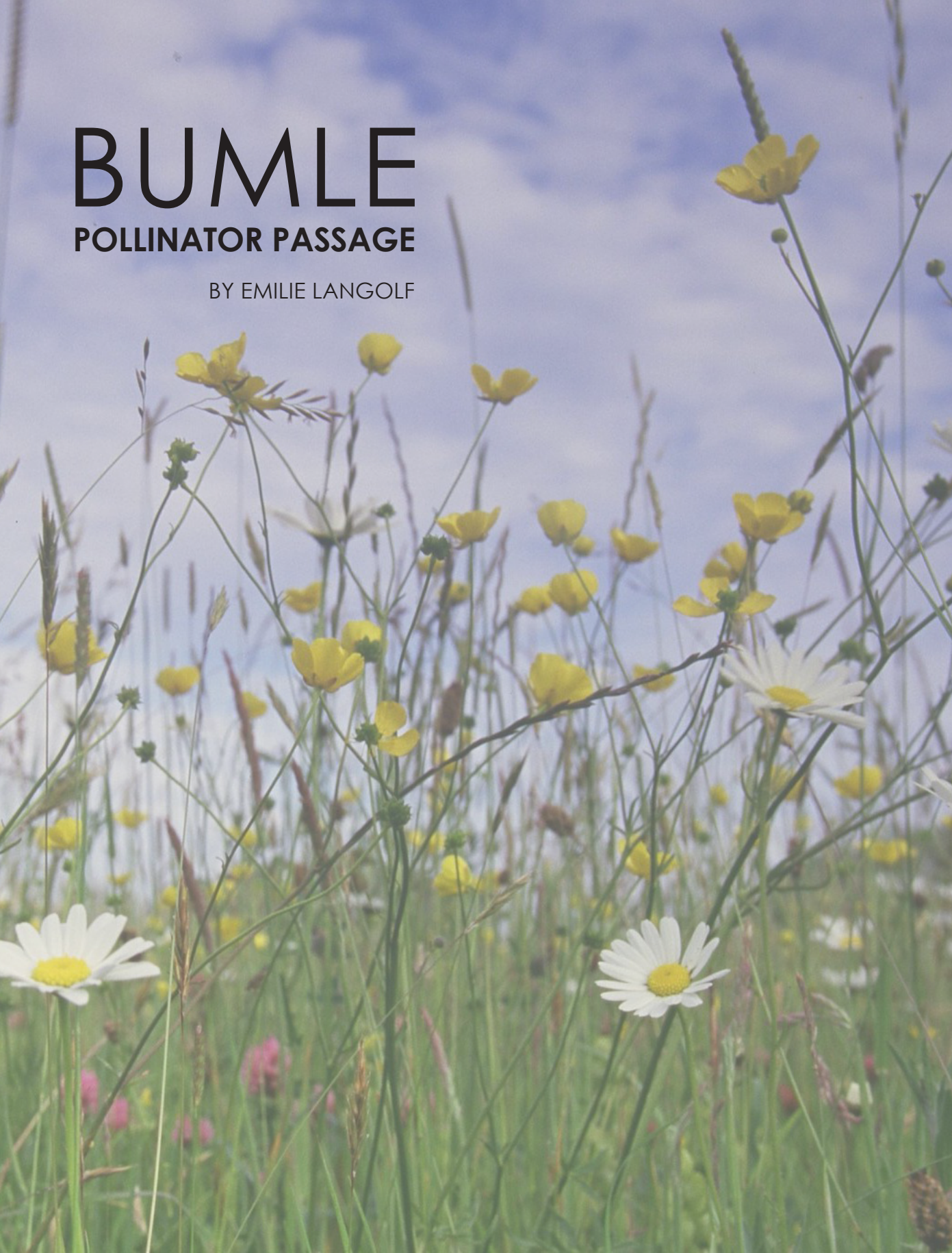

BUMLE

POLLINATOR PASSAGE

BY EMILIE LANGOLF

BUMLE
POLLINATOR PASSAGE

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FIELD
Industrial Design
Systems-oriented Design

Institute of Design
The Oslo School of Architecture and Design
(AHO) 2020

ABSTRACT

Pollinating insects such as bees, butterflies, beetles and flies, are necessary for flowering plants to pollinate. Insects have a variety of other important jobs to, for example, they recycle and feed other animals, they keep the entire ecosystem running. But in spite of their importance the global amount of all insects are decreasing rapidly.

The Norwegian Ministries has therefore published a National pollinator strategy with the aim of ensuring continued diversity of wild bees. Based on this strategy, the aim of this project has been to create good habitats for wild bees and raise awareness of the topic, because without bees, it will be much less food for us to eat.

With a systemic approach, I have created a gigamap which gives an insight into the whole bee situation. The Gigamap shows an overview of the complexities surrounding the different bee species and how pollination works, but also what kind of challenges our important bees have. By using industrial design, I have created a habitat that meets the needs of our wild bees and that will provide them with better living conditions so that they can continue their important pollination work.

I hope this project can help our bees diversity and make us more aware of the importance of our bees.

Foto: Øyvind Holmstad

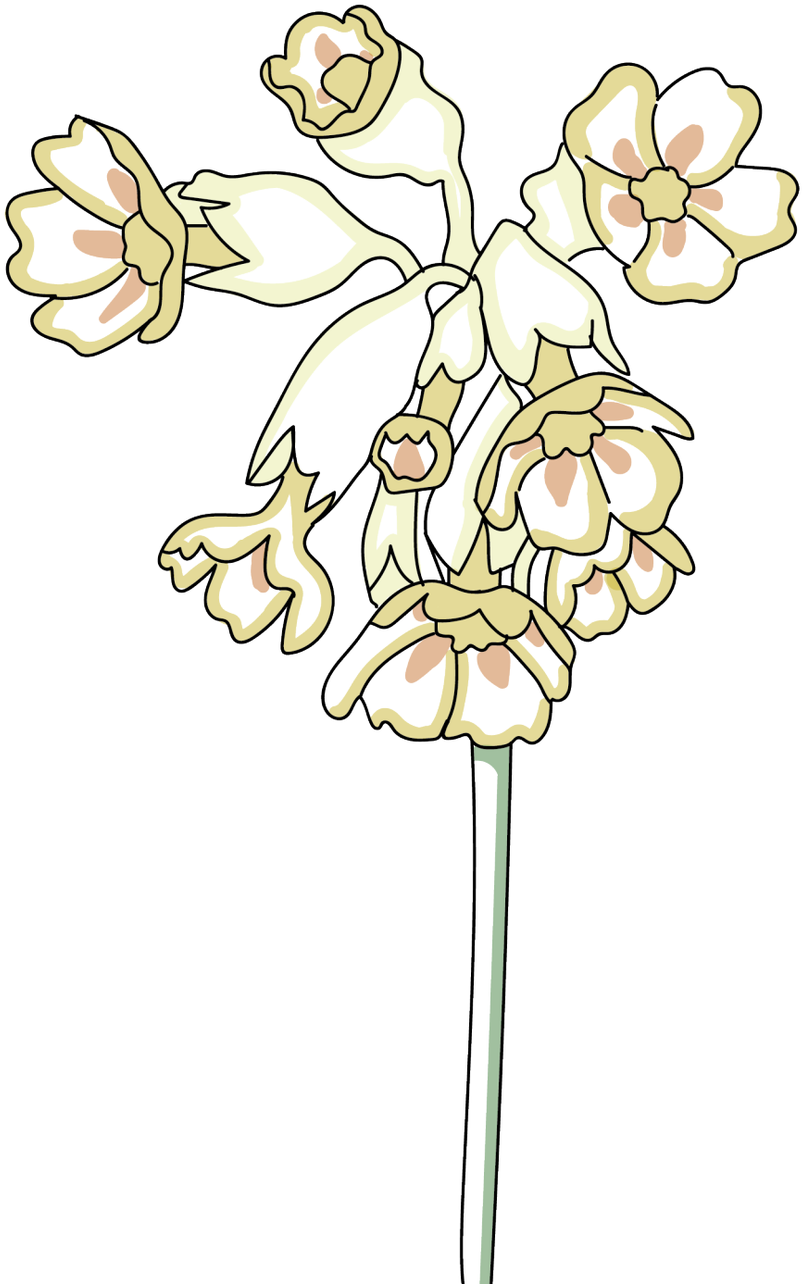
FOREWORD

My motivation for this project has been to use my knowledge and abilities to design a project and a product that has a deeper meaning for us as human beings, our planet and the environment. With this diploma project I wanted to explore our nature and learn more about it, as well as see how design can contribute to something positive for our nature.

Working with nature as a starting point in this project has given me an incredible insight into the world of our pollinating insects. It has been an exciting project that has been both educational and an eye-opener. I have gathered all the exciting things I have learned from working on my project in this report.

In the report, I mention ”wild bees” as a common term for both solitary bees and social bumblebees. You will learn more about the meaning of this later in the report.

Foto: SABIMA



1. INTRODUCTION

METHODS

In this project I have used a number of different methods from start to finish. In the beginning of the project I read research reports on the subject to gain a deeper understanding of the topic and to learn more about the needs and challenges the wild bees have.

I was lucky and got a great collaboration with a number of experts in biology, botany and zoology. I have conducted interviews and mapped the situation of the wild bees in collaboration with the experts. They have also given me feedback and guidance on how to design good habitats. I have also been invited to attend lectures on seed preserving and how to build insect hotels through the collaboration with the experts.

With a systematic approach, I have made a map of the input i have recived to get a overview of the project. And with the use of industrial design methods like 3B-analysis, sketching, 3D-modeling with both clay and Solidworks i have shaped the product.

I have used these methods to design a solution that can help the diversity of our wild bees.

If all mankind were to disappear, the world would regenerate back to the rich state of equilibrium that existed ten thousand years ago. If insects were to vanish, the environment would collapse into chaos.

E. O. Wilson

BUMLE

BUMLE-Pollinator Passage is a modular series of public furniture which acts as a passage for wild bees. This passage helps the wild bees to travel in the landscape and ties our landscape with flower meadows and gardens together. With a home for breeding and hibernating pluss food for the wild bees, this passage is working to increase the chance of more wild bees to succeed because it make easier for them to travel in the landscape, and with doing so help the diversity of our important pollinating wild bees.

Bumle also consists of additional modules that are seating benches. These allow the audience a place to sit down to either observe the bees or simply sit down to relax.

2. APPROACH

THE SITUATION IN NORWAY

The Norwegian Ministries has published a national strategy, requested by the Norwegian Parliament, with the aim of ensuring continued diversity of wild bees and other pollinating insects.

In the report we can read that In north-west Europe and North America, both the diversity and distribution of wild pollinators are declining. And there are several reasons for this, including climate change, invasive alien species, parasites and land use as well as changes in land use.

This report aims at 3 strategies to ensuring viable populations of wild bees and other pollinating insects in order to sustain pollination in food production and natural ecosystems. These goals are to increase knowledge of pollinating species, prevent loss and reduction of good habitats for pollinators, and communicate information about pollinators to all target groups.

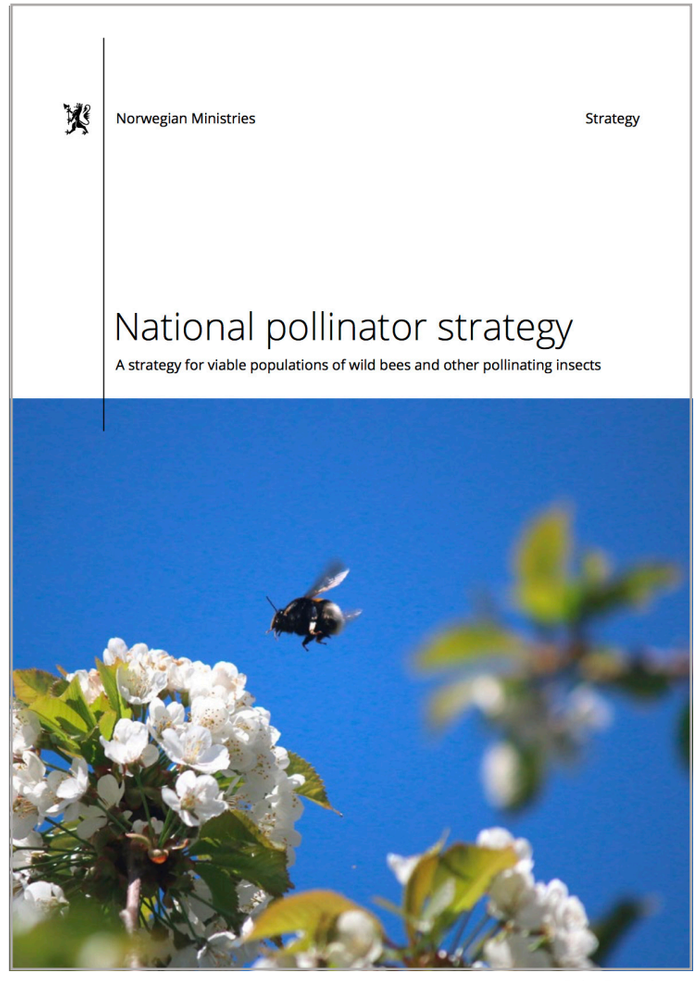


Foto: Regjeringen

BEES ARE IMPORTANT

To gain a greater understanding of how our pollinators work, and what challenges and needs they have, I examined a selection of reports. From there, I learned that ”bees and bumblebees are the most important groups of pollinators in our part of the world” (Totland, Hovstad, Ødegaar and Åström, 2013, p. 20).

