UTMARKEN

: envisioning Skåne's new edible landscapes

ASBM01: DEGREE PROJECT
in Sustainable Urban Design

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useful words

regeneration

1 : an act or the process of regenerating : the state of being regenerated.

2 : spiritual renewal or revival.

3 : renewal or restoration of a body, bodily part, or biological system (such as a forest) after injury or as a normal process.

permaculture

1: A system of perennial agriculture emphasizing the use of renewable natural resources and the enrichment of local ecosystems.

2: Any system of sustainable agriculture that renews natural resources and enriches local ecosystems.

3: The design, installation and maintenance of indefinitely sustainable human communities set in balanced ecologies, both urban and rural.

agroforestry

1: A system of land use in which harvestable trees or shrubs are grown among or around crops or on pastureland, as a means of preserving or enhancing the productivity of the land.

2: An agricultural approach of using the interactive benefits from combining trees and shrubs with crops and/or livestock.

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SUDes
Sustainable Urban Design

School of Architecture, Lund University
spring semester 2022

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acknowledgments

I would like to express my warm thanks to all the amazing people that has been around me throughout this thesis project - it would not have been what it is without all those discussions, the support and guidance.

Firstly, I want to thank my dynamic supervisor-duo Erik and Daniel, for your patience, guidance, insights and all the humorous, existential and engaging discussions we have had. I also wish to thank all the other teachers and staff of the SUDes-programme - your enthusiasm, knowledge and teachings has been invaluable to me these two years. I am truly grateful for this time I got with you.

Secondly, I want to thank my classmates for all support you have given me and all the things you have taught me - whether it being about the world or sustainable urban design! I am truly grateful for all moments we have shared so far.

Finally, I want to thank my family and friends for your warm support, love and patience when I'm rallied up in the issues of the world. Your support carries me- and the making of this thesis project.

Hugo Settergren
September 2022

abstract

Planet earth is getting hotter and regional climates are becoming increasingly unpredictable across the globe. Cities and communities on all continents are already impacted by the changing climate, but also by two other crises – the fossil-energy decent and the 6th mass extinction event. These three complex and interconnected crises all increase the risk of food becoming a scarce resource. In fact, historically, feeding people is the key factor of maintaining stability in human societies.

The countryside provide the foundational systems of which feeds all cities and communities. Relationships between countryside and cities are therefore becoming increasingly important on a local level as these crises unfold. Borders between cities and countrysides are where the collaboration of both sides will begin, along the process learning how to feed ourselves sustainably in a more local world.

Today, there are systems of cultivation which produces substantial amounts of food and resources without the negative consequences of industrial (or conventional) agricultural practices. These systems are founded on practices that has been used in different corners of the globe for millennia – the difference is that these systems now are seen from a scientific perspective. The benefits of agroforestry and restoration agriculture have the potential of; restoring habitats for wildlife, increasing soil fertility, preventing erosion, stabilize weather patterns – all while producing resources that cities anc communities need.

Integrating local cultivation of food and resources is crucial for both production and educational purposes- both important when working towards food security. This project is about finding a bridge between the city, in this case Brunnshög in Lund, and its neighbouring and vast agricultural lands on the Scanian plains. I hope my findings in this thesis can shine light upon the pressing issue of local food security, and to contribute in envisioning ways to design new edible landscapes.

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introduction

- nature, food and us

"There are only nine meals between mankind and anarchy"

- Alfred Henry Lewis, 1896

project objectives

This degree project aims to do three things:

1) Gather relevant and crucial insights on climate impacts related to human way of life, in particular society's fundamental aspects of food security

2) Explore how resilient systems can be implemented through ecologically focused strategies

3) Show how implementation of these strategies could work through a design project.

In turn, the design project aims to act as a potential site for exhibition - acting as an arena for these ideas and strategies. Lund has the potential to lead by example, and generate a larger international interest for localized and resilient and diversified food-production.

The objectives translated to the chapters:

1. research

Mapping the background, impacts and relationships between food and communities

2. site & context

Understanding the project site context, conditions and potentials

3. strategies & toolbox

Presenting applicable strategies and design principles

4. design project

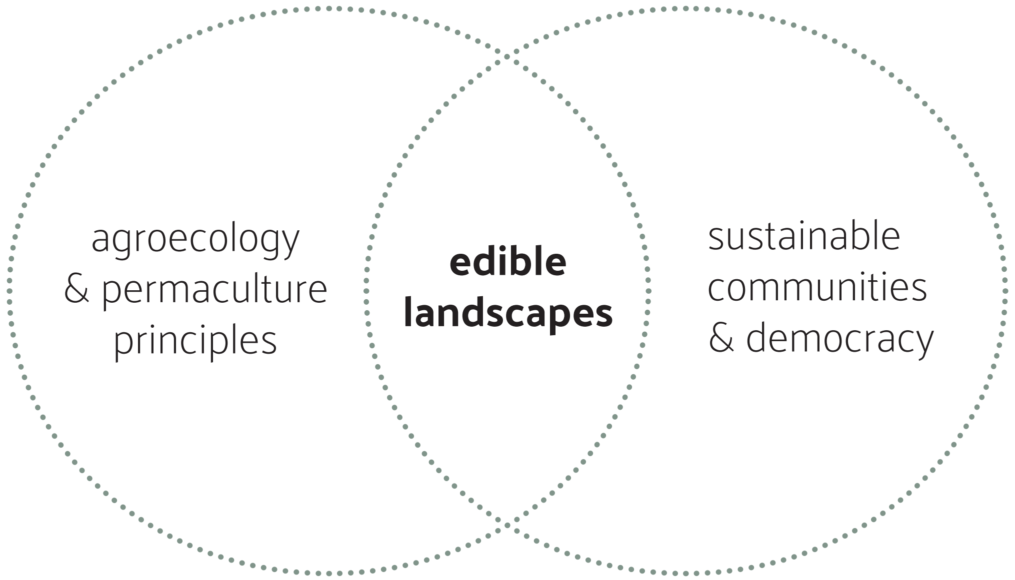
Showing potentials in accordance to the agroforestry concept

what is an edible landscape?

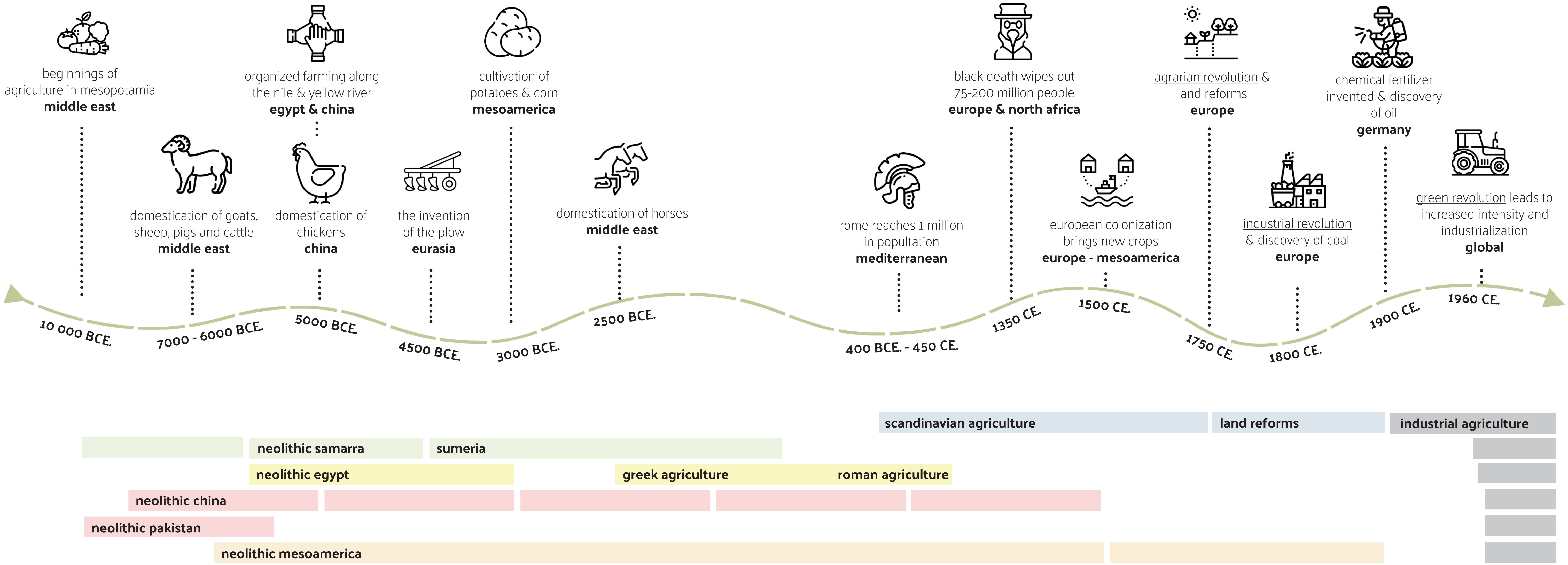
An *'edible landscape'* is a landscape which contains and supports plants and animals that produces food (and other resources that we, humans, need). In this thesis, these edible landscapes are also by definition designed in accordance with natural proccesses of regeneration and the interspeciary interactions which occurs within and between ecosystems. Sustainable communities are vital to act as stewards of these semi-natural agricultural systems.

why do we need them?

The debate on the modern industrial agricultural system has become more pressing in past years - and rightly so. The modern food system is responsible for large parts of global carbon emissions by both production and transportation, but also a key driver of ecosystem collapses and species extinction. Planet Earth with its ecological foundation is neccesary for our survival - and therefore we need new ways to heal our soils and feed ourselves.



food cultivation timeline*



food - a prerequisite for cities

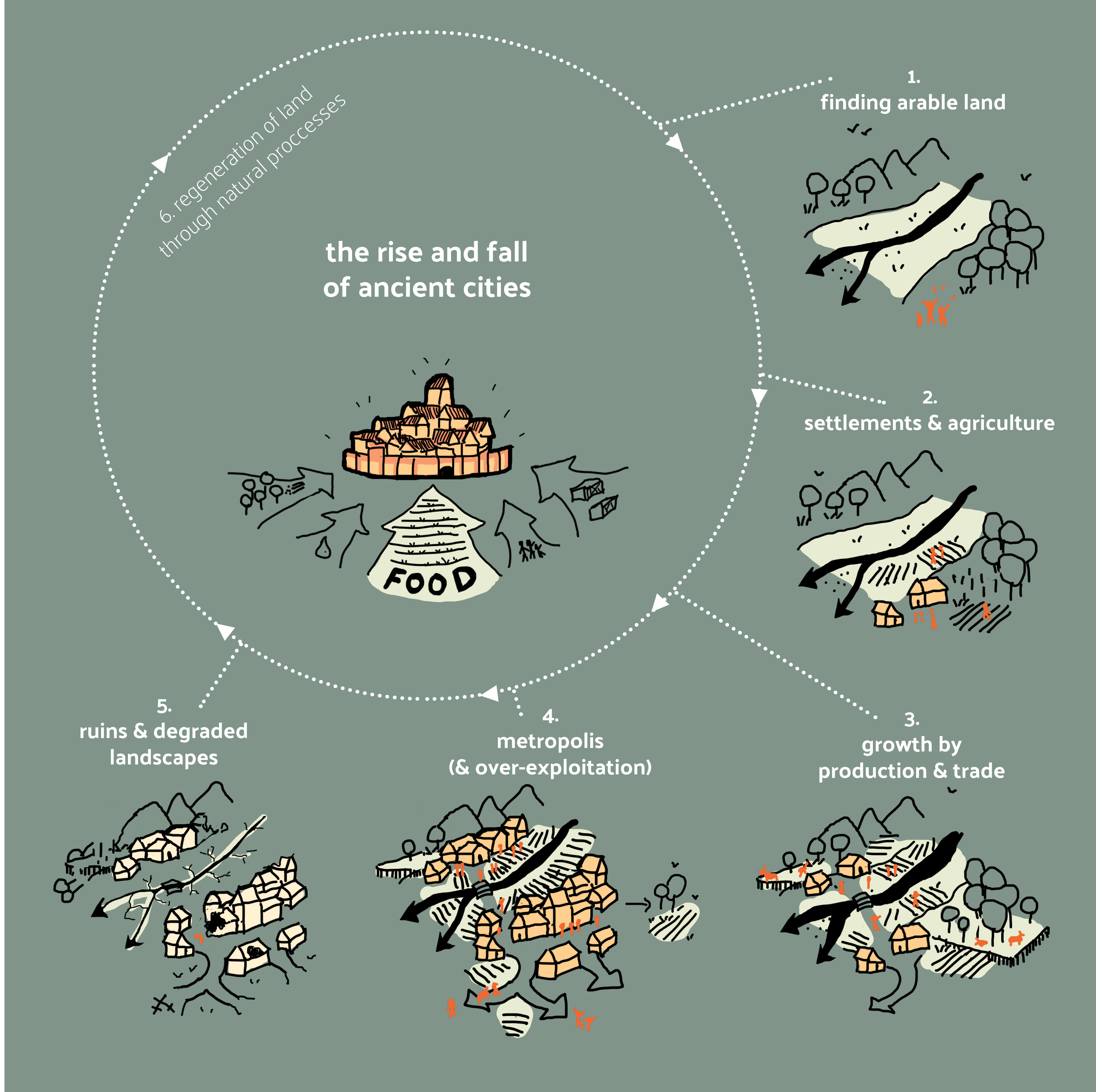
10 000 BCE. - 1700 CE.

Pre-industrial cities rarely reached a population over 100 000 citizens due to difficulties of food supply. (Rome was an exeption).

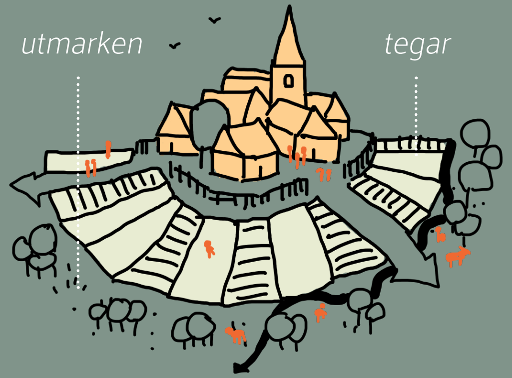
When the Sumerian empire founded their first urban settlements over 5500 years ago, it all started – the co-evolution of cities and agriculture, highly dependent on one-another and resulting in human civilization. Geographical factors, such as proximity to fresh water, arable lands and trade route opportunities were vital for founding cities. Settling on rivers met all these requirements, which essentially existed to feed the populations of cities. Food availability was also a premise for philosophical-and scientific progress, calculus and even the invention of the concept of money.

Both Aristotle and Plato had ideas of the ideal structure of the polis (city-or Greek city state); Plato argued that each citizen/family should have two plots of land to farm, one in the city and one outside, while Aristotle pointed out the importance of regarding self-sufficiency as the foundation of a stable society. Resources essential to the functioning of *the polis* should be supplied by the areas in close proximity, otherwise it would be much harder to sustain and defend (Steel, 2020).

Contrary to modern nations, many pre-industrial cities enforced laws to keep people from monopolizing the trade and production of food. In pre-revolution France for example, bakers were prohibited to mill their own grains, and the millers from baking bread. The purpose of these regulations were to control and limit the influence that they could have on the market-shares on vital necessities such as food. Even in ancient Rome, providing food to the city was regarded as one of the foremost tasks of the ruling class. Failing to feed the people was a highway to political ruin, which can be observed throughout the history of human civilization (Steel, 2008).



before *'storskiftet'*



after *'storskiftet'*

after *'enskiftet'*

the swedish land reforms

1700 - 1850 CE.

In Sweden in the early 1700s, agricultural lands were usually distributed in *tegar* (narrow strips of arable land around the villages, divided equally among the farmers). These strips could be as small as 200 m^2 and mainly to be used for the sowing and reaping of grains. Even though the land was divided, the act of providing food was a concern for the whole village – with cooperation and community being a strong force for providing enough food for everyone. The buildings of the village were usually situated close to each other, as a group or unit – making up a village with social cohesion and relatively easy to defend from plundering (in comparison to solitary farms). Around the village with its *tegar, the commons* stretched far and wide. These commons were often managed by the villages as a shared piece of land which could provide many benefits and uses such as; meadows for grazing for cattle, sheep or goats, forests for providing a source of wood for heating, cooking and woodworking and as a place to gather fruits, nuts and other useful plants (Åberg, 1953). They were called *Utmarken*, the outlands (Wallander, 2013).

Storskiftet / *the great shift*

In the mid 1700s, the governing class and nobles across Sweden had a growing interest in reforming the agricultural practices, claiming that the farmers current management practices were not efficient enough. The proposed change was keeping the collected structures of the villages, but combining and rearranging *tegarna*, the strips of land, so every farmer could have a larger and collected piece of land instead of having them spread out on different sides of the village. This change would also result in larger fields, potentially increasing yields – but with the downside of having some farmers getting lands of worse quality and further away, changing the balance of equality within the village. Another effect of the change resulted in straitening rivers and creating ditches for irrigation. The proposal was approved by the government as of 1755 and thereafter rolled out across the country (Åberg, 1953).

Rutger Maclean & Enskiftet / *the one-shift*

Wars in Europe with its increased needs and trading opportunities in the late 1700s made it significantly more profitable to grow and sell grains across the continent- sparking the interest of nobles and landowners to increase agricultural production. *Rutger Maclean* was a military captain who inherited the estate of Svaneholm in Skåne in 1782. His passion for modern agriculture, literature in the subject and connections in England and Denmark (where rationalizations to the land-use and practices of the agricultural sector had already been implemented in a wider scale) made him a crucial figure in what in Sweden became the splitting of the villages (and a founding moment for the agricultural landscape we still have to this day.

He ended up implemented a new shift on his estate, splitting the village into detached farmhouses and scattered them across the landscape. Each farmer farmed the lands surrounding the farmhouse, with greater distances to the neighbors than before. This change resulted in a double-win situation for the ruling class, landowners and Rutger Maclean; 1) the fields were combined yet again, providing larger fields and easier to use rational and modern practices for higher yields of grains and produce and 2) the (already) frustrated and ill-willed mob of farmers was divided as a group with the splitting of the village, essentially eliminating their ability to form resistance to the new enforced changes (Åberg, 1953).

industrialization of food

1800 - 1980 CE.

Starting in the mid 1800s, a range of scientific discoveries (as the steam engine and the Haber-Bosch methodology of artificially fixing Nitrogen), technological advances (as the rationalized manufacturing belts by Henry Ford) and cultural/ideological shifts (as the economical principles formulated by Adam Smith) paved the way for industrialization and commercialization in human societies (Steel, 2008). The coal powered steam-trains revolutionized transportation, just as frigates and channels had done centuries before. The difference was the concentration of energy input relative to the work done (energy output) which was greatly increased by fossil fuels (Aleklett, 2012). Just leading up to this era of increased efficiency, Adam Smith, customs officer and Professor of moral philosophy writes one of the most influential tract on the topic of economy ever written – setting up the principles for capitalism with the thesis that free-market trade is the most effective way to generate wealth. He was a city-dweller, also reflecting about the relationship between town and country (Steel, 2008).

Today, his statements can be put in contrast with the late development of farmers' exposed and fragile financial situations induced by systemic pressure from the industrialized commercialized reality of modern food production.

The industrialization of the food system meant that food could be shipped further and faster, be refrigerated and processed, and traded cheaper on the free market. This meant that populations in cities could grow at a faster rate than ever before in history. Combined with commodification, industrialization also led to less plant varieties being cultivated and sold to the wider public due to the aim of maximizing profits (Steel 2008). This selective domestication and cultivation of varieties has been made at the expense of other plants and animals (Steel, 2020), over the following centuries pushing wild species to a concentration of less than 4% of all biomass on planet Earth (WWF, 2020). Fewer cultivated species also leads to lessened biodiversity across the board; less diversity of ecosystems, fewer wild species and lessened genetic

diversity within populations. These conditions have through history increased ecological fragility, paving the way for pests, land degradation and species extinction (Steel, 2020 & Montgonmery, 2007). The rationalized industrial agricultural system developed to deal with these issues by converting larger areas to agricultural use (logging, ditching etc.), applying more chemical fertilizer and using tougher pesticides. These measures have been able to keep both yields and profit high but dramatically worsened the ecological and social conditions of food production and even factors of human health (GRAIN, 2016).

Over time, fewer and fewer people became directly involved in agriculture due to oil powered mechanization and automation, making the whole food-supply-chain increasingly industrial and invisible to the public. Accompanied by industrialization was urbanization – people moved to the cities to find work. In 1800 only 17% lived in cities in Britain, by 1900 this number reached 54% (Steel, 2020), and now it's closer to 86% (Macrotrends, 2022).

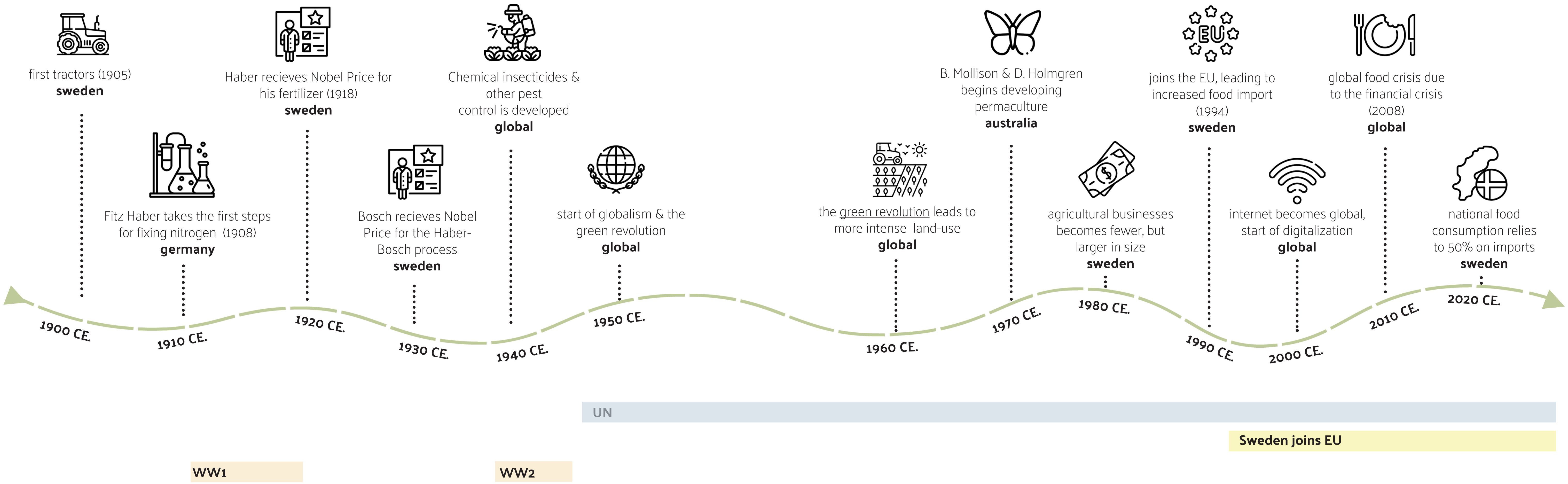
The same trend is also seen in other countries, arund the world, including Sweden where about 87% lives in urbanized areas today (World Population Review, 2022). An industrial, urbanized society have *less people* producing *more food,* and more people engaged in other specialized professions. To feed everyone, energy input from fossil sources "replaced" manual labour. Today, the industrial food system consumes about 10 calories of oil to produce 1 calorie of food (Shiva, 2008). This means that we are emptying the "battery" of stored fossil oil to sustain one of our most fundamental needs - food (Hagens, 2022).

1:10

calorie of food | calories of oil

Fig. 1. *The ratio of which the modern day industrial agricultural system uses energy. After (Shiva, 2008) & (Hagens, 2022).*

1900 - 2020 agricultural milestones*



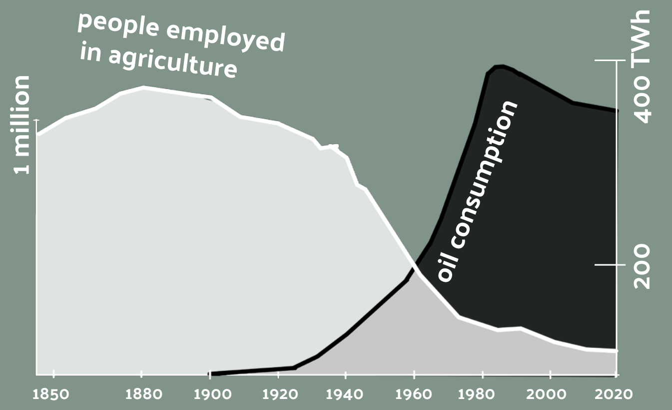


***Fig. 2**. Swedish national oil consumption compared to people employed in the agricultural sector between 1850-2020. Based on graphs and data from OurWorldinData & Ourfiniteworld (2022).*

food system's impacts on earth

Eutrophication of land, in lakes and seas

Extensive loss of biodiversity (ecosystem diversity, species diversity and genetic diversity)

Dependence on fossil fuels for both production and transportation

(Temporarily) high profits (for a handful of people)

global food, just in time

1900- today

The intricate systems that feed cities of the world in the 21st century are largely invisible when moving about in our day-to-day activities. In fact, never before in the history of our species have such a large percentage of the population been distanced from the food-system as today. This system has been fine-tuned for decades, even centuries to appear this way. The way we produce, transport, store and trade food has even shaped the spatial structures of our cities and societies throughout the history of human civilization – but with a massive shift from the time of the industrial revolution. The physical distances and lack of visibility keeps the population even further from the origins of food (Steel, 2008).

Today, 40-50 % of the land on earth is put to agricultural use. But arable land per capita is decreasing worldwide due to population growth and increased rate of soil degradation (Smith et al, 2007). Today, much of the world's food is produced industrially by large agricultural companies & fisheries which are driven by financial (and sometimes even political) interests. This industrialization and commodification of the food system have had critical negative impacts on both the planet and our societies (Shiva, 2016). These large companies have to a degree monopolized the food market by lobbying for laws and regulations for seed-monopolization, monetary policies and trade regulations benefiting large scale industrial operations (GRAIN, 2016). The food market is increasingly global, pressing prices along the supply chain which are run by oil-powered flight, truck-or-freight-shipping. Strangely, exporting and importing food across nations and cultures has historically been very lucrative since it can be sold for better prices elsewhere. Most transported food is either treated for preservation, shipped before ripeness, or contained/stored/chilled in various ways along this chain. The supermarkets are not storing vast amounts of inventory, since their role is merely to pass on the product to the consumer and register amounts sold (bar-codes) for estimation of future demand. This is 'Just in time' – the "logistical nightmare" which keeps bringing "fresh" food and fullness to many parts of the world. (Steel, 2008).

The whole process requires an indirect but vast material infrastructure (ships, containers, machinery, factories), claims large areas of land (mono-crop fields, roads, rails and other logistics) and both the process of the food supply-chain and maintaining the infrastructure around it consumes fossil energy, oil to be specific, to function at scale (GRAIN, 2016). Bio-fuels and electric vehicles have in recent years been increasingly subsidized and spoken of as a replacement, but what is often missed it that these "replacements" are also dependent on fossil-fuel input in their manufacturing (Trainer, 2007), while also the negative impacts of the already unsustainable practices stay unaddressed (tilling the soil, mono-cultures and more). Those unsustainable practices are in fact what has driven humanity across several of the planetary boundaries (Rockström et al. 2009).

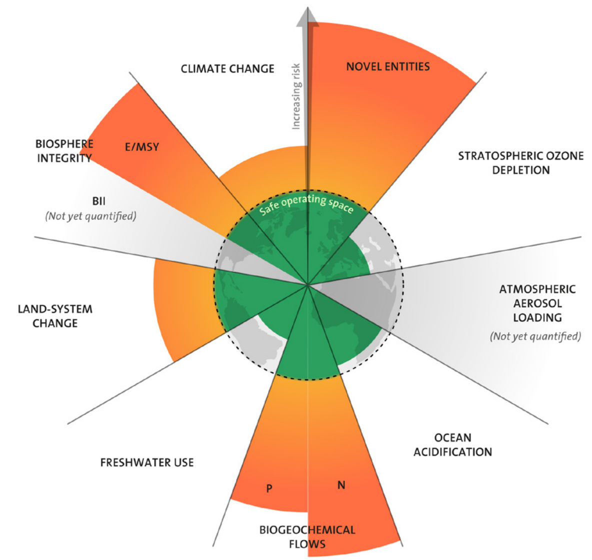


***Fig. 3**. Planetary boundaries. Azote for Stockholm Resilience Centre, based on analysis in Persson et al 2022 and Steffen et al 2015 .*

PEAK OIL & THE ENERGY CRUNCH

Oil (and coal) are finite sources of energy which formed under very special conditions in the Earth's geological history. The discovery and emergence of these fuels launched a new era in human civilization, making energy more transportable and thus more accessible to people and industry. The word finite indicates that this resource will run out; it will be consumed until it's not profitable to do so (Aleklett, 2012).

Today, not many reflect upon the fact that nearly every good we produce, all the food we eat and almost everything we do is possible because of oil and fossil fuels. Ugo Bardi (2011) states that, there were already concerns about what impacts the oil-powered economy would have on the world in the mid 1900s, and the projections and modeling that was made in Donella's et al. publication Limits to Growth (1972) shows steadily declining resources and an industrial output peak in the first half of the 2000s (see image 5 & 6). Most of the fossil fuels are used for transportation of people, goods or foods. Aleklett also states that the most vital impact of Peak Oil is the way it will force us to change the system for food production since transportation, pesticides and chemical fertilizer will be largely unavailable as of today's standards.

Growing food in closer proximity to our cities is one of the most important changes that will be needed after Peak Oil, according to Aleklett.

Another often overlooked topic is that renewable energy and nuclear power are also dependent on fossil-fuels for their manufacturing and maintenance. There are no "clean" energy sources, since diesel och oil is required to maintain the infrastructure which supports these large industrial energy-systems (Trainer, 2007).

