVAT
TIETÄMÄTTÖMYYTTÄÄN
VALINPITÄMTTÖMYYTTÄÄN
KIIHTYVÄÄ TAHTIA TEHTÄÄN PILLIT
UJELSIVAT.

MITENKÖHÄN ON?

OVATKOHAN PORSSILISTALLA NY-
KYÄÄN MONENSIA?

AIKA EI OLE RAHAA
RAHA EI OLE AIKAA
MIELEN RAKENTAMIA JÄRJESTELMIÄ
ÄKKIKUOLEVIA MENETELMIÄ.
HELPOSTI UNOHTUU

AIKA KUN OIKEASTI LOPPUU
SE MYÖS TAPPAA

PUHEITA PUHEITA
NUHTEITA NUHTEITA
HUUTOA
VASTATOIMEEN
VASTAVOIMIA

PERKELE!

MINÄ NYT ITSE KOITAN!

KERÄÄN TÄTÄ SÄÄSTÄÄ
REVIN, KISKON, KOURIN, OTAN
YRITÄN EDES HIEMAN VIEDÄ TULEVIEN
LAPSIEN TUSKAA.
TÄYSIN MEIDÄNHÄN ON TÄMÄ MOKA.
EI SE OLE HEIDÄN VIKA.

KÄNNÄN KAIKEN OLEVAISEN RISTIÄ
VASTUU NISKOILLENI PAINAUTUU
LÄPI TÄMÄN HARMAAN SAVUN
MIHIN HILJALLEEN MAAPALLO HAUTUTUU.
JA MONI LUULI TÄMÄN OLEVAN VITSIÄ.
LAPSENI JO KASVAESSA AHDISTUU.

MAAILMA TÄÄNTUU

EI.

ON AIKA VAIHTAA SUUNTAA

PIENIKIN TEKO TILANNETTA MUUNTAA

TIEDÄTHÄN,
PISARASTA PURO
PUROSTA JOKI
JOESTA MERI

USKON MUUTOKSEEN
NIIN KAUAN KUIN SUONISSAMME
VIRTAA VERI
MINÄ OTAN JA REVIN

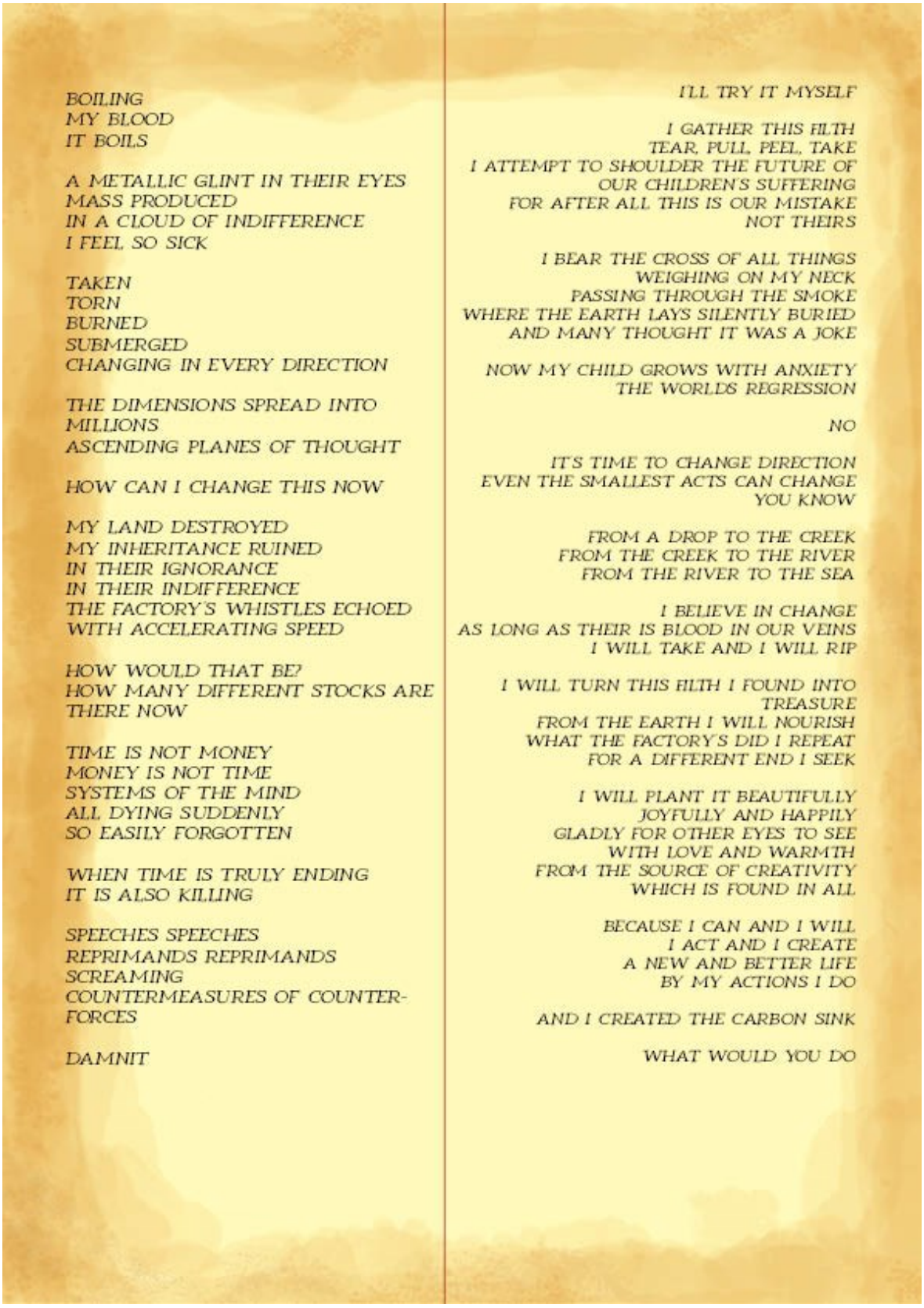
MUUNNAN TÄMÄN LÖYTÄMÄNI
HUKÄN AARTEEKSI
MÄÄTÄ RAVITSEVAKSI RAVINTEEKSI.
MITÄ TEHTÄÄT TEKI, TOISTAN.
TOISEN LOPPUTULOKSEN KOITAN.

ISTUTAN SEN KAUNIISTI
ILAHDUTTAVASTI JA HAUSKASTI
MUILLE SILMÄN ILOKSI
LÄMMÖLLÄ JA RAKKAUDELLA
LUOVUUDEN VOIMALLA
JOKA LÖYTYY KAIKILTA

KOSKA VOIN JA PYSTYN
MINÄ TOIMIN JA LOIHDIN
UUTTA PAREMPAA ELÄMÄÄ
TEOILLANI TEIN SEN

JA HIILINIELUKSI NIMESIN SEN.
MITÄ SINÄ TEKISIT?