But large-scale loss of species and biotopes as a result of human activities is the greatest environmental challenge of our time. The loss of natural diversity has many causes, but the main cause is direct loss of natural habitats. (Elven and Bjureke, 2019, p.11)

Through the reports I got an overview of the relationship between bees and pollination. But also what needs they have and challenges. From these reports I quickly gained insight into how our way of farming, ie monoculture, destroys the diversity of species in nature and makes it more difficult for the bees to do their important pollination work. (Monoculture are large land areas with only one type of plant species, such as a typical grain field).

Our bees and bumblebees need coherent arias with a suitable biotope to spread effectively between separate flower meadows. This is called ”Stepping stones” or ”Pollinator passage”. (Elven and Bjureke, 2019, p.38)

Foto: Colourbox

FLOWER MEDOWS

In Oslo, Bymiljøetaten has had an increased focus on preserving the old flower meadows, and the flower meadows are now being processed in the traditional way. This is a part of Bymiljøetatens increased focus on the diversity of wild bees and their efforts to facilitate better conditions for them. On the map on the next page we can see the different flower meadows in Oslo that are beeing preserved (Source: Bård Bredesen, Bymiljøetaten). But there are still long distances between these meadows.

At the same time, there is also an increased focus on adapting private gardens to be more optimal for wild bees, but this is only done by those who have an interest in it themselves.

Long distances between the flower meadows and varying adaptation of private gardens creates incoherent nature and makes it difficult for the wild bees to move in the landscape. For example bumlebees fly a maximum of 2 km in radius before it runs out of fuel (Jonas Oliver Elnes, La Humla Suse).

There is a need to link our flower meadows and gardens together to give the wild bees a passage to move in the landscape.

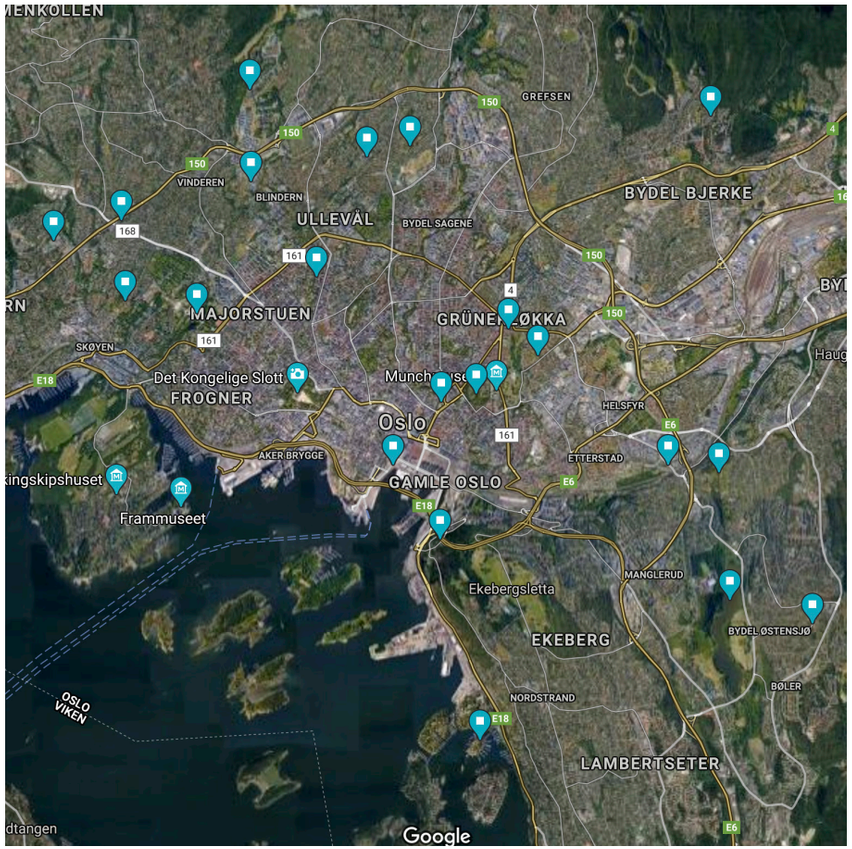
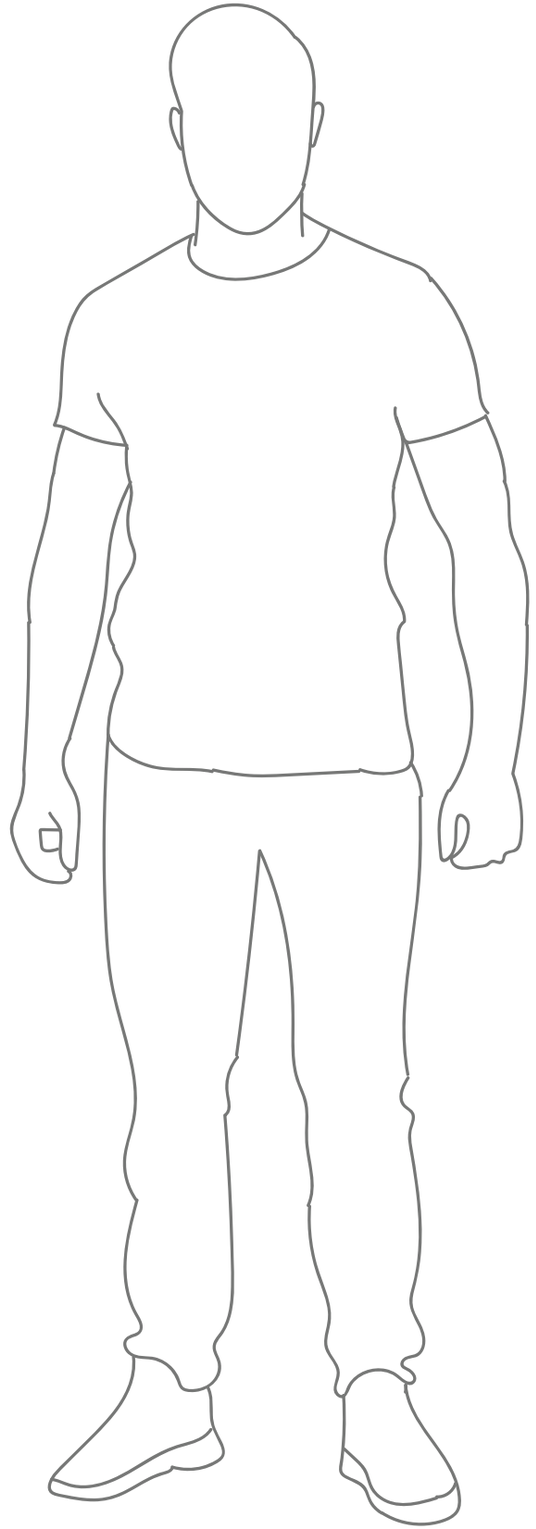


Foto: Google

80 %
of the wild plants in Norway are dependent on insect pollination

(Totland, Hovstad, Ødegaar and Åström, 2013, p. 10).



30%
of the food we eat are dependent on bee pollination

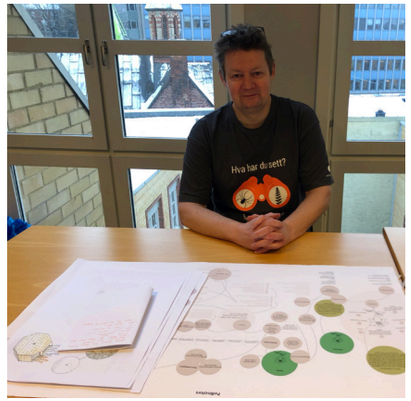
(https://www.sabima.no/trua-natur/humler-og-bier/)

PROFESSIONAL INPUT

In this project I have been in contact with a number of experts. They have been very good at communicating information that has been relevant to my project, as well as taught me a lot about habitat needs and challenges bees and bumblebees have. Through Botanisk hage på Tøyen I have been able to talk to experts on both insects and plants. I have also visited SABIMA, an environmental organization that works to stop the loss of the natures diversity.

I attended 2 events to learn more about bees and flowers, this where a lecture at Tøyen hovedgård, with Hallvard Elven with the topic: Insect hotels. At this lecture, he talked about how the interest in these hotels has increased in recent years and the limitations of such hotels.

And a lecture on seed harvesting with Det norske Hageselskap-Nordstrand hagelag at Nordseter Gård with Kristina Bjureke, on the topic: Seed, Function and storage. At this lecture I got a good insight into which flowers are important for our bees. Kristina also talked about how seeds are collected, processed and stored so that they can be used for the next season or stored in a national seed bank for conservation.



”It is important to focus on plants and diversity in the landscape, like having more meadows in the cities, maybe in the height / upwards buildings and on roofs. Some plants are better off with a greater variety of species that visit them to pollinate. This is because some species, for example, prefer to visit only the lower part of the plant.

Solitary bees are the ones that use perforated holes / insect hotels to lay eggs. They lay eggs, seal it with isolation (Leaves etc.), and leave it forever and never comes back to check on it. Social bees, as most bumblebees are live in colonies inside empty holes, or boxes. Bumblebees boxes should not be moved, as the bumblebees will struggle to find their way home again and may die leaving them permanently looking for their home. They memorize the surroundings as they move out of the box to start the work day.”

From conversation with Christian Steel, SABIMA.

”There has been a major change in the landscape in recent years which has contributed to more difficult living conditions for our pollinators. Flowers meadows, stone rubbles and stone walls have been removed. Ponds and marshes have been dug away and open trenches have been laid in pipes. The edges of cultivated aerials have been leveled and the often lush edge zones with flowers have disappeared. These are elements that our pollinators depend on. Many of our cultivated plants such as wheat, barley and rye are wind pollinating and offer no resources of value to the pollinators.

I work on collecting seeds that are preserved in a seed bank. This work also includes the collection of meadow flower seeds that are sold in packages here at Botanisk Hage. These are a collection of seeds of flowers that are great for pollinators. In this work I have also put together a menu of suggestions for flowers that provide important nourishment to our pollinators, and ensure that the pollinators have nourishment throughout the season.”

From conversation with Kristina Bjureke, UiO.

”Habitats in chains between green lungs are wise to create a passage so the insects can travel. Because if there are to far between the green lungs it is not possible for the wild bees to travel.

Classic bumblebee boxes cover only 2 out of 3 needs the bumblebee has, and these are, preventing being food for others and space for breeding. But these boxes do not meet the need for providing food / nutrition”.

From conversation with Petter Bøckman, UiO

”Bumblebee boxes, they require very special modules, often several compartments in the same box, with the enterances in different directions. The modules should have a parasite lock that stops the parasites to enter. If you are going to have a viewing window, you may want to have some kind of door over it so that the bumblebees dont not feel exposed to the surrounding elements. Because if they feel uncomfortable, they will seal the viewing window with materials so that no one will be able to look inside.”

Atle Mjelde, La Humla Suse

”Artificial lighting is NOT beneficial, neither for bumblebees or other insects (or wild animals in general…). Light pollution is a growing problem for our diversity”

Anne Sverdrup-Thygeson, NMBU

Solitary bees habitat

Bumblebees habitat

3. MAPPING

GIGAMAPPING THE SITUATION

Based on the insight I got from research reports and the experts I talked to, I created a gigamap. This map gives an overview of the situation for the bees. The map looks at how the pollination process works, what pollinators we have, the bee families, habitat needs, challenges and strategy.

The gigamap has been used as a conversation tool during the project and has been formed along the way.

BUMLE - Pollinator Passage

Pollinination process

What is pollination?

Pollination is the act of transferring pollen grains from the male anther of a flower to the female stigma. The goal of every living organism, including plants, is to create offspring for the next generation. One of the ways that plants can produce offspring is by making seeds. Seeds contain the genetic information to produce a new plant.

Pollination

Electrical signals that tell exactly how long it has been since the last insect visited.

Colour

Fragrance

Nectar as Reward

Shape of the petal

Patterns on the petal

Dust carriers with tiny pollen grains that the insects can eat or take home.

Pollination:
Attracting insects

What is a pollinator?

A pollinator is an animal/insect that moves pollen from the male anther of a flower to the female stigma of a flower. This helps to bring about fertilization of the ovules in the flower by the male gametes from the pollen grains.

Insect pollination

Insects are the only pollinators in Norway

Wind pollination

Pollination process

-Insect visit flower
-Nectar as Reward
-Pollen grain from the male part of the flower attaches to the insect
-Insect leave and moves on
-Insect visit next flower
-Pollen grain is transfered to female part of the flower
-Nectar as Reward
-The fertilized flower produce seeds
-Flower starts to reproduce and/or form fruit.