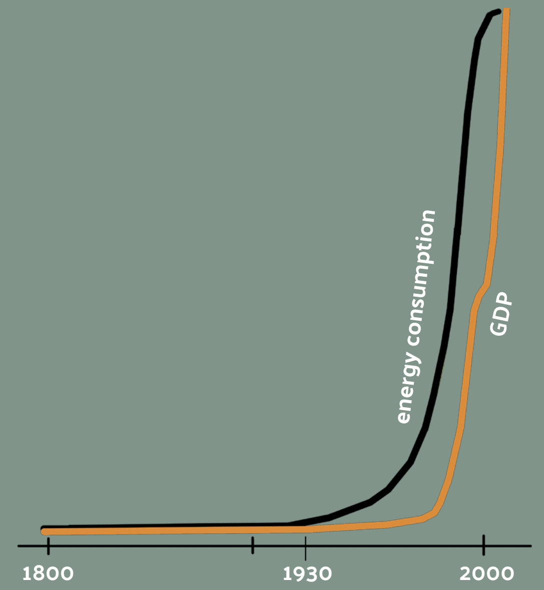


Fig. 4. *Relationship between oil consumption and money supply in a 200-year perspective. Graph after (Martenson, 2011).*

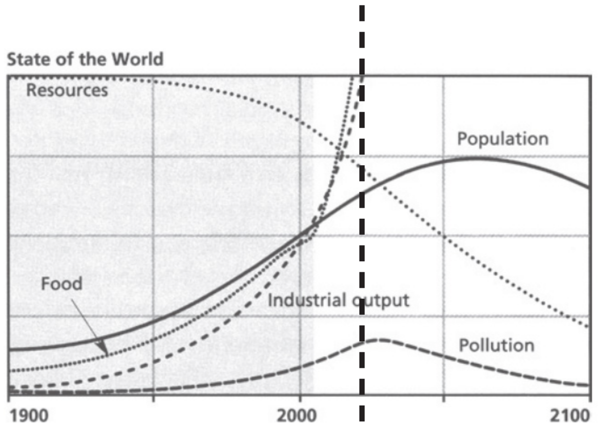


Fig. 5. *Simulation assuming resources on earth are infinate, just like the ability to control pollution (Bardi, Ugo. 2011).*

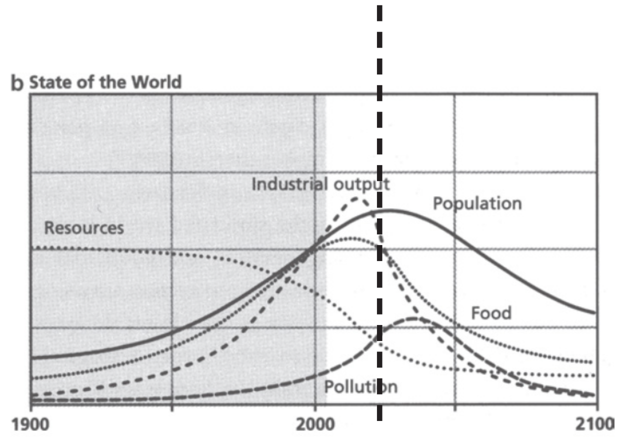


Fig. 6. *Simulation assuming resources on earth are finite (Bardi, Ugo. 2011).*

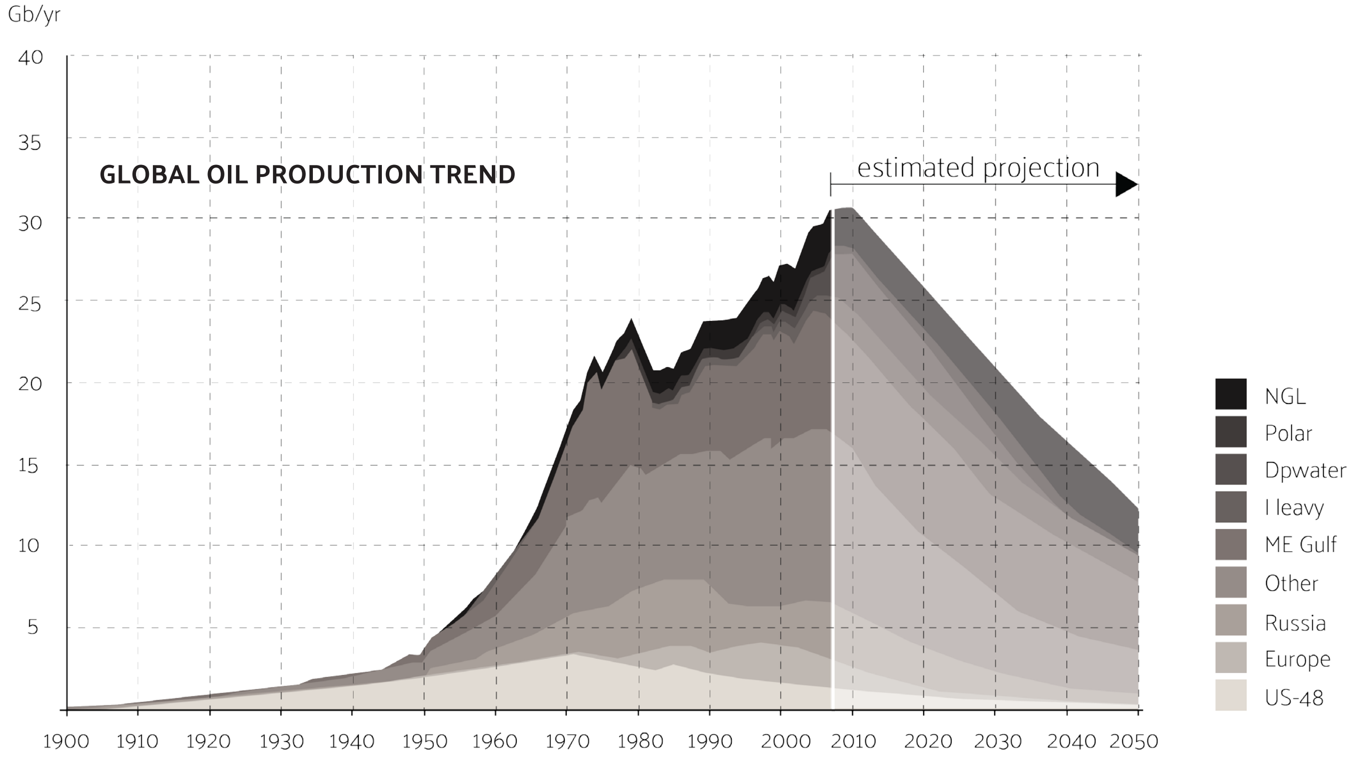
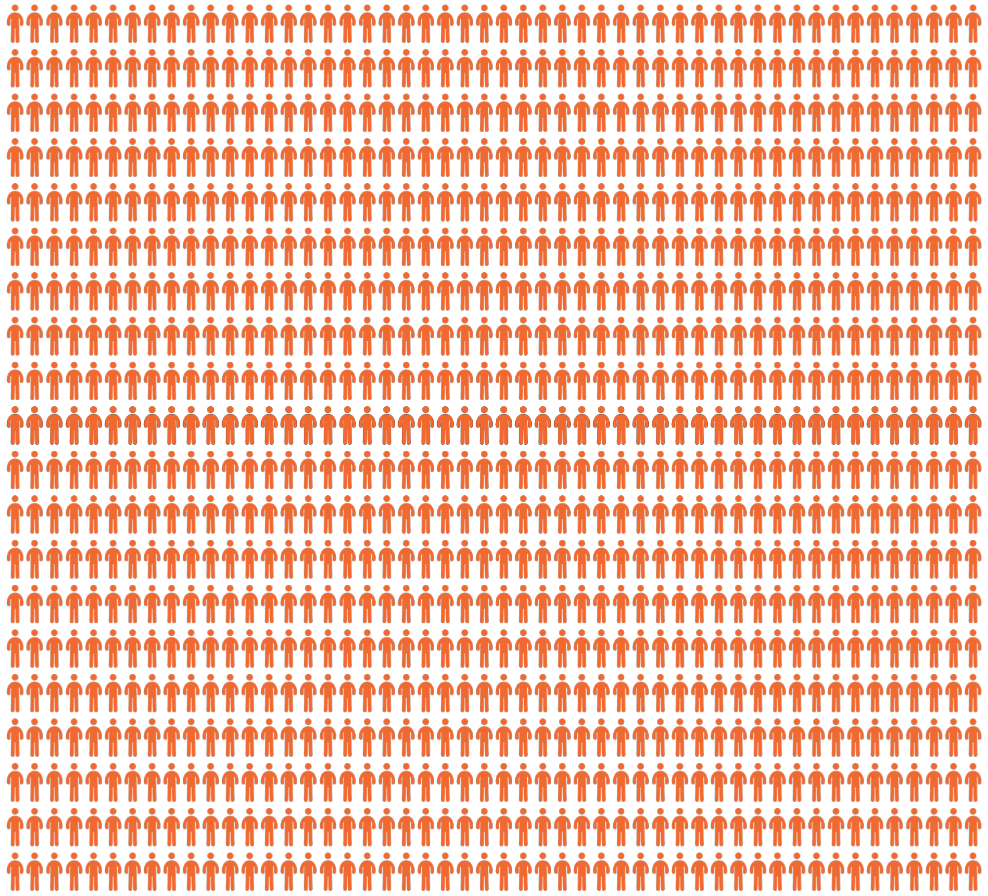


Fig. 7. *Global Oil Production Trend and forecast. Graph after (ASPO Newsletter 89, 2008)*

100 fossil-powered machines

....has added the equivalent labour-power to the world as the work of...

1000 humans



(Hagens, 2022).

TRANSPORTATION & SUPPLY CHAINS

The UN has reported that the global transport sector is reliant on petroleum fuels (oil) to 95% and the sector alone is responsible for 23% of GHG-emissions (Khan Ribiero et al. 2007). The dependence on oil is according to global-strategy analyst Peter Zeihan (2022), these long-distance and complex supply chains are likely to have reached a turning point. He means that, up until now, manufacturing and shipping has been increasingly globalized (Zeihan, 2022). However, this trend seems to be changing due to multiple and complex factors such as;

1) The Covid-19 pandemic (2019 – 2022)
; which has caused factories to shut down resulting in supply chain disruptions. These disruptions have thrown the entire system off-balance since it depends on continuous and plan-able flows of goods. This is believed to have caused (and gotten worsened) by 2).

2) The shipping container crisis (UNCTAD, 2021),
; which came into being when lockdowns across different countries left empty containers and freights in unexpected places due to an insufficent reliable workforce globally. These lockdowns also created production standstills of many crutial components for the functioning of the modern global financial system.

3) The Russian-Ukraine war (Feb 2022 – now)
; which has great impacts on the world energy markets due to the fact that Russia is the 3rd largest producer of oil in the world (Sönnichsen, 2022). Both countries are top producers of wheat (3rd, Russia and 8th, Ukraine) (World Population Review, 2022). Wheat is one of the 5 staple crops which feeds the world in today's industrial agricultural system (Zeihan, 2022).This war contributes to the worsening of:

4) The Food crisis & (energy-crisis)
; which strikes every country of the world differently because of trade exports/imports of produce, and agricultural inputs such as fertilizers, herbicides and pesticides (Zeihan, 2022). Another contributing factor is crop failures due to climatic factors such as droughts as can be seen across several major producing countries. This crisis will lead to increased hunger in many parts of the world, and increased food prices globally because of scarcity (The World Bank, 2022). Spiking energy prices worsens this crisis.

"Energy decent is a process whereby a society either voluntarily or involuntarily reduces its total energy consumption"

CO^2 embedded in trade

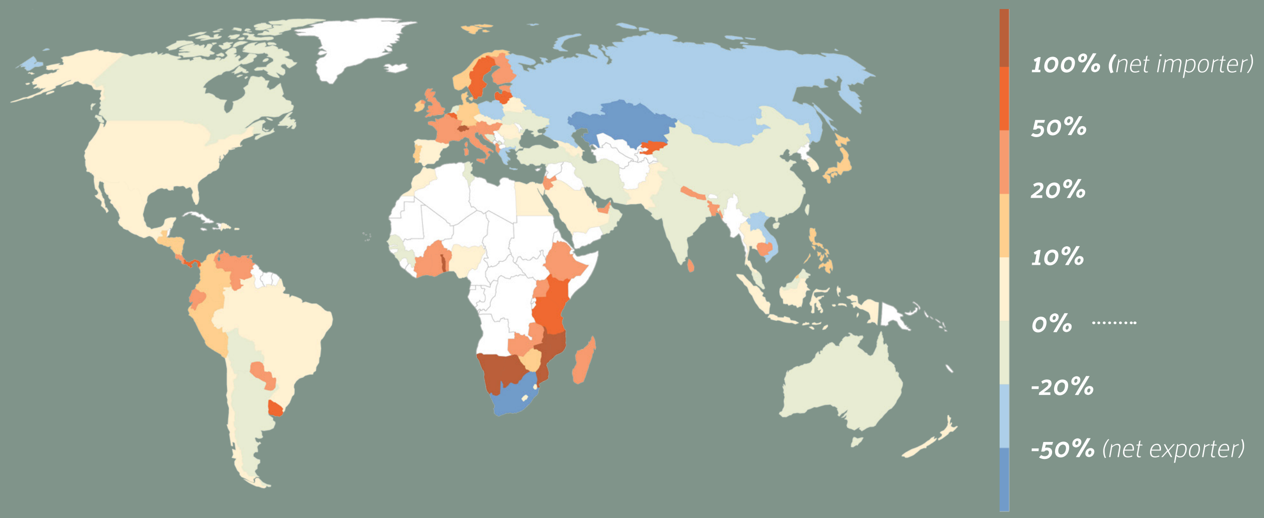


Fig. 8. Global CO2 emissions embedded in trade per country (OurWorldInData.org, 2019).

ecological efficiency of development

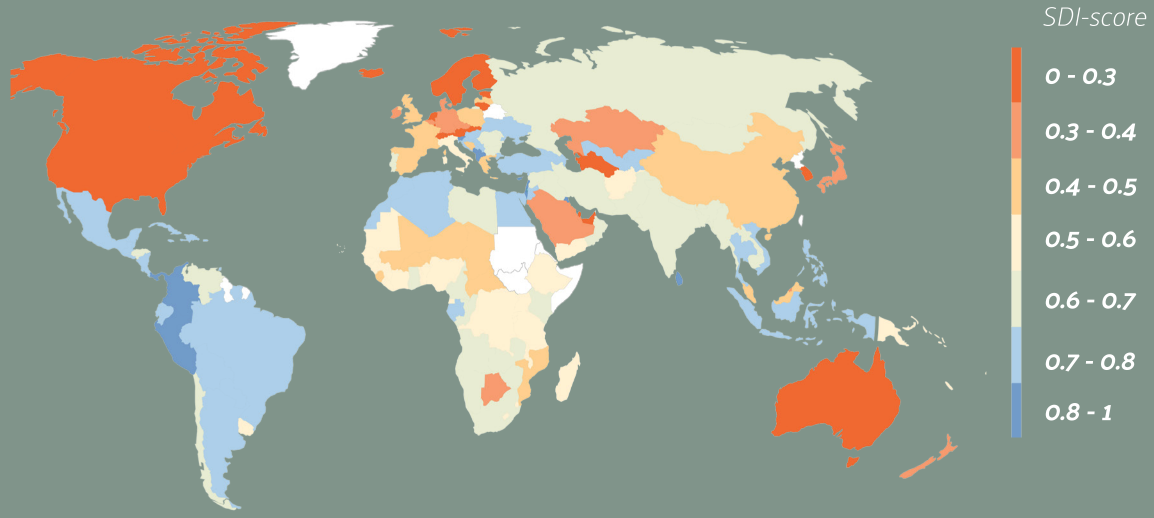


Fig. 9. Ecological efficiency of human development (SDI, 2019) .

impacts on food security

Continued deforestation and intense-fossil-fuel dependent agriculture will make it significantly harder to adjust to the changes in the planets heating climate. These practices lead to land degradation, which has been the key factor of starvation and civilization-collapse since the dawn of agrarianism. Land degradation is today a global issue, impacting food security across the planet, and is driven by unsustainable actions and practices on local levels (EU-Pressmeddelande; Montgomery, 2007). Since fertile soils i.e high percentage of organic matter/ humus, water holding capacity and good soil structure takes time to form, while coventional agi-scapes tend to require larger amounts of external inputs such as chemical fertilizer and energy-intensive labor (Johansson, 2005).

An industrial energy-decent is probable- in order to keep us fed we must change our ways of producing food away from degraded landscapes. A conclusion reached by Lorentzon et al. (2013) stated that if the inputs of oil decreases 50-75% in Sweden, a starvation situation could arise because of the fall of primary production in the agricultural sector (Lorentzon et al. 2013). With potentially decreasing yields in crisis-faced present day agriculture, more arable land would be needed to produce the same quantities of grains, yet again shining light upon the importance of protecting agricultural lands from exploitation as a national concern (Eriksson, 2018; Jordbruksverket, 2013). Depending on how a crisis unfolds and how long it would last, such as a long-term energy-shortage, different actions are needed to adapt for almost all types of modern farming operations since present day conventional and organic farming are reliant on external inputs in various ways.

The steps towards increasing food security and system resilience is to become more self-sufficient (or co-sufficient) in the inputs such as fertilizer (committing to organic manure and compost), seeds and labor (Eriksson, 2018). There should also be greater involvement of the public in agricultural issues in order to create broader understanding how food is, and can be, produced and how important arable land is for food security (Jordbruksverket, 2013). Lastly, shifting to restoration agriculture and agroforestry systems could in the long term reduce negative impacts caused by industrial agriculture while producing more food in less space (Sheppard, 2013).

	discovered issues	challenges to face
ENERGY	oil and fossil-fuels powers all of our daily needs	Shift away from fossil-fuel and high-energy dependence
	energy demand will increase, but supply will decrease	collaborate
	industrial activity and the mindset of growth overexploits the planet	finding or re-discovering alternative souces of energy
	supply-chains are too long and complex, and thereby fragile	strenghen local supply chains
ENVIRONMENT	industrial agriculture is heavily dependent on chemical inputs	cylce nutrients locally - composting
	the planet is getting hotter, and boundaries has been crossed	restore landscapes with perennial vegetation
	monocultures and intense farming destroys arable land	restore the disrupted water cycles
	biodiversity is rapidly declining because of land-use change	integrate biodiversity with human-used spaces
SOCIAL	social isolation	community & re-establish commons
	injustice	participation to learn and connect
	knowledge-gap	education to comprehend
	space avaliability?	finding spaces to grow!

WHERE?

LOCAL

potential outcomes to aim for

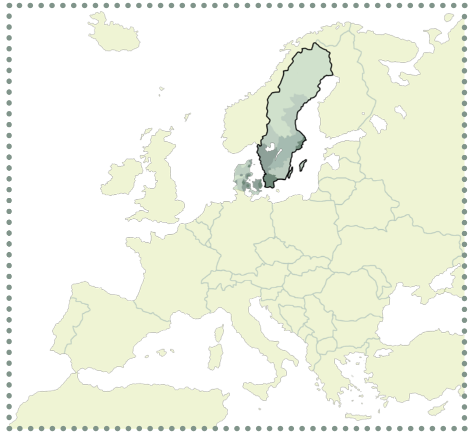
02.

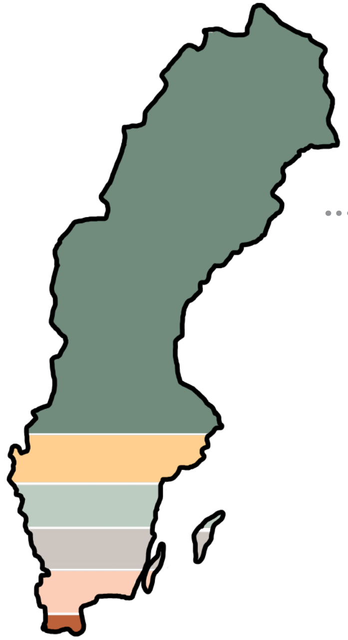
the site

- between forest and food

large scale analysis - sweden

Sweden is located in northern Europe, along with the other Nordic countries. It is the most populous in the region with 10.3 million inhabitants (Denmark 5.8 million; Finland 5.5 million; Norway 5.5 million; Iceland 345 000 and Greenland 56 000) (World Population Review, 2022). Across the Baltic sea, other neighbors include Russia, Estonia, Latvia, Lithuania, Poland and Germany. Within its borders, Sweden's most populous areas include the Stockholm and Scania regions (visual to the right). 87% of the Swedish population live in urban areas in 2021 (Statista, 2022).





LAND-USE

69 % FOREST

8 % FARMING

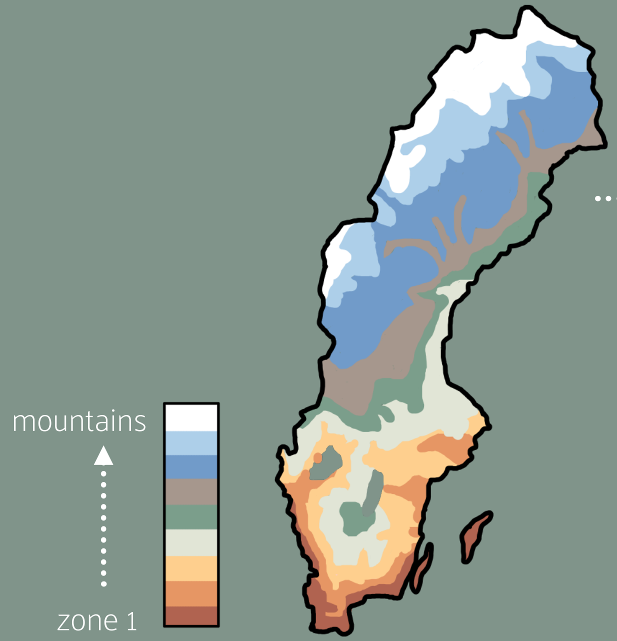
8 % GRASSLAND

7 % MIRE

5 % MOUNTAINS & OTHER LAND

3 % BUILT ENVIRONMENT

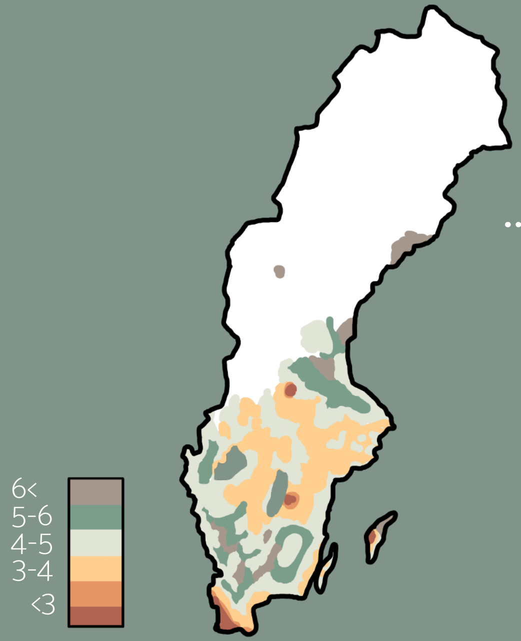
Map based on statistics from 'Markanvänding i Sverige' by SCB, 2015.



VEGETATION HARDINESS ZONES

Vegetation hardiness roughly determens which species, or varieties within species that can tolerate/thrive in a certain climate. These climates are determened by several factors such as annual temperature-ranges and light conditions. Along the coasts and southern parts of Sweden, the zones are generally 1-2 which means that more species of trees can potentially grow there, even continental ones. However, these zones are estimates- zone 1 can be recreated in zone 5 if provided with the right microclimactic conditions. Furthermore this map may change as the climate changes and mean temperatures rise.

Map based on 'Zonkarta- växtzon' by Riksförbundet Svensk Trädgård.



HUMUS IN SOILS (%)

Humus is a part of the soil which contains organic matter, which consists of decomposed or partly decomposed organisms as plants and animals. This soil layer tends to hold many of the essential nutrients for plant growth, making it and important factor in agriculture. Humus also balances soil, holding water in sandy soils while aggregating hevy clay soils. Unfortunately, the humus in topsoils are eroding when exposed to distrubance (plowing) and the weather as winds and rainfall. A standard maker for humus in soils is around 3-4 %. The south-west parts of Skåne, whichis heavlily farmed, has less than 3%.

Map based on 'Mullhalt i matjorden' by SLU, 2015.

SKÅNE - SWEDENS GRAIN BASKET

Skåne lies in the borderlands between two bioregions – the forested Sweden in the north and the agricultural plains in Denmark in the west and Germany in the south. This unique location is an important edge-zone for Sweden since up to 50% of all domestic agricultural produce is grown there (SCB, 2015). The Region of Skåne has a large primary production of food and accounts for up to half of Swedish agricultural production. Its soils have been recognized as among the best agricultural soils in the world, making it an even more important region for future food security.

Since Sweden entered the EU in 1995, the Swedish (and thereby also scanian) agricultural production has dropped below 50% and has been replaced by increased import (Region Skåne, 2017).

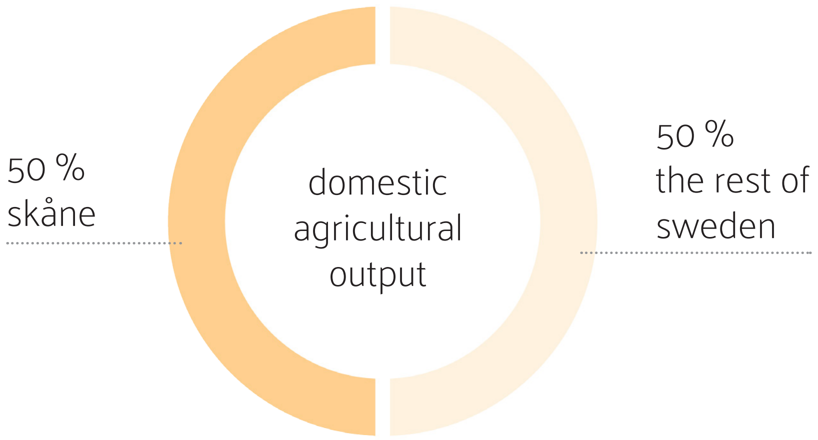
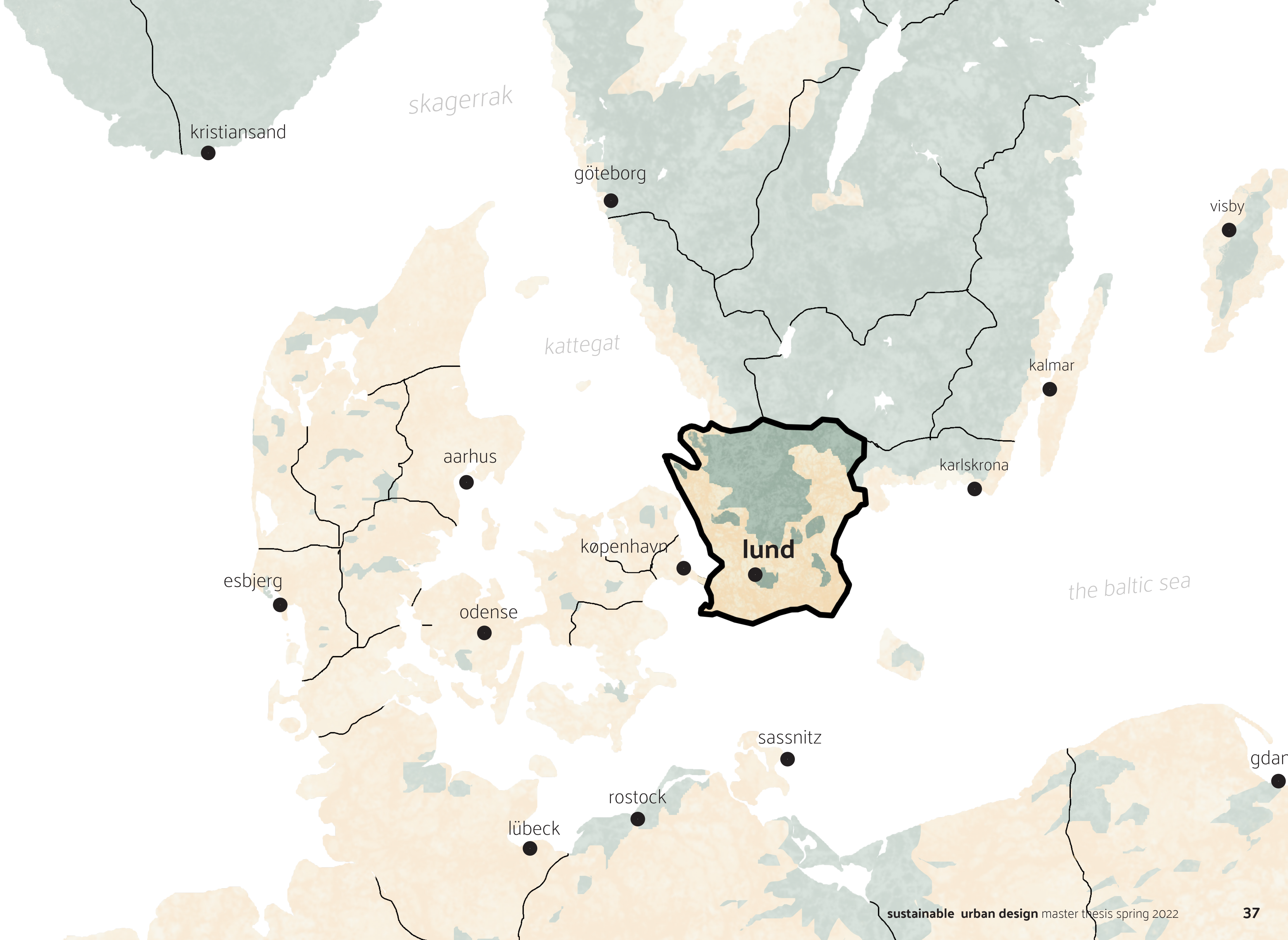


Diagram based on statistics from 'Markanvänding i Sverige' by SCB, 2015.



biodiversity loss

In Scania, intensification of industrial agriculture, urban expansion and abandonment of grazed and traditionally managed grasslands have caused habitats to be fragmented for species of butterflies, birds and bees. Land conversion as previously mentioned with the added changes in land-management drives the local losses of biodiversity. To reverse this trend, pastures and grasslands must be restored and maintained, perhaps in traditional manners, in favor of diversity in ecosystems, species and genes (Naturvårdsverket, 2020). The Regions of Scania and Hallandia have the highest yielding agricultural fields of Sweden, but have historically been exploiting them for urban expansion due to a combination of factors such as lack of other available space and lack of policy. The most extensive urban exploitation of agricultural lands occurred in the time of 1960-1985 (Jordbruksverket, 2013).

Tyto alba

Pontia edusa

47 ENDANGERED SPECIES IN THE AGRICULTURAL LANDSCAPE OF SKÅNE

Source: SLU Artdatabanken (2022).