PICTURE 24. Spell-like spoken word in Finnish in its own lay out by Isa Kiviaho.



PICTURE 25. Spell-like spoken word in English tranlasted by Brandon Emene.

PICTURE 26. Isa Kiviaho shooting scene with Pietari Autio. Picture by Piia Muurinaho.

4.3 Filming

We filmed the parts of the actors in the video in July 2022. We had also filmed the parts of the video with actor Oiva Suonio, Pietari Hyvärinen and me, as well as the pyrolysis process and the tearing of zero fibre with actors Robert Eftychiou and Karo Junell at Hirvitalo and when the sun was shining from a clear sky, so it was important that the final footage was also on a summer day.

My friends Pietari Hyvärinen, Piia Muurinaho, Karoliina Vuorinen, Onni Takkinen, Salla Rusanen and Pietari Autio volunteered to be actors on a fast schedule. I had already planned the shooting locations at Hiedanranta and at the steps of Pispala. I drew the composition, image size, cropping and angle on paper for the actors, so the work was fast-paced and smooth. Directing the actors was done with easy, because I wanted a natural reaction, not a play. I directed my actors to look genuinely and intently at the lake, stand as it is and walk. I wanted an authentic impression.

PICTURE 27. Salla Rusanen, Pietari Hyvärinen, Pietari Autio and Piia Muurinaho in the scene in Hiedanranta 21.07.2022. Photo by Isa Kiviaho.

In the Hiedanranta section, I needed to shoot the eyes of the actors as a special close-up and the actors from the front and from the back on the shore of Näsijärvi with a half-shot. I also wanted a picture with each actor as a full picture, where they walk past the camera and in the middle of the
composition look behind them. We filmed in three different places in the water and on the shore of Hiedanranta's beach area.

PICTURE 28. Extra close-up from Piia Muurinahos eyes. Screenshot from Carbon Sink -video.

PICTURE 29. Half-shot from Salla Rusanen from Hiedanranta. Screenshot from Carbon Sink -video.

PICTURE 30. Half-shot from the back of the Karoliina Vuorinen in Hiedanranta. Screenshot from Carbon Sink -video.

The shooting locations was in the Hiedanranta – Pispala steps. The grand staircase is a visual experience related to the journey and is still a symbol, change happens step by step. On the stairs, we reached a high point, where the actors look at the lake in the distance, so that the illusion of a long distance is created for the viewer.

PICTURE 31. Isa Kiviaho: Hiilinielu I Carbon Sink, 2022, video, screenshot of the video: view from the stairs.

The main point of the journey folds into a large cauldron, where pyrolysis is ignited, and biochar is poured into the coal sink in the final scene. In the video, the journey and doing itself is secondary and there is no precise definition, but the video focuses on movement, moving forward.

PICTURE 32. Isa Kiviaho: Hiilinielu I Carbon Sink, 2022, video, screenshot of the video: view from the stairs II.

PICTURE 33. Isa Kiviaho, Onni Takkinen and Piia Muurinaho in the stairs at the stair’s scene. From behind-the-scenes documentation. Photo by Pietari Hyvärinen.

4.2.1 Visualizing word

In the video, we all simultaneously follow the journey of a person with a face to change, but at the same time, in accordance with the incantatory thought narrative, the image sometimes jumps into the person's mental images and visually illustrates their own thoughts.

I photographed the visual elements of mental images during the summer in the Tampere, Mikkeli and Puumala regions. The photos of the factories are mainly from Tampere, but the old-growth forest, economic forest and clear-cutting are from the Puumala areas. The economic curve, demonstrations, and politicians' representations are filmed with a camera from a computer screen. The child is my goddaughter, and the individual hands belong to friends.

PICTURE 34. Isa Kiviaho: Hiilinielu I Carbon Sink, 2022, video, screenshot of the video: factory scene.

I had exact plans based on my own mental images of what I wanted as mental images, but the exact scenes and places were found purely by chance, and I carried my camera with me everywhere throughout the summer. The last frame is a GoPro shot of an underwater hand in Mikkeli at the beginning of the video. We also filmed in Hiedanranta, but the photo was destroyed.

PICTURE 35. PICTURE 34. Isa Kiviaho: Hiilinielu I Carbon Sink, 2022, video, screenshot of the video: forest scene.

PICTURE 36. PICTURE 34. Isa Kiviaho: Hiilinielu I Carbon Sink, 2022, video, screenshot of the video: child scene.

4.3 Recording voice

I tried with a couple of professional actors and singers, but still the rhythm and spell-like statement in my own way was the best option. I acted as a voice actor and narrator in the video I haven't worked with my voice before, I didn't pronounce anything and I don't feel the narrative is the best possible bet, but due to the schedule I had to leave my own criticality and refinement and make quick decisions suddenly.

I borrowed a professional sound card and a mic from musician Miika Kovanen, which I used to record my own speech in several takes. I first tried breaking the parts, but the chord was broken with it, so the only option was to wrap the narrative up at once. The 18th take ended up in the final video.

4.4 Outsourcing the recording process and editing

In my mind, I had a ready-made minimalistic soundscape to support the narrative, the splash of water, the ticking of a clock, the noise of a demonstration. However, due to tight schedules, I made the decision to outsource the voice work. We collaborated with Brandon Emene, who started TAMK in the same year from the line of music production, who had worked with me before in translating my narrative.

Working was instructive. Cooperation was challenging. However, I received the audio piece just in time, when there was only a couple of weeks to set up the exhibition. The sound world in the video is dark and dramatic, surreal and distorted. Water sounds and dark bell cumin can be found in the background. Halfway through the video, the dense atmosphere eases.

Throughout filming in the summer, my own editing work was very clear. Due to today’s development and skill of reading fast-paced information on, for example, because of social media, I first wanted to create as fast-paced as possible with the quick cuts. However, after the first cut version, I ended up with a slower one. I wanted to rhythm the video image beautifully with the narrative. A more careful viewer can notice in some places the movement with the dancing sound.

I wanted to keep the video footage authentic and documentarist creating a more realistic image for the viewer, however, I worked a little with contrast and colour definitions to find a nice balance for the video. The video's message is powerful, so excessive editing work would have weakened the content.

PICTURE 37. PICTURE 34. Isa Kiviaho: Hiilinielu I Carbon Sink, 2022, video, screenshot of the video: ending scene.