Pollinators

Bees

Norwegian bee Family

- Melittidae 4 Species in Norway
- Andrenidae 41 Species in Norway
- Hylaeus 19 Species in Norway
- Halictidae 35 Species in Norway
- Megachilidae 41 Species in Norway
- Apidae 41 Species in Norway

Butterflies

Beetle

Apidae
- Xylocopidae family 1 species in Norway
- Halictidae family 26 species in Norway
- Andrenidae family 40 species in Norway
- Melittidae family 3 species in Norway
- Megachilidae family 40 species in Norway
- Anthophoridae family 25 species in Norway
- Colletidae family 19 species in Norway

Bombus "Humle" 35 species in Norway

Most endangerd
- Bombus subterraneus Slåttehumle
- Bombus distinguendus Kløverhumle

Young queens freez at winter/ Hibernation after mating with males

Old queens die at winter

-Wakes up from hibernation in April
-Finds first food from Salix caprea (goat willow)
-Drinks nectar from Salix caprea so they get energy to fly
-Later in the spring other flowers bloom
-Gets food for the season

Needs

The solitary bees are often more specialized than the social bees for host plants. Around 20% of the species is considered oligolectic, which means that they only collect pollen from a few plant species.

Solitary bees

Queen
-Lays eggs in hollow spaces
-Seal the egg and leave it.

- Old wood
- Insect hotel
- Sand

7 are Solitary bees

Social bees

Queen
-Makes and takes care of eggs
-All eggs at spring are female
-Eggs at fall are male

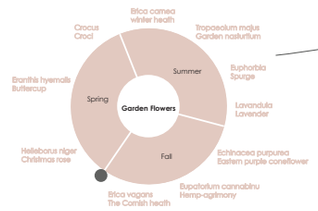
- Mouse hives
- Hollow space
- Empty bird box

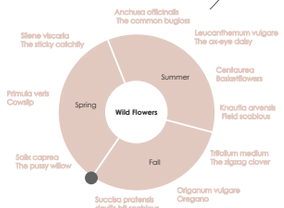
28 are Social bees

Needs
- Home for breeding/ Hybernating
- Shelter from preditors
- Food

Building nests
-Pollen is placed in the bees Pollen-basket (corbicula)
-Uses legs to collect pollen
-Flying to habitat
-Kicks of the pollen in the habitat
-After many rounds she can lay eggs
-Separates wax from the body
-Builds a basket
-Fills basket with honey
-Builds a small wax basket on the pollen ball

Laying eggs
(4 weeks)
-Lays 10 eggs in the basket
-Settles for hatching the eggs
-Eggs turn to small larvae
-Larvae lives inside the pollen
-When they are bigger they spin a cocoon
-Cocoon turns to a pupa
-Then undergoes a complete transformation
-Eggs are hatched





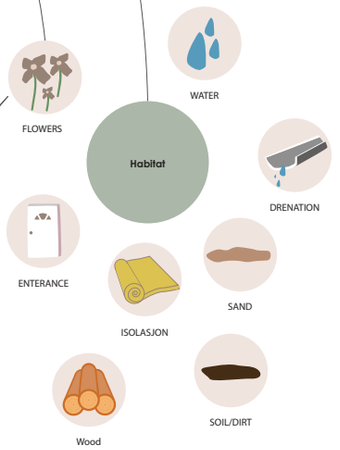
Challenges

Today, one of three bee species is on the Norwegian red list, which means that they are at risk of extinction. 12 of our 208 bi-species have probably disappeared for good.

Decreasing bee population

30% of the food we eat are dependent on bee pollination

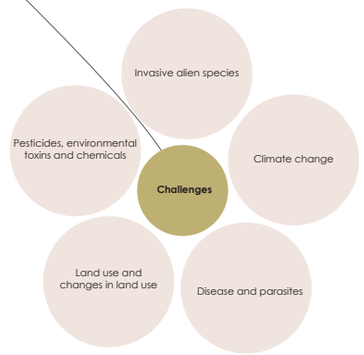
80 % of the wild plants in Norway are dependent on insect pollination



Strategy

National Pollinator Strategy

- Communication
- Increasing knowledge
- Good habitats

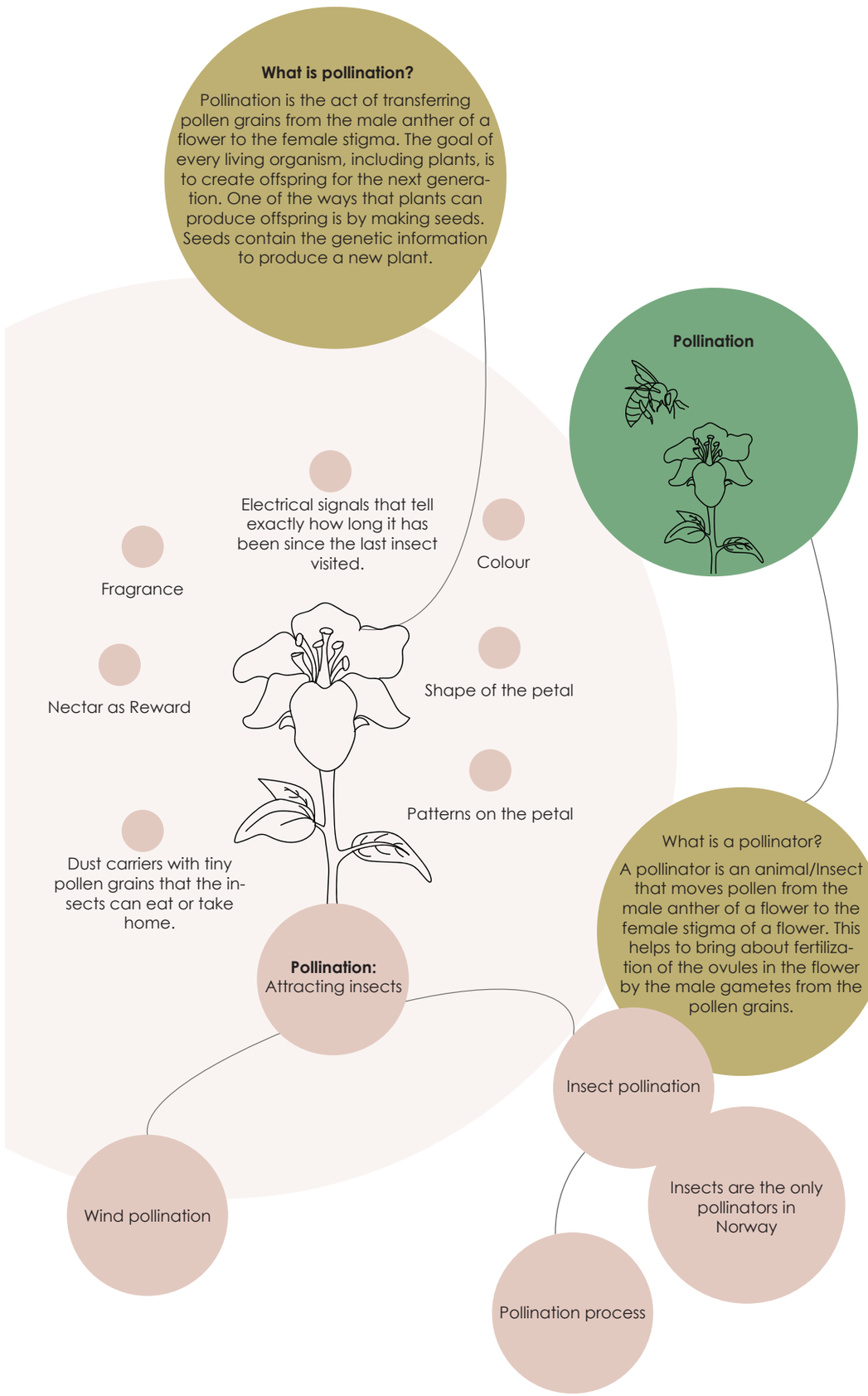


Reduced opportunities to find good nesting sites may also be a reason for the limited occurrence of species that start the season late, as they perform poorly in competition with species that have started earlier in the season.

WHAT IS POLLINATION?

Pollination is the act of transferring pollen grains from the male organ ”stamen” of a flower to the female organs of the plant called ”stigma”. One of the ways that plants can produce offsprings is by making seeds. Seeds contain the genetic information for producing new plants. Seeds can only be produced when pollen is transferred between flowers of the same species.

The transferring of pollen must occur for the the plant to become fertilized and produce fruits and seeds. The plant attracts the insects by using colors, smell and other tempting things. The plant then gives nectar to the insects as a kind of payment for their visit.

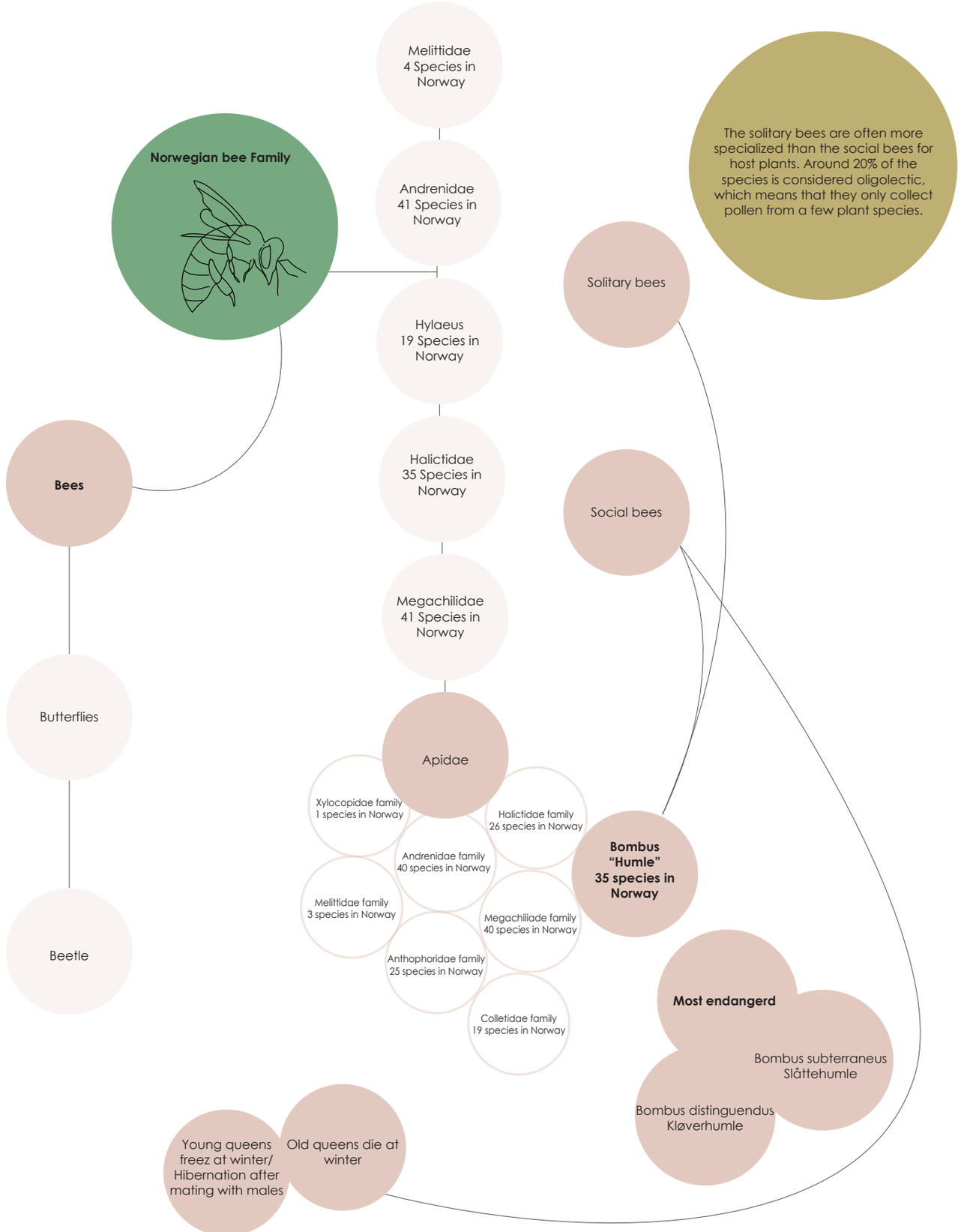


WHAT IS A POLLINATOR?

A pollinator is anything that helps carry pollen from the male part of the flower ”stamen” to the female part of the same or another flower ”stigma”. Some pollinators, including many bee species, intentionally collect pollen. Others, such as many butterflies move pollen accidentally. Pollen sticks on their bodies while they are drinking or feeding on nectar then pollen is moved from flower to flower resulting in pollination.

We have 208 bee species in Norway, These are divided into 6 main families, and they have many sub-families.

It is important to emphasize that the honey bee which is best known for us is a form of livestock that lives at its best, these have become very popular to have in cubes at home. According to Christian Steel from SABIMA, these are a threat to bumblebees as they take much of the nectar they need and become a strong competitor. Therefore, this project does not focus on honeybees. According to Christian Steel, bumblebees are the most important pollinators we have, as well as the most vulnerable. It has a lot to do with them being out of hibernation a bit later in the season and having greater difficulty getting started and building new colonies, for the best places for new colonies are already occupied.