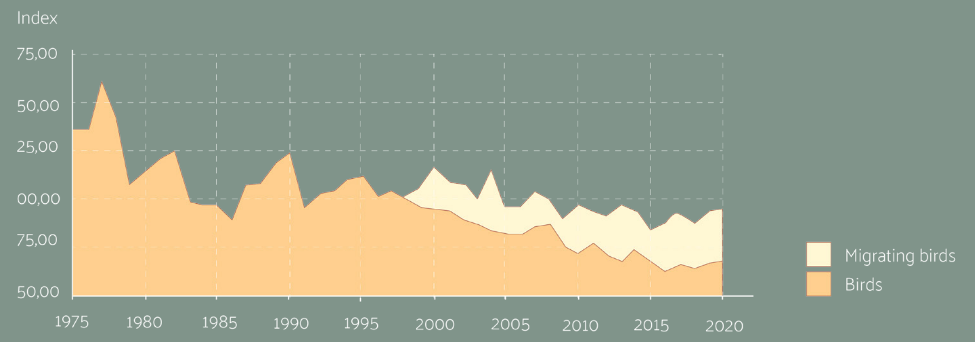
blåklintsplattmal
klätt
sydlig toffelmossa
fjällgås
kamomillkulla
spädnarv
klubbfibbla
smal sågmossa
renlosta
brinklosta
råglosta
stor silverbryum
fjälluggla
sydlig ladlav
grå ladlav
svart penningörtsvivel
östersjömålla
grönfink
vit stork
ängshök
silverstreckad säckmal
kornsparv
ortolansparv
mjölfly

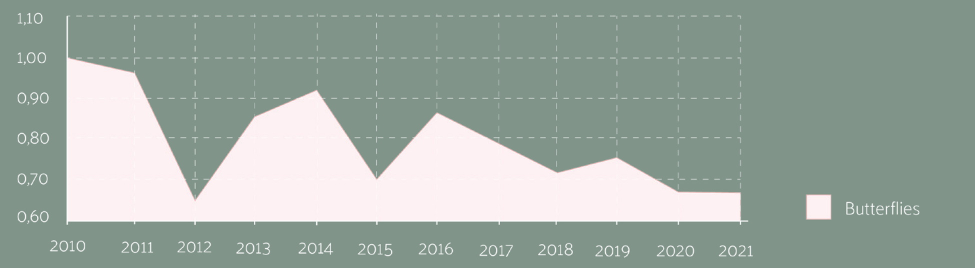
Agonopterix laterella
Agrostemma githago
Aloina ambigua
Anser erythropus
Anthemis cotula
Arenaria leptoclados
Arnoseris minima
Atrichum angustatum
Bromus arvensis
Bromus commutatus
Bromus secalinus
Bryum funkii
Bubo scandiacus
Calicium notarisii
Calicium trachylioides
Ceutorhynchus granulicollis
Chenopodium striatiforme
Chloris chloris
Ciconia ciconia
Circus pygargus
Coleophora chalcogrammella
Emberiza calandra
Emberiza hortulana
Eublemma minutata

skärblad
grusnejlika
platt frölöpare
dvärgjohannesört
spjutsporre
piggfrö
rödspov
grå puckelmätare

brun glada
korndådra
storspov
åkerkullaspetsvivel
kortbladig sylmossa
grönfläckig vitfjäril
åkerskallra
dvärgrosettmossa
sandnörel
nålkörvel
tornuggla
ölandskungsljus
alvarveronika
kortskaftad krusmossa

Falcaria vulgaris
Gypsophila muralis
Harpalus hirtipes
Hypericum humifusum
Kickxia elatine
Lappula squarrosa
Limosa limosa
Lithostege griseata
Meligethes serripes
Milvus migrans
Neslia paniculata
Numenius arquata
Omphalapion laevigatum
Pleuridium acuminatum
Pontia edusa
Rhinanthus angustifolius subsp. apterus
Riccia warnstorfii
Sabulina viscosa
Scandix pecten-veneris
Tyto alba
Verbascum densiflorum
Veronica praecox
Weissia rostellata

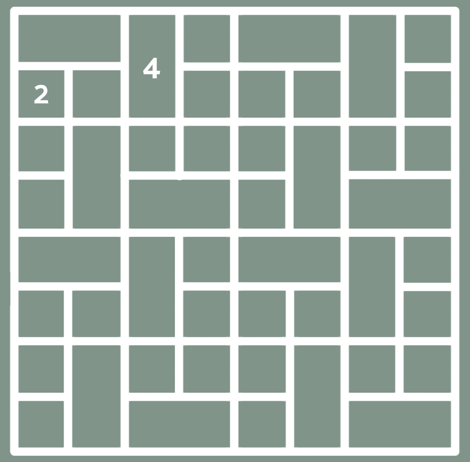




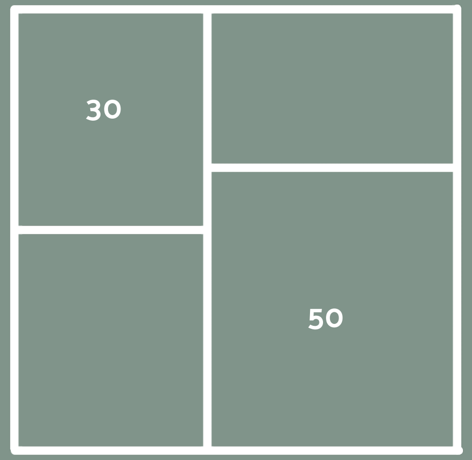
The agricultural landscapes have historically provided a diverse set of habitats for various types of wildlife. Populations of indicator-species as birds and butterflies are on a declining trend since almost 50 years ago.

One of the main drivers is habitat loss. This means that the nesting grounds and homes of these animals dissappear when farming is intensified or edge-zones cleared. (Sveriges Miljömål, 2022)

1960s (ha)



2020s (ha)

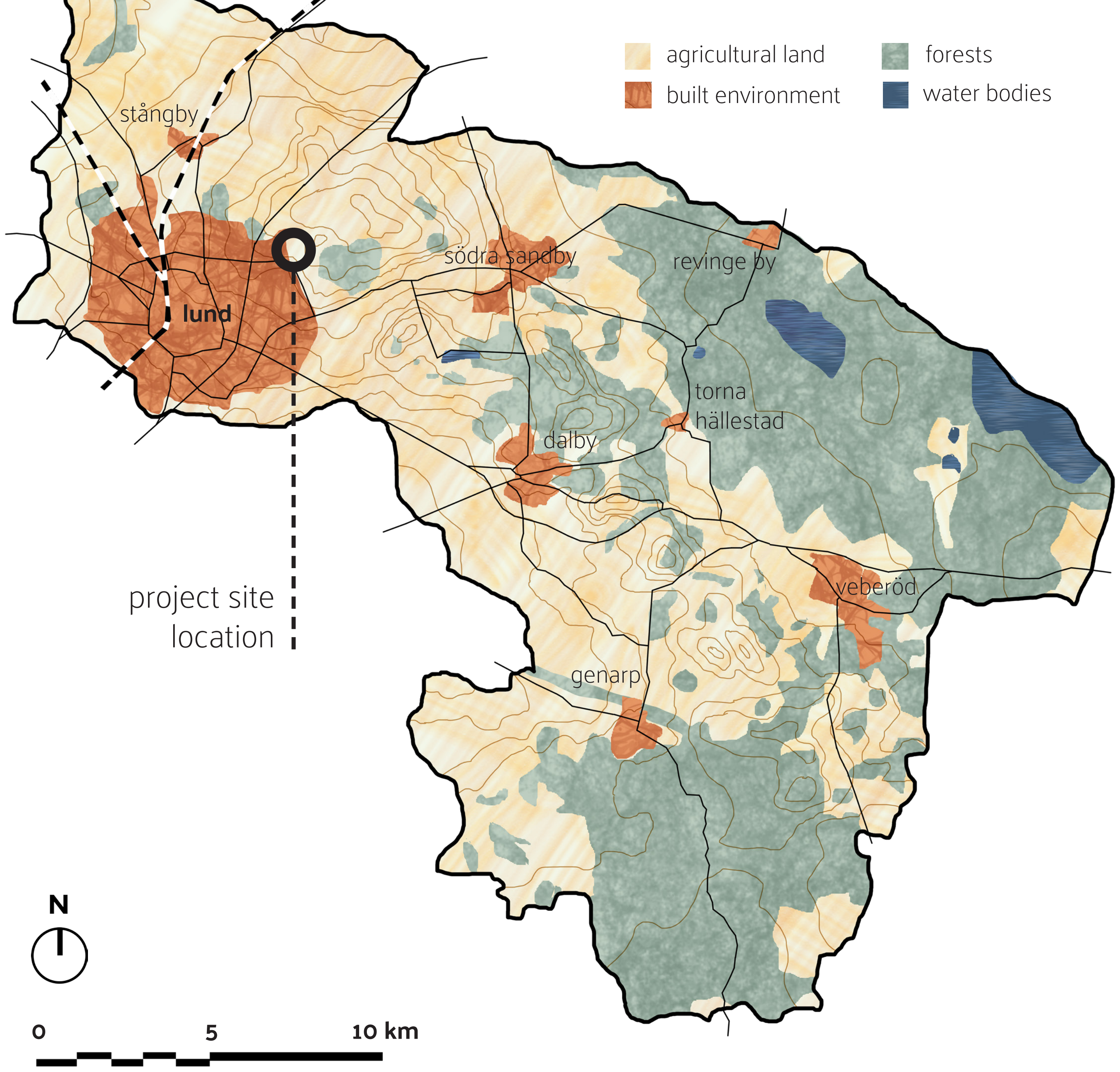


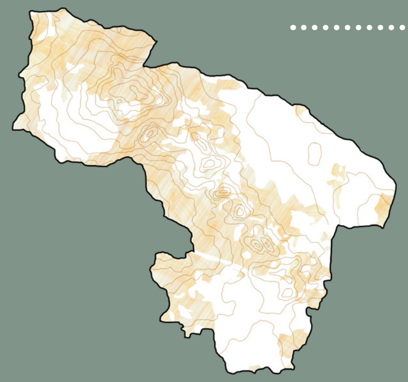
FIELD SIZE TREND

A trend of increasing field sizes can be seen thoughout mappings and satelite photos of the area since the early 1900s.

In sixty years, from 1960 to 2020 the average field size has increased up to **900%** from about 2-5 hectares per field up to about 30-50 hectares.

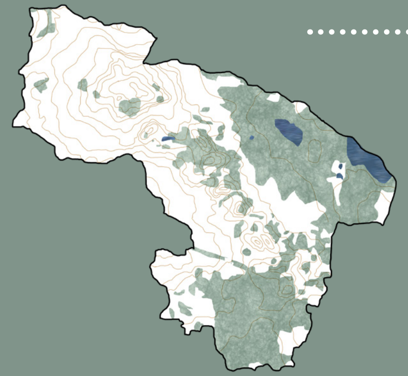
lund municipality





AGRICULTURAL PLAINS

Near 50 % of Lund municipality's area is agricultural lands producing foods. The fields are generally in the westens plains while there are some smaller in the eastern mountainous region (by romeleåsen). The soil is mostly clay-till, regarded as among the finest soils in Europe for agriculture.



DECIDIOUS FORESTS

Large areas in the eastern parts of the municiality are forested. These forests are usually decidious and consists of Beech *Fagus sylvatica*, sandy soils are housing mostly pine *Pinus sylvestris* and birch *Betula pendula*, wet valleys usually have alder *alnus glutinosa* and goat-willow *salix caprea*.

TOWNS & ROADS

Lund is the city of the municipality with the majority of all inhabitants. There are four medium sized villages: *Dalby, Södra Sandby, Veberöd and Genarp*. In the municipality, as in the rest of Skåne, you can oftentimes see brick buildings and cobblestone streets in the oldest parts of the cities /towns. This is less common further north.

***Fig. 10**. The plains of Lund (Photo by: Jorchr).*

the city of lund

The city of Lund was founded ca 990 CE on the south facing slope of Romeleåsen. In 1060, the city got the status as an *Episcopal see*, and the early cathedral was also founded around this time. Since then, strong bonds to the church, the sciences, culture and the arts has been forged. In the 1300s Lund was regarded as the most importat city in Denmark. The city has been fought over at several occations, most known is *The Battle of Lund* which had part in Skåne becoming Swedish.

Today, Lund is a vibrant, medium-sized university city with global reputation. The city centre have many historical urban features such as buildings, streets and parks. Many of which has an connection to the church or the university. A significant part of Lunds population are in fact students of *Lund University*.

50,5 % - 49,5 %
(2022)

94 983
(2022)

Universitetshuset - the University Building

Domkyrkan - the catherdral

Old town - streets in the old parts of Lund

UNIVERSITY CITY

Lund University was founded in 1666, just as Skåne became swedish. In its 350 years-old history, the universiy has grown from a small local academy to a large world-leading and internationally esteemed university. As of 2022 it ranks:

1st in Sweden (of 39)

20th in Europe (of 2 785)

26th in Nutrition and Food science (of 1 514)

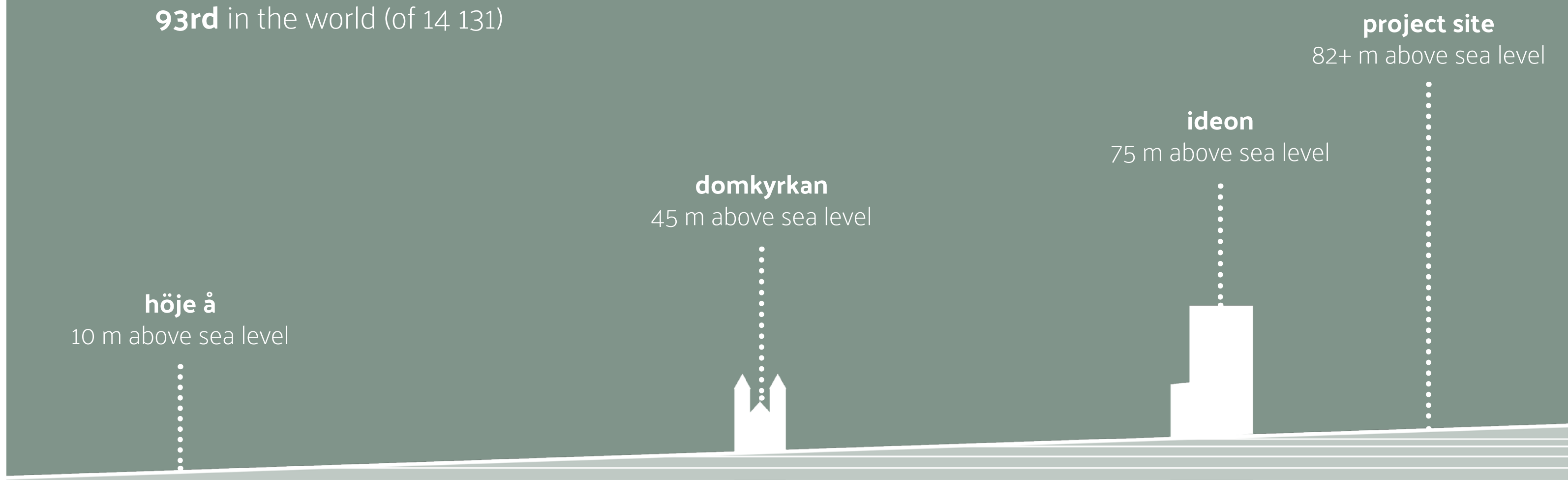
93rd in the world (of 14 131)

KNOWLEDGE CITY

Along with the Universiy-city comes knowledge. Actually, even before that, the cathedral and bishops were gathering and sharing information about inventions, medicins and plant-uses hundreds of years prior to the founding of the university. The spirit of knowledge is ingained to the city of Lund. As of 2022, the research and innovation in Lund is world leading in many fields- such as medicin.

GARDEN CITY

Further, Lund is among the greenest cities in Skåne, having plentiful of parks, green neighbourhood pathways and residential areas with gardens. The three major central parks include *Stadsparken, Botaniska trädgården, Norra Kyrkogården* and *Sankt Hans Backar.*

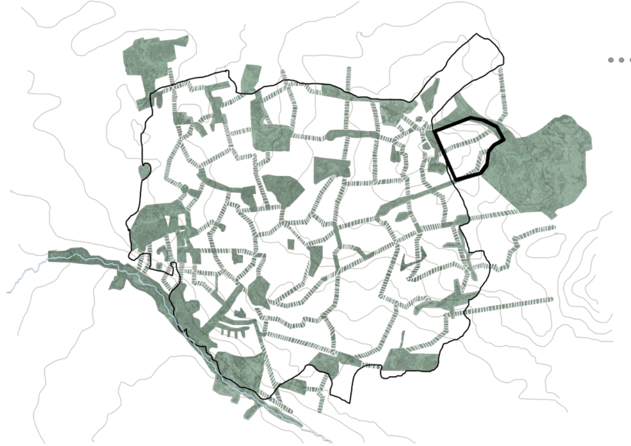


KUNSKAPSSTRÅKET

Kunskapsstråket is a conceptual pathway stretching from the city centre of Lund to the research facilities ESS and MAX IV and the *Brunnshög* urban development project. A tramline is also connecting the city centreto Brunnshög along this line, with a commute for about 15 minutes one way. *Kunskapsstråket* translates to "*the knowledge path*", which becomes clear since it crosses the university hospital, the university and of course ESS/ MAX IV.

FOOD PRODUCTION

The city of Lund has approximately 18 sites for alotment gardening /urban farming (red dots in the map to the left). The majority of those are situated in the south-west part of Lund. Gaining access to places to grow food coud therefore be challenging if you happen to live in an apartment in the north-eastern parts of Lund.

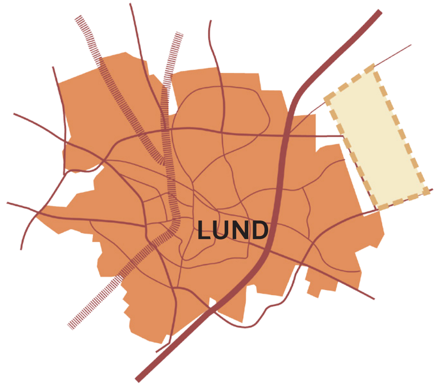


GREEN NETWORK

Lund has a unique network of green pathways which usually align with the bike network between different parts of the city. These pathways connect parks and other areas for recreation and activity, are owned by the municipality. Some of them already have fruit-and nut trees avaliable and all of them offer great oppuntunity through the lens of agroforestry and food security.

feeding lund: space estimate study*

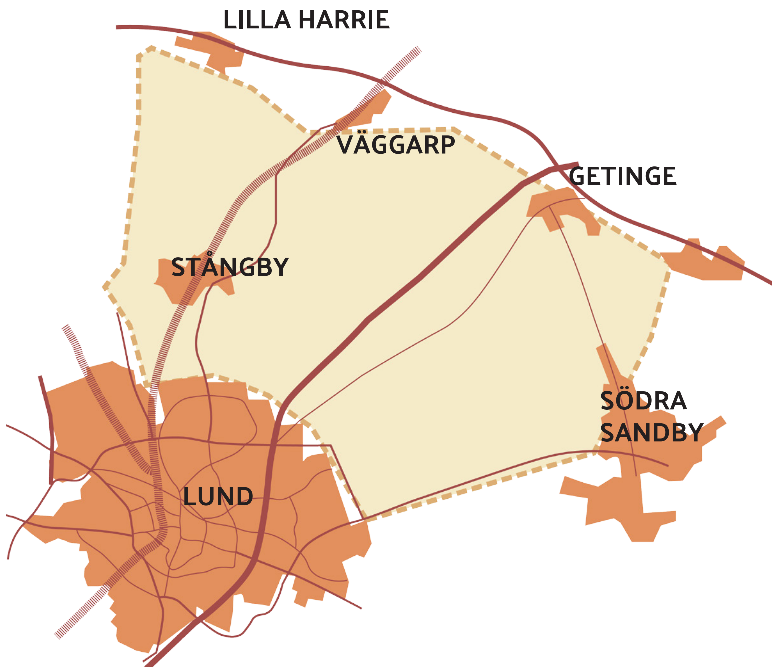
*Approximate numbers from (Swanson, 2020)



SURVIVAL DIET

3 km² — **30 m² / person**, *94 000 people*

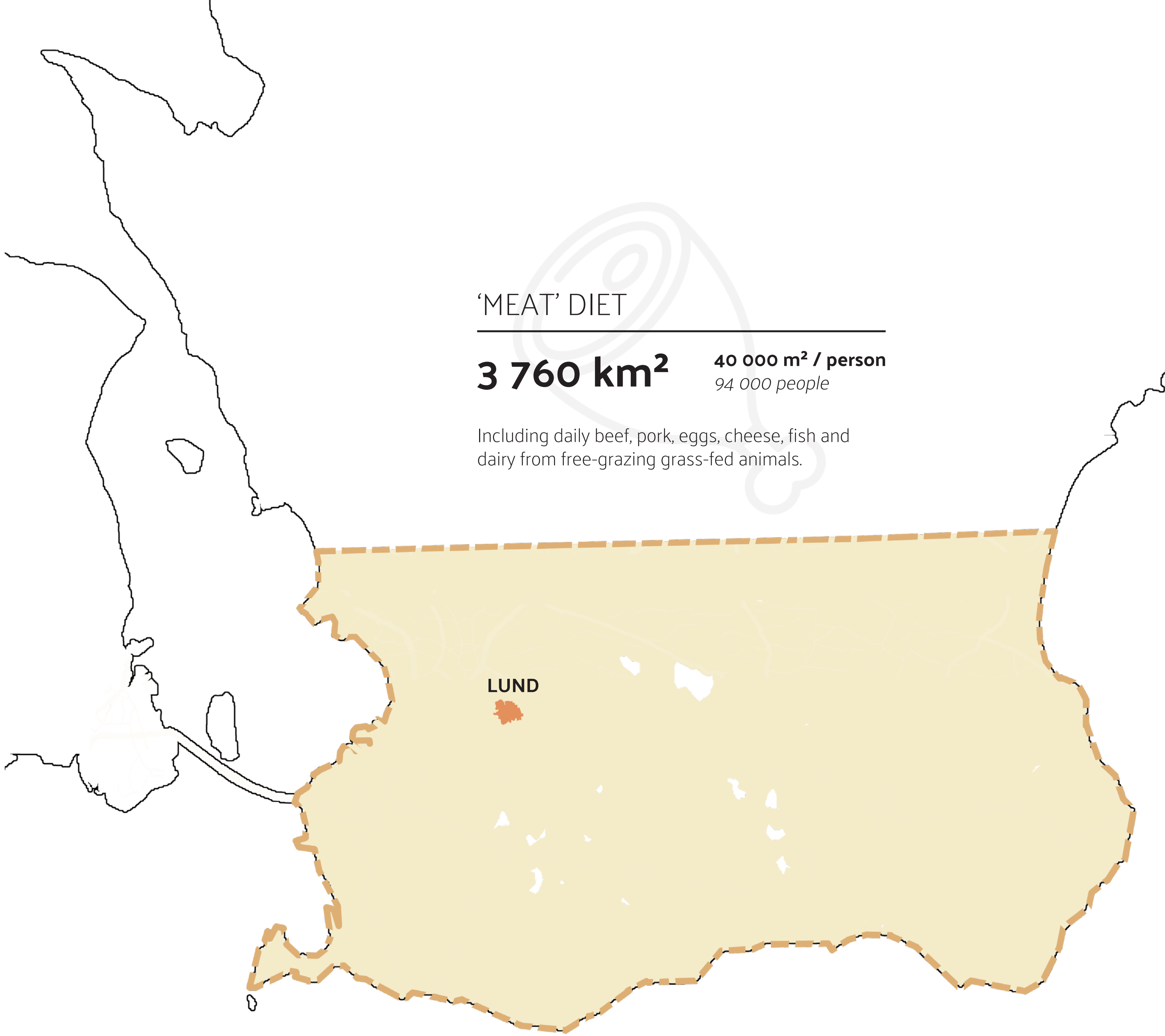
Intensive small scale farming of claorie-rich foods such as potatoes, pumpkins
Population on the brink of starvation.



VEGETARIAN DIET

66 km² — **700 m² / person**, *94 000 people*

Including occasional eggs, cheese, fish and dairy from free-grazing grass-fed animals.



'MEAT' DIET

3 760 km² — **40 000 m² / person**, *94 000 people*

Including daily beef, pork, eggs, cheese, fish and dairy from free-grazing grass-fed animals.

the brunnshög project & site outline

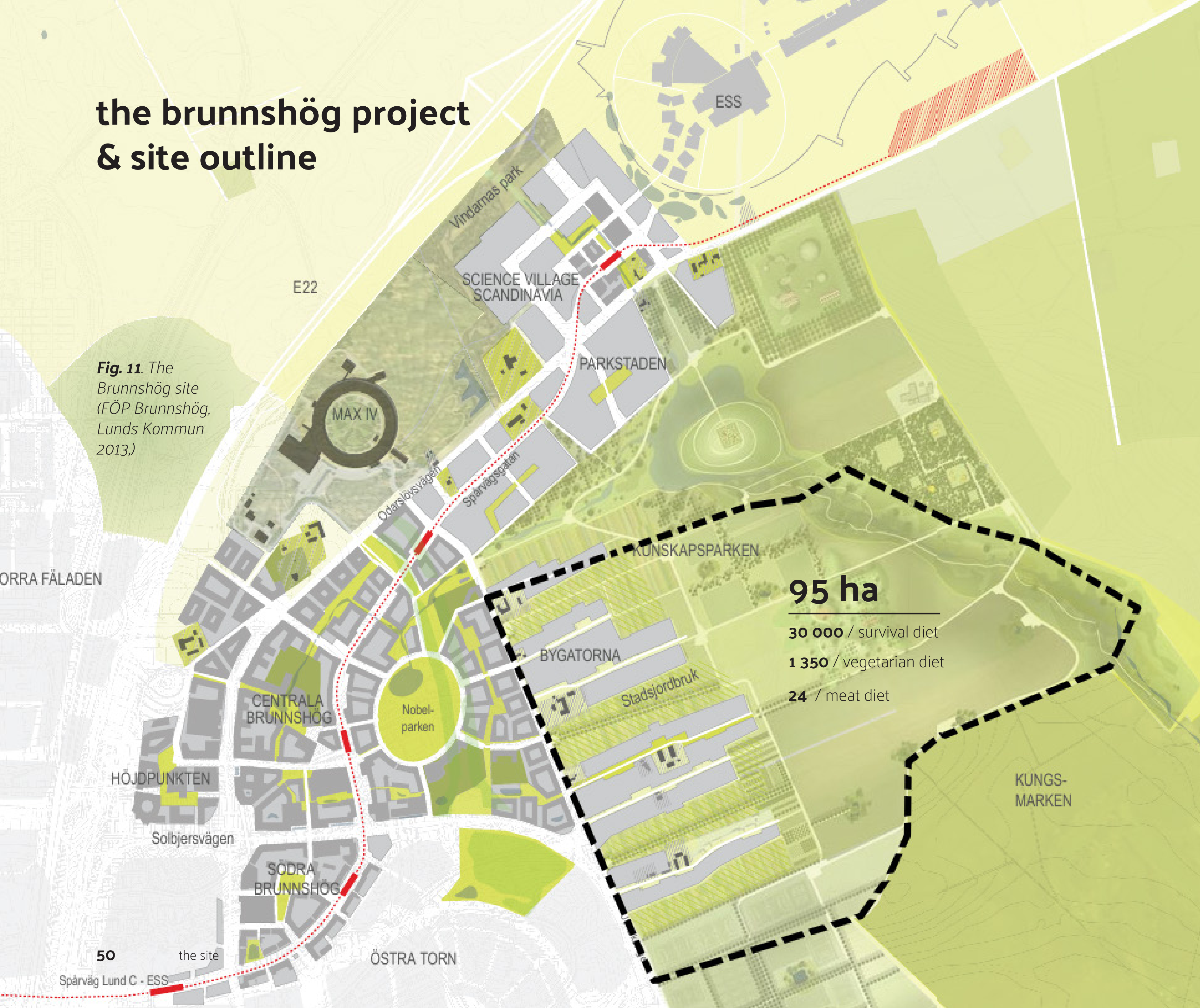


***Fig. 11**. The Brunnshög site (FÖP Brunnshög, Lunds Kommun 2013,)*

THESIS SITE & BRUNNSHÖG RELATIONSHIP

The Brunnshög urban development project is connected to the larger Copenhagen-Malmö-Lund stretch of urban development. It has recently been connected to this conceptual pathway with the tramline as a facilitator of sustainable mobility. The overwhelming majority of the site was high value agricultural lands, and the ambition of the Brunnshög project is to build dense and high to maximize the use of the space. The development is characterized by its connection to advanced research and innovation, therefore parts of the site is named Science village.

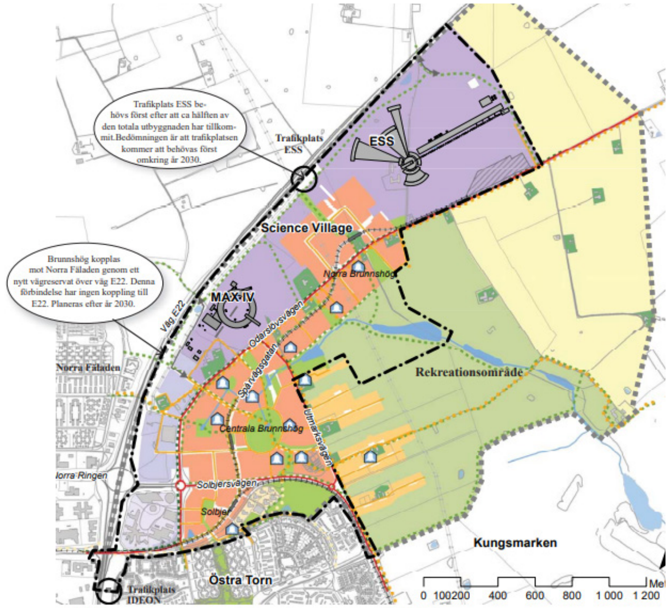


***Fig. 12** Summary of site vision for land-use in Brunnshög, within the time span 2030-2050. (FÖP Brunnshög, Lunds Kommun 2013, s.7)*

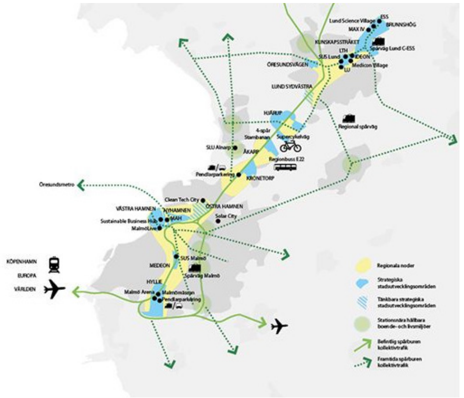


***Fig. 13**. Strategic areas for future developments. Lunds Kommuns ÖP, 2018.*

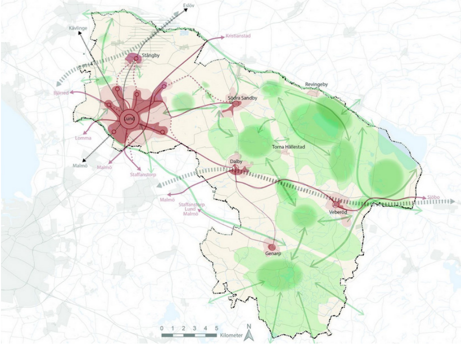
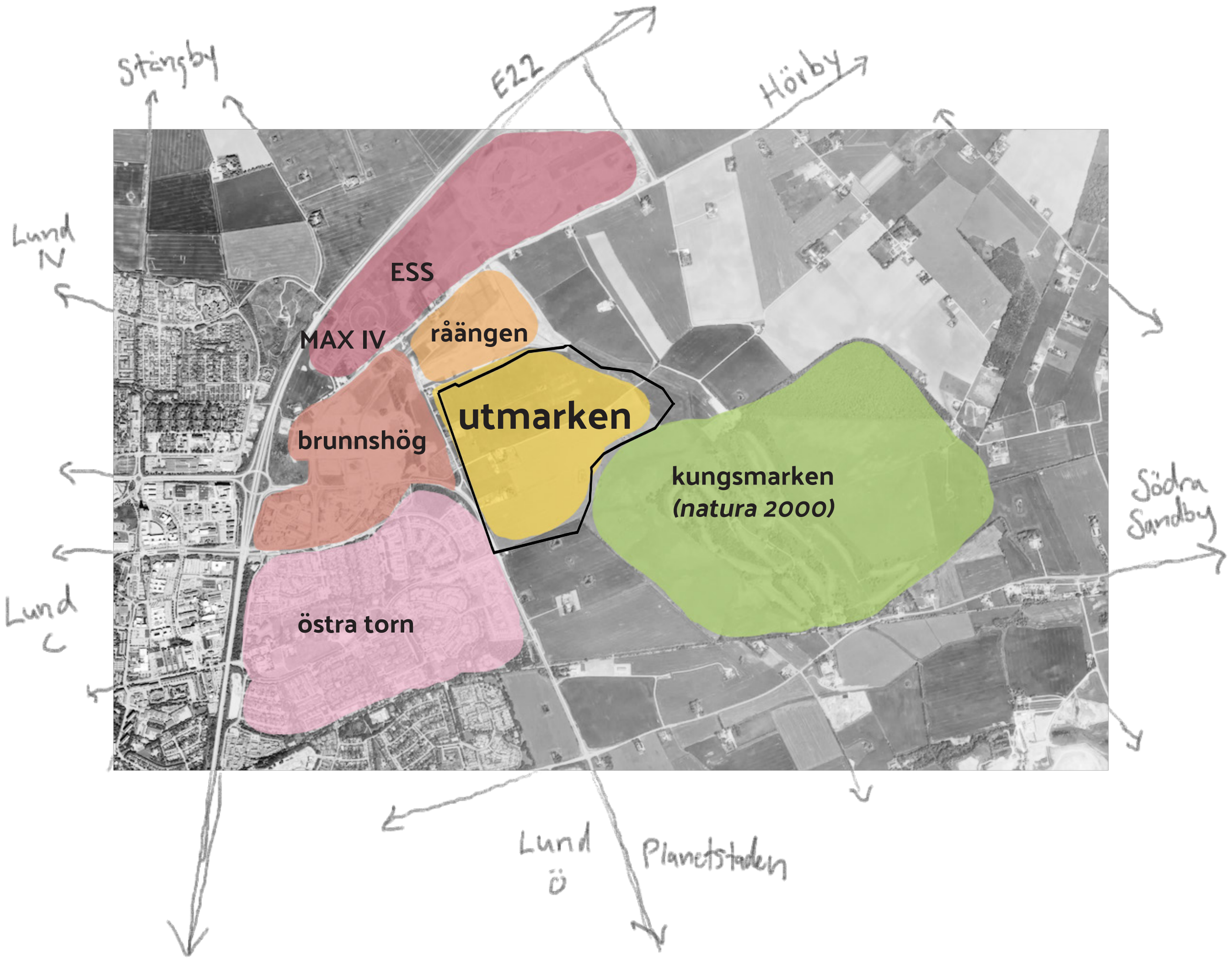


***Fig. 14**. Transit-and landscape connectivity on municipal scale. Lunds Kommuns ÖP, 2018.*

***Fig. 15**. : Vision area- the long term development and site borders in a 20-year perspective (FÖP Brunnshög, Lunds Kommun 2013, s.5)*

site context today



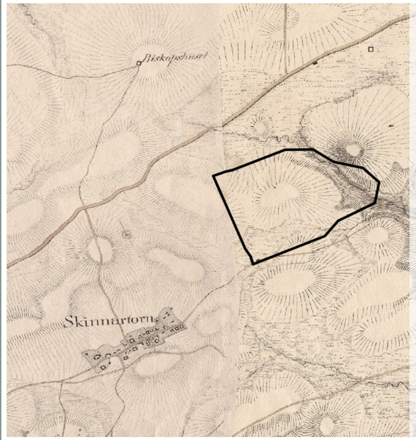
The site is located next to several urban development areas to the west. The site-name *utmarken* is proposed by me, as I see it fit both historically and at the local context (the road between Brunnshög and Utmarken is called Utmarksvägen).