5 PLANNING AND PREMILINARY PREPARATION FOR AN EDUCATIONAL PHOTO WORK

I was inspired by old educational boards and wondered how possible it would be to realise the photo works in an educational board-like format instead of a traditional photo print for the final exhibition. Old Finnish picture boards are part of Finnish educational history, and they were used to visualise school subjects for students before the photo and video era. My thesis supervisor Juha Suonpää gave practical instructions for the implementation of the teaching board. I made a digital school board printed it on plain paper, I would attach the work to the background cardboard with a glue stick, and finally I would attach a hanging wire to the top with sail rings.

5.1 The educational board as a work of art

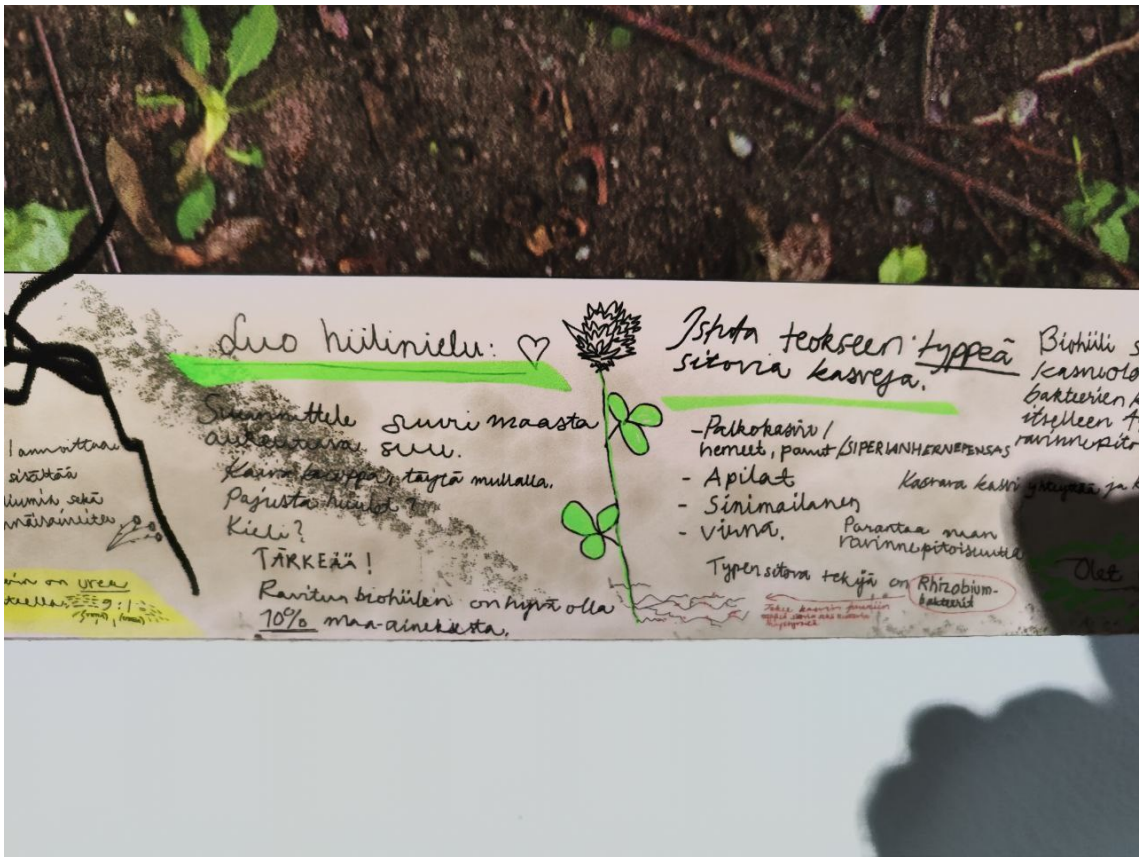
I designed an old patina aesthetic for my photos digitally with Adobe Photoshop and Fresco. I did background research on the elements and spirit of old educational boards from friends' walls, pictures and flea markets. I specifically research frame sizes, fonts, details and content. As a result of the empirical research, I found that the frame size was free, ending and unending fonts were mixed in the content. Most of the time, the large title manifested an art deco aesthetic or a terminal font at the bottom of the board, larger in the middle. And on the page, there were publishers and printing houses and, on the bottom, right, the image maker.

PICTURE 38. Digital artwork of Carbon Sink – design.

I digitally created the yellowed surface of old cardboard for my photos and made good use of different brush elements of Photoshop and fresco to create wear, dirty splashes, scratched surfaces, discoloration and traces of time. I treated the colour space to an old vintage glow. I simplified my content selection to just the name of the work and used a serif font.

PICTURE 39. Detail from digital artwork.

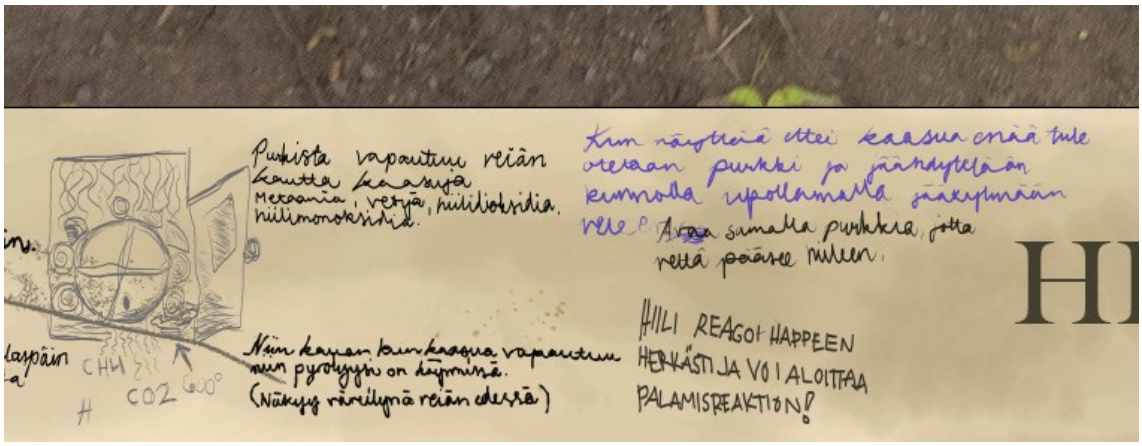
I created a side story for the viewer of my educational board. In my work, my agenda was also to inspire to make a change and, through example,
the opportunity to follow suit. I looked for my old notes in sketchbooks, a phone memo, and wrote instructions on how to pyrolyze zero-fibre biochar and create a carbon sink. I scanned my handwritten instructions and with Adobe Fresco I digitised my handwriting pixel by pixel into a vector, so that the text can be stretched to large dimensions without losing quality or becoming unclear. I placed the instructions at the bottom of the teaching board like a researcher's notes on a school board.