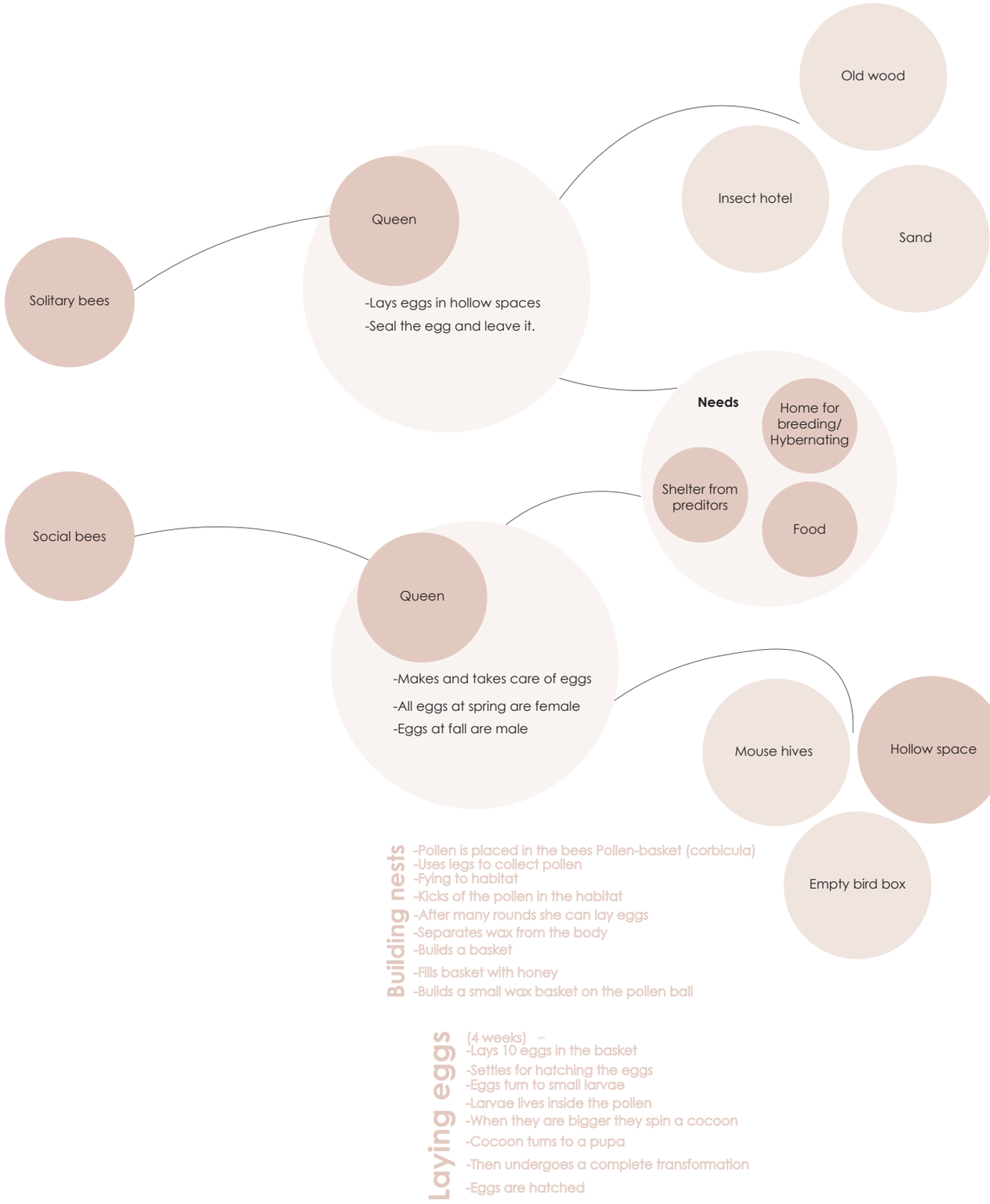
HABITAT

I have narrowed down the target group for this diploma to The Bombus family. These are 35 bumblebees that are both social and solitary.

Solitary bees:
These live alone. They lay eggs in cavities and seal them with wax, leaving them forever. They never go back to check their eggs.

Social bees:
These live in colonies where you have a queen, drones and workers.
The queen makes female workers who collect pollen and do their work. and at the end of the season towards the fall, the queen makes male bees that she pairs with to make queens for the next season.

Both the solitary and the social bees are important to keep pollination going. These 2 groups have very different habitat needs. The solitaire needs small holes to lay eggs, and the social need a hollow space to house a colony. Therefore, the product must be able to be modular and allow for either of these two.



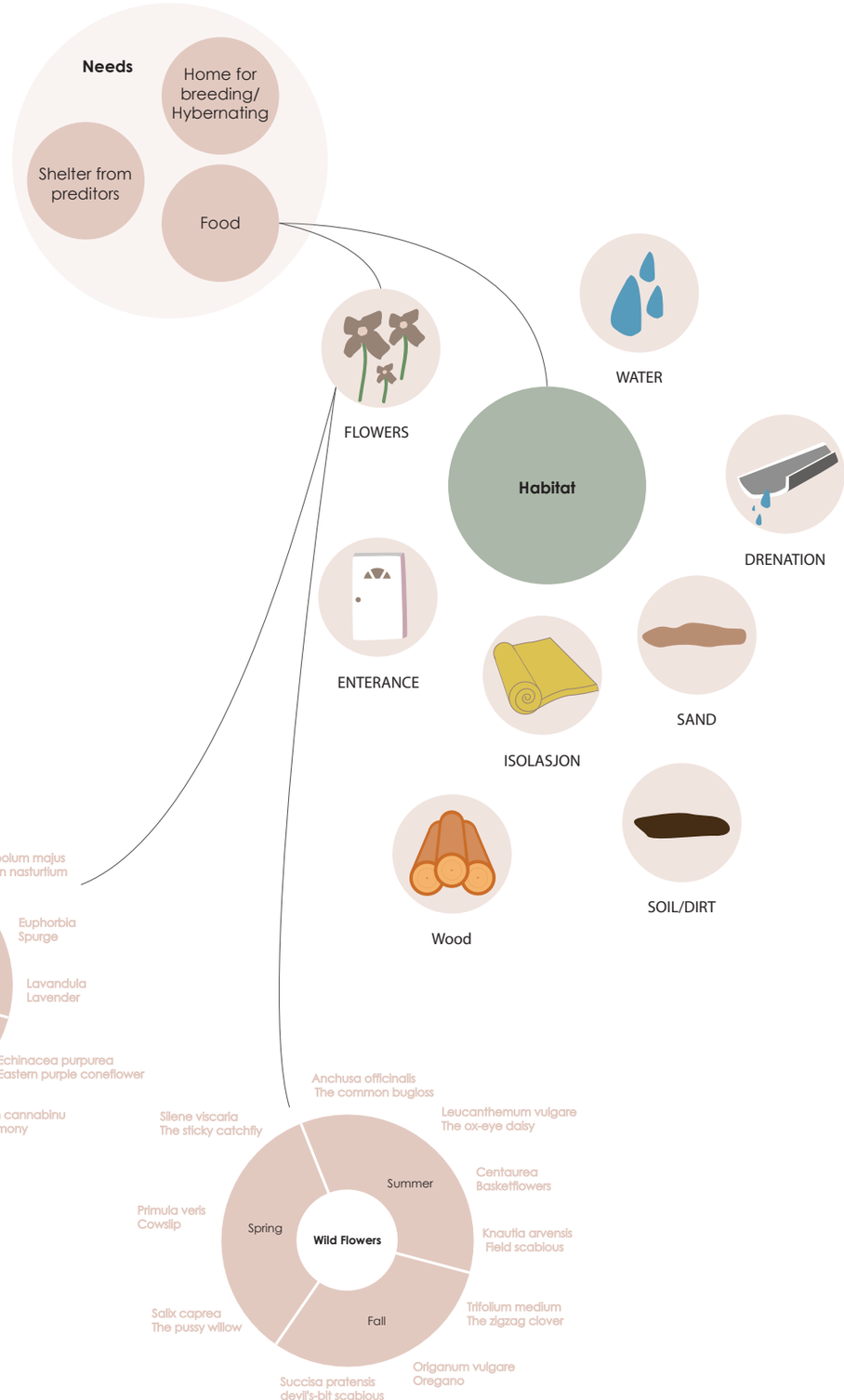
HABITAT NEEDS

Petter Bøckman and I met to talk about habitat needs for the bumblebees. He was explained that a solution for the bumblebees should not contain many technical solutions that needed maintenance, as this would be demanding to maintain and the bumblebees prefer natural materials.

What is important for the bees is to have access to a rich variety of flowers, and not least the right flowers. Kristina Bjureke at UiO has developed a special menu of flowers (Blomstermeny) in collaboration with Det norske hageselskap, ByBi, FAGUS, Sabima, Naturvernforbundet i Oslo og Akershus, La Humla Suse, Bymiljøetaten, Norsk Botanisk Forening And Naturhistorisk museum i Oslo. This menu shows examples of which flowers the bees need throughout the season.

”For example The goat willow tree is very important to the bee in the spring, it is the one that gives the bee the first important nutrition after coming out of hibernation.”

Kristina Bjureke, Botanist



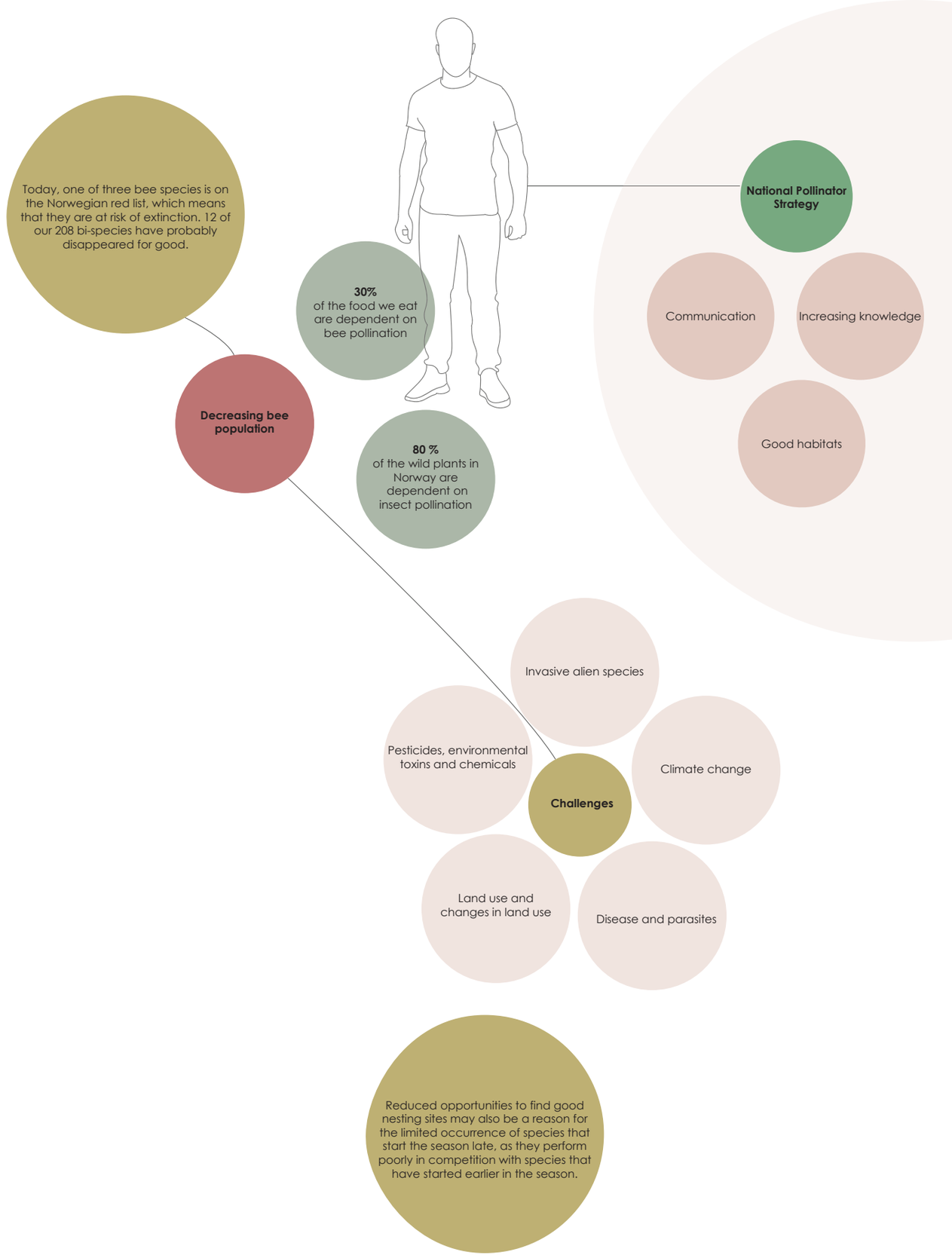
CHALLENGES AND STRATEGY

But today, the global number of pollinating insects and especially the number of bees is decreasing.