FROM RURAL TO PERI-URBAN

The site is on the border between urban and rural, and located on the hilltops north-east of Lund. In the 1970s, the expansion and urban sprawl of Lund reached the proximity of the site and in the 2000s the science centers of MAX IV and ESS were established. Since the 2010s, the major ongoing urban development project Brunnshög is currently the closest urban neighbor of the site.

LUND, 1940

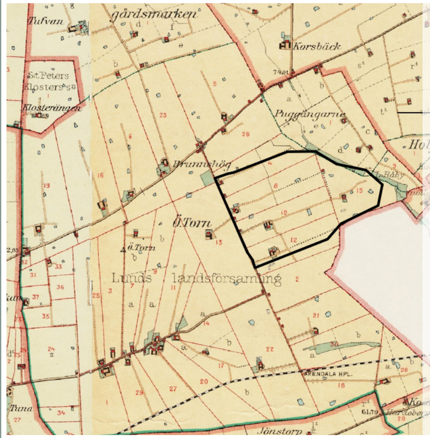
LUND 2020



1810 (map)

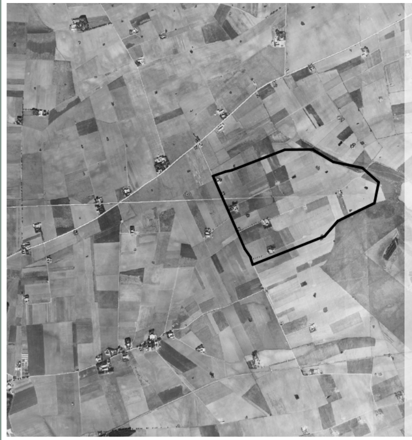
Topographical landscape mapping. Skinnartorn (Later Östra Torns by) was the closest settlement. the creek in the north-east corner is clearly visible here.

Source: Riksarkivet (through https://vattenatlas.se/)



1900 (map)
The site was rural and for agricultural production. *Östra Torns by* can be seen south west of the site.

Source: Kartrummet, Stockholm University.

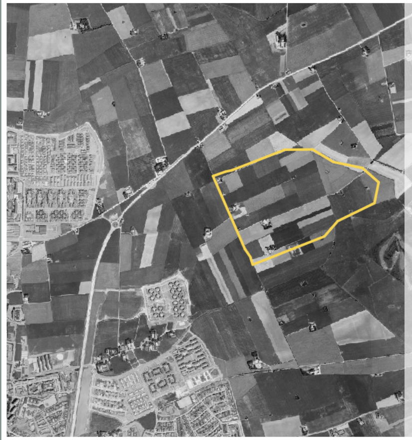


1947 (aerial photo)
First aerial photo of the site.

Source: Production: Lantmäteriet. Digitalization and distribution: GIS-centrum, Lunds University.

1960 (aerial photo)

Source: Lantmäteriet (through https://vattenatlas.se/)



1970 (aerial photo)
Lunds extensive urban expansion in the 1970s becomes a new context for the site.

Source:Lantmäteriet (through https://vattenatlas.se/)

2020 (satelite photo)
The urban expansion project *Brunnshög* is being constructed west of the site. The agrucultural fields are significantly larger than previously.

Source:Mapbox (through https://vattenatlas.se/)

roads
(by size)

urban development
private property (existing)
agricultural land

river valley
park / recreation
stream

märgelgrav
park / recreation

today: site analysis

The site is put to agricultural use. The majority of the land is owned by Lunds Domkyrka, Svenska Kyrkan (the swedish church). It is situated near highest point in Lund, approximately 85 meters above sea level (the lowest part would be by Höje Å in the south, about 10 m above sea lev-el). This location provides nice views across the landscape, vast skies - but is also exposed to winds and droughts'.

hydrology

CLOUDBURSTS

Lund Municipality's cloudbust mapping from 2016 shows the hydrological context of the site with its surroundings. Within the site border, there are primarily two points the water will flow towards (the mid-north and the south west, see map below). The runoff water from the Brunnshög-project is planned to run to Kunskapsparken, just north of the site, and then into the stream in the eastern edge of the site.

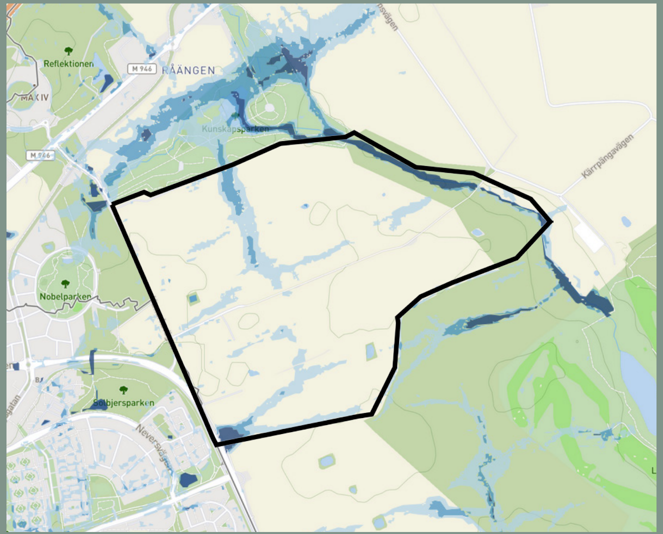
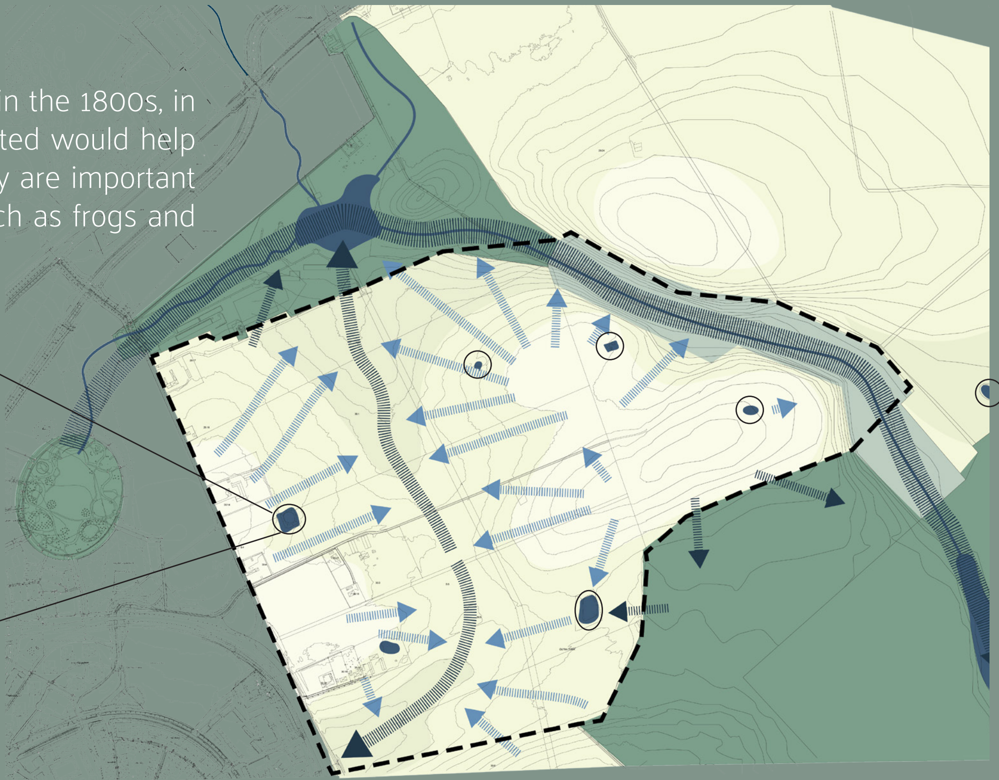


Fig. 16. Cloudburst mapping. Lunds Kommun. https://vattenatlas.se/

MÄRGELGRAVAR

These ~10x10 ponds were dug in the 1800s, in hope that the materials excavated would help improve soil fertility. Today, they are important nodes for amfibious wildlife such as frogs and toads.



KÄVLINGEÅN WATER CATCHMENT AREA

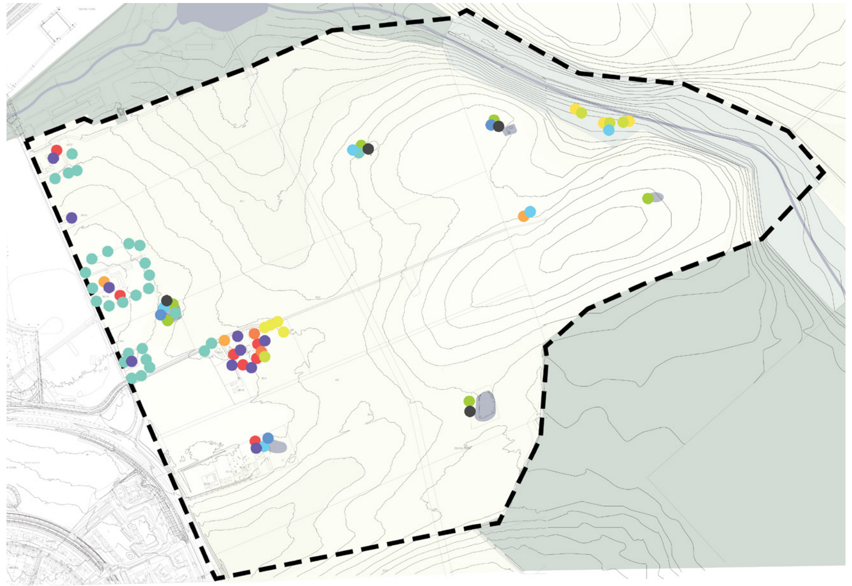
The site is located on one of the highest altitudes in the city of Lund, approximately 80-90 meters above the current sea level. In contrast to most of the city, the water catchment of this area is a part of the catchment of a river to the north of Lund called Kävlingeån instead of the south Höje å.

Fig. 17 Kävlingeån Watershed. Based on ' Avrinningsområden'. https://vattenatlas.se/ (visited 2022))

vegetation

The larger trees and bushes on site are mostly on, or close to privately owned properties or the märgelgravar in the fields. The vegetation close to the buildings are mostly garden-like with mixed native and non-native plants.

The agricultural land mostly consists of production of sugar beets, rapeseed, wheat and barley in a four-year crop rotation.



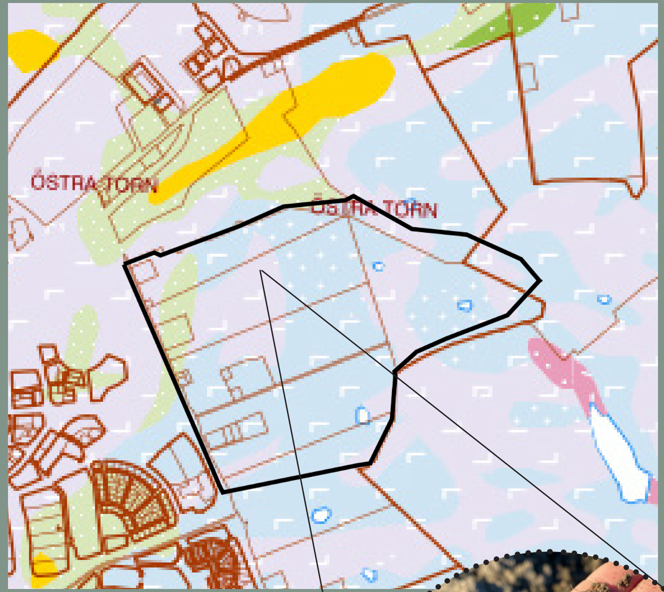
rowan
sorbus ssp.

apple
malus ssp.

willow
salix ssp.

hackberry
prunus padus

species on site	english name	latin name	edible	medicinal	wood
1.	**maple**	*Acer ssp.*			X
2.	**hazlenut**	*Corylus avellana*	X		X
3.	**horse chestnut**	*Hippocastanum aesculus*			
4.	**wild apple**	*Malus ssp.*	X		
5.	**aspen**	*Populus tremula*			X
6.	**hackberry**	*Prunus padus*	X		
7.	**blackberry**	*Rubus rubus*	X		
8.	**goat willow**	*Salix caprea*		X	
9.	**willow**	*Salix ssp.*		X	
10.	**european elder**	*Sambucus nigra*	X		
11.	**rowan**	*Sorbus acuparia*	X		
12.	**linden**	*Tilia ssp.*	X	X	X



Clay till
Lerig morän
Sandy till
Sandig morän
Fine-to heavy clay till
Fin-grovlermorän
Fine silt/sand
Fin silt-sandjord

soil (dirt)

The soil of the majority of the site is exposed to agricultural use (see more in 3.5 farmland vegetation). This soil is either clay-or sandy loam till, which indicates that the water holding / drainage capacity varies throughout the site. Clay-loam has finer aggregates that hold water while sandy loam has larger aggregates, causing water to drain more easily (Ashman & Puri, 2002). The exact extent of fertilizer-use and other inputs on this land is uncertain, however, due to the sheer size of these mono-cultures (approximately 30 – 50 hectares) there is a possibility that some inputs are required to get good yields.

The agricultural land is tilled, and has been tilled for decades. This impacts this type of land by the following: 1) It is compacted by the weight of the tractor, which especially complicates water-drainage in clay-soils. (Eldor, 2014). 2) It presumably has lower occurrences of soil life such as worms, nematodes and fungi which are essential in natural processes as for example decomposes in the carbon-cycle (Eldor, 2014).
3) It is exposed, meaning that the soil dries out quicker, becomes hard which makes it more prone to erode and less likely to have water percolating through to the ground water tables (Yeomans, 1954).

***Fig. 18**. Soil conditions. SGU Geokartan. https://apps.sgu.se/geokartan/ (visited 2022))*

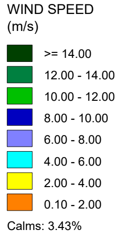
***Fig. 19.** Tilled farmland on site . March 2022.*

climate data

WIND CONDITIONS

The conditions measured by two stations near the site (Station Lund Tunavägen, and Station Gastelyckan) shows prominent winds from in the east-west directions, primarily in the summer.

Northern and southern winds appear to be unusual during all times of the year in the past 50 years.



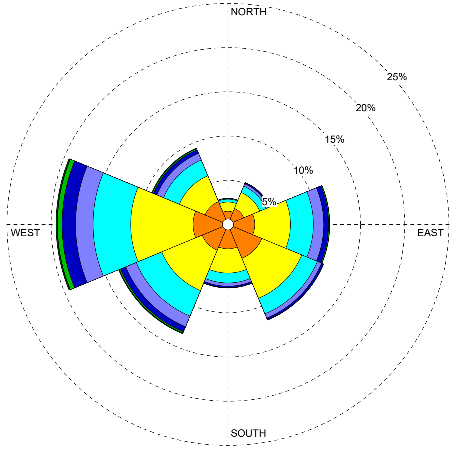


Fig. 20. *Annual wind rose (Station Lund Tunavägen 1972-1992)*

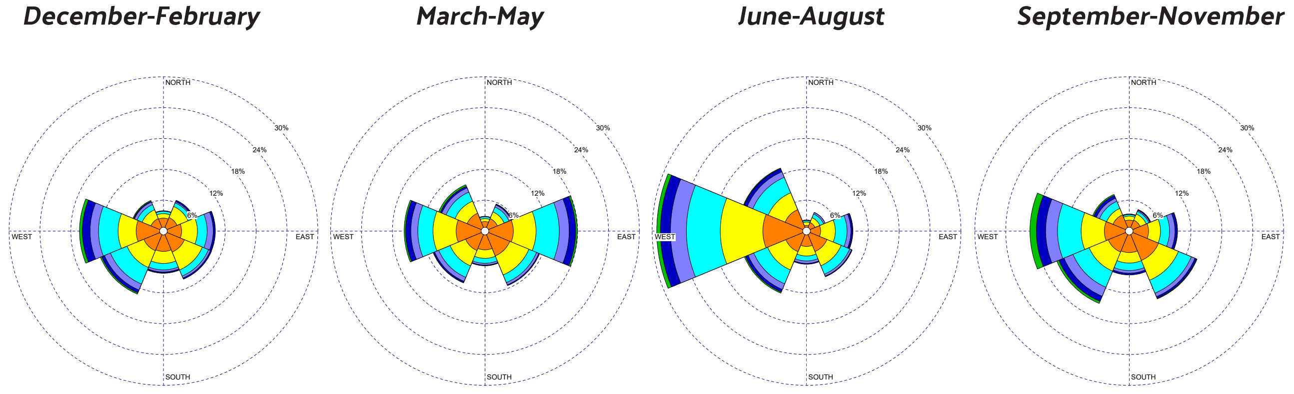
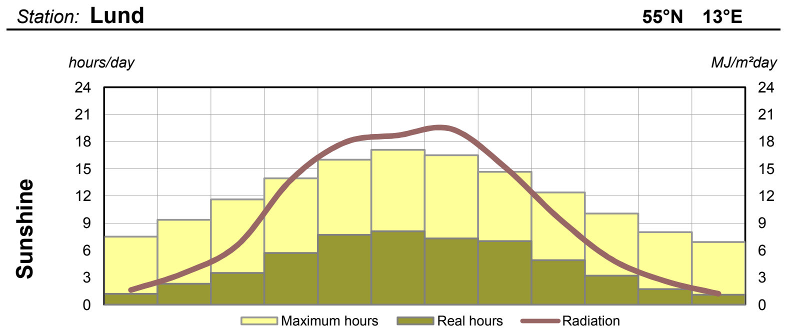


Fig. 21. *Monthly wind roses (Station Gastelyckan 1992-present day)*

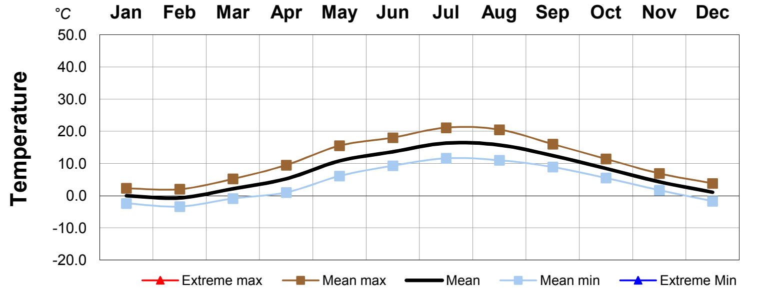
SUN

The sun-hours follows the same patterns as the nordic region with long summer days (up to 17 hours of sun) to short winter days (down to 1-3 hours of sun). This is important when planning for passive heating by the sun.



TEMPERATURE

The mean temperature is around 0 degrees celcius in the winter and 18 in the summer. However in alignment to the changing climate, summers are becoming hotter and drier. Below is the estimated change in local mean temperatures.



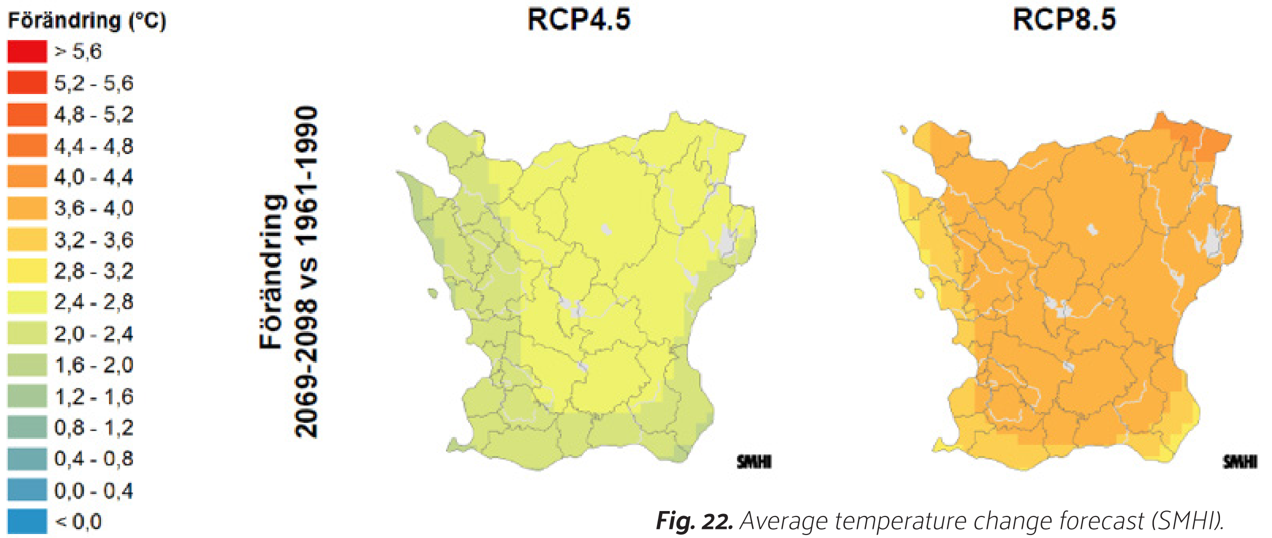
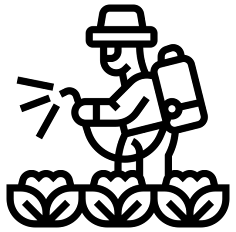


Fig. 22. *Average temperature change forecast (SMHI).*

site swot

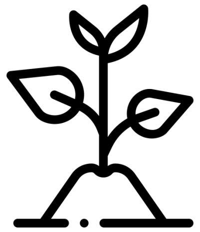
STRENGHTS

- **proximity** to Lund and Öresund
- **proximity** to natura 2000 (kungsmarken)
- **agricultural landscape**
- **hilltop** (local highpoint)
- **terrain** (sloping)
- **ownership** (Svenska Kyrkan)



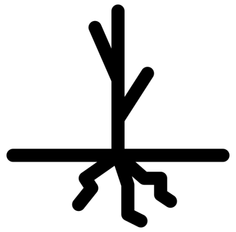
WEAKNESSES

- **tilled soil** (with low microbiota)
- **dependent** on external agricultural inputs
- **herbicides / pesticides**
- **wind exposed**
- **far away** from the city centre (uphill)



OPPURTUNITIES

- **showcase area** for sustainable food pruduction
- **soil restoration**
- **diversifyed productivity**
- **drought-proofing**
- **increased water percolation**
- **community engagement**
- **perennial production**



THREATS

- **soil erosion**
- **urban sprawl**
- **drought / heat waves**
- **biodiversity loss**
- **car- dependency**
- **“paveification”**
- **loss of agricultural productivity**

03.

design tools

- strategies for food everywhere

introducing restorative agroforestry

WHAT IS AGROFORESTRY?

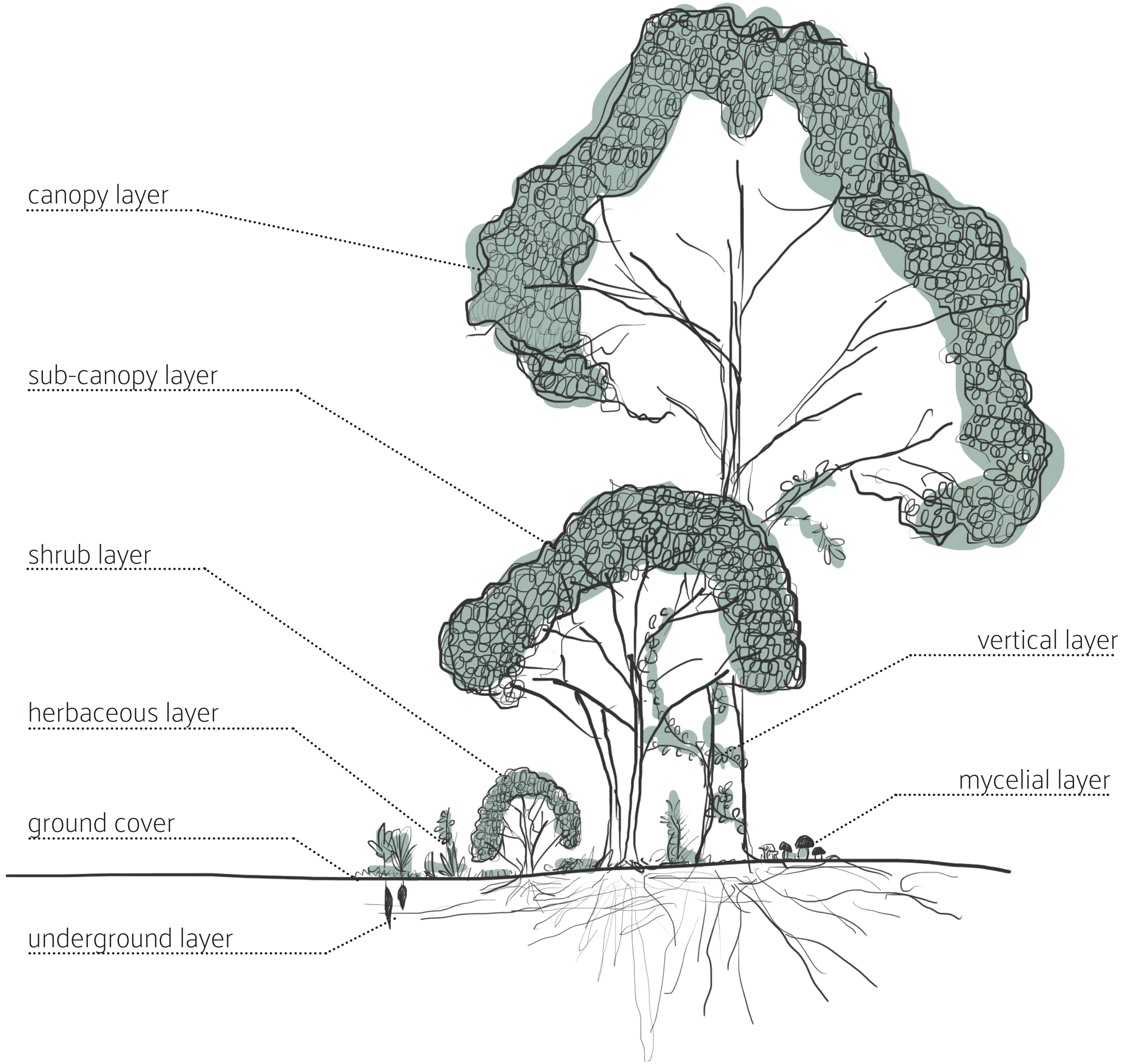
Agroforestry is the practice of planting food or other resource-bearing crops in a way that mimics the succession of forests. This is an old practice that can be traced among different cultures across the globe (Agroforestry Sverige, 2022). The huge benefit in regards to today's agricultural issues of erosion and eutrophication is that when an agroforestry system is established, it does less damage to the soil, and therefore is more resilient than modern agriculture (Sheppard, 2013).

A key concept is integrating species-diversity to food production with, for example, companion-planting. Companion planting is planting a set of different species next to one-another in order form a polyculture. These plants are usually combined to provide different functions which are beneficial to their neighbors. These functions can be accelerator, aromatic-confuser, pollinator magnet etc. (Jackie & Toensmeier, 2005). The plants included in these poly-cultures are also chosen to fit the conditions of the site and fill a niche as in the spatial composition (see picture to the right) (Weiss, 2018).

Another benefit is that these systems can be designed to be largely perennial, meaning that food is produced without re-sowing every season (which is the case with wheat, barley, corn, soy etc). These perennial systems can be established in steps, integrating trees and bushes into conventional agriculture – also called a silvoarable system. This can be viewed as a commercially viable stepping-stone, slowly integrating trees, bushes and perennials into an existing mono-cultural system.

These types of systems can be implemented in various ways across the globe as a way to increase food security, decrease erosion of soils and potentially capture large amounts of atmospheric carbon. These systems have been rated among the top 10 that can have most impact in sequestering carbon from the atmosphere (Hawken, 2017).