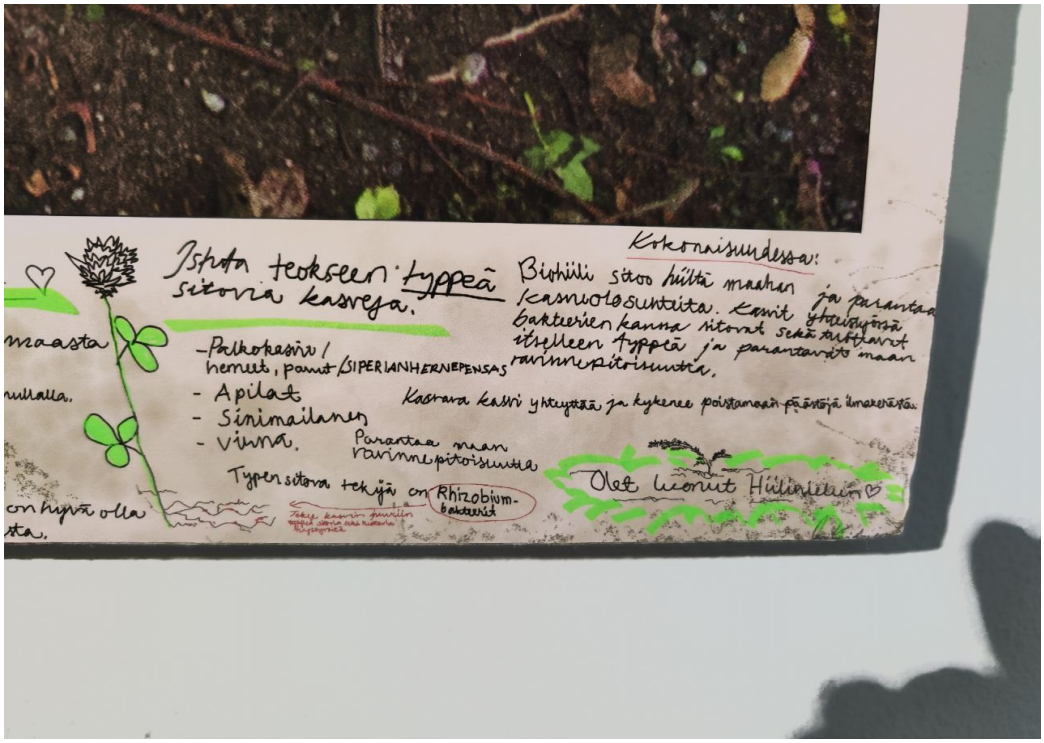
PICTURE 40. Detail from the artwork from Carbon Sink teaching board artwork from gallery space. Photo by Isa Kiviaho.

I used different elements to create the school world. I created vector graphics and instructions as if they were written in different styles such as pencil, blue ballpoint pen and red pen. Also, as if it were written with biochar, and for the school spirit I also used a green and yellow highlighter-like drawing. I made details as if the

functionality of the pens had been tested, as well as drawings. This is how I created a story about how someone would have studied and written the instructions on the school board in the time limit.



PICTURE 41. Detail from the digital Carbon Sink teaching board artwork.



PICTURE 41. Detail from the teaching board artwork in gallery space. Photo by Isa Kiviaho.

I made the educational board on 100x70cm machine cardboard, which was the largest I could find on the market of printing houses in Manner's online store. I also collaborated with Mikkeli Kopiopiste, where we thought about the paper quality and how we could get the best result and the print stuck to the cardboard. The copy point didn't have the option of plain paper, but we tried a couple of different paper qualities and fixed them with glue and spray glue. Our experiment did not

produce exact results, but we chose the thickest possible paper quality, which would withstand stronger glue, but at the same time guarantee the best print quality.

PICTURE 41. Isa Kiviaho: Hiilinielu I Carbon Sink, 2022, educational board. Photo by Isa Kiviaho.

6 INSTALLATION

During the process, I had an idea to create a sculpture from the elements of my own work of art, for example, in which I embody the materials, otherwise elements from the wood industry, where this problem started, and I would follow the traditional aesthetics and practices of environmental art.

In my background work, I found Korean artist Seon Ghi Bahki's Suspended Charcoal Installations Echo Man-Made Figures (Noorata 2012), where he had created wonderful different shapes with charcoal and fishing line using just this technique. In the end, the realisation of the work brought challenges and I found the work too difficult to realise.

I also thought about the community artistic aspect, where viewers could touch charcoal and draw with charcoal in the gallery. In the background research of environmental art, I admire the use of still water surfaces as a mirror in the landscape. And I thought about using mirrors in a possible sculpture. Rock balancing is a form of environmental art, a method used by environmental artists Andy Goldsworthy and Bill Dan, for example. I could visually see this succeeding in a smaller model for sculpture.

6.1 Materials

It was a coincidence that I found black and clear honeycomb mirror pieces in my childhood home. The chemical composition and diagram of biochar creates a honeycomb-like structure. I see this as a wonderful combination of visually combining a chemical diagrammatic feature and the aesthetics of environmental art in the form of a small sculpture.

PICTURE 42. Detail from a draft a Carbon Sink -sculpture. Photo by Isa Kiviaho

I thought about bringing wood into the sculpture and decided that I would use processed wood for interior and construction, i.e., fingerboard and circular list to create a base. This substrate lies below the water surface of the mirrors and is the reason why the mirror surface elements exist.

I applied minimalism and an abstract echo to the overall shape of the work. In a way I went for a Nordic spirit with my colour palette of light wood, black, silver and brown and I wanted one accent colour which is green. In some ways, due to the meditative nature of the work, I also realised in the middle of the process that this also follows the basic elements of a Japanese garden, stones, evergreens, water and various structures.

6.2 Process of the sculpture

I assembled a free-form base from the finger panel and drilled the holes where I set up the circular list like tree trunks. I attached the mirrors to each other with an iron and used the green acrylic paint left at the bottom of the jar to get an effect colour under the mirrors, I bent the shapes where they reflect at different angles. I attached the mirrors to the round panel with magnets and started a meditative and precise process of balancing the stones on the mirror surfaces with zero fibre and biocarbon. I attached the elements to each other with quick glue. It was very precise and careful with each piece and several minutes waiting for the glue to dry in place. For each group of mirrors, I used different settings and entities that could be realised in environmental art with stones in the environment.

PICTURE 45. Carbon Sink -sculpture in Himmelblau gallery. 06.03.2023. Photo by Isa Kiviaho.