Habitat loss, climate change, alien species and other environmental changes threatens the species richness of both pollinating insects and the plants they depend on. This can have far-reaching consequences for the integrity of the ecosystems stability and composition, and a global pollination crisis could threaten food security in the world. And the nowledge level on the importance of pollination as one ecosystem process in Norway is low. (Totland, Hovstad, Ødegaar and Åström, 2013, p.7)

The Norwegian Ministries national pollinator strategy report points out the different challenges the bees have in Norway. And, it states that the land use and changes in land use are one of the biggest threats for the bees.

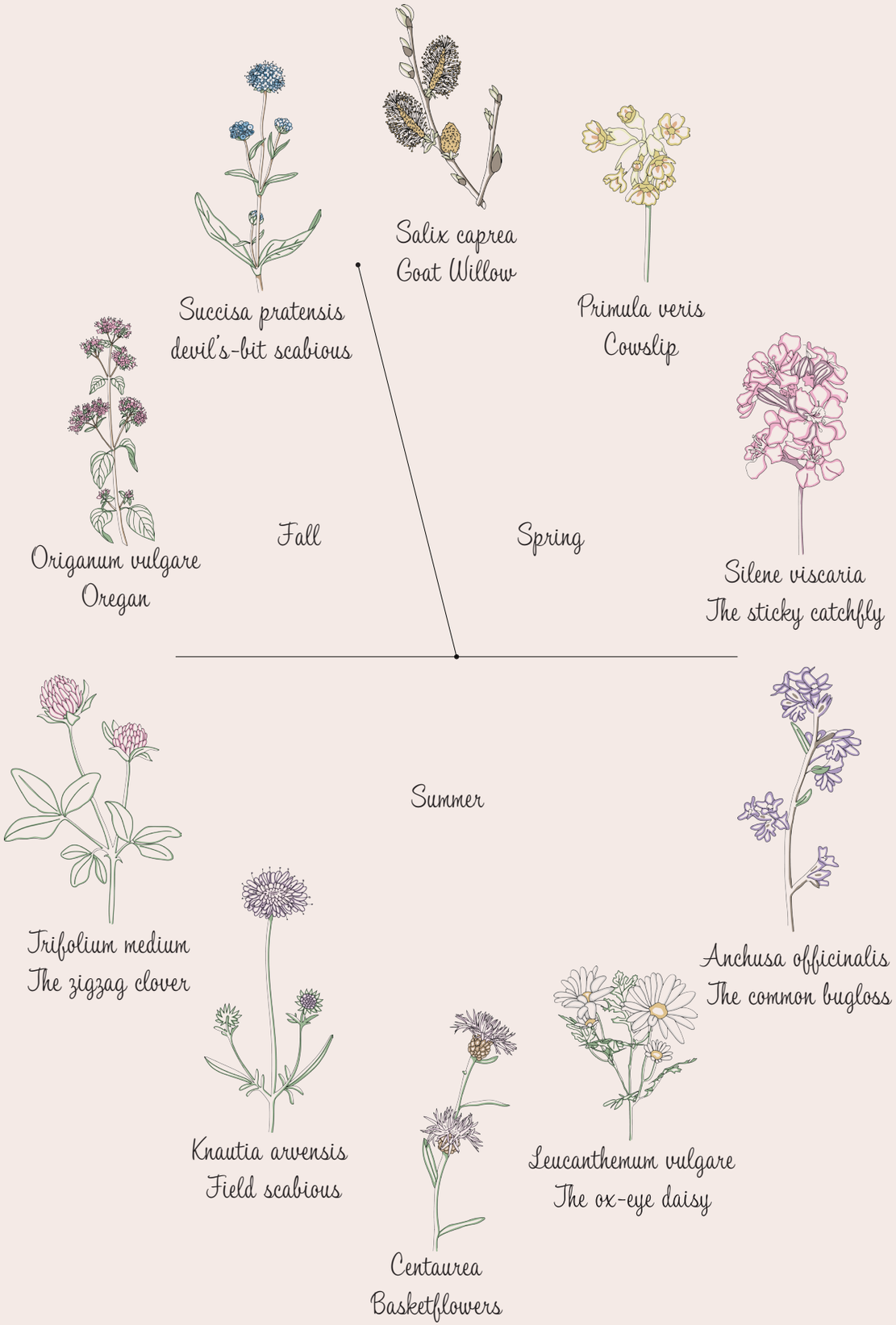
The report aims at 3 strategies aimed at ensuring viable populations of wild bees and other pollinating insects in order to sustain pollination in food production and natural ecosystems. These goals are to increase knowledge of pollinating species, prevent loss and reduction of good habitats for pollinators, and communicate information about pollinators to all target groups.



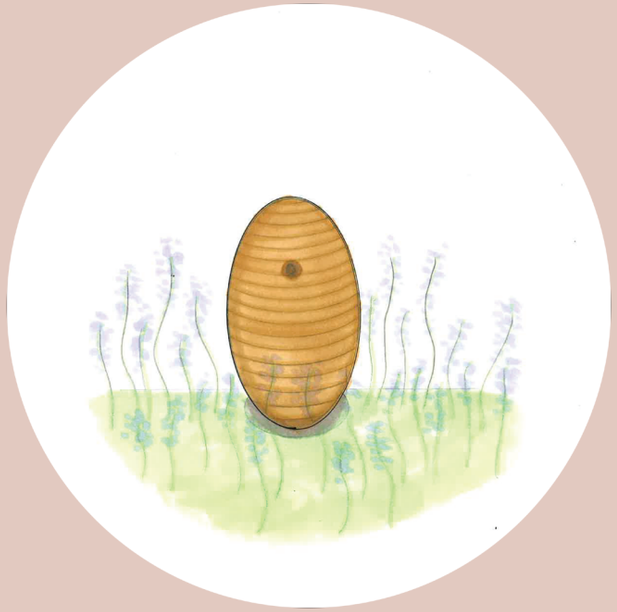
MAPPING SUMMARY

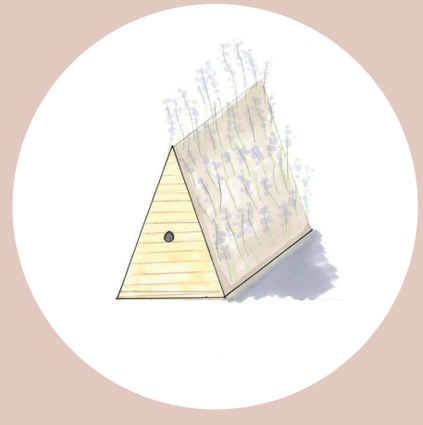
Based on the gigamapping, I chose to focus further on the government's goal of good habitats for the bees. And with this work with good continuous flower access for the bees, as well as a place for them to breed and hybernating. Since both social and solitary bees are equally important but have very different needs, this means that two different habitats must be designed for them.

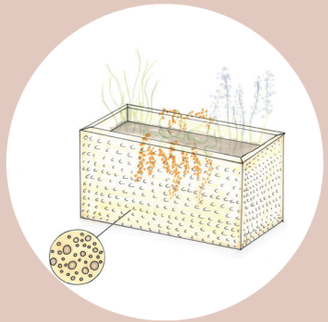
The flower menu should also be so central to the design of the product, and it should also include information on the importance of bees to raise awareness.

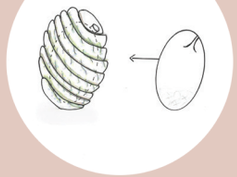


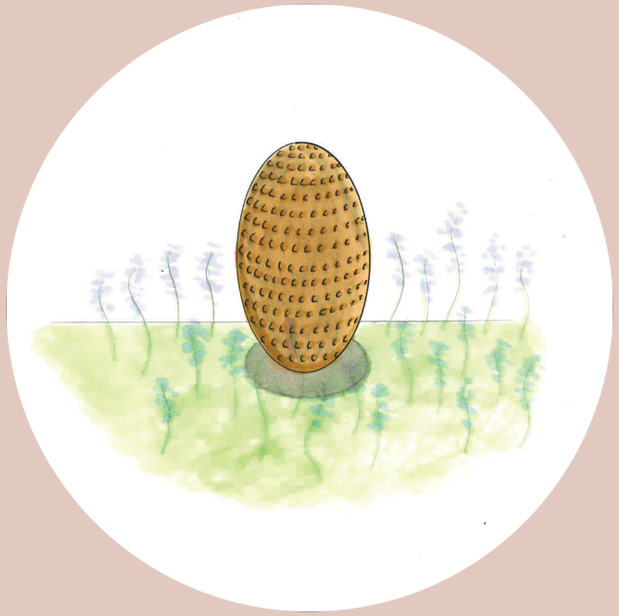
4. DEVELOPMENT

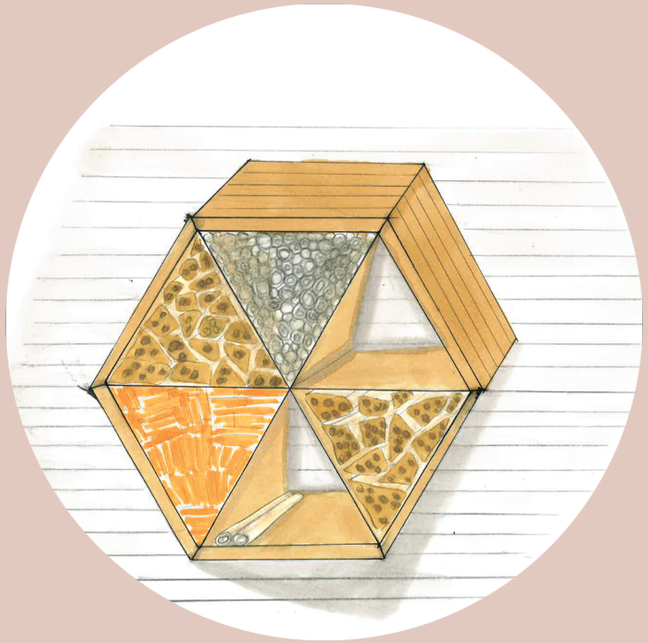


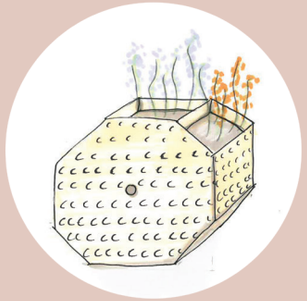










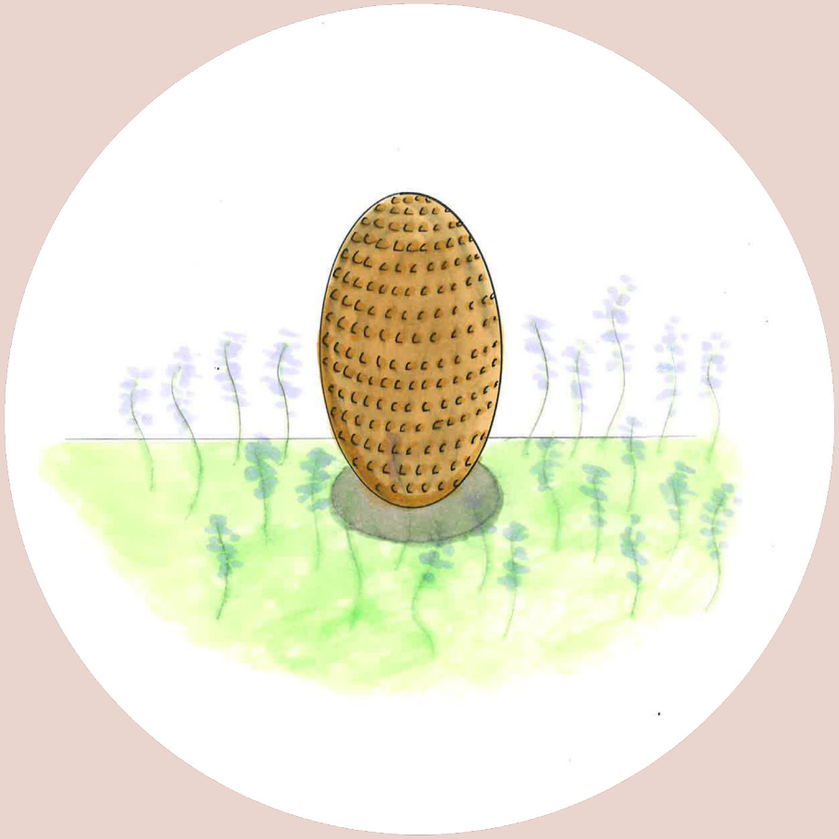


IDEAS

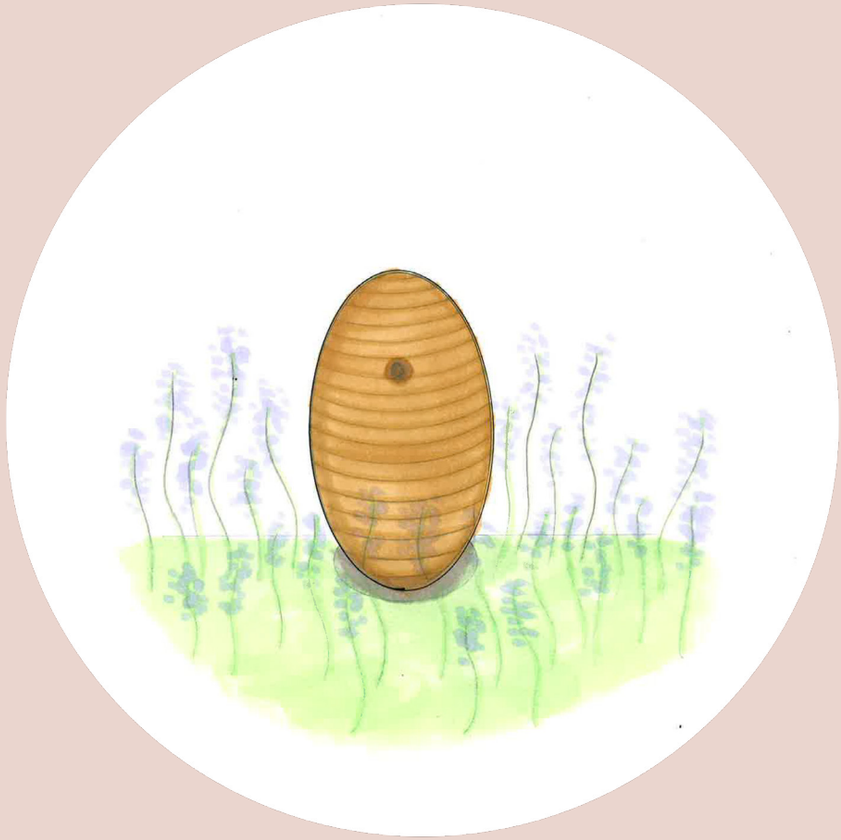
On the way to a refined concept, I had many different solutions and ideas. How do you make nature become the context of product design? And how can we create good living conditions for our important pollinator workers? These ideas were discussed with the experts and led to more insight that helped the project further in development.