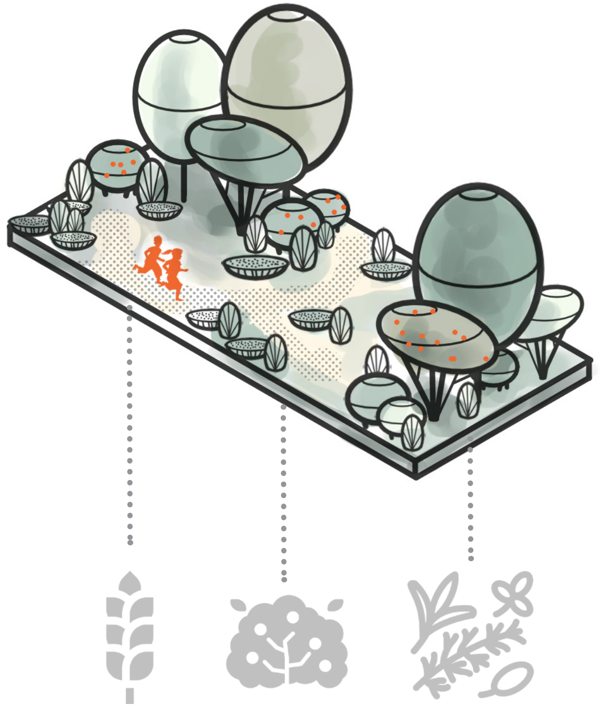
These types of systems can thereby be one key to more restorative and resilient food-production for Lund and other cities/communities around Skåne s well as the rest of the world!



agroforestry systems

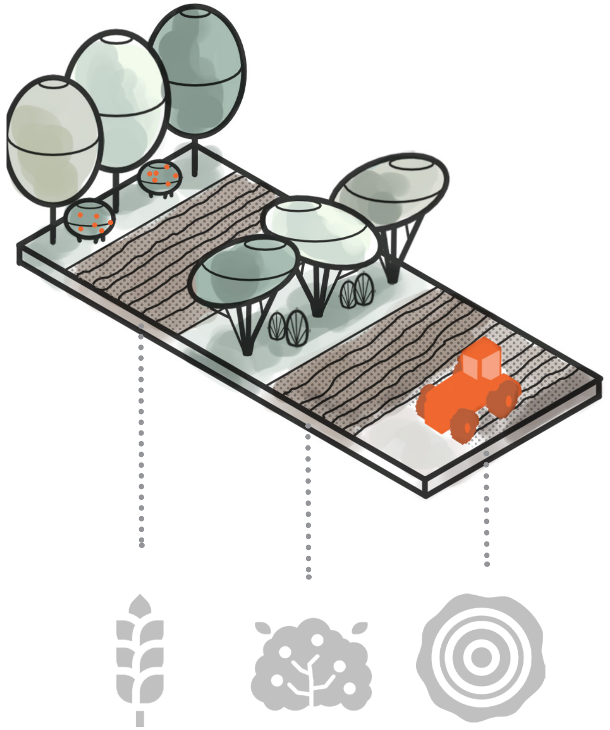
FOREST GARDENS
(& boundary / edge systems)

These systems can be designed along edges and in small spaces (such as gardens). It is the system that mimics ecosystems most accurately, both in structurally, in biodiversity and functionality of the plants. A main goal is for the system to sustain its own fertility (Agroforestry Sverige, 2022).



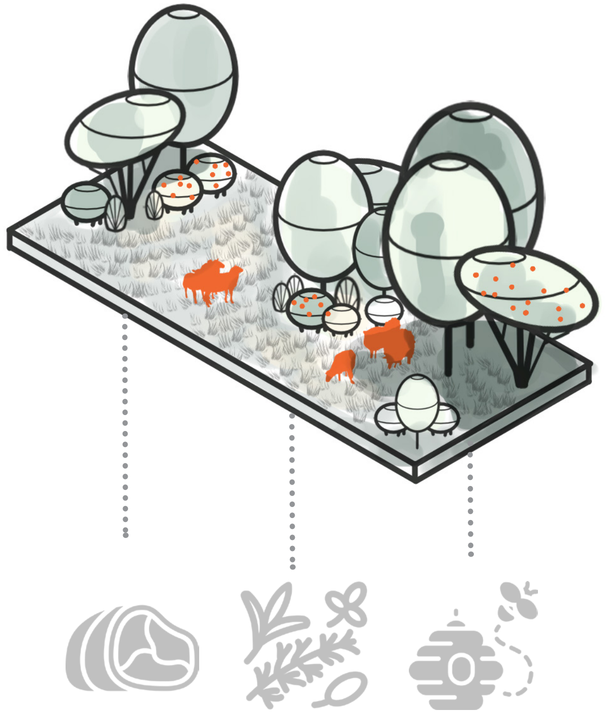
SILVOARABLE SYSTEMS
(tree intercropping)

Between rows of resource-generating trees and/or bushes, annual or biennial crops can be grown. The trees provide habitats for birds and wildlife while it also creates better microclimate between the rows. This system is a good bridge between industrial agiculture and food forest systems.The width of the tree rows can be adjusted to the width of the machine.



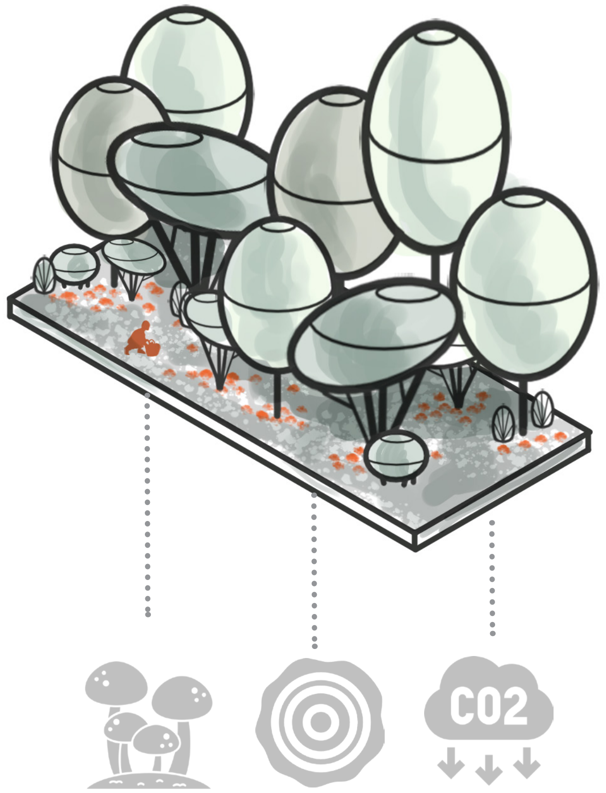
SILVOPASTURAL SYSTEMS

Having rotational grazing animals under tree canopies has been tradition in agriculture for centuries. The animals assist in the cycling of nutrients and vitalizes the ecosystems and soils. The canopies provide shelter, and the meadows an abundance of varied food - both of which has proven benificial to the health of the animals (Agroforestry Sverige, 2022).



FOREST FARMING SYSTEMS

Under the dark-multi-layered canopies, several herbs , berries and mushrooms can be grown. Paired with Lübeck-model timber production, these systems can generate both foods, woods and wonderful recreational spaces with spaces of wild flora and fauna.



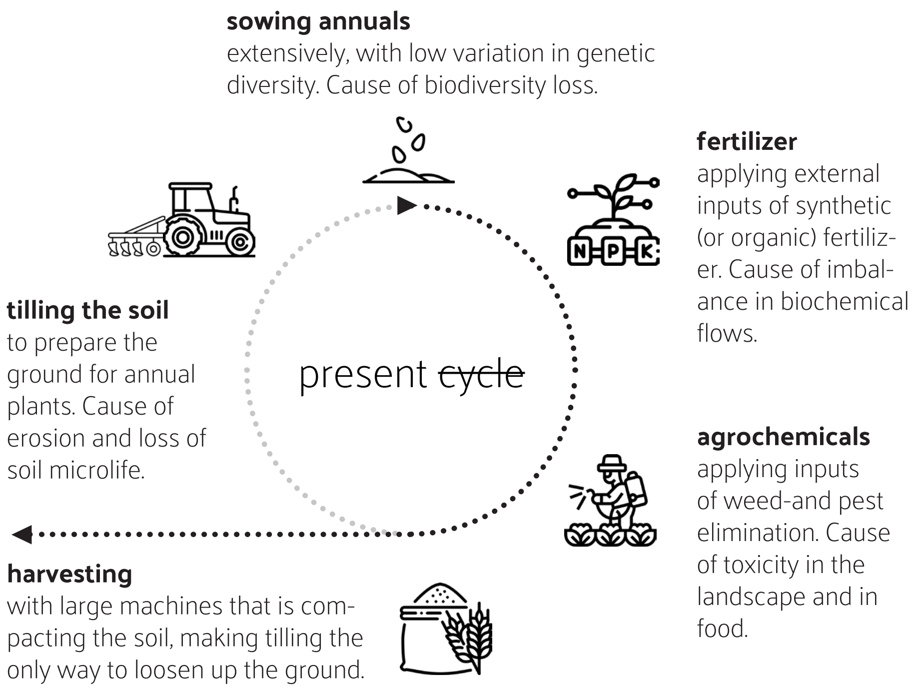
key principles

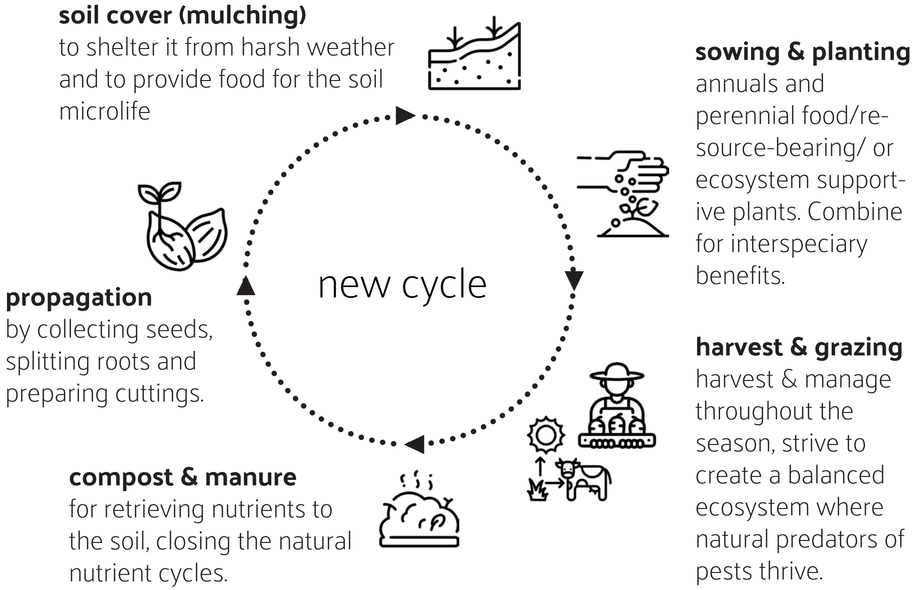
CLOSING THE LOOP

Today's industrial agriculture is based on disturbing the soil by tilling, in order to sow annual crops such as grains, legumes etc.

This vicious cycle creates a myriad of micro-and macro problems for biodiversity and ecosystem health, as stated previously in this thesis.

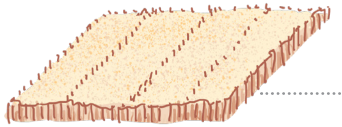
Therefore there is substantial reason to alter this cycle into local, cyclical and ecologically sound systems instead. In nature, efficient systems of nutrient recycling has been evolving since the dawn of time - why not use this? If we adjust our food production systems and applying methods (as shown to the right) we can improve the quality and fertility of the soil instead!





Space-efficiency*

*Diagrammatic drawings



wheat yield(1)
550 grams of flour per m²

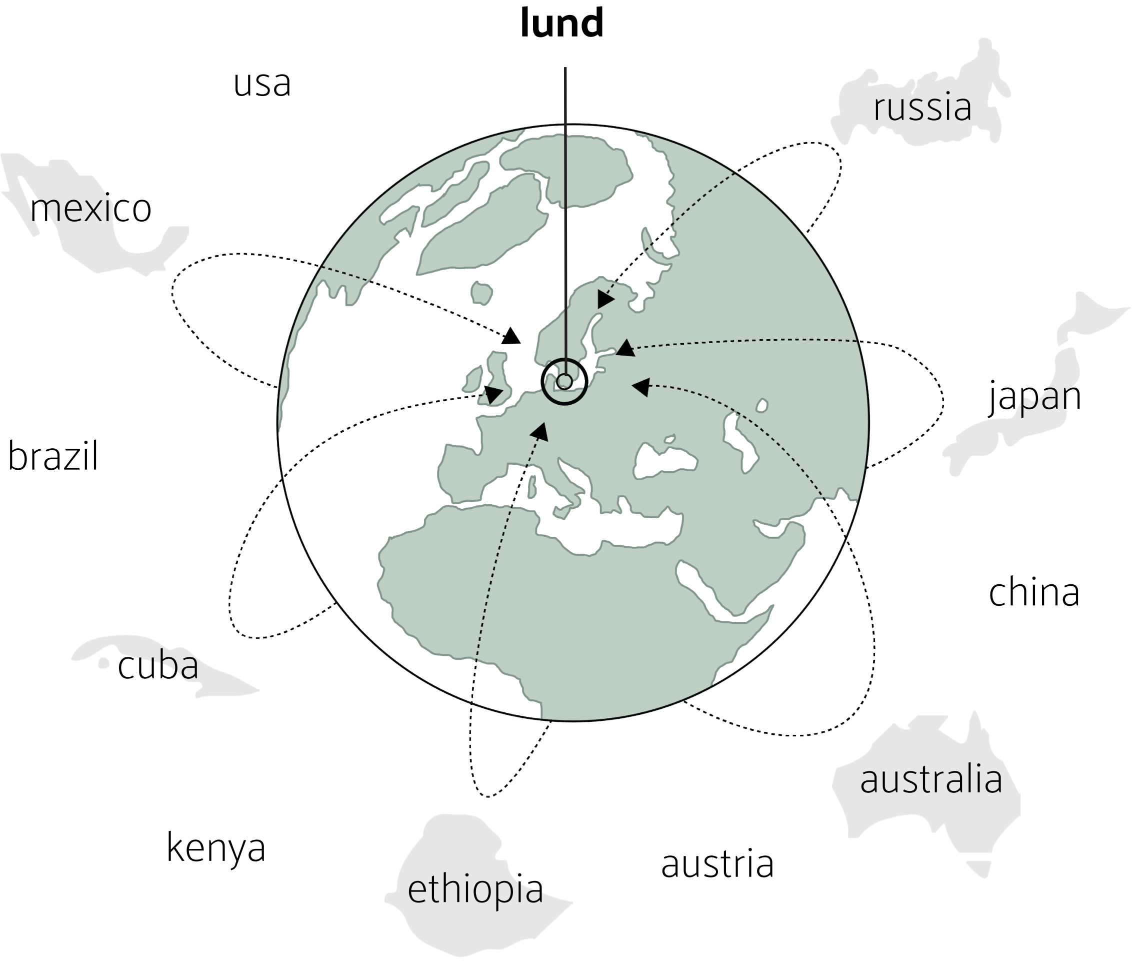
chestnut yield(2)
340 grams of nuts per m²
(tree distances included)

grape yield(3)
300 grams of grapes per vine

rhubarb yield(4)
800 grams of rhubard per m²

potato yield(5)
4000 grams of potatoes per m²

lessons from around the world



russia: dacha gardens

The *Dachas* are traditionally the russian people's summer homes, where food is usually grown. In times of hardship, these gardens were oftentimes vital for keeping the population fed. Similar gardening cultures exists in other parts of eastern Europe.

ethiopia: restoration agriculture

In large parts of the hilled Ethiopia, groups of farmers has closed off barren lands from grazing, created water-catchment systems and planted vegetation. This has resulted in less erosion, higher fertility and lower risks in drought-scenarios.

japan: miyawaki forests

Akria Miyawaki, a japanese botanist, developed a method of quickly establishing natural forests. By carefully choosing and mixing a variety of species, and planting them closely, Akira successfully mimiced the succession of natural vegetation.

mexico: chinampas

The *Chinampas* in Mexico City are ancient and legendary floating gardens. They are situated on marshlands, with trees and channels providing irrigation and access to the gardens. These systems are believed to have existed since the Aztecs'.

australia: permaculture

Bill Mollisson and *David Holmgren* laid the foundation for permaculture (permanent + agriculture) in the 1970s. The idea was to observe and work with nature rather than against it - while producing the resources humans need (Bane, 2012).

cuba: agroecology

Cuba became excluded from fossil-fuel trade in the 1990s and was forced to feed its population without external inputs. With the labor of the community and oxens, the cubans enforced a new agroecological system which still more resillient then most modern systems.

04.

design project

- a new edible landscape

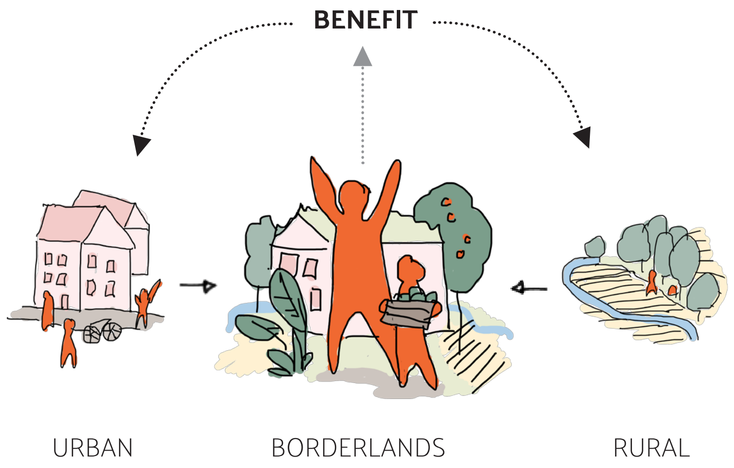
The only sustainable city... is a city in balance with its countryside.

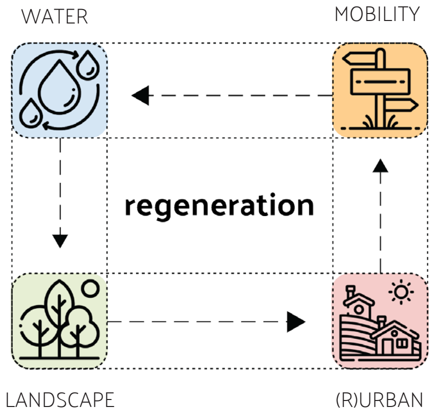
– Wendell Berry

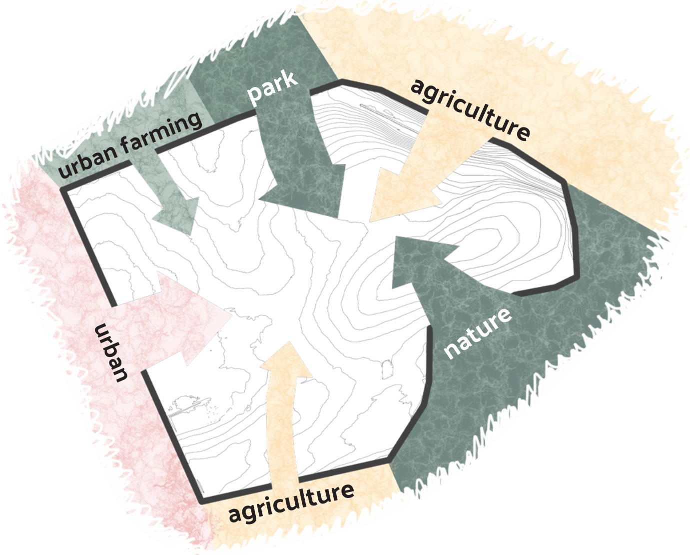
site vision

Imagine a new type of landscpe, just on the border of the city. It is a place where food is grown, for the benefit of the city. It is a place where citizens can learn how to grow food, using nature as a guide. It is a place where people of all ages can go for a walk or do outdoor activities - contributing to healthy lifestyles.

It is a new edible landscape - and it must be shown to the world!







EXHIBITION

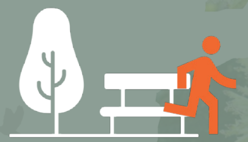
The landscape strategies applied to the site are still somewhat uncommon in standard practice. *Utmarken* can be a place to research the benefits of these landscape interventions - and showcase them to the world! It would be one of the largest agroforestry-areas in Scandinavia, and possibly even in Europe.

Lund has all the potential of being a centerpiece in the European food-security process. The city has the perfect preconditions, a culture of research and knowledge, international connections and good geographical conditions!

PRODUCTION

The site poses as one huge regeneration project. The cycles of industrial agriculture are to be converted into more regenerative practices over time.

With the rediscovering of ancient agroforestry systems, and learnings from the world - the site will still be indentified as a productive landscape. More diverse, more alive and with more abundance!

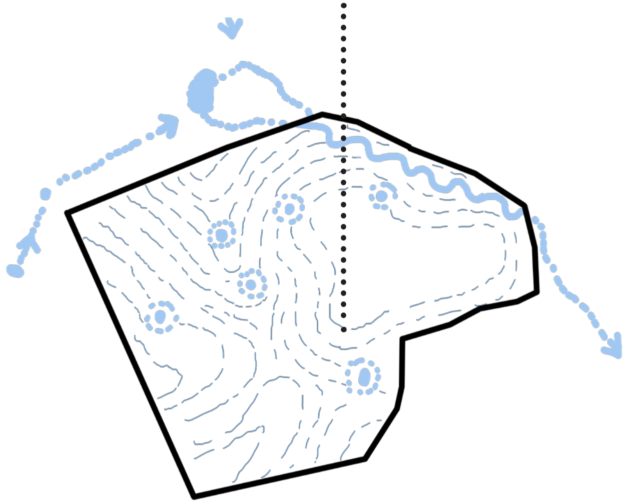


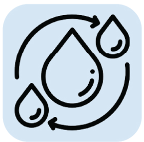
RECREATION

The municipality aims to stretch Kunskapsparken into the site and call it *"the world park"*. This project embraces that idea but adds a significant twist by combining the park with agroforestry food production. So it is "the *world food forest park"*!

site strategies

keylines
(maintaining water-infiltration on site)





WATER

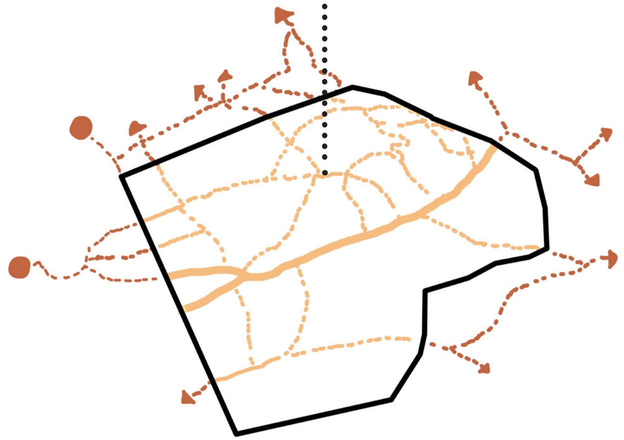
Restore the natural water cycles by implementing keyline design principles. Protect the existing 'märgelgravar' and provide locations for new ponds. Restore the natural meandering of Glomsbäcken.

world food forest
(recreation + production park)

LANDSCAPE

Regenerate the landscape and soil life by establishing permaculture-and agroforestry systems. Provide a variety of habitats for wildlife and diverse food production, whilst giving space for recreation, education and leisure.

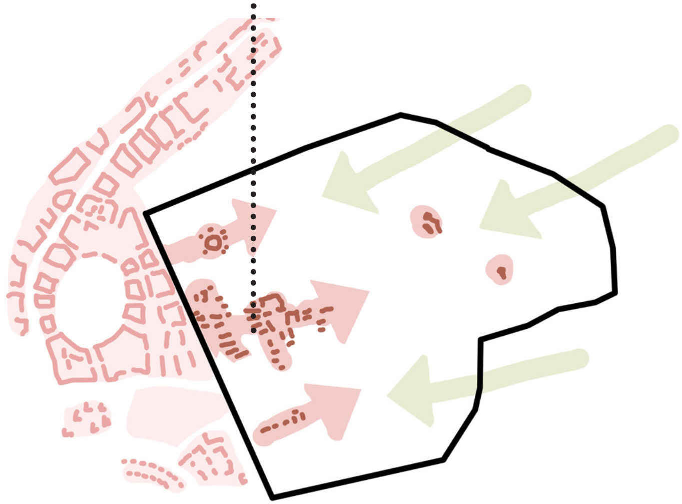
paths for slow mobility
(landscape access)



MOBILITY

Connect importnat existing and futute mobility nodes, such as tram stops in brunnshög and exsiting recreational trails in kunskapsparken. Provide access to the landscape at large with recreational trails and paths for *slow mobility*.

village development
(life in the urban fringe)



(R)URBAN

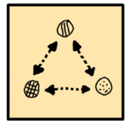
Soften the urban fringe by re-envisioning how the municipal vision of *"bygatorna"/ the village streets* can balnace the urban brunnshög with the rural agricultural landscape.
Rural + Urban = Rurban

24 design goals

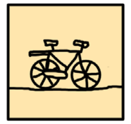
MOBILITY

access landscape
to provide greater recreational possibilities

recreation for all
through varied and accessible paths for all walks of life



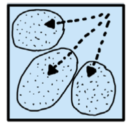
connect nodes
to provide easy access to important functions / places



slow & shared
to provide safe mobility spaces and encourage sustainable transportation

WATER

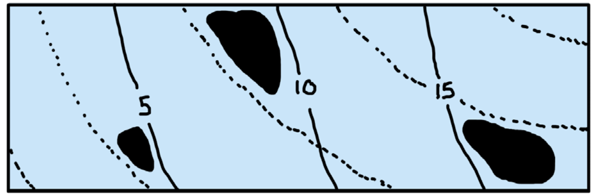
slow
to prevent soil erosion in heavy rainfalls



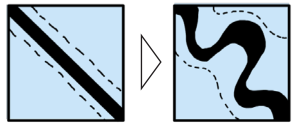
spread
to distribute water across the landscape

sink
to recharge water tables and reduce risk of fires

store
to keep water for irrigation and wildlife habitats

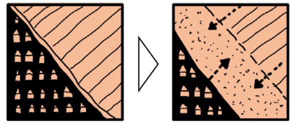


keyline design
: an established design framework to shape the landscape to consciously slow, spread, sink and store rainwater. A method developed in Australia in the 1950s to regenerate eroded agricultural lands (Yeomans, 1954). The method is today used in projects across the globe



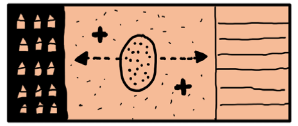
restore streams
to regenerate lost habitats for wildlife

(R)URBAN



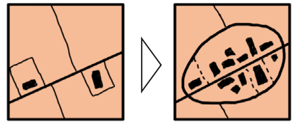
bridge
urban and rural qualities as a transition zone

integrate farming
to show that food can be produced everywhere



benefit both
add value to both city and countryside

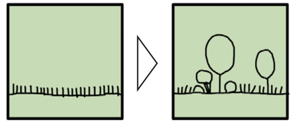
integrate commons
to provide niche-spaces avaliable to all



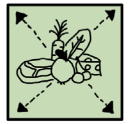
unite
to increase social cohesion & community

adapt to climate
to provide habitable spaces in a changed climate

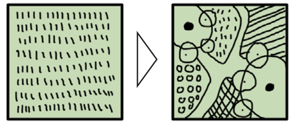
LANDSCAPE



convert to agroforestry
to make the landscape more resillient to climate change and more productive

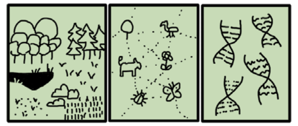


maximize abundance
to generate resources as food, water, seeds, wood and knowledge

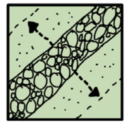


convert to polyculture
to provide natural pest control, food diversity and richer landscapes

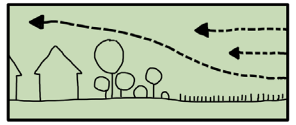
diversify landscape
to reap the benefits of natural systems



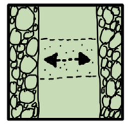
enrich biodiversity
through diversity in habitats, species and genetics



expand key habitats
to provide more space for endangered species



create microclimates
to provide habitat niches for a variey of species (including humans)



connect key habitats
to secure movement and DNA-pools of species

1. lund's farming hub

This is the public gathering point and center for Lund's pioneering agricultural venture. Generator and hub.

5. world food forest

The combined production-recreation showcase park. In the food forests fruits from across the world can be found and visited!

4. windmills

At the hilltop, the windmills stand proud. For educational purpouses and as a backup-grain-mill/sawmill, this place can educate and attract people from the whole city!

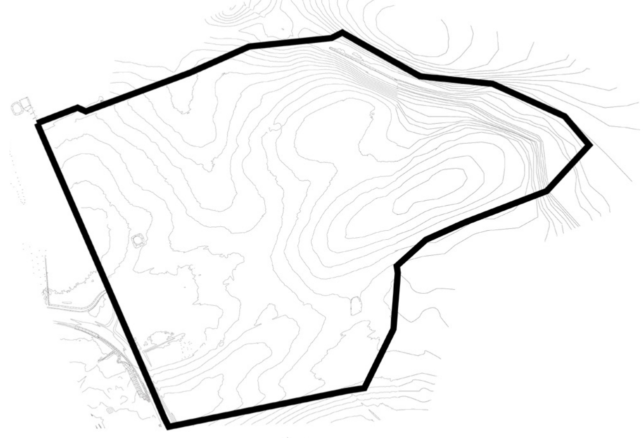
2. urmarksbyn

A small (r)urban village in the borderlands between rural and urban. Robust, down-to-earth and community-oriented development.

step 1

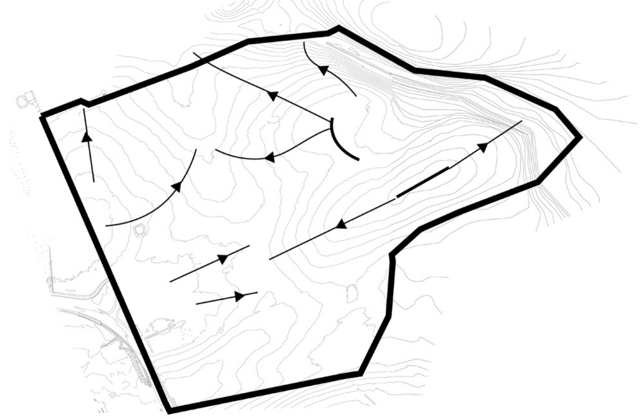
restore the water cycle

Applying the '*Keyline Design Method*' will be a network of embankments and small swales across the landscape with the purpose of slowing, sinking, spreading and storing the rainwater. Combined with vegetation, these systems can potentially recharge groundwater tables and prevent topsoil erosion. This method was initially developed by PA.Yeomans in Australia and has been continiously applied in degraded landscapes across the world (Yeo-mans, 1954).



1. TERRAIN MAPPING

The first step is to look at the heights of the site and its surroundings. Notice directions of ridges, valleys and find highpoints. This site has an altitude level of ca 80-92 meters above sea level which is among the highest points in the city of Lund. High altitudes are generally drier landscapes, which makes restoring local water cycles crutial in this site.

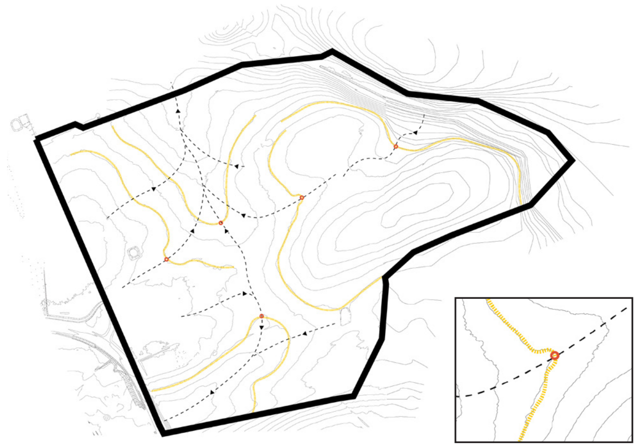


2. RIDGES

The second step is fidning the ridg-es in the sloping landscape. Water will run away from these lines along the directions of the arrows. The darker/heavier lines resemble the highest points of the site.