6.3 Kill your Darling at the last minute.

The sculpture never reached the viewers, because when the Carbon Sink ensemble was built up in the gallery, the supervisor of my thesis directed that the work does not belong to the ensemble, and it may not open to the viewer. Placing first draft for the sculpture in the exhibition would be a high risk due to use of new material not having connection to original idea of environmental artwork.

I pulled the sculpture out of the exhibition and returned to my original idea of the bottle arrangement, where very simply and effectively I show the viewer the zero fibre when wet, how it looks in the water, dried before the pyrolysis process and as biochar. This allows the viewer to see the elements as they are and the process. This is the solution where simplicity is the most effective solution. This enhances the concreteness of the issue.

PICTURE 46. Composition with bottles for gallery 07.03.2023. Photo by Isa Kiviaho.

I chose transparent bottles with cork lids to continue the vintage-like aesthetic of the educational board, and I also found a wonderful sampling bottle with a cork lid, where I placed the biochar. The whole setting creates a nostalgic and scientific laboratory-like spirit at the same time. In the still life, I created a small side story of my own where there is movement, the biochar sampling bottle is placed as if it had accidentally fallen over, and the biochar has spread on the sculpture stand. In this way, the viewer can look at the coal very closely without a glass wall.

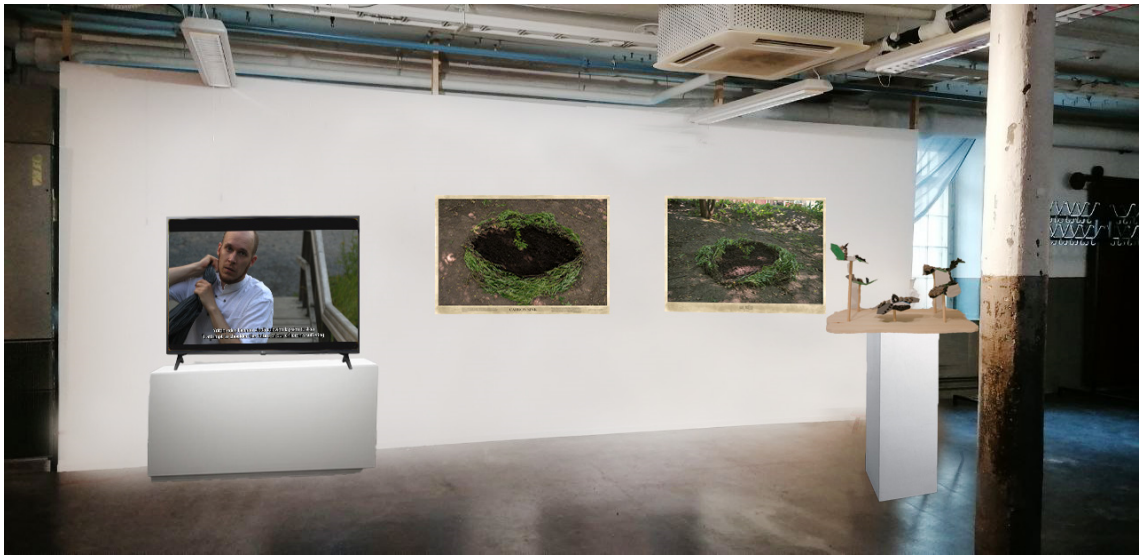
PICTURE 47. Isa Kiviaho: Hiilinielu I Carbon Sink, 2022, still life -installation. Photo by Isa Kiviaho.

PICTURE 48. Isa Kiviaho: Hiilinielu I Carbon Sink, 2022, still life -installation. Photo by Isa Kiviaho.

7 CONCEPTUAL AND ENVIRONMENTAL ART FOR GALLERY SPACE

My work was exhibited in Grafiikanpaja Himmelblau's Kutomosali in the first of three exhibition rooms. The location changed three times in the process of building the exhibition, and I liked the last location the most. My work is the first work in the exhibition when entering and the last when leaving. The message is important and powerful, so at this point it doesn't get lost among the great works of many other talented artists and still gives a reminder of itself when you leave.

Exhibiting my work was influenced by many external factors and circumstances. For the presentation of the video, we decided on a screen with the cooperation of technicians and guiding teachers. Projection would have been too blurry for the nature of the video, and the image from the screen is much brighter, deeper and sharper. Through school, my biggest possible option was a 55’-inch television screen.



PICTURE 50. Preliminary sketch with photoshop of composition of the exhibition. Photo by Isa Kiviaho.

Fortunately, my educational board was almost the same size as the video screen. Almost naturally, they belonged in the middle of the wall and next to each other. The elements of my work are very simple in form, so I also aim for a minimalist layout and a beautiful simple balance in the layout. The content and message of my works is strong, so the layout didn't need any major gimmicks, because at worst it would have disturbed the message itself.

PICTURE 51. Isa Kiviaho: Hiilinielu I Carbon Sink, 2022, video installation. Photo by Isa Kiviaho.

I spent the most time on the arrangement during the erection process and ended up with the final result according to the western way of reading from left to right. The first is a video that tells its own narrative describes the trip and things we do, which are not told or opened in the video. The last image of the video is of a view of an environmental work, which is a guiding thread and consistently the educational board embodies the work as an image. In the educational board, the sharp-eyed will find instructions for pyrolyzing zero fibre and creating a carbon sink. When continuing forward, the viewer is faced with a statement that explains the starting point of the entire work and what happens and what it is about in the previous works. Next to the statue, on a sculpture stand, the viewer is faced with bottles that concretely show zero fibre in water, dried, and biochar. The viewer, while gradually following the work, gets a picture of the whole.

PICTURE 52. Isa Kiviaho: Hiilinielu I Carbon Sink, 2022, installation. Photo by Isa Kiviaho.

8 DISCUSSION

In this thesis I asked how to transform the by-product of factory production into an environmentally friendly element and utilize it in an ecologically sustainable artistic process that would also inspire change for the benefit of the climate?
Time for Carbon Sink production is more current than ever before. Increasing carbon sink reserves and, among other things, restoring forests and bogs in order to increase carbon sinks and natural diversity are decisive factors. I created a concrete, carbon sink as a work of art. I approached the matter through my own example, thinking that if I could do it, why not someone else.

When Pietari Hyvärinen brought the existence of zero fibre to my knowledge for the first time while we were planning the work, I immediately set out to find out the situation and its scope, as well as what zero fibre actually is. However, it didn't seem like the right solution to spread environmental waste from one place to another, and the idea of its possible conversion came right from the first meters. In my background investigation, I understood that zero fibre is organic matter and I saw the possibility of converting it into biochar.