”The bumblebees move over large areas in their important search for nutrition. For such species, even a small meadow could be of great value because it comes in addition to other similar meadow spots sorted around the landscape.”

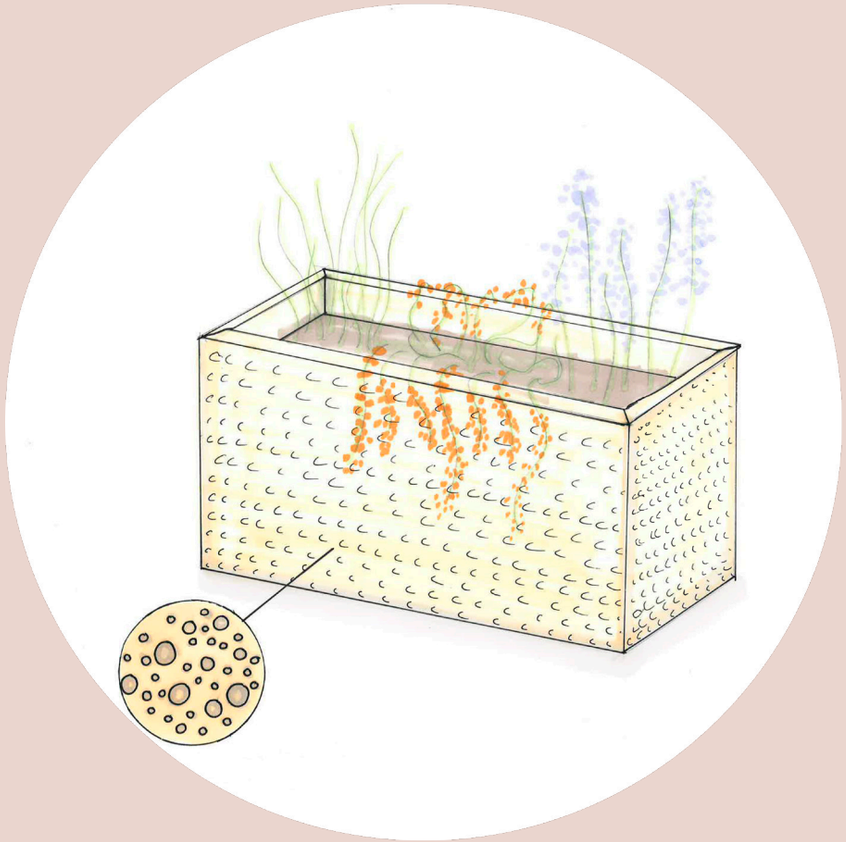
(Elven and Bjureke, 2019, p.38)



Using arias like roundabouts, parks, roads holders and so on where there are space for correct landscaping, Vegvesenet could have placed these kind of habitats and provide homes for the bees as a service, and keep the landscape surrounding it correct at the same time.

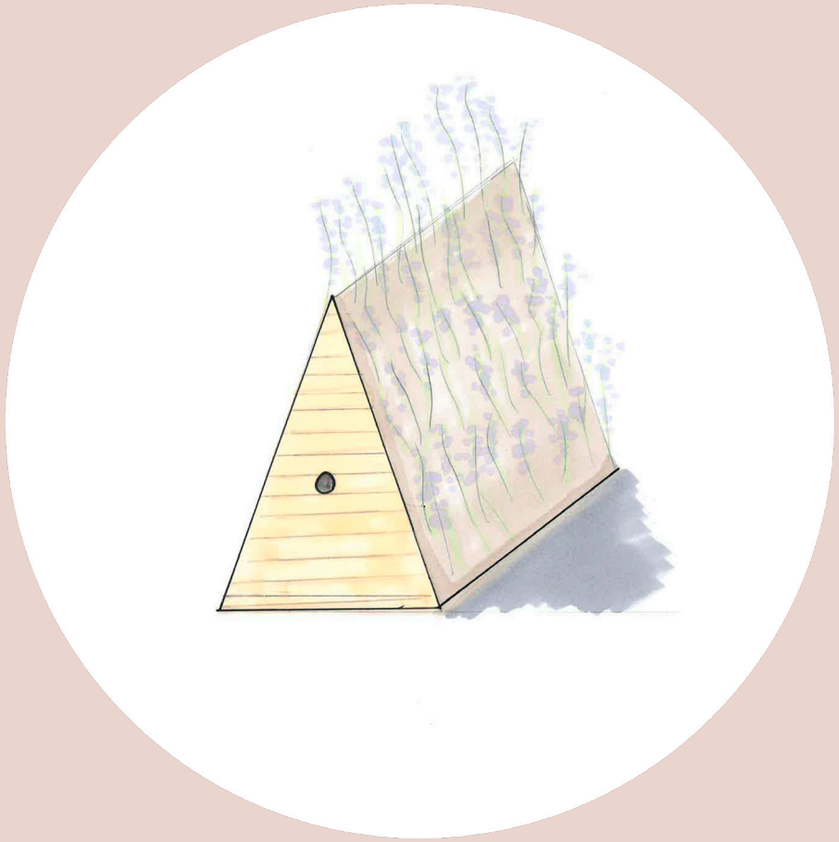


This is the same concept as one of the ones for solitary bees, but it contains a home for a collony. Using arias like roundabouts, parks, roads holders and so on where there are space for correct landscaping, Vegvesenet could have placed these kind of habitats and provide homes for the bees as a service, and keep the landscape surrounding it correct at the same time.

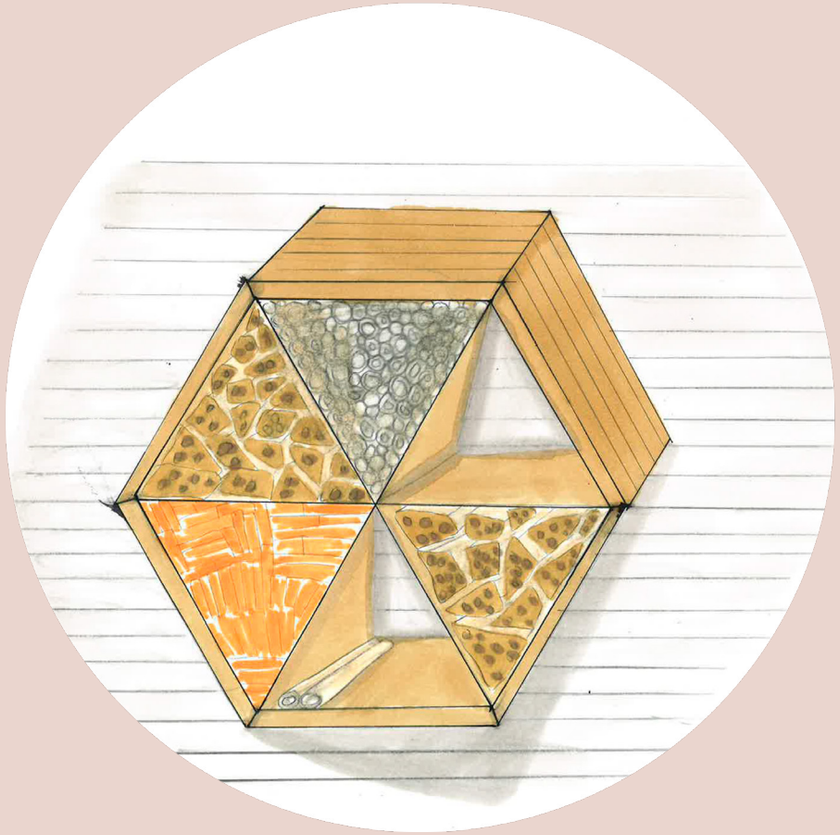


This public furniture implements the structures the solitary bees need to lay their eggs, and providing them with food at the same time.

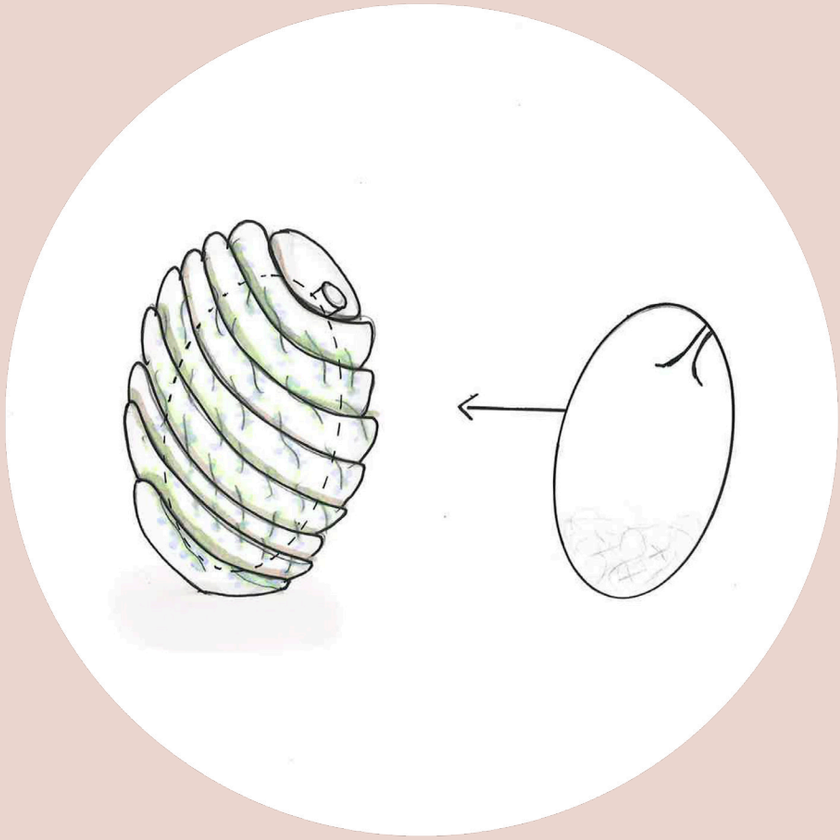
This public installation could work as a extended version of the educational and informative part when it comes to bees. Her the public can learn about the bees and at the same time the bees can lay eggs and get food.



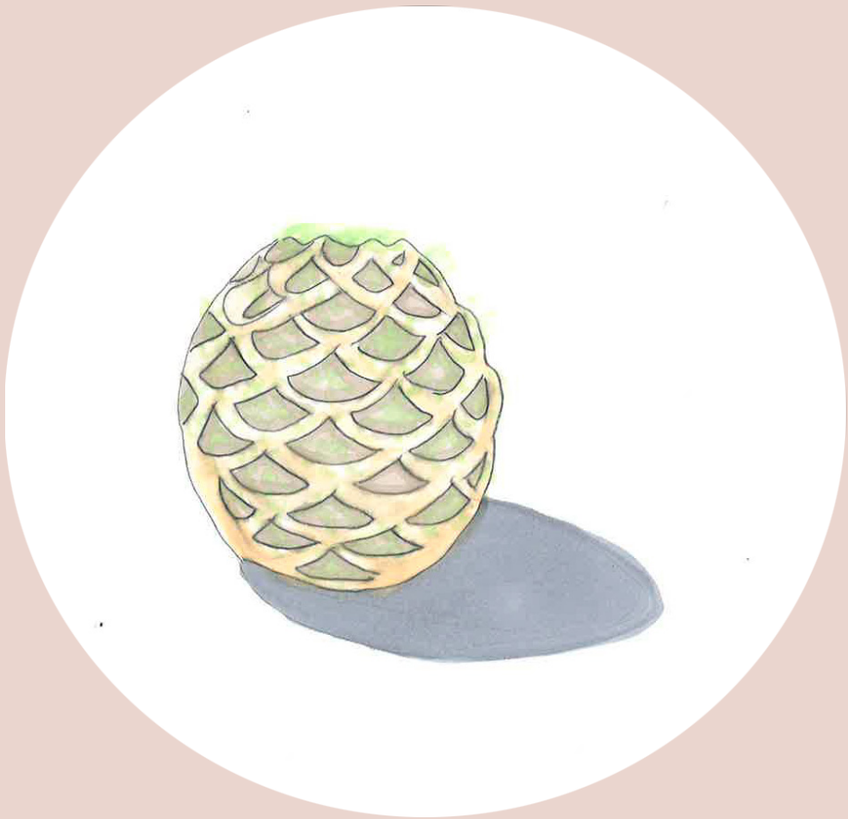
A cabin with nesting place inside and with nutrition on the structure.