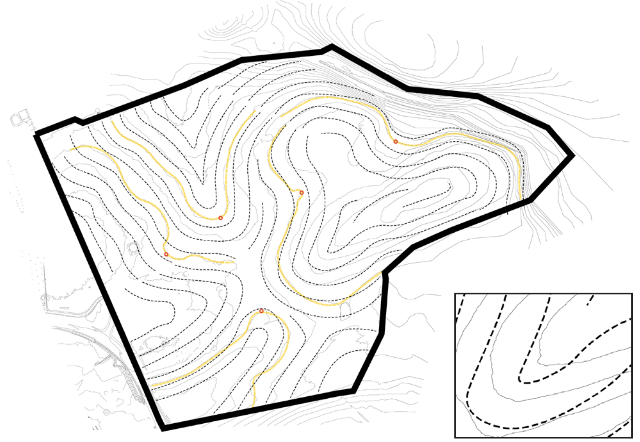
3. VALLEYS

The third step is to find the valleys along the hills. These lines show where the water will run to; and the arrows shows the direction of the water runoff.



4. KEYPOINTS

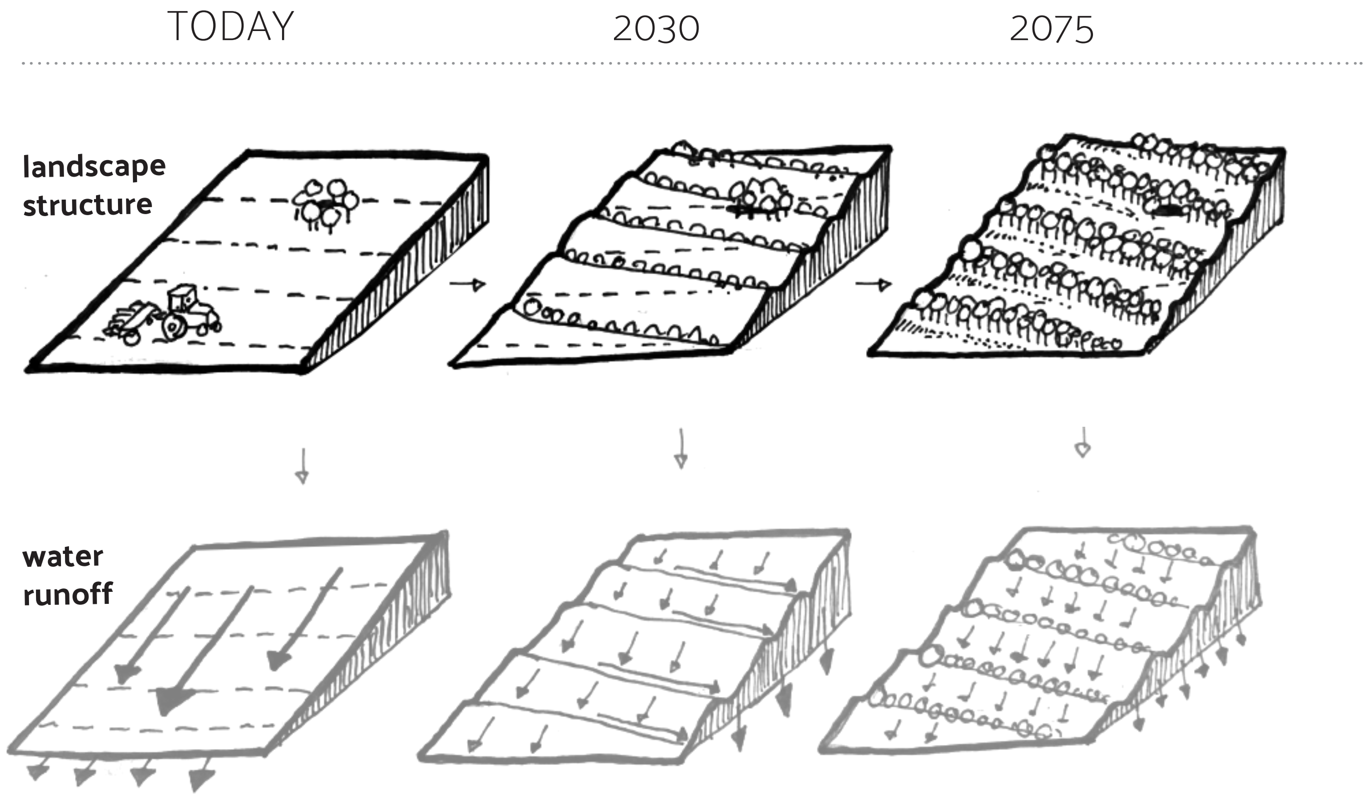
Keypoints (marked in orange) are found at the inflection points in the landscape, which are where the heightlines have a drastic change in thier convex shape (marked in yellow in the map).

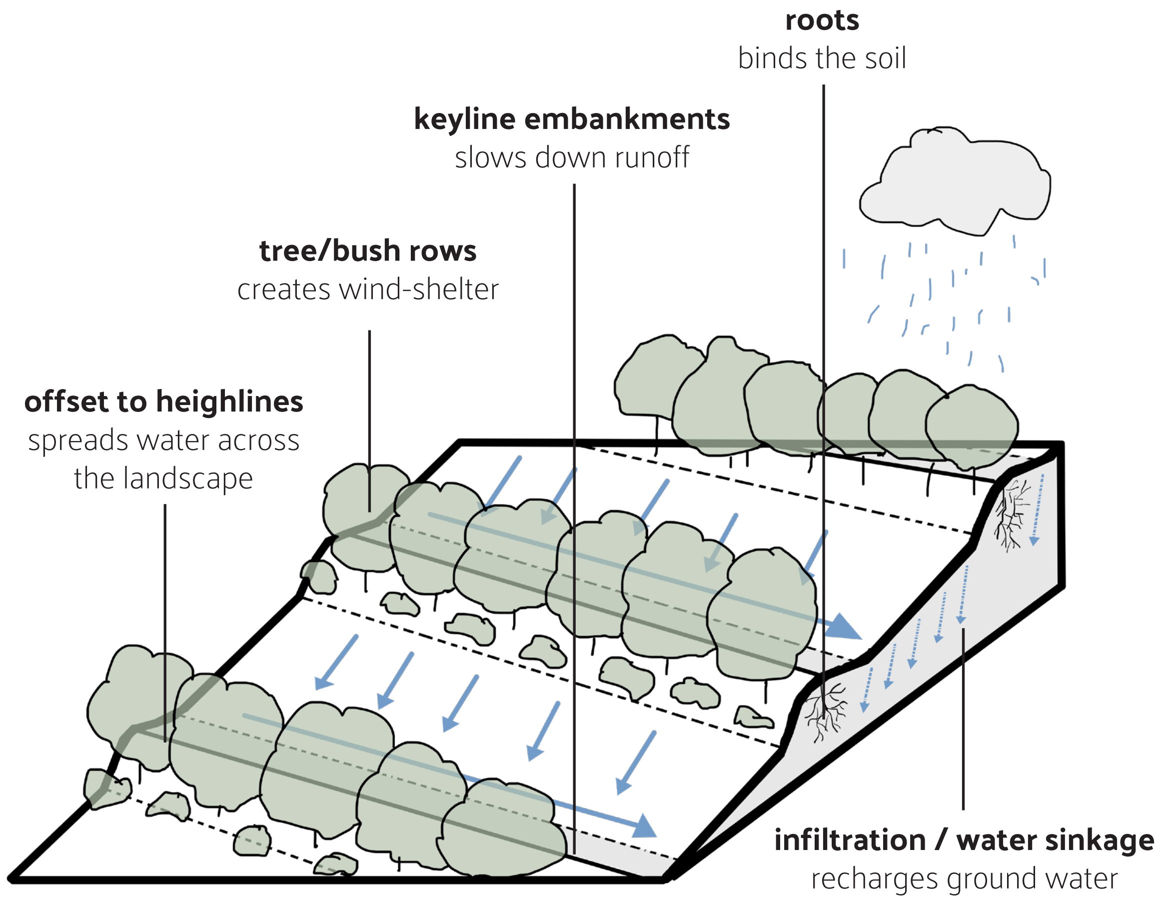


5. KEYLINES

The fifth and final step is draw the keylines (marked with heavy dashed lines). These lines have a fixed spacing of ca 40 meters. They are based on the keypoints (orange), and to loosely follow the hightline-curvatures. By having the keylines intersecting the height-lines, angeled terraces will be creat-ed (as shown in the enlarged detail).

keylines & function over time





- industrialized farmland
- prone to erosion
- contributes to eutrophication
- contributes to biodiversity loss

+ keylines established
+ less prone to erosion
+ more resilient to droughts
+ increased percolation
+ contributes to biodiversity

+ keylines maturing
+ even less prone to erosion
+ resilient to droughts, cool microclimate
+ increased percolation
+ contributes to biodiversity

A NEW WATER LANDSACPE

This landscape has the potential to be significantly more resilliant in terms of drought-resistance- making it suitable in the hotter temperatures that climate change is bringing. Applying similar strategies to surrounding areas can increase the positive effects of the system at a larger scale.

step 2

regenerate the landscape

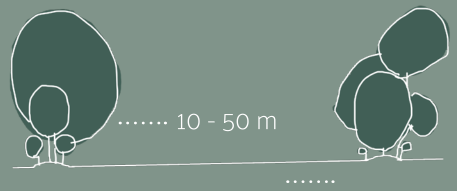
THE MIYAWAKI AFFORESTATION METHOD

The Miyawaki-method is applied where trees, bushes and other perennial vegetation is established. Plants are carefully selected, planted close to eachother and have a good amount of mulch on the surronding soil to improve microlife and retain water.

KEYLINE VEGETATION

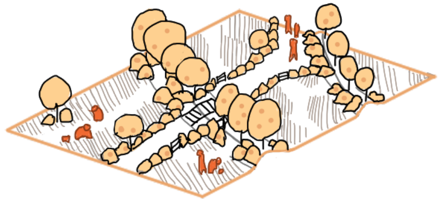
The vegetation is established along the keyline-ridges, creating long alley across the landscape. This pattern is slighty broken up by ponds, paths and other interventions.

SPACING



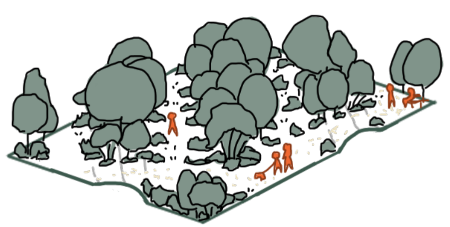
LANDSCAPE TYPOLOGIES

The landscape is proposed to be divided in five macro landscape types (see below). These types are based on usage & programme, variation in suitable vegetation and lastly variation in agroforestry sytems. The idea behind this is to showcase different spatialities of the agroforestry-concept as well as how they can be conbined with different programs/ways of maintainence/care.



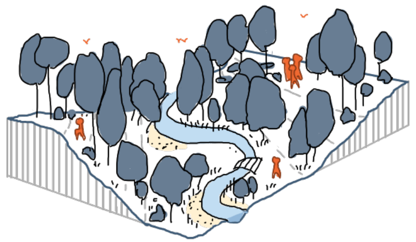
citizen gardens

These gardens are for rent by the people living in Lund, primarily in local neighbourhoods. Community-Supported Agriculture can be applied here.



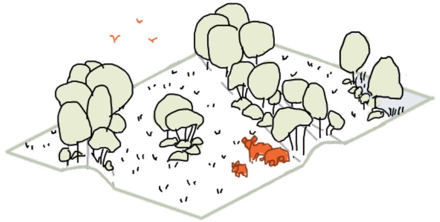
world food forest

This forest is a public food-producing park for recreational purpouse. It will contain edible species from all over the world. It will act as a testing ground and gene-bank.



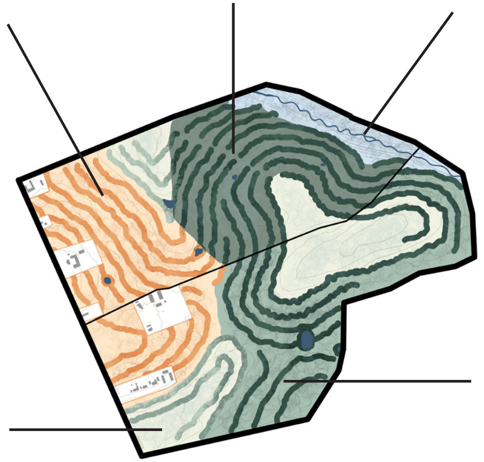
river valley

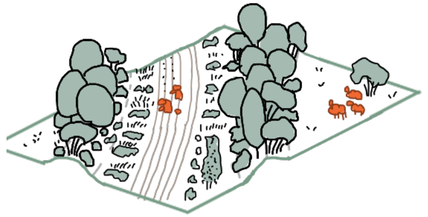
The river valley will be restored to a meandering river, with small wetlands to delay the water further. Dense vegetation of alder and willow will be here.



meadows & silvopasture

These fields and meadows serve as places for grazing animals, as well as meadows for insects and birds.

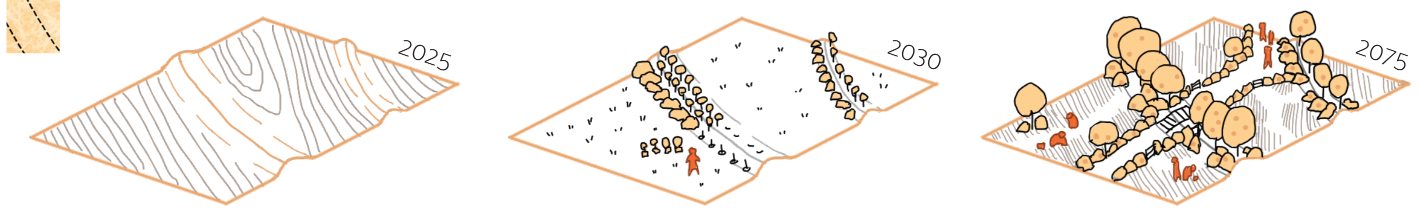




silvoarable & silvopasture

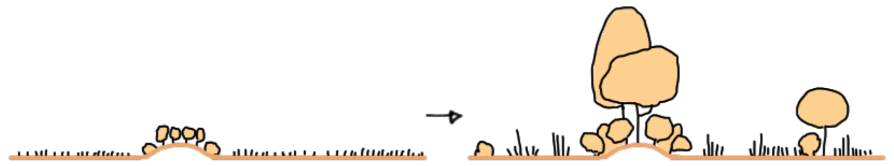
These rows will demonstrate how an existing field can be converted to an agroforestry system.

citizen gardens



pioneers

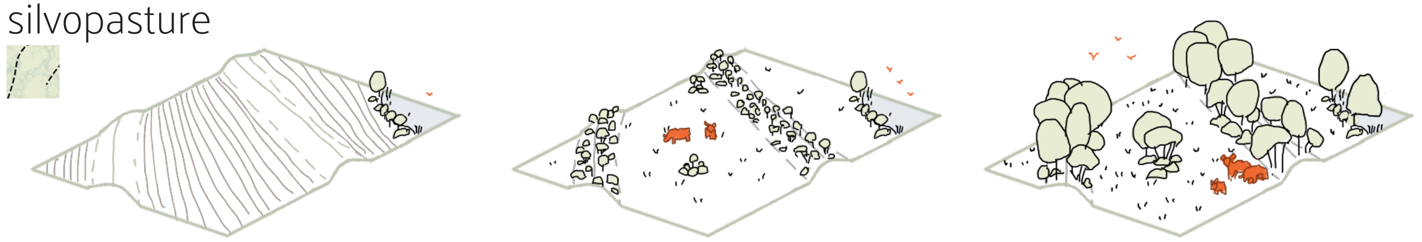
betula pendula
crataeus monogyna
cydonia oblonga
malus domestica
prunus avium
sorbus acuparia
toona sinensis



mix aim

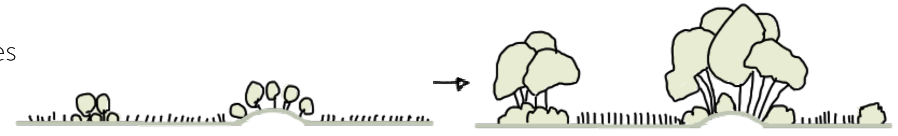
castanea sativa
castanea mollisima
castanea japonica
chaenomeles japonica
corylus colurna
prunus persica
malus domestica

silvopasture



pioneers

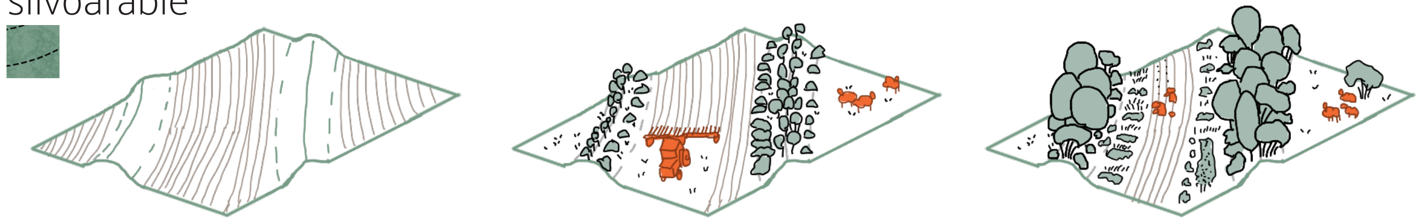
amelanchier ssp.
crataeus monogyna
cydonia oblonga
malus domestica
hippophaë rhamnoides
prunus avium
pyrus communis



mix aim

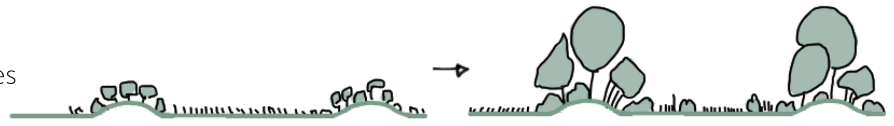
castanea sativa
castanea mollisima
castanea japonica
corylus colurna
lonicera caerulea
malus domestica
pyrus communis

silvoarable



pioneers

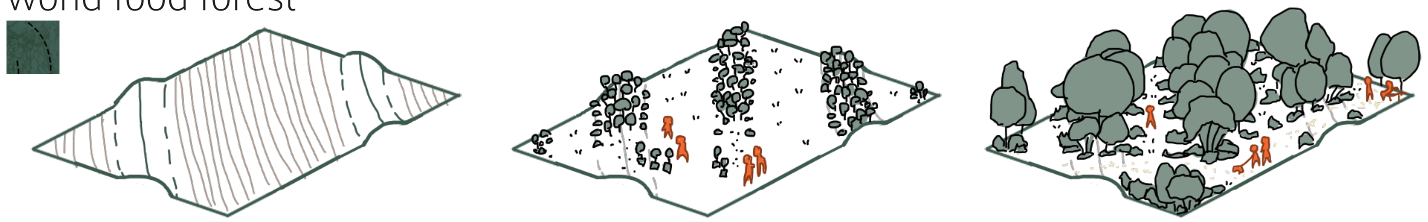
amelanchier ssp.
crataeus monogyna
cydonia oblonga
malus domestica
hippophaë rhamnoides
prunus avium
pyrus communis



mix aim

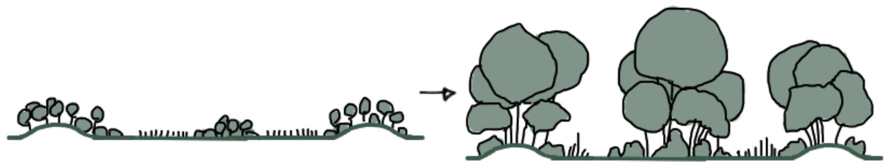
amelanchier ssp.
corylus avellana
cydonia oblonga
malus domestica
hippophaë rhamnoides
prunus avium
prunus domestica

world food forest



pioneers

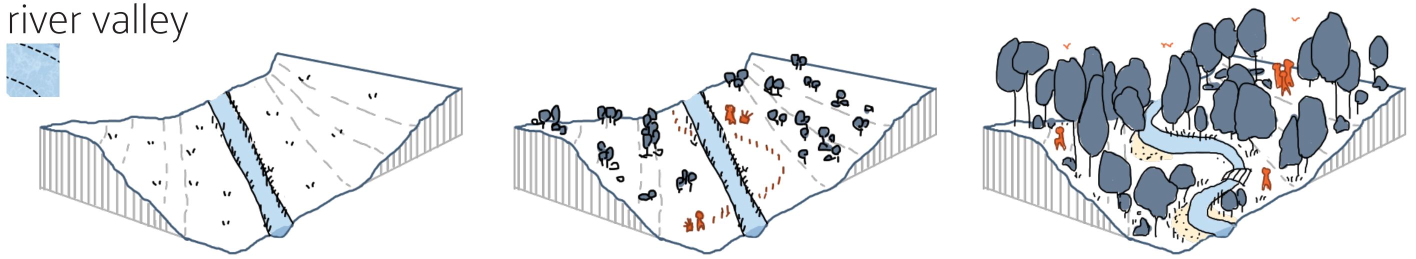
chaenomeles japonica
acer ssp.
alnus ssp.
morus ssp.
prunus armeniaca
prunus virginia
prunus dulcis



mix aim

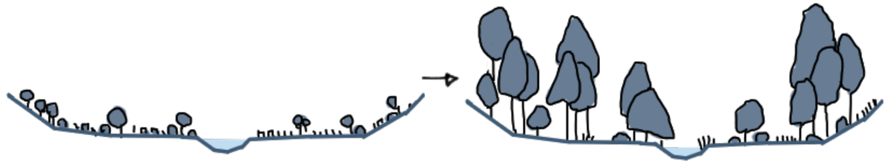
asimina triloba
castanea ssp.
ginko biloba
juglans ssp.
morus ssp.
prunus armeniaca
prunus dulcis

river valley



pioneers

alnus ssp.
betula ssp.
cornus mas
salix caprea
sorbus ssp.
prunus domestica



mix aim

alnus ssp.
betula ssp.
cornus mas
prunus domestica
salix caprea
staphylea pinnata
quercus ssp.

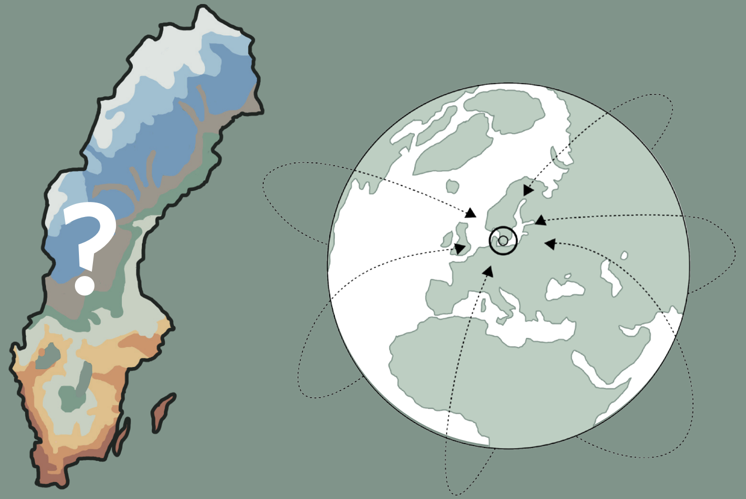
hot-house earth & species migration

ANOTHER POST-GLACIAL PLANT MIGRATION?

The current rate of climate change is likely to outrun most plant species ability to migrate (Natural plant migration is based on generational migration by new generations of seeded saplings). Current dominant species in local ecosystems are at risk when their local climate changes faster than their new generations are adapted to. These processes takes centuries to decades, so the consequences of rapid climate change could have serious effects on plant communities. This human-induced climate change is also likely to alternate the functioning and distribution of terrestrial ecosystems such as; boreal forest borders are likely to creep up north while droughts and desertification becomes increasingly common in more southern equatorial regions (P.Nielson et al. 2005).

The adabtapility of an ecosystem to rapid changes is related to the systems' diversity in species and (genetic) traits that are able to fill lost niches/functions within the ecosystem. Greater diversity correlates to a more adaptive ecosystem which is less likely to be negatively impacted my climate change (P.Nielson et al. 2005).

This proposal takes aim to (safely, with appropriate measues) diversify the new agricultural ecosystems by; 1) restoring lost ecosystems and 2) carefully introducing new species into the edile landscape. The site can take active part to lead careful plant propagation to diversify gene-pools to increase the chances that species evolve a myriad of traits that are better adapted to the changed climate.



world food forest: species

em que dolendis sum quo con re nos dendunto estore con nihillu ptassunda dolorep udignim usciendus qui blacculpa earibus, te vit et estia nitatus essimolo.

edible chestnut
castanea japonica
japan

mulberry
morus ssp.
china

walnut
juglans ssp.
north america

apricot
prunus armeniaca
armenia

pepper
lanthoxylum ssp.
noth america

hawthorn
h. rhamnoides
europe

chaenomeles
chaenomeles
china

honeyberry
lonicera caerulea
siberia

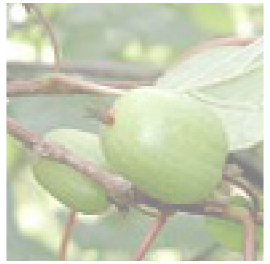
goji-berry
lycium barbarum
china

baloon-berry
rubus illecebrosus
japan

daylily
hemerocallis ssp.
korea

squash
cucurbita ssp.
america

corn
zea mays ssp.
america



kiwi
actinidia arguta
siberia

rhubarb
r. rhabarbarum
china

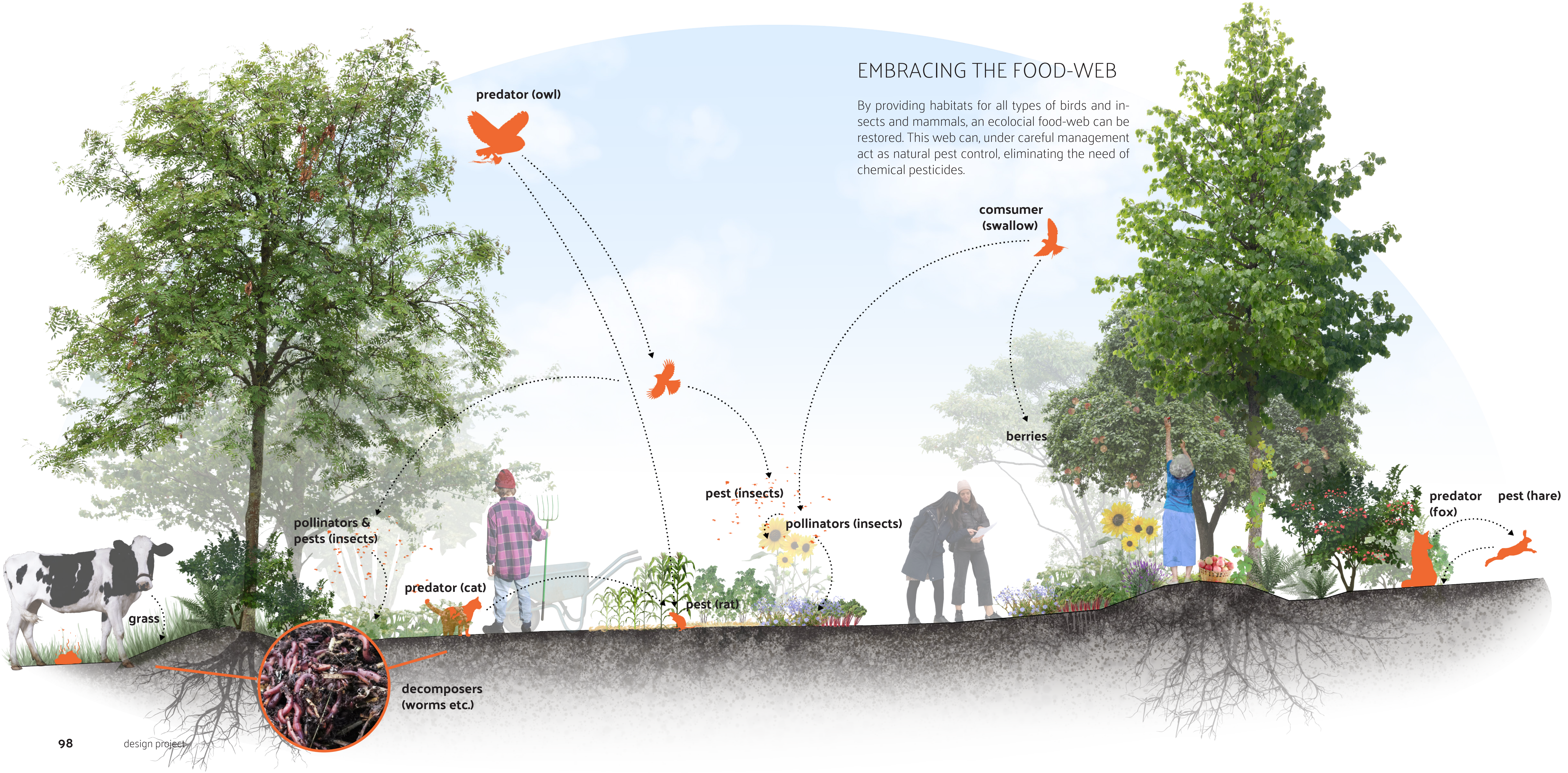
the new edible landscape

EMBRACING POLYCULTURE

This new edible landscape is very different to the views of vast fields that are usually seen in Skåne. But, it offers the promise of a greater abundance in species-richness of plants and animals, which in turn makes it a more ecologically resillient food system.