I had become familiar with biochar and its properties through my aunt Anna-Kaisa Elo and her partner Jarkko Nummela, who are biochar experts and work with it in the field of science. I have personally learned a lot from them about the properties of biochar and its benefits in terms of the environment, so the idea of possibility to include biochar in this project came as if automatically. They advocated pyrolyzing zero fibre into biochar as theoretically possible and they can help me in the process.

I also contacted Matti Huhta, who is responsible for the Hiedanranta area, by email to ask for permission to collect zero fibre on the spot, but it turned out that zero fibre cannot be collected by a private person, but through him I received zero fibre as a donation for my artistic experiment.

Due to the climate-themed nature of the work, Jarkko Nummela taught me the lowest possible emission and ecological method and solutions to pyrolyze biochar. The starting material for pyrolysis must be solid, as dense as possible and

dry. I pressed and compacted the wet zero fibre and placed it in a sunny place to dry for a week using the natural heat energy produced by the sun. The first pyrolysis experiment in practice was done together with expert Jarkko Nummela with his homemade pyrolysis built from recycled materials. At the same time, Nummela taught and instructed the pyrolysis process and how I can implement the same myself. It is important to heat an airtight container with a small hole at high heat so that the gases released from the pyrolysis process can escape, until there is no more gas, the pyrolysis is complete. We already succeeded in our first experiment and created biochar from the zero fibre of Lake Näsijärvi.

With Nummela's instructions, I continued to carry out the pyrolysis process and the conversion of zero fibre into biochar independently in the yard of Hirvitalo. According to Nummela's guidelines, the soil must contain at least 10% biochar in order to achieve the carbon sequestration capacity required for the carbon sink. Which meant five litres of biochar for the 50 litres of soil we measured for the environmental work. Pietari Hyvärinen and I gathered recycled wood and everything to burn in an old cast iron cauldron in the yard, we placed zero fibre in an old coffee can found in recycling, we made a hole in it with an 8 mm nail and heated it in the cauldron for a couple of hours. We also succeeded in our independent pyrolysis process and thus we had the necessary amount to implement a carbon sink.

Biochar itself does not nourish the earth, but it must be nourished. Urea produced by humans is a good natural nutrient and I organized a community project at Hirvitalo, where each participant peed into a biochar bucket to nourish it and thus, we got the necessary amount of nutrients for the biochar.

8.1 Carbon Mouth

We converted the by-product of factory production into an environmentally friendly one and obtained material from it to create the carbon sink. What was significant was the understanding of the inadequacy of one's own skills and knowledge and the ability to immediately approach experts and follow their instructions.

The physical artistic form of the environmental work was built in connection with the biochar process. In my mind, the confluence of science and fairy-tale was formed and this determined the nature of the physical condition of the work. In my imagination and with the little wordplay, I ended up with a large, gaping mouth rising from the ground. Carbon sink in Finnish is “Hiilinielu” what is literally means carbon mouth. Together with Pietari, we wanted to create a natural solution characteristic of environmental art, a work that is grounded in time. We thought about earthy materials and together we decided on willow as the material we would use to build and braid the lips. Both had an interest in willow as a design material and knew in advance a couple of places where it grew abundantly and needed thinning. When fresh, willow can be easily bent and shaped, and when it dries, it stays in its defined shape, which makes it an ideal material for natural sculpture.

We dug a large hole, which we filled with 50 litres of soil. We collected willow and arranged it around the soil. We bent and tied the willow with willow branches and cord thread together to form the upper lip and the lower lip. Our original plan also had a tongue, but we felt that without that the artwork was more interesting. In the middle of the mouth, we planted a nitrogen-producing Siberian pea bush to increase the effectiveness of the carbon sink. The bush placed in the middle symbolizes the pharynx. Finally, we buried the nourished biochar in the soil and the Carbon Sink environmental artwork was finished.

The big mouth delighted the people of Pispala throughout the summer of 2022 and stayed there. In the end, the green willow leaves turned brown, and the work slowly began its grounding process. The Siberian pea bush continues to grow in the middle of the soil. Who knows what will build up in the work overtime, because the work nourishes its surrounding soil, so new growth can appear on the ground. Even if the work is buried in time and disappears, the biochar below the surface continues to bind carbon and acts as a carbon sink in the area, unless the soil is interfered with by external factors.

At this point, I had created a carbon sink as an environmental work, a by-product of factory production as a starting material. Due to the location-bound nature of my work, it also could not be brought into the gallery space by itself. In the original idea, we were making a video performance with Pietari, where Pietari collects

zero fibre and carries it from the Hiedanranta area up the stairs of Pispala to Hirvitalo, where we worked on an environmental piece. The actual performance was cancelled due to the impossibility of collecting zero fibre, but we decided to let the story live in the video work.

We decided to bring our doing into the video work as a side plot of our own process. We would describe a person's journey to making a change with a video with a poem as a narrative. I worked into the text and the script of the video's narrative a mental landscape expressing climate anxiety, even angry at the world situation, how a person is tired of old continuous mistakes and decides to take control of its own and learn from mistakes. The work proceeds with its own will to implement change and ends full of hope. The result is a spell-like and manifesting free word rather than an emphasis on the structure of the poem. The purpose is to reveal anxiety and learning from the past, yet to create hope and the power of change.

Based on the text and the story of the trip, I started to build a video entity. Together with Pietari, we came to a solution where instead of one person and the main character, we would enlarge the image of the phenomenon with many faces. So, we ended up using a human with many faces as the main character, which meant as many and changing actors as possible. We shot the travel scenes in Hiedanranta and on the steps of Pispala with the cast we had assembled. One by one, I directed each actor to perform the same movement and gesture in a natural way for them. The person first looks at the water angrily and eventually the anger turns to sadness as the video progresses. A person collects zero fibre from the bottom of the water, puts it in a sack and carries it far from the water's edge to the yard, where it is processed into biochar and finally an environmental work. Grief turns into a purposeful forward journey and finally into action. The planting of the bush and the pouring of biochar in the final scene that ended up in the video is material from the real moment recorded on the video, in which Pietari and I played the roles.

The second side plot of the video's journey is photos for the mental landscape of the narrative. We describe a primeval forest, an economic forest, factors, a stock market crash, a protest, politicians and children. These reflect the poem and are built on the video as if they were the imagination of a multi-faceted person as the

poem unfolds and symbolizes the causes and consequences and side effects of the climate crisis. I filmed material throughout the summer where I saw an interesting and inspiring screen and gathered all the material together at the end of the summer. In the video, the images change alternately to depict a person's journey and progress, and at the same time sinking into the abyss and mental images.