A frame where families can place it in their gardens and use leftover materials and garden scraps to build homes for the solitary bees.



This pod have plants structured into pockets on the outside. And on the inside there is a nestingplace.



A foodpod that is a steppingstone with nutrition for all bees, but don’t contain a home for eggs or colonies.

FEEDBACK ON IDEAS

After further input and discussions about the product with the experts, I went further with the idea of creating a product that fits the public environment of the city. Especially after the insight from Bård Bredesen from Bymiljøetaten i Oslo, where he talked about how the flower meadows in Oslo are now starting to be better looked after and there is more focus on preserving the natural flower medows, but there is a need for passages throughout the city that link it all together. So from here I started to work out a solution that could work for both the social and solitaire bees, which would link the natural flower meadows together in a form of passage, which would also offer a habitat that allows breeding and hybernating. It is also important to include information dissemination when you have a project of such importance located centrally in the city. Here you have many opportunities to inform the public about the importance of taking care of our bees.

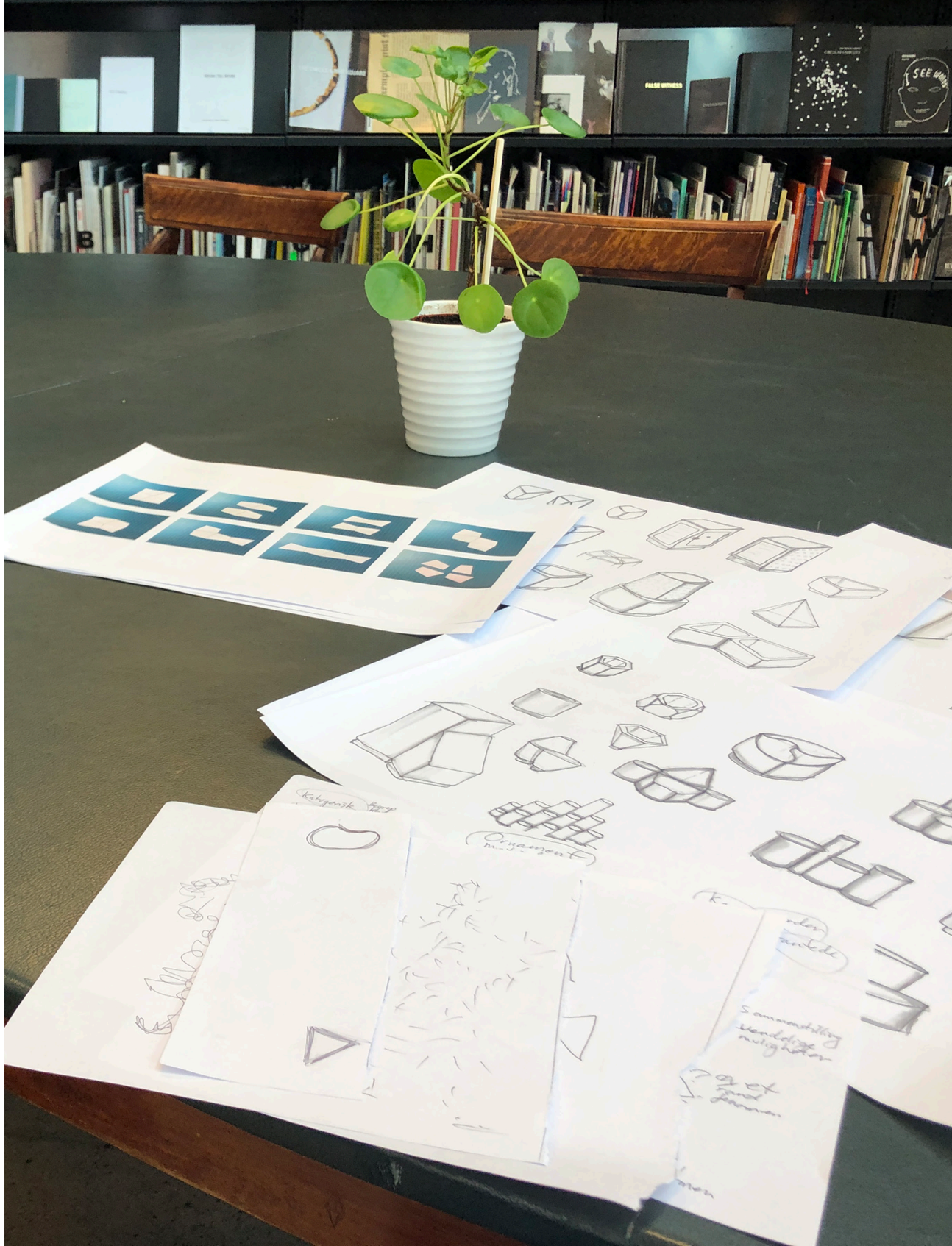
FURTHER DEVELOPMENT

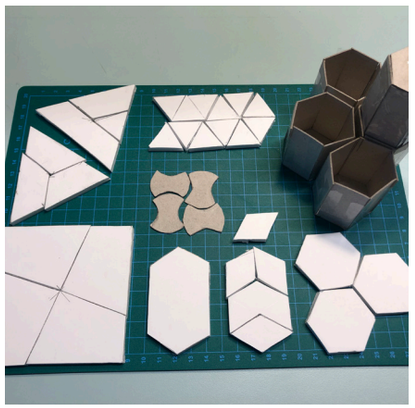
As mentioned earlier, both the solitary and the social bees are important to keep pollination going. These 2 groups have very different habitat needs. The solitaire needs small holes to lay eggs, and the social need a hollow space to house a colony. Therefore, the product must be able to be modular and allow space for these two.

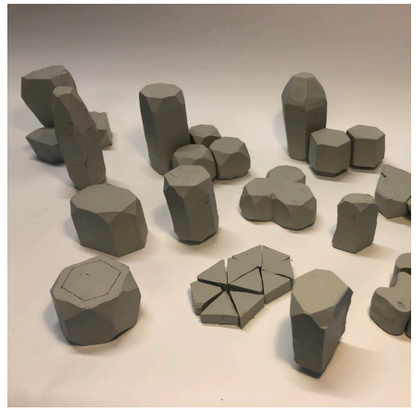
There are also differences in the arials where the product can be placed. For example, we have both large squares and small streets in the city. Therefore, it is important to come up with a module-based product that can be placed according to the size of the area it is placed, and to have modules that includes habitats for both solitary and social bees.

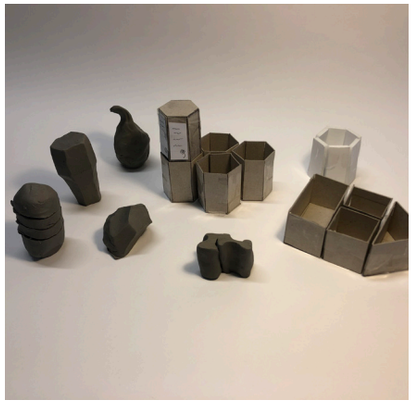
I met Karen Disen at Oslo National Academy of the Arts. Karen gave me insight in form, expression and how to use geometrical rythem and compositions.

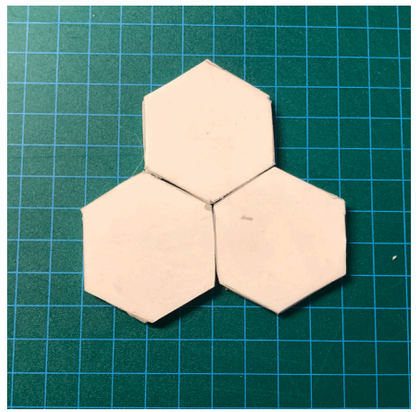
From this I started to do some tests. I started by creating tessellations, a repetitive geometric pattern. I also tried to share different geometric shapes and put them together in other ways. Furthermore, I worked with technical clay and try out the pattern in 3D to see how the shapes complemented each other, to create a modular solution.

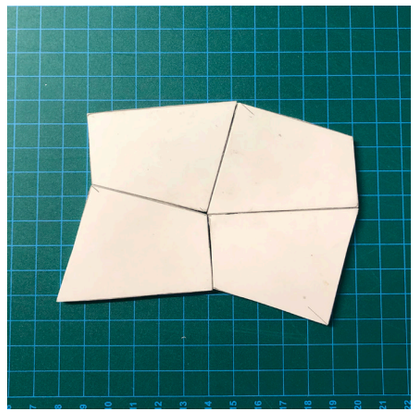


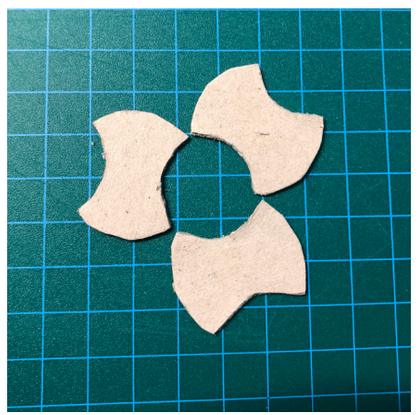


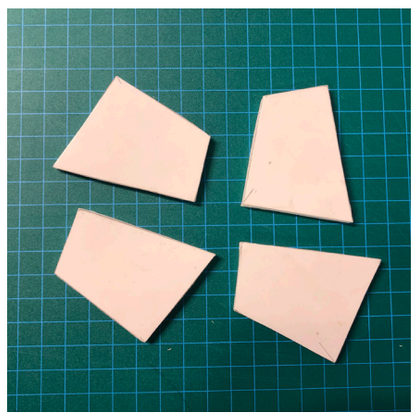












FEATURES

From the conversations with the experts and the research reports, I got a specific list of criteria the product must or should contain. These criteria ensure the best possible living conditions for flowers, solitary bees and social bumblebees.

Proper natural materials are important for the bees to settle as well as interior materials like dry grass. Flowers also need water, but not too much water so they drown, so there must be drainage for excess water. Flowers needs to be sown in soil. And sand should be included for those bees who prefer it.

Suitable Materials Bees prefer natural materials

Interior materials The social bees need interior materials such as grass and straw so the eggs do not freeze

Enterance There must be an entrance so the bees can lay eggs or build a colony

Drainage is needed so that the plants or bees do not drown

Water The flowers need access to water so that they do not dry out

Flowers are needed in the product for the bees to get food and nutrition

Soil / dirt - The flowers need soil to live

Sand Many of the bee species prefer sand to lay eggs

Modular The product should be able to be modulated to be customized for solitary or social bees

Information The product placed in public spaces is a great way to communicate to the public how to care for our bees, therefore it should contain information

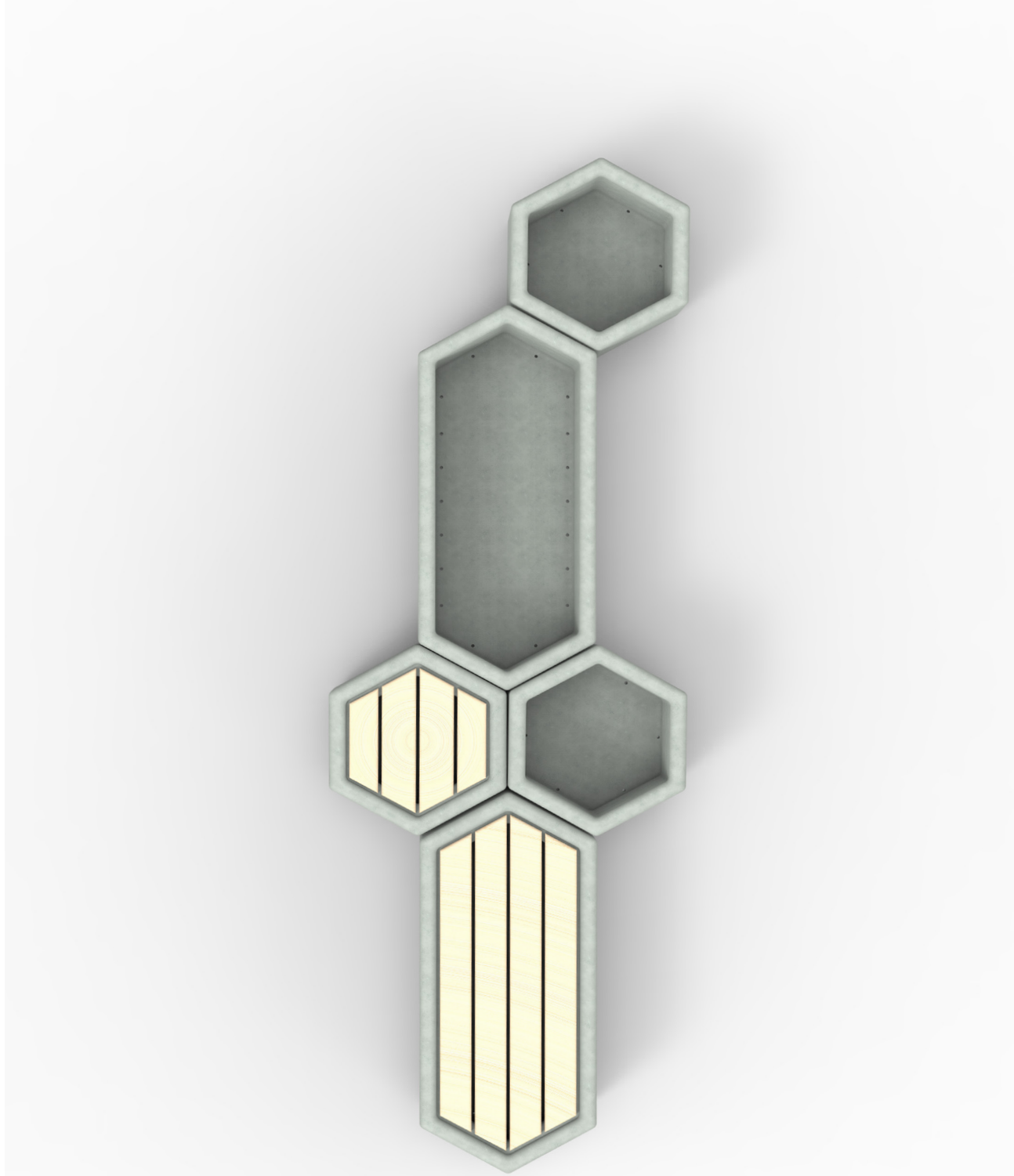
7. THE PRODUCT


pwc
Deloitte.

BUMLE-POLLINATOR PASSAGE

BUMLE-Pollinator Passage is a modular series of public furniture which acts as a passage for wild bees. This passage helps the wild bees to travel in the landscape and ties our landscape with flower meadows and gardens together. With a home for breeding and hibernating pluss food for the wild bees, this passage is working to increase the chance of more wild bees to succeed because it make easier for them to travel in the landscape, and with doing so help the diversity of our important pollinating wild bees.

In addition, there are benches where people can sit and observe the wild bees as they visit flowers or are inside their home. Because BUMLE is also an important communication tool to tell the public on how important it is that we take care of our nature and our wild bees. With informative posters the public can read about the important work the wild bees do in pollinating the flowers and the food we eat. At the same time people can observe life inside the boxes and see what the colony of bumblebees are doing. By opening the small door on the box people can look inside the box and watch the colony.



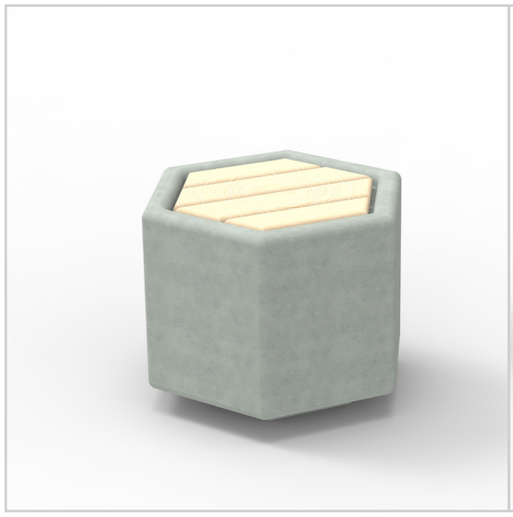
The hexagon shape of the modules makes it easy to place Bumle in many different environments and arials and create unique composition. The hexagon shape is also very associated with bees. Although this form is created inside the honeybee cubes, it still communicates that this is something that belongs to bees and pollination.

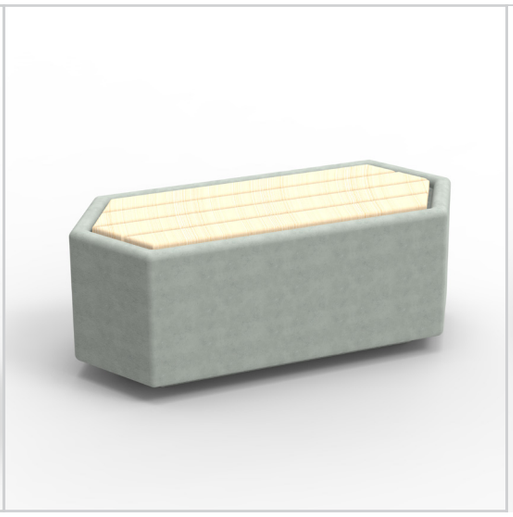
BUMLE consists of pine and concrete. Pine is the material in the parts of the product that the bees are staying, pluss the benches have pine seats for comfort. The bases, flower boxes and benches are molded in concrete to make the product heavy and stable so that it is not beeing moved and it will have a very long life.

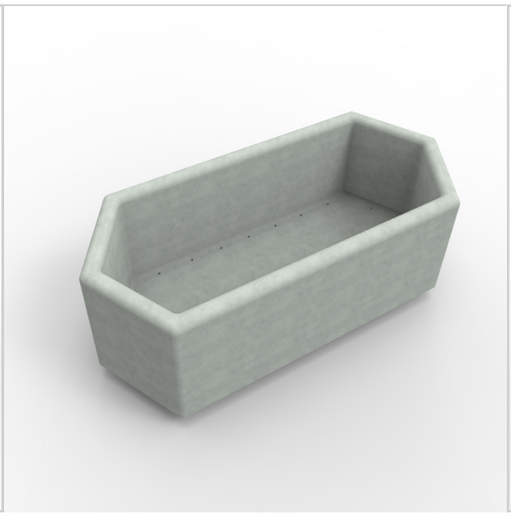
At the bottom of the flower boxes and benches are drainage holes so that they are not flooded with water. There are 2 different sizes for both benches and flower boxes, plus there is a low flower box where you can have sand for the solitary bees.

The modules are 120x60x45, 60x45 and 30x45 cm.

The hatch above the entrance to the social boxes, several experts pointed out as important as parasites can be a threat. But with a small hurdle, they are less likely to find their way in. In order for the social bumblebees to be least disturbed, there is a hatch above the viewing window so that it is closed when people are not looking inside. This is also important as the social bumlebees wants to feel safe.







There are 2 boxes in this module. The bumblebee boxes has a small hurdle over the entrance which makes it more difficult for parasites to penetrate the box.

The bumblebee boxes have a viewing window that the public can access by lifting the hatch. This allows the audience to observe life inside the box and learn more about the bumblebees.

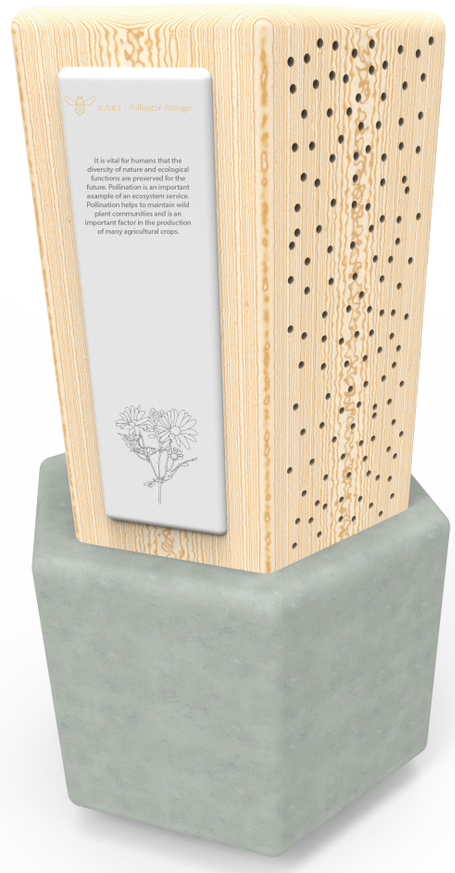
Each box measures 25x60 cm and is placed above each other. They are stably placed on a base and at the top they are locked with a key. By using the key, the operator is given access to load and change materials every season.

Inside each box there is plenty of room for a bumblebee colony to settle. Here, the materials souch as dry grass are laid in to create insulation and to be used to build nests.

INFORMATIVE POSTER

As a link between our flower meadows and gardens Bumle acts as a pollinator passage in the city. This means that the Bumle will be placed in areas where people are located. Therefore, BUMLE will also be a very good provider of information about solitaty bees and bumblebees. Here everyone can read about the importance of preserving flower-rich gardens and flower meadows, and observing the lives of the bumblebees and bees. The poster also contain the flower menu.

This module is also designed so that the solitary bees can lay their eggs in small holes.



EXTRA FEATURES

As a central information provider and passage for our wild bees, BUMLE is located around the city. This means that it can also be used for several different purposes. First as a passageway for the bumblebees and solitary bees, then information communicator, and a place to sit. Also, due to its volume and heaviness, bumblebees can act as roadblocks in pedestrian streets. In larger cities, barriers are needed where people are located to avoid vehicles, and Bumle can work for that as well.

In the box of the social bumblebees, it was first an idea about inserting a camera so you could watch a live transmission from what the life of the box was like. But according to Christian steel in SABIMA, this could be of little significance as the bumblebees rotate a lot in their nest and there is a very high chance that they will cover the camera with materials. It was also an idea of creating lighting that should be part of the modules so that the passages could be lit, but as Anne Sverdrup-Thygeson at NMBU pointed out, our insects are sensitive to light, and light is also polluting to insects.

THE SERVICE

Bymiljøetaten i Oslo are the ones who control the public areas of the city. Therefore, they are a possible service provider for Bumle. Bymiljøetaten i Oslo already has good routines and a lot of focus on well-being in the city. Therefore, existing services around flower maintenance and watering of flowers are already implemented.

The materials in the boxes needs to be changed every season and the flowers must be sown and watered. By creating ready-made packages with information brochures, flower seeds and materials to keep in the boxes of the social bumblebees, it possible for BUMLE to succeed in the best possible way.

6.SUMMARY

REFLECTIONS

In this project, my goal has been to get an overview of how pollination takes place and what challenges exist around it and to look more closely at how we can arrange for our wild bees to have the best possible habitat. By creating BUMLE-Pollinator Passage i belive that i have done that in a way that both give the wild bees better living conditions and at the same time use this as a way of communicating the importance of good habitats for wild bees. Of course, working with wild bees as a target group is not the easiest, because because I can't even ask them how they wish their home was built.

Given the Covid-19 pandemic that struck, it was also very difficult to try to build mock-ups without access to tools or materials. Before the pandemic started, I had a close collaboration with the experts who gave me a lot of insight that I have used as a template when working with the project and designing the product. With the collaboration with the experts and the use of reports that summarize how bees can be created most optimally, I believe that BUMLE will serve as a good passage for our bees. It is also important to mention that this does not solve the whole situation for our wild bees, but that this is a step in the right direction by creating small habitats and passages plus providing information. In order for us to optimize the living conditions of our pollinating insects, we must begin to use our land in a more considerate way.

Furthermore, I imagine that this could have been a realizable project in collaboration with Bymiljøetaten and, for example, La Humla Suse.

COVID-19 PANDEMIC

March 12.-The strongest measures we have taken in peacetime in Norway was announced by the Norwegian Prime Minister Erna Solberg.

It was declared a pandemic called Corvid-19 all over the world, which also spread to Norway. Parts of our society closed. This also applied to all universities and colleges, including The Oslo School of Architecture and Design. We had to stay 2 meters away from other people and we were not allowed to gather in groups. Unfortunately, this situation has affected my diploma project to the extent that it has not been possible to perform tests and make mocups since the workshops has been closed, as well as keep in touch with the experts.The school did not open again until April 27, and then with restrictions that only diploma students were allowed to return, none of our supervisors were allowed to return.

Picture of my workplace at school taken on March 12, the day I went to pick up my most important assets before closing.

ACKNOWLEDGEMENTS

I would like to thank all the experts who have taken the time to get involved in the project and who have shared valuable information on both flowers and bees and everything else related to my project.

Petter Bøckman
Zoologist and University lecturer at UiO: University of Oslo, Natural History Museum

Kristina Bjureke
Botanist and University lecturer at UiO: University of Oslo, Natural History Museum

Christian Steel
Biologist and Secretary General at SABIMA

Sigrid-Ann Mortensen
Former leader of Nordstrand Hagelag and public speaker

Karen Disen
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Anne Sverdrup-Thygeson
Professor NMBU og vitenskapelig rådgiver for NINA

Atle Mjelde
Biologist, La humla Suse

Monica Marcella
Chairman, La Humla Suse

Jonas Oliver Elnes
La Humla Suse

Bård Bredesen
Biologis at Bymiljøetaten Oslo

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PICTURES

Drawings and illustations
Emilie Langolf

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APPENDIX

Gigamap - Gigamap_Bumle.pdf