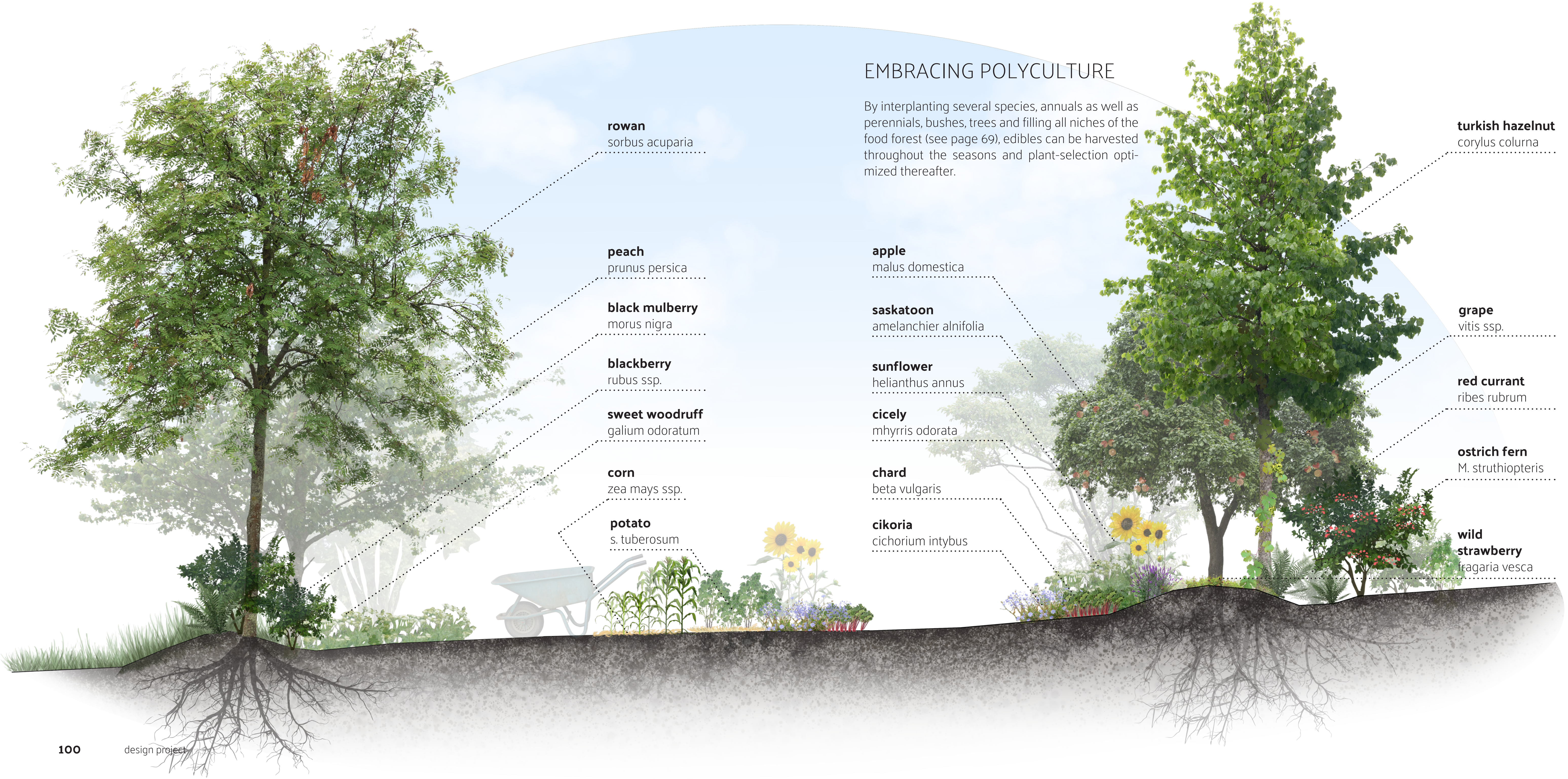
EMBRACING THE FOOD-WEB

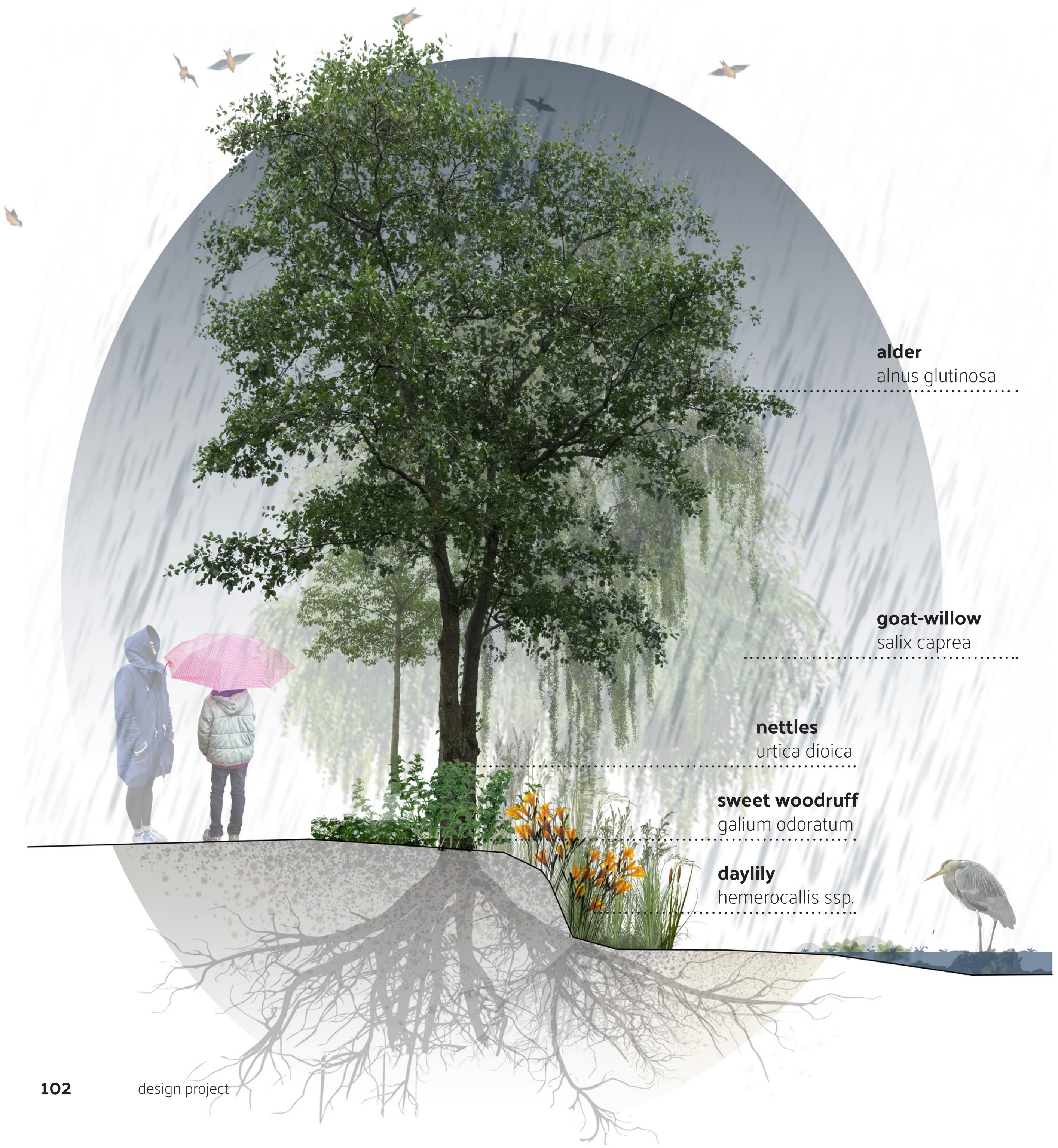
By providing habitats for all types of birds and insects and mammals, an ecolocial food-web can be restored. This web can, under careful management act as natural pest control, eliminating the need of chemical pesticides.



EMBRACING POLYCULTURE

By interplanting several species, annuals as well as perennials, bushes, trees and filling all niches of the food forest (see page 69), edibles can be harvested throughout the seasons and plant-selection optimized thereafter.

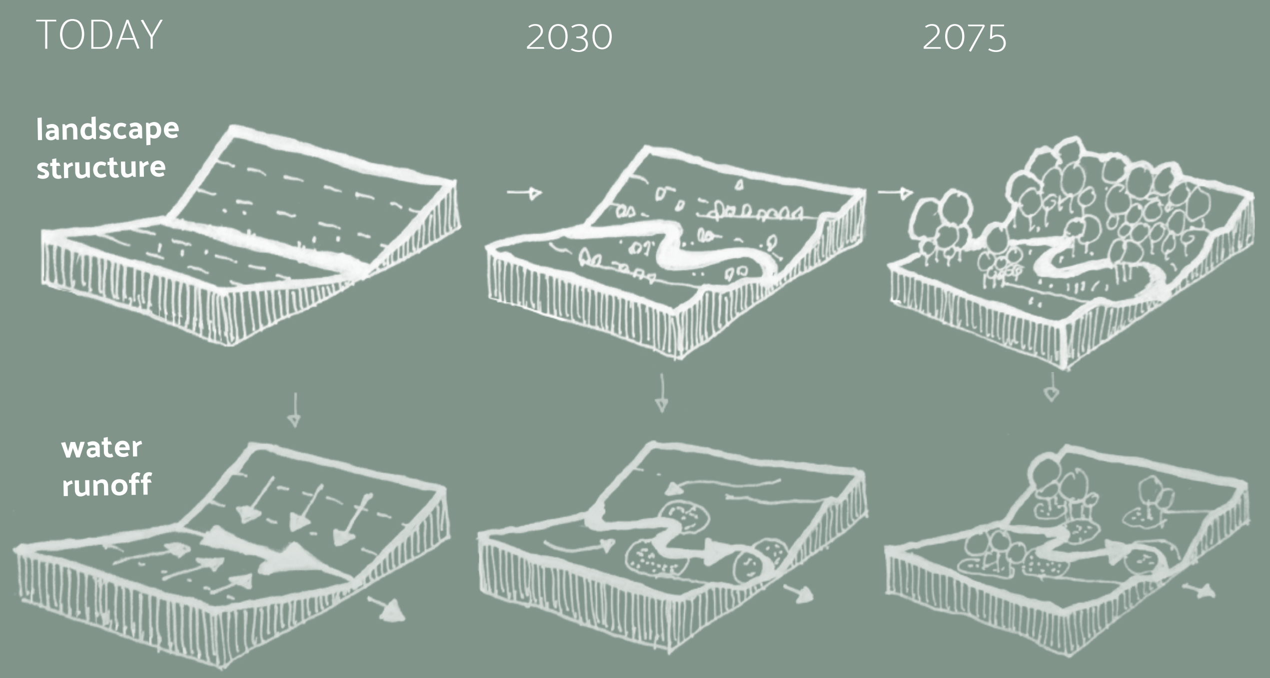




river valley

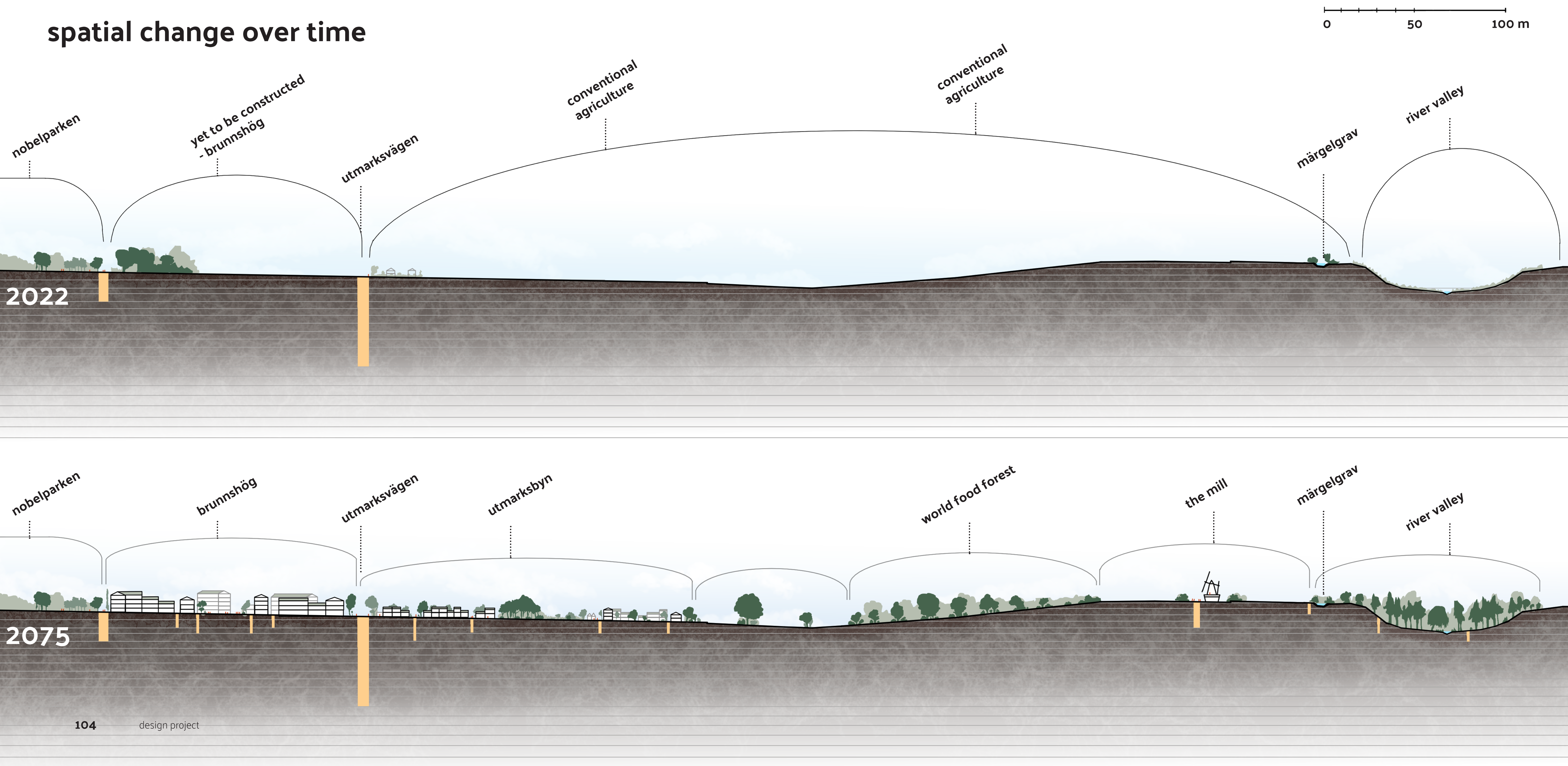
WE ALL NEED WATER

The river *Glomsbäcken* is restored to it's meandering shape. This shape slows down the water, and along with increased riverside vegetation, creates habitats for water loving birds and other wildlife. This also creates great recreational values, creating the perfect extension of kunskapsparkens recreational paths and running- tracks.



TODAY	2030	2075
- industrialized farmland - prone to erosion - contributes to eutrophication - contributes to biodiversity loss	+ keylines established + less prone to erosion + more resilient to droughts + increased percolation + contributes to biodiversity	+ keylines maturing + even less prone to erosion + resilient to droughts, cool microclimate + increased percolation

spatial change over time




(whispering)
Deers! Wow!
wass dat?
(pointing)

utmarksbyn

~ **350-400** new inhabitants

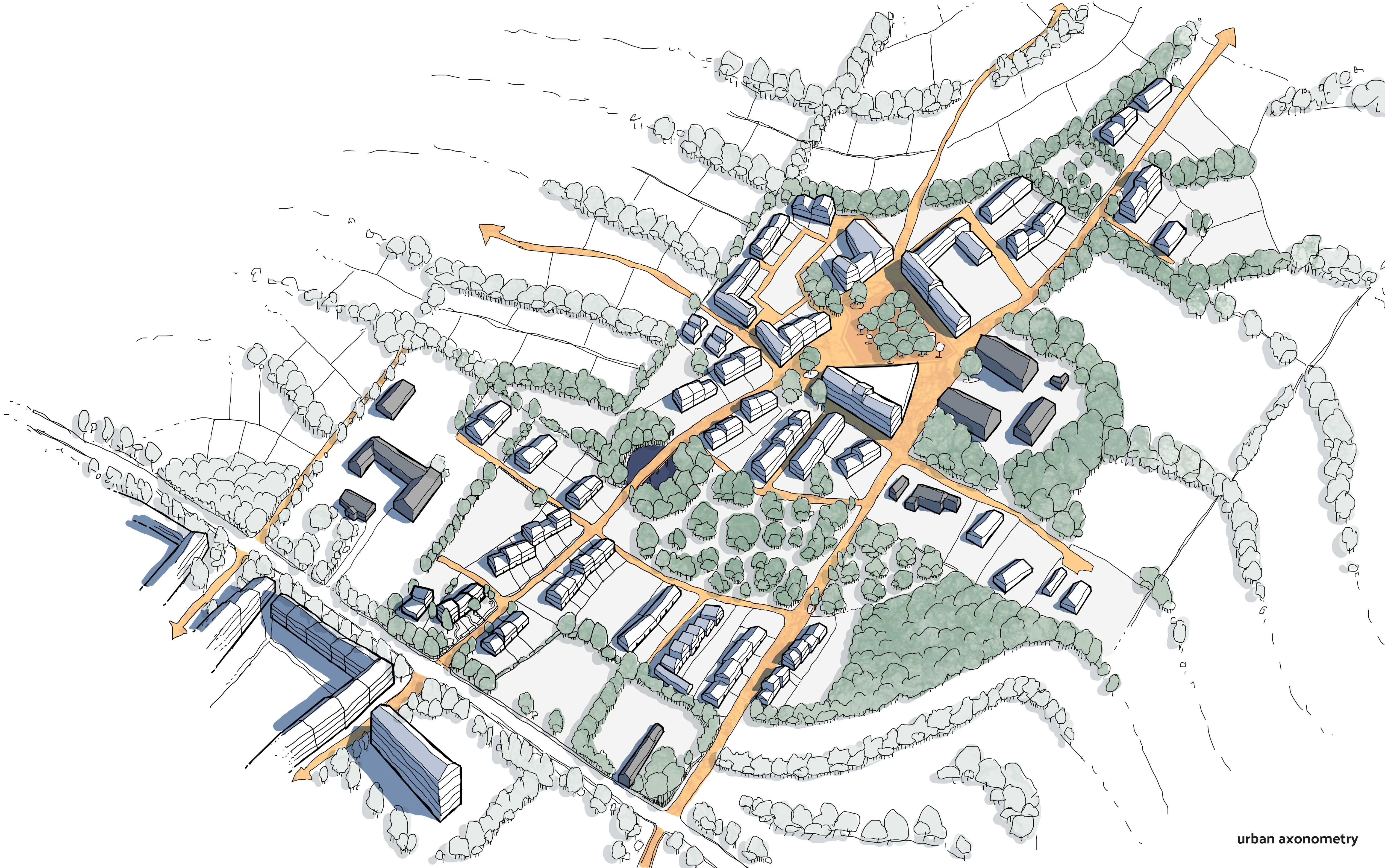
101 new building units

12 exsisting building units

12 community gardens

Utmarksbyn is a relatively small development, designed with the purpose of bridging the high density urban life with the rural context while still relating to both.
This particular design framework is a suggestion of how the following core principles can be applied on the area:

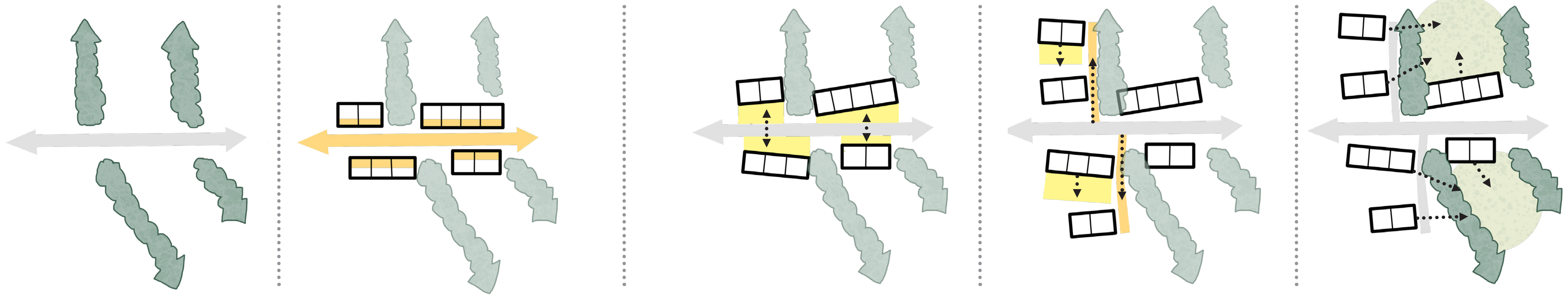
1). Showcasing new lifestyles & how to implement them
2). Integrated cultivation spaces (private, community & public)
3). Slow and shared mobility
4). Robust and designed to be resilient towards effects of climate change.
5). Local and circular systems of materials, produce and waste



urban axonometry

MORPHOLOGY STRATEGIES

From the existing road, and proposed keyline strucutre, the concept of the village street is implemented, but re-morphologized and adjusted in regards to community gardens and smaller neighbourhood streets.



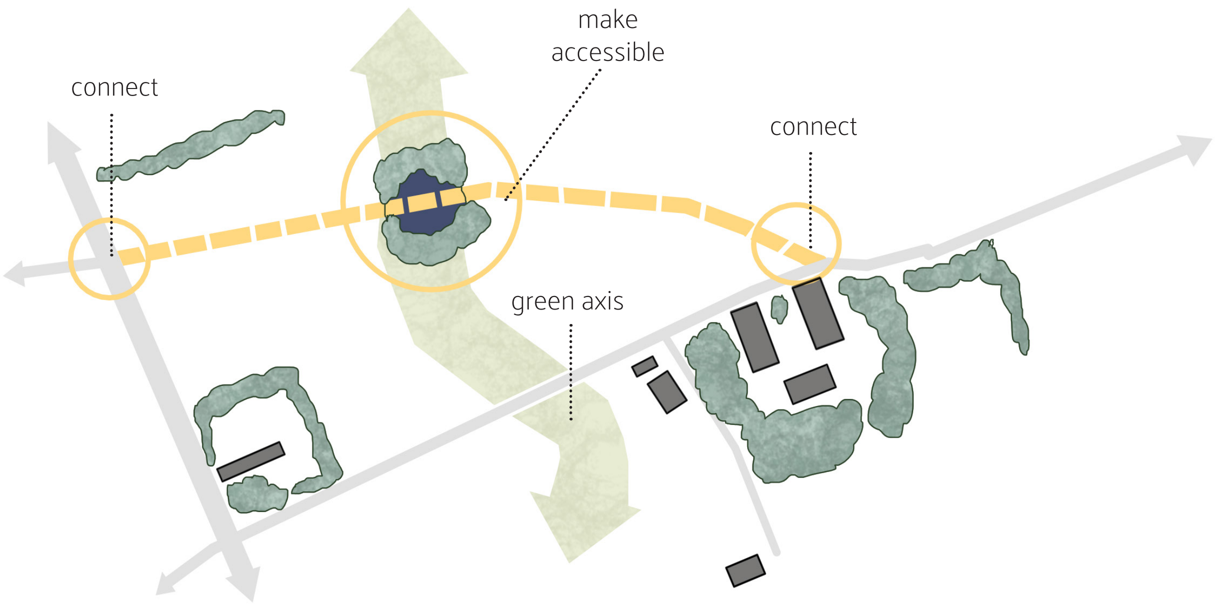
1. keyline vegetation & main streets

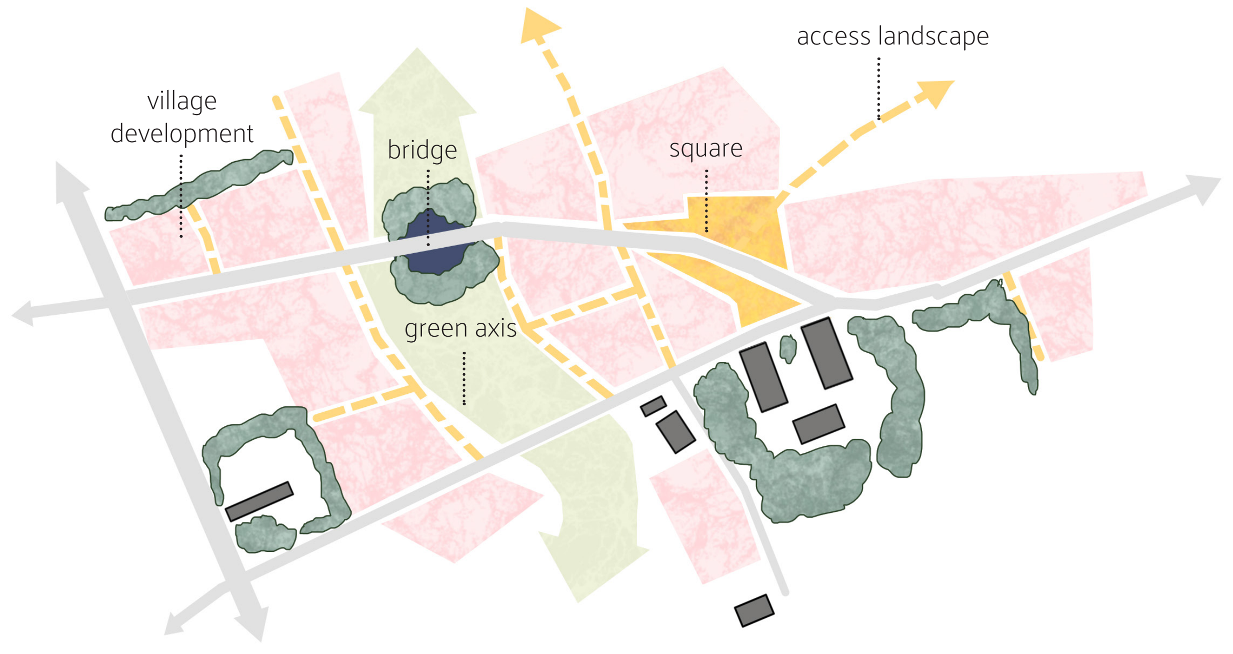
2. village street (as municipality planned)

3. daylight / landscape adjustments

4. neighbourhood streets / additional housing

5. neighbourhood community gardens






N
A-A
detail plan
A-A
health center
social-house
library
market hall / food hub
workshop
reuse-warehouse
eldercare/daycare
greenhouses
0
100 m

section A-A

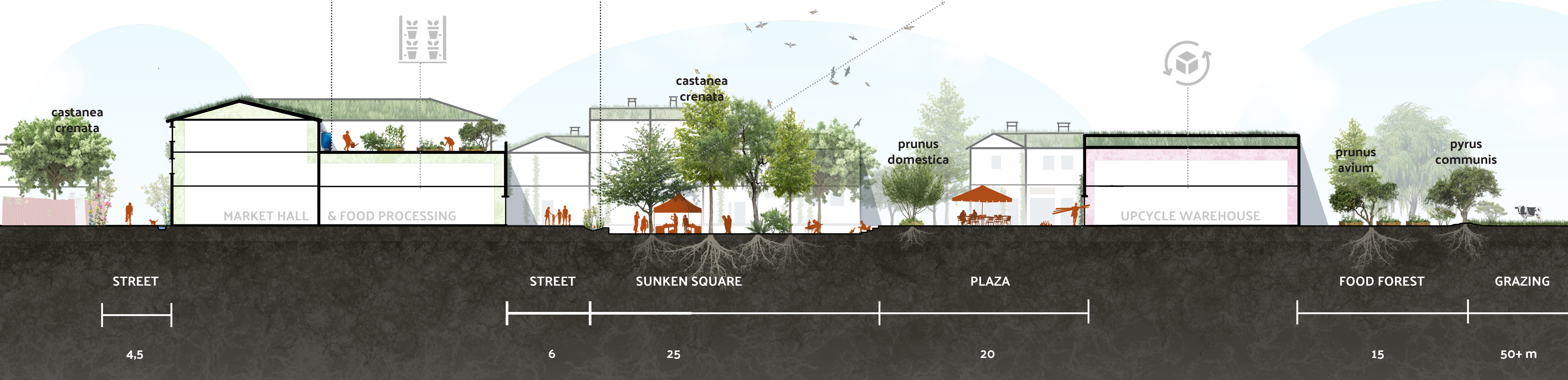
ROOF GARDEN

Providing spaces to grow vegetables on the roof of the market hall. This place showcases how food can be grown in denser urban environments, but still close to distribution centers. Yum!

RAIN GARDENS

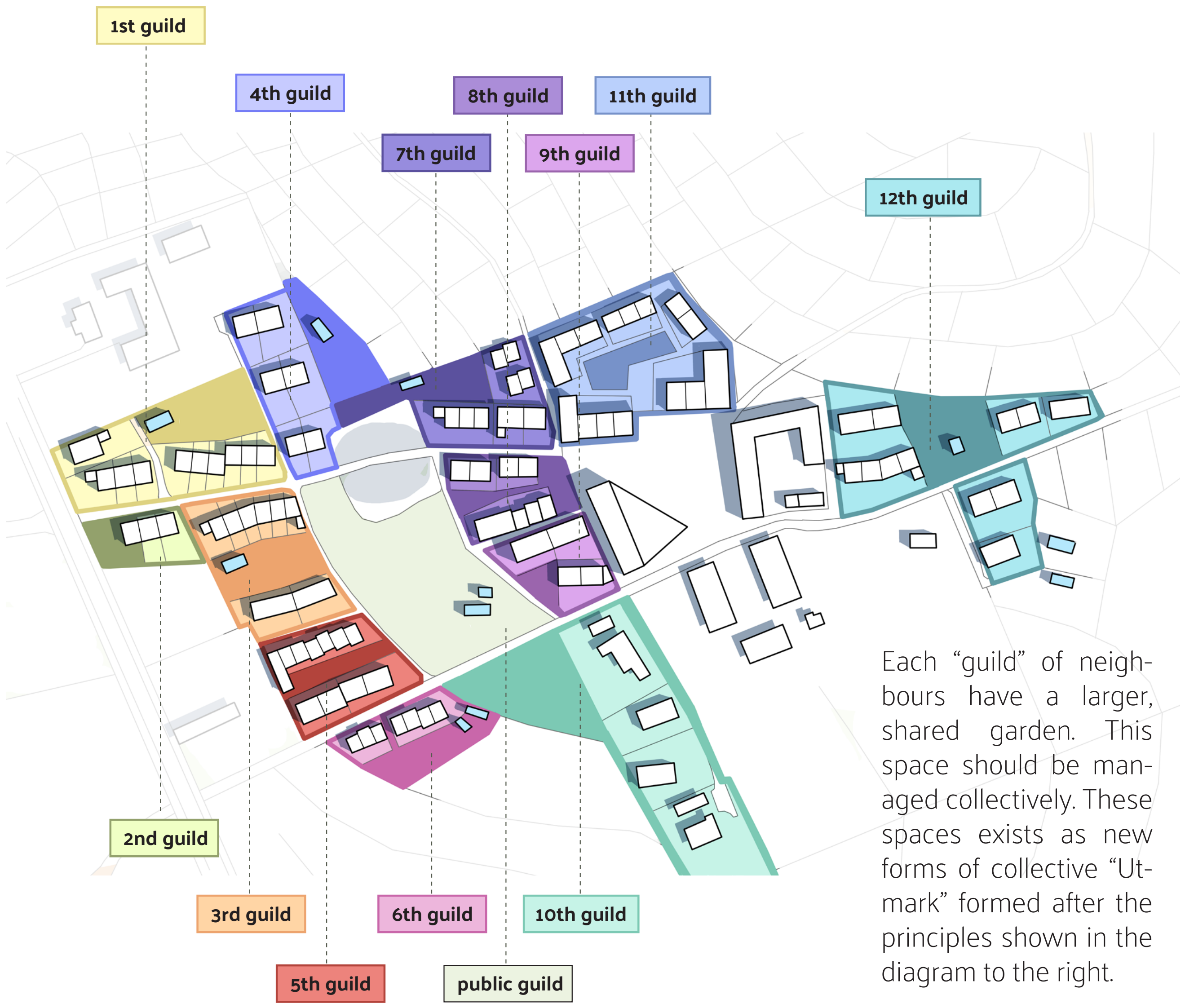
SUNKEN SQUARE

This square offers spaces below the tree canopies to have markets in the summertime. It is sunken down and connected to the rainwater-runoff system and can flood and become an infiltration surface when the area is subject heavy rainfalls. These concepts can be applied elsewhere, as a part in showcasing climate adaption.

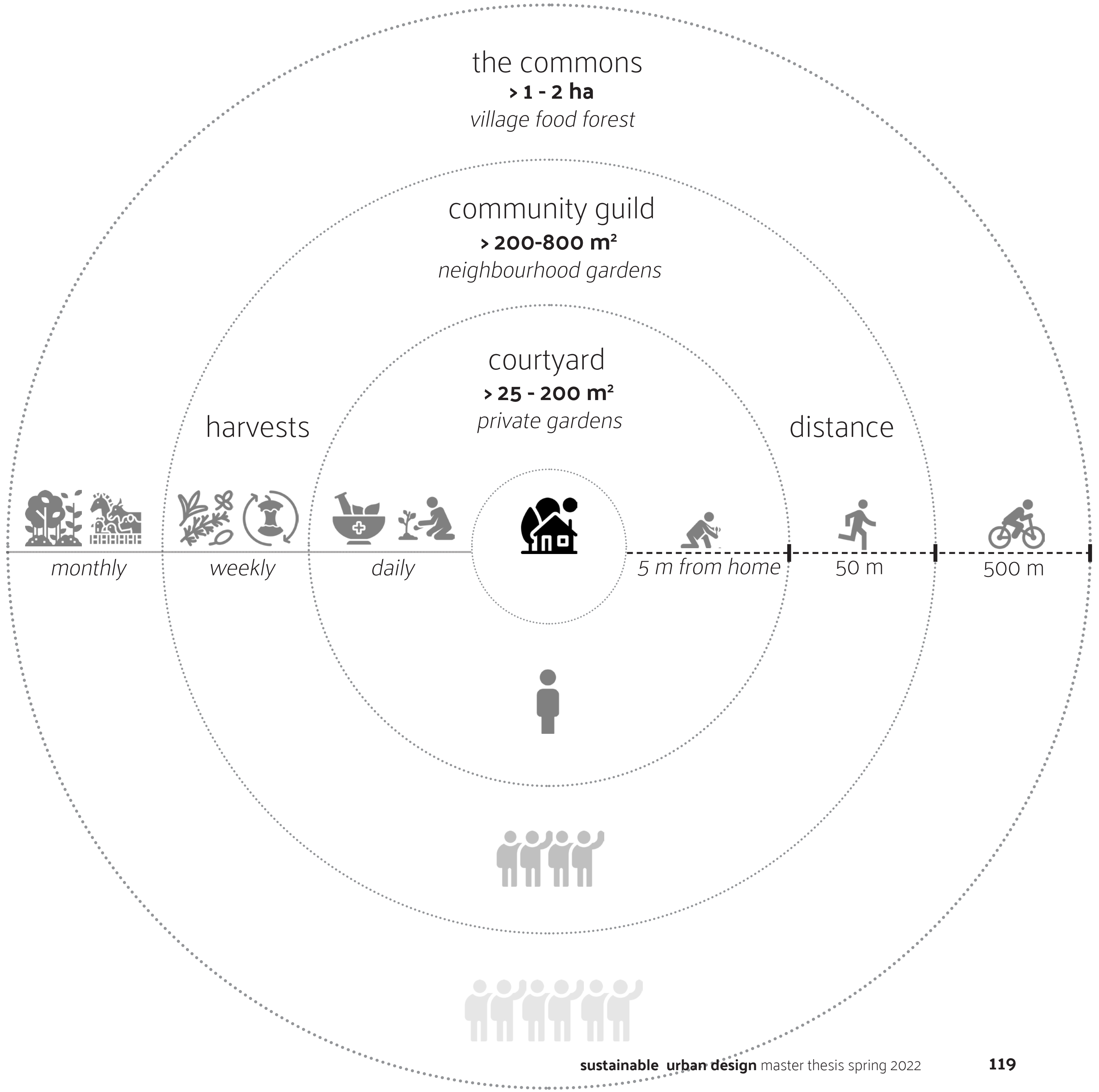



Oh! we could have solar panels like that!
want some greens?

indivudual, collective & community!



Each "guild" of neighbours have a larger, shared garden. This space should be managed collectively. These spaces exists as new forms of collective "Utmark" formed after the principles shown in the diagram to the right.



example:
1st community guild

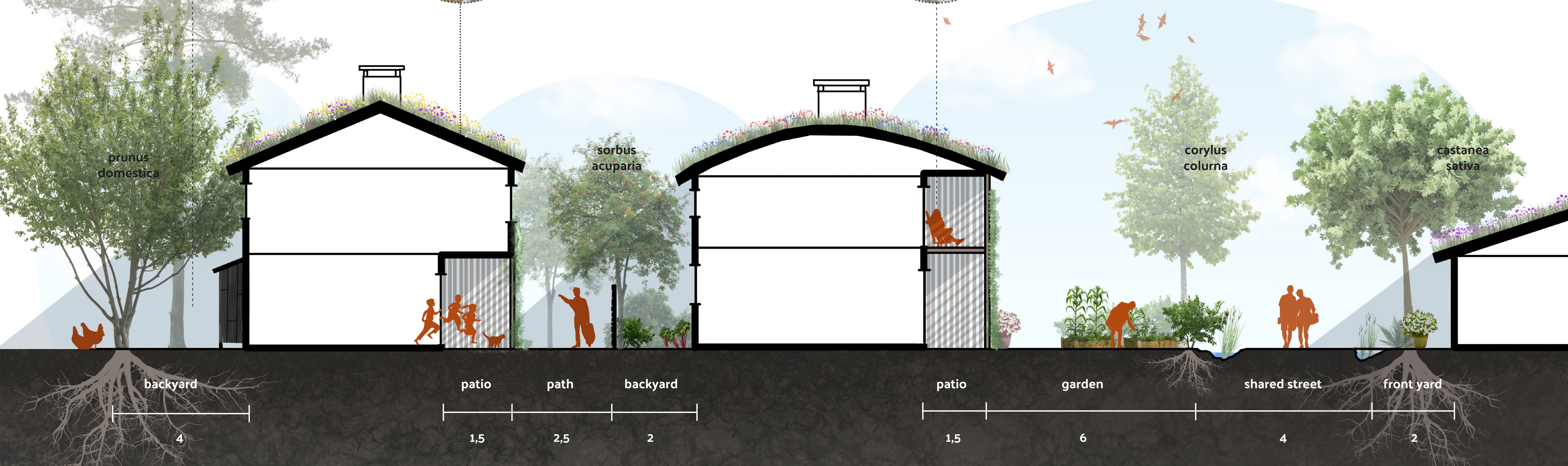
section B-B

BIOTOPE ROOFS

Utilizing the roof-space for wildflower meadows, providing homes and feeding grounds for birds and insects.

SHADED PATIO

Providing shelter from strong sunshine and unpleasant winds. Becomes the second living room in the summer, with spaces to grow!



axonometry

NATURE-BASED LIFESTYLE

The purpose of Utmarksbyn is to be a living-lab, an area that can be showcased as how one could live a more grounded life, closer to the natural systems. It offers a lens of which we can see our daily practices can start processes of regeneration rather than depletion. Here, the resources such as food, water and energy are gathered on site. Building-materials are up-cycled, reused or repurposed. The greenery is lush, the air full of birdsong and hope is nigh.

building typologies

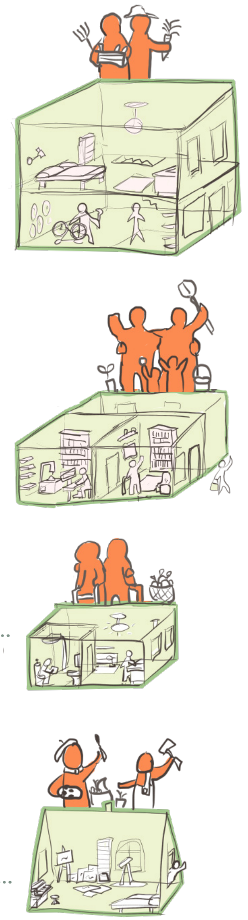
FLEXIBLE FLOORPLANS

FARMERS /
FARMERS TO-BE

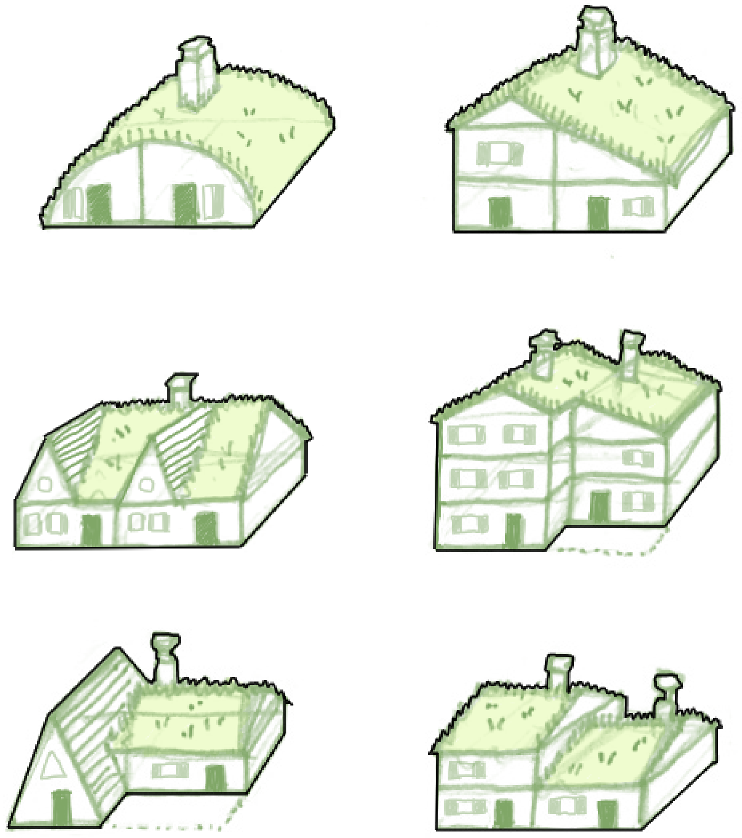
FAMILIES

SENIORS

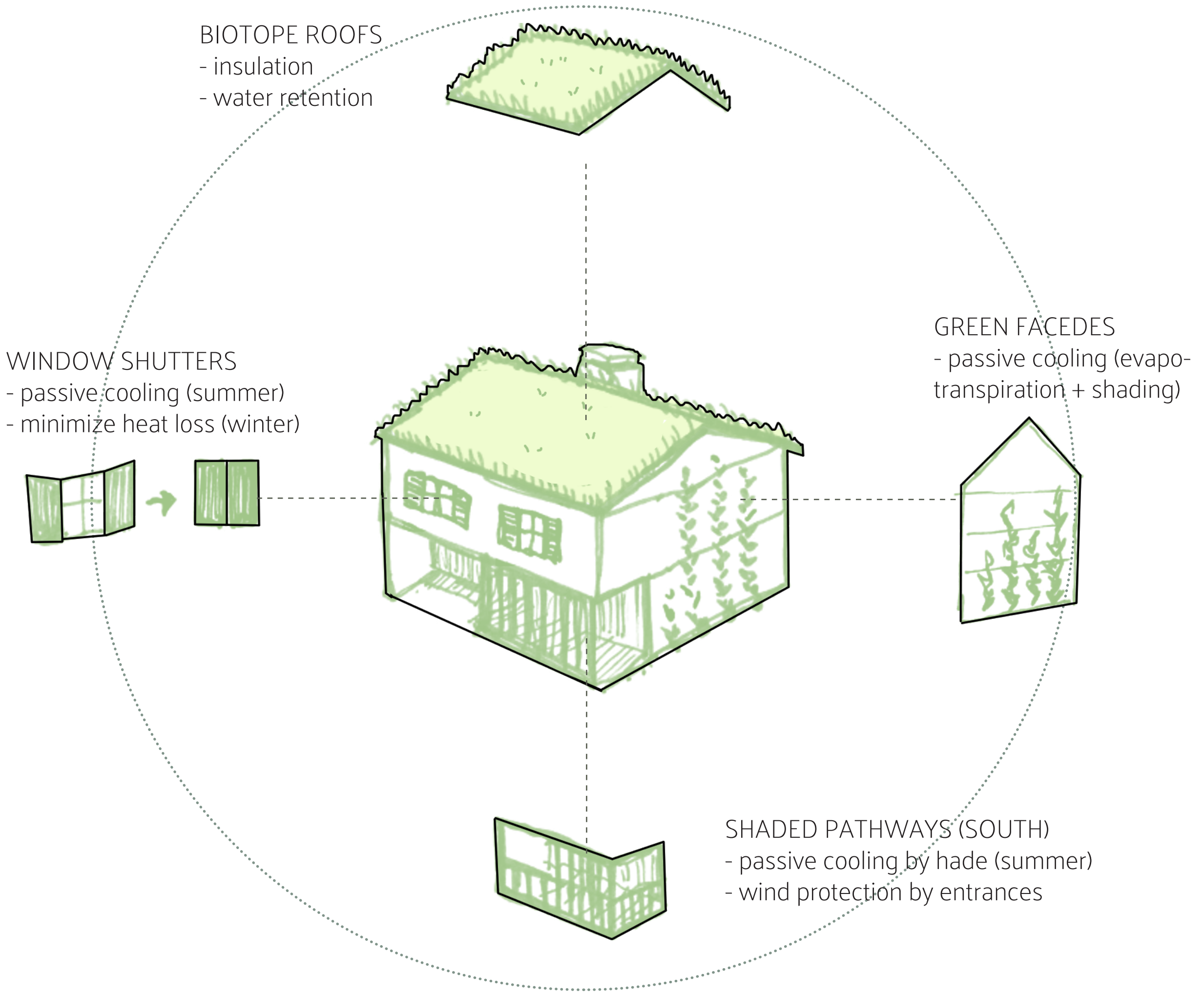
AND ALL
OTHERS!



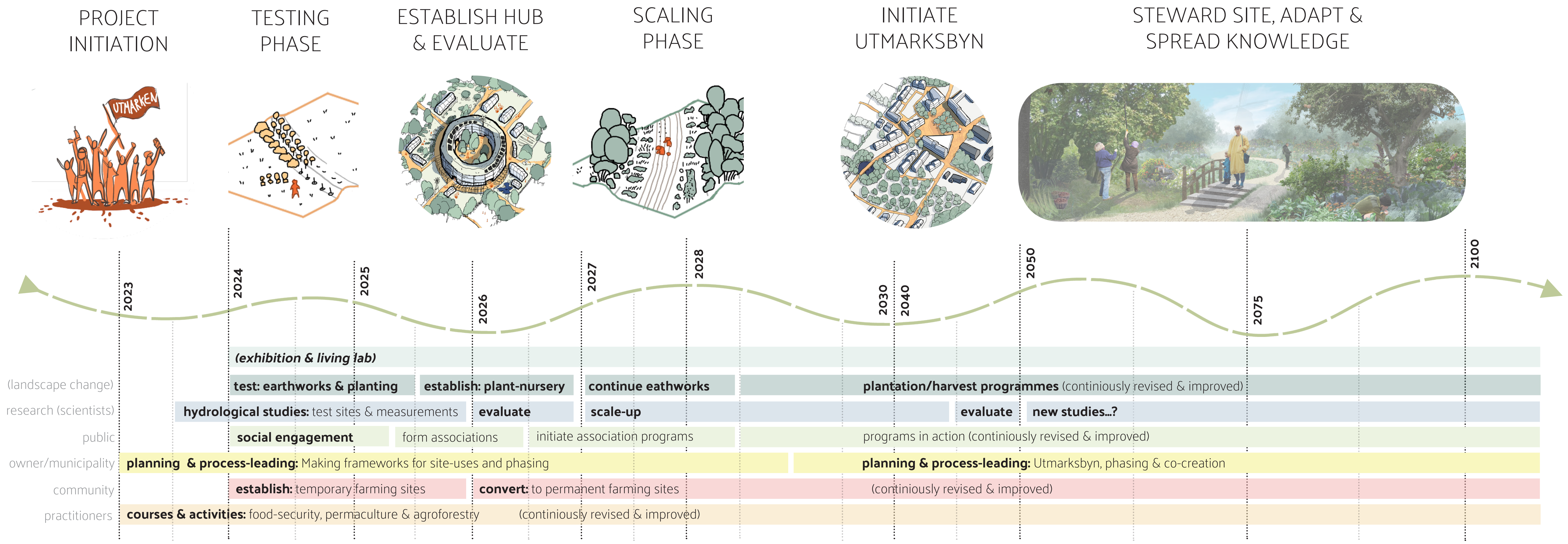
BUILDING VARIATIONS



climate adaption



phasing & implementation



05.

reflections

"You are not Atlas carrying the world on your shoulder. It is good to remember that the planet is carrying you."

- Vandana Shiva

reflections

I believe that this project shines a light on some of the most pressing issues of our time and shows ways to adapt and restore robustness to our natural (and human) ecosystems. This project has been like using binoculars for me to discover and deepen my knowledge on both global and local issues/valuable experiences to tackle these very issues through the literature review. One of the most crucial steps was to start translating my gathered knowledge to site-specific strategies and figuring out how to incorporate them in the actual design work. When I realized how complex some of the issues and my design had become, I started to focus on food security and the different dimensions of how cultivation spaces could function in accordance with the reviews' insights.

Even though, I've barely scratched the surface of how this type of project can (and should) be designed. For example, I am aware of that this thesis just roughly describes agroforestry systems, and that there is deep practical knowledge on specifics on how to design these systems out there. I actually attended the Swedish Agroforestry Conference in early October 2022 and met wonderful & knowledgeable people in the field, got to visit actual (swedish!) food forests and was presented with the reality of what I had only just read about. Attending this conference strengthened my insight on that a larger scale landscape perspective might be very valuable in this transition of edible and restorative landscapes. For example – the issue of replenishing groundwater levels will be a pressing issue which could be dealt with strategically on a larger landscape scale (and favorably also with agroforestry). This would need to be investigated properly on national, regional and local levels.

I found that working with an interdisciplinary field of questions touching ecology, culture, agriculture, forestry and urbanism was incredibly giving. I hope that this thesis has planted new perspectives to the site in question – and perhaps even provided some seeds of thought.

"It's surely our responsibility to do everything within our power to create a planet that provides a home not just for us, but for all life on Earth." - Sir. David Attenborough.

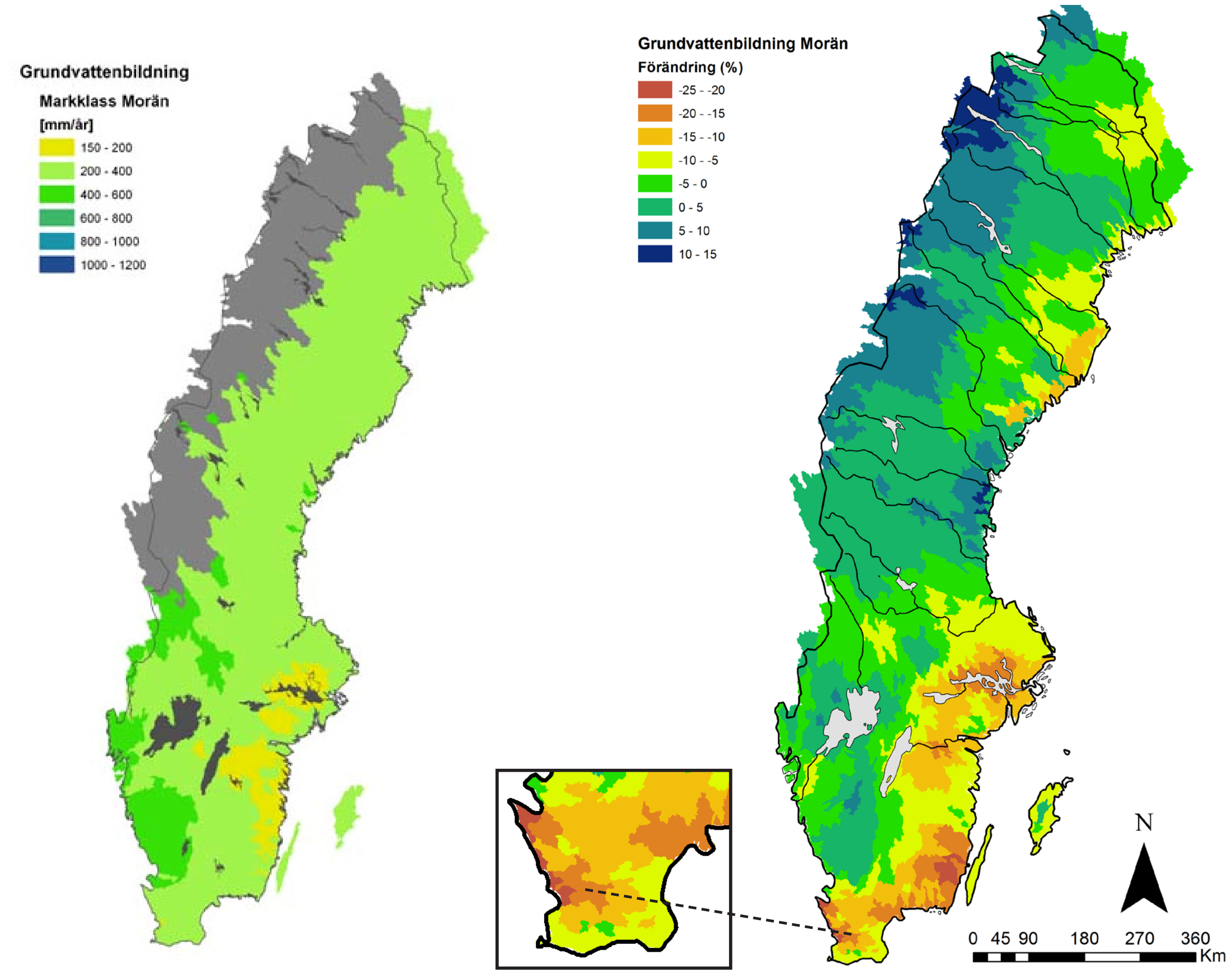


Fig 23. Groundwater recharge in todays' climate (left 1961-1990) and estimated change up to 2071-2100. (Rodhe et al 2007).

06.

literature, figures & resources

sustainability, energy paradigm & planetary bounderies

Aleklett, Kjell. (2012). Peeking at Peak Oil. New York Heidelberg, Dordrecht, London: Springer. Switzerland.

Bardi, Ugo. (2011). Limits to Growth Revisited. New York Heidelberg, Dordrecht, London: Springer. Switzerland.

Donella, H; Meadows, Dennis L.; Randers, Jörgen; Behrens III, William W. (1972).The Limits to Growth: A Report for Club Rome's Project on the Predicament of Mankind. Potomac Associates.

Hagens, Nate. (2022). The Great Simplification. [Film]. The Great Simplification by Nate Hagens. https://www.thegreatsimplification.com/ (hämtat 2022-09-05)

Hawken, Paul. (2017). Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming. Penguin Books. New York. USA.

Heinberg, Richard. (2008). The Party's Over: Oil, War and the Fate of Industrial Societies. New Society Publishers. Gabriola Island.

Hickel, J. (2020). The sustainable development index: Measuring the ecological efficiency of human development in the anthropocene. Ecological Economics (167) https://doi.org/10.1016/j.ecolecon.2019.05.011 (hämtad 2022-01-21)

Huberman, Leo. (1936). Människans rikedomar. tema nova. Rabén & Sjögren. Kristianstad.

IPCC. (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. IPCC Sixth Assessment Report. https://www.ipcc.ch/report/ar6/wg2/ (hämtad: 2022-03-18)

IPCC. (2021). Climate Change 2021: The Physical Science Basis. Switzerland, IPCC. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf (hämtad 2022-01-12)

Kahn Ribeiro, S.; S. Kobayashi; M. Beuthe; J. Gasca; D. Greene; D. S. Lee; Y. Muromachi; P. J. Newton; S. Plotkin; D. Sperling; R. Wit; P. J. Zhou, (2007): Transport and its infrastructure. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)],

Martenson, Chris. (2011). The Crash Course: The Unsustainable Future of Our Economy, Energy and Environment. Wiley. USA.

Ritchie, Hannah. (2018). How urban is the world? Our World in Data. https://ourworldindata.org/how-urban-is-the-world (hämtad 2022-01-25)

Ritchie, Hannah; Roser Max. (2020). Energy - Country Profile: Sweden. Our World in Data. https://ourworldindata.org/energy/country/sweden (hämtad 2022-01-25). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

Rockström, J., W. Steffen, K. Noone, Å. Persson, F. S. Chapin, III, E. Lambin, T. M. Lenton, M. Scheffer, C. Folke, H. Schellnhuber, B. Nykvist, C. A. De Wit, T. Hughes, S. van der Leeuw, H. Rodhe, S. Sörlin, P. K. Snyder, R. Costanza, U. Svedin, M. Falkenmark, L. Karlberg, R. W. Corell, V. J. Fabry, J. Hansen, B. Walker, D. Liverman, K. Richardson, P. Crutzen, and J. Foley. (2009). Planetary boundaries: exploring the safe operating space for humanity. Ecology and Society 14(2): 32. [online] URL: http://www.ecologyandsociety.org/vol14/iss2/art32/

Rodhe, Allan; Lindström, Göran; Dahnée, Joel. (2007). Grundvattennivåer I ett förändrat klimat. Slutrapport från SGU-projektet "Grundvattenbildning i ett förändrat klimat". proj nr 60-1642/2007. Uppsala och Norrköping.

SDI. (2019). Sustainable Development Index. https://www.sustainabledevelopmentindex.org/ (hämtad 2022-01-25)

SGU. (2020). Kritiska Råvaror. Sveriges Geologiska Undersökning. https://www.sgu.se/mineralnaring/kritiska-ravaror/ (hämtad 2022-03-20)

Thackara, John. (2015). How to thrive in the next economy: Designing tomorrow's world today. Thames & Hudson. London. UK.

Trainer, Ted. (2007). Renewable Energy Cannot Sustain a Consumer Society. Springer. The Netherlands.

Van Oost K, Quine TA, Govers G, De Gryze S, Six J, Harden JW, Ritchie JC, McCarty GW, Heckrath G, Kosmas C; Giraldez JV; da Silva JR; Merckx R. (2007). The impact of agricultural soil erosion on the global carbon cycle. Science. 2007 Oct 26;318(5850):626-9. doi: 10.1126/science.1145724. PMID: 17962559.

Wessles, Tom. (2006). The Myth of Progress. Burlington: University of Vermont Press. Vermont, USA.

Zeihan, Peter. (2022). The end of the world is just the beginning: Mapping the collapse of globalization. Harper Collins. New York. USA.

biodiversity

Cengiz, A. Esra. (2013). Impacts of Improper Land Uses in Cities on the Natural Environment and Ecological Landscape Planning. London: InTechOpen. London, United Kingdom. DOI: 10.5772/55755 https://www.intechopen.com/chapters/45405 (hämtad 2022-01-12)

E. Lovejoy, Thomas; Hannah, Lee. (2019). Biodiversity and Climate Change: Transforming the Biosphere. New Haven & London: Yale University Press. USA.

Filho, Leal Walter; Barbir, Jelena; Preziosi, Richard. (2019). Handbook of Climate Change and Biodiversity. Cham: Springer. Switzerland.

Gyllin, Mats. (2004). Biological diversity in urban environments – positions, values and estimation methods. Diss,. Swedish University of Agricultural Sciences. Alnarp, Sweden. https://pub.epsilon.slu.se › 566 › 1 › Agraria461.pdf (hämtad 2022-01-12)

Magrini, L. and Facure, KG. (2008). Barn owl (Tyto alba) predation on small mammals and its role in the control of hantavirus natural reservoirs in a periurban area in southeastern Brazil. Laboratório de Taxonomia, Ecologia Comportamental e Sistemática de Anuros Neotropicais, Instituto de Biologia, Universidade Federal de Uberlândia – UFU. Uberlândia, MG, Brazil.

Naturvårdsverket. (2020). Sveriges arter och naturtyper i EU:s art-och habitatdirektiv. Resultat från rapportering 2019 till EU av Bevarandestatus 2013-2018. Naturvårdsverket. Stockholm. Sweden. https://www.naturvardsverket.se/globalassets/media/publikationer-pdf/6900/978-91-620-6914-8.pdf (hämtad 2022-02-03)

Nilsson, Sven G.; Franzén, Markus; Pettersson, Lars B. (2013). Land-use changes, farm management and the decline of butterflies associated with semi-natural grasslands in southern Sweden. Nature Conservation 18: 31–48. doi: 10.3897/natureconservation.6.5205

Sánchez-Bayo, Fransisco; Wyckhuys, Kris A:G. (2019). Worldwide decline of the entomofauna: A review of its drivers. Biological Conservation (232): 8-27. https://doi.org/10.1016/j.biocon.2019.01.020 (hämtad 2022-01-12)

SLU Artdatabanken. (2020). Rödlistade arter i Sverige 2020. SLU, Uppsala

SLU Artdatabanken. (2022). Artfakta: Naturvård: Rödlistade arter. https://artfakta.se/rodlistan?lt=%5B663%5D&mu=%5B1281%5D&bt=%5B1508%5D&rl=%5B2,3,5,4%5D (hämtat 2022-09-05).

Sveriges Miljömål. (2021). Fåglar och fjärilar i odlingslandskapet. Elektronisk källa. https://sverigesmiljomal.se/miljomalen/ett-rikt-odlingslandskap/faglar-och-fjarilar/ (hämtad 5/8-2022)

WWF. (2020) Living Planet Report 2020 - Bending the curve of biodiversity loss. Almond, R.E.A., Grooten M. and Petersen, T. (Eds). WWF, Gland, Switzerland.

agriculture & food security

Ashman, M.R. & Puri G. (2002). Essential Soil Science. A clear and concise introduction to soil science. Blackwell Publishing. Oxford. UK.

Baky, Andras; Widerberg, Anna; Landquist Birgit, Norberg, Ida; Berlin, Johanna; Engström, Jonas; Svanäng, Karin; Lorentzon, Katarina; Cronholm, Lars-Åke; Petterson, Ola. (2013). Sweden's primary production and supply of food – the possible consequences of a lack of fossil energy. JTI-Rapport 2013, Lantbruk & Industri nr 410. JTI – Institutet för jordbruks-och miljöteknik. ISSN-1401-4963.

Borg, Henrik. (2005). Den skånska livsmedelsindustrin. Kristianstad, Lund: Regionmuseet Kristianstad, Landsantikvarien i Skåne.

Eldor A. Paul. (2014). Soil Microbiology, Ecology and Biochemistry. Fourth Edition. Academic Press-Elsevier. Oxford UK.

Eriksson, Camilla. (2018). Livsmedelsproduktion ur ett beredskapsperspektiv: Sårbarheter och lösningar för ökad resiliens. Swedish University of Agricultural Sciences. Research-platform SLU Future Food. Uppsala.

Fogelfors, Håkan; Wivstad, Maria; Eckersten, Henrik; Holstein, Fredrik; Johansson, Susanne; Verwijist, Theo. (2009). Strategic Analysis of Swedish Agriculture: Production systems and agricultural landscapes in a time of change. Swedish University of Agricultural Sciences. Department of Crop Production Ecology. Uppsala. ISBN 978-91-86197-55-1

GRAIN. (2016). The Great Climate Robbery: How the Food System Drives Climate Change and What We Can Do About It. Oxford: New Internationalist Press. United Kingdom.

Johansson, Susanne. (2005). The Swedish Foodprint. An Agroecological Study of Food Consumption. Diss. Swedish University of Agricultural Sciences. Uppsala. Sweden. https://pub.epsilon.slu.se › 843 › 1 › FOODPRINT.pdf (hämtad 2022-02-03)

Jordbruksverket. (2021). Chapter: Hur stor andel av livsmedlen som säljs på marknaden är producerade i Sverige? from På tal om jordbruk och fiske – fördjupning om aktuella frågor. Nyhetsbrev 2021. Jordbruksverket. https://jordbruksverket.se/mat-och-drycker/