When editing the video, I had an idea of its sequence, which had already been built while shooting the material, so the work was smooth. I built a multi-faceted person with quick cuts, building the same uniform movement from the material filmed with different actors. The video steadily follows the journey of a multifaceted person moving forward, and with quick cuts we move to a mental landscape, from which we return to the journey again. This same formula is repeated several times in the video.

I recorded the narrative myself and cut the transitions according to the pace of the narrative. I wanted to keep the video image as authentic as possible, so I worked on the image on the editing table with very little contrast and unified the video images with colour corrections. I outsourced the sound design to Brandon Emene, who created a tight atmosphere for the video. In the end, the whole developed into a three-minute video work.

I photographed the environmental work when it was completed from the side and from above. My plan was to bring two photo prints to the gallery to embody the work for viewers alongside the video. However, I ended up developing photographic works in an educational board-like format. Old educational boards have visualized educational material in the past and the visuality of educational boards delights me, at the same time I was looking for an educational undertone and association with teaching. I studied old educational boards and the elements and the whole they contained. I digitally created board-like design from a photo taken from an environmental work, which we realized in collaboration with Mikkeli Kopiopiste on cardboard. The detail of the design is a digital imitation of my own handwriting and instructions on how to pyrolyze biochar from zero fibre and create a real carbon sink. This way, one can learn from my photo work how to make a

change. The text font for the final form were unfortunately very small. And there is room for improvement in the form of the educational board in the future.

I had a background story of what I had done and where. I had visualized the journey and brought the power of change emerging from climate anxiety to the video, which can also be used to interpret why and how this entity came about. As well as bringing a picture of what I did to the gallery for the artists, as well as revealing detailed instructions on how we did it.

Zero fibre and biochar remain abstract in the earlier works, and they are not presented in more detail, so I decided to bring zero fibre and biochar to the gallery to be seen. Tampere's zero fibre problem lies deep at the bottom of Lake Näsijärvi, it is reported and told what it is, but for many, zero fibre as a form remains an invisible element, which is known to be a lot, but what it looks like remains open. Our pyrolyzed and nourished biochar, on the other hand, is where it belongs, hidden underground, sequestering carbon. During the process, I set aside a small amount of zero fibre and biochar to visualize the problem and the solution for a viewer in the gallery.

I created a minimalist still life with bottles, which embodies the life cycle of the process material. The biggest bottle has zero fibre when wet and under water. It shows how zero fibre looks like in the waterbed, and how it also colours the water green. The second bottle has zero fibre compressed into pieces and dried, which is an important step for the pyrolysis process. Finally, the smallest glass bottle contains biochar made from zero fibre. I placed the smallest bottle as if it had fallen over, where the biochar has spread on the surface of the sculpture stand, so that the viewer could look as close as possible to the char, and not just through the glass as in the previous parts of the work. I placed the biocarbon in front of the dried zero fibre so that the viewer can observe and compare the properties of zero fibre and biochar. Biochar leaves the shape of the original starting material, so biochar is very similar to dried zero fibre. I brought the problem and my solution to the viewer.

The Carbon Sink project was announced and presented at Grafiikanpaja Himmelblau at the RAW final work exhibition in March 2023. During the construction process of the exhibition, my place changed three times, which always changed the nature of the way the work was presented. The result is very stripped down from my original plan due to resources and the nature of the space, but I still find it to be simply compact and functional. A video on a 55' screen is arranged side by side on the wall and the teaching board is almost identical in size, so the works create a balance. I placed the sculpture stand and the bottle arrangement a little further from the wall, so that the viewer can move around and explore the arrangement from all directions.

The arrangement slowly reveals the content and nature of the work to the viewer. First comes a video that reveals the theme and nature of the work with a narrative, as well as why the whole was created and describes the journey, how. Next, the educational board reveals with its picture of the environmental artwork what was created and with its detailed instructions what was done in the previous video. The key to the entire work is the statement, where the holistic nature of the project is revealed, we converted Näsijärvi's zero fibre to biocarbon and created a carbon sink in Pispala's Contemporary Art Center Hirvitalo sculpture park as an environmental work. And finally, there is a layout next to it that shows the problem, i.e., zero fibre, and the solution, i.e., biochar.

8.2 Afterwords

Based on the knowledge of Tiainen's thesis, my own work fulfils an art activist activity, because the goal of my work is to make the world a better place, an activity that strives for social change, and I have used creative means and my ability to touch people on an emotional level. (Tiainen 2022.) And art and artists have a great importance in creating information, hope and above all possibly building new values for society with their works. Art has the opportunity to influence people's activities and lifestyles. And the current society is built in an unsustainable way and a lot of new perspectives and approaches are needed on how to create a society of sustainable development and adapt a person accustomed to overconsumption to a better future.

By nature, I was passionately trusted my problem-solving ability and preliminary skills, that I set out to implement the project, even though nothing was certain at the beginning. With this thesis and the Carbon Sink project, I challenged my knowledge and skills with big chunks and leaps. I have never combined science and art, implemented a large environmental work and worked on a multi-stage video production like the art video of this project. As a reward, I have discovered a lot of new information and artistic methods for the future through this work, and I have developed enormously. The body of work covers an ecologically sustainable environmental work, a photographic work of an environmental work, a video and the elements and outputs of my scientific artistic process as a concrete arrangement for the viewer.

However, I managed to learn and transform Näsijärvi's zero fibre into environmentally friendly biocarbon from the starting point of an art student, build a carbon sink as an environmental artwork, and create a body of work that enables and inspires change for the art community.

The work's agenda is also to inspire change through one's own example. During my process and after the publication of my work, I have received a lot of positive feedback and praise for bringing the issue to the fore. Based on the large amount of feedback, I can say that the climate crisis touches many people. These also include a law student who was inspired and has now decided to focus on international climate policy and pursue carbon sink issues. A couple of forestry professionals and forest managers became interested in the use of biochar for nutritional purposes and in growing the carbon sink reserve, and I instructed them in the method. The art student was inspired and experienced my work in the exhibition as his own, and after our conversation, he was inspired to focus and work on climate issues. And at the opening, I saw two people photographing the instructions of the photo piece on their phone. Even one of these proves to me the influence of art and the fact that I managed to inspire a desire for change through my actions.

REFERENCES

AV-Arkki. N.d. IC-98. Read on 5.4.2023.
https://www.av-arkki.fi/fi/artists/ic-98/

Bioart Society. N.d. State of the Art Network Teemu Lehmusruusu. Read on 12.4.2023
https://bioartsociety.fi/projects/state-of-the-art-network/pages/teemu-lehmusruusu

Elo, A., Nummela, J. & Kymäläinen, M. 2021. Biohiili kiertotalousratkaisuna Kanta-Hämeessä. Häme University of Applied Science. HAMKin e-julkaisuja 5/2021. Read on 21.2.2023.
https://www.theseus.fi/bitstream/handle/10024/506425/HAMK%20Eloym.%20biohiili%20kiertotalousratkaisuna%20kanta_hameessa%20WEB%202021-10-21.pdf?sequence=2

Erkkilä, H., Haapala, L., Johansson, H., Sakari, M. 1999. Katoava Taide. Valtion taidemuseo, kirjoittajat, taiteilijat, valokuvaajat. Edition 800. Hollola: Salpausselän Kirjapaino Oy.

Finnish Painters. N.d. Nabbteeri. Read on 5.4.2023.
https://finnishpainters.fi/painter/nabbteeri/

Huhmarniemi, M., Jokela, T. 2018. Ympäristötaide taiteilijan soveltavana ja integroituna osaamisena. Lapin yliopiston taiteiden tiedekunnan julkaisuja. Sarja C, Katsauksia ja puheenvuoroja. Read on 24.3.2023.
https://lauda.ulapland.fi/bitstream/handle/10024/63487/Huhmarniemi%3B%20Jokela.part4.pdf?sequence=1&isAllowed=y

IPCC-report. Released on 20.03.2023. Read on 22.03.2023.
https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_SPM.pdf

Johansson, H. 2004. Maataidetta jäljittämässä. Luonnon ja läsnäolon kirjoitusta suomalaisessa nykytaiteessa 1970-1995. 66–67. Edition 1. Helsinki: Like.

Kokkonen, T. N.d. Tuija Kokkonen. Read on 5.4.2023
http://tuijakokkonen.fi/fi/

Lahtinen, L. 2016. Selluteollisuuden nollakuitusedimentin hyödyntäminen biokaasuprosessissa. Master of Schience Thesis. Tampere University of Technology. Read on 22.2.2023.
https://trepo.tuni.fi/bitstream/handle/123456789/24743/lahtinen.pdf?sequence=4

Malila, R. Viskari, E-L. Kallio, J. 2019. Virtsan ravinteet kiertoon. MORTTI-hankkeen loppuraportti. Suomen Ympäristökeskuksen raportteja 49 I 2019. Suomen ympäristökeskus. Read on 28.2.2023.
https://helda.helsinki.fi/handle/10138/307654

Ministry of Agriculture and Forestry of Finland. Released on 1.2.2023. New guide outlines good practices for voluntary carbon market. Read on 1.2.2023. https://mmm.fi/en/-/1410903/new-guide-outlines-good-practices-for-voluntary-carbon-market?languageId=en_US

Mistä kyse? - Puistokatu 4. N.d. Tieteen ja toivon talo on paikka ekologisesti kestävän tulevaisuuden rakentajille. Read on 7.4.2023. https://puistokatu4.fi/mista-kyse/

Mäki, T. 2017. Taiteen Tehtävä. Esseitä Teemu Mäki. 465-473. Helsinki: Into Kustannus Oy. Read on 12.4.2023.

Nummela, J. CTO of PUHI Oy. 2022. Interview on 16.08.2022. Sahalahti.

Nurmesniemi, H., Kuokkanen, T., Pöykiö, R., Kujala, K., Kaakine,n J. & Kuokkanen, M. 2008. Chemical Speciation and Bioavailability.
Chemical and leaching properties of paper mill sludge. 111-123. Taylor and Francis Group LLC 2008. Read on 23.2.2023.

Noorata, P. 2012. Suspended Charcoal Installations Echo Man-Made Figures. My Modern net. Read on 12.4.2023.
https://mymodernmet.com/seon-ghi-bahk-an-aggregate-charcoal-sculptures/

Palmroth, H. 2019, Panosmädätetyn nollakuidun hyödyntämiskohteet. Degree Programme in Bioproduct and Process Engineering. Bachelor's thesis. Tampere University of Applied Sciences. Read on 22.2.2023.
https://www.theseus.fi/bitstream/handle/10024/266429/Palmroth_Henry.pdf?sequence=2

Patrykiejew, M. 2003. Suomalaiset kalevalamatriset loitsut ja niiden suullisuus Walter Ongin teorien valossa. Folia Scandinavica Posnaniensia. Adam Mickiewisz University. Read on 10.3.2023.
https://repozytorium.amu.edu.pl/bitstream/10593/3926/1/17_Magdalena_PATRYKIEJEW_Suomalaiset_kalevalamatriset_loitsut_261-269.PDF

Polamo, Jaana. 2016. ...sitä saattaa sanoa mitä tahansa... ...piirtää huulipunalla linnunpoikia takaikkunaan... Taiteilija yhdistää runon ja videon.
Open University of Jyväskylä. Bachelor's Thesis. Read on 11.3.2023.
https://jyx.jyu.fi/bitstream/handle/123456789/50277/URN%3aNBN%3afi%3ajyu-201606133044.pdf?sequence=1&isAllowed=y

Rönkkö, N. N.d. Nastja Säde Rönkkö info. Read on 5.4.2023.
https://www.nastjaronkko.com/info

Seuri, P. 2018. Biologinen typensidonta. Lecture. Luonnonvarakeskus 15.1.2018. Webinar. Luke. Read on 15.3.2023.
https://www.ilmastoviisas.fi/wp-content/uploads/2018/01/biologinentypensidonta2.pdf

Tiainen, V. 2022. Art activism in the age of eco-crises. Aalto University. Master's thesis. Read on 28.3.2023.
https://aaltodoc.aalto.fi/bitstream/handle/123456789/113224/master_Tiainen_Veera_2022.pdf?sequence=1&isAllowed=y

Valtioneuvosto. 2023. IPCC:n raportti: Nyt tehtävät päätökset vaikuttavat tuhansia vuosia – ilmastonmuutoksen haasteisiin mahdollista vastata nopeilla ja laajoilla toimilla. Read on 22.03.2023.
https://valtioneuvosto.fi/-/1410903/ipcc-n-raportti-nyt-tehtavat-paatokset-vaikuttava-tuhansia-vuosia-ilmastonmuutoksen-haasteisiin-mahdollista-vastata-nopeilla-ja-laajoilla-toimilla?languageId=fi_FI

Wihurin Rahasto. N.d. Antti Laitinen. Read on 5.4.2023
https://wihurinrahasto.fi/apurahatarinat/antti-laitinen/

Östman, H. 2015. Ekologisesti ennallistava ympäristötaide.
University of Helsinki. Faculty of Biological and Environmental Sciences, Department of Environmental Sciences. Master's thesis. Read on 20.3.2023.
https://helda.helsinki.fi/handle/10138/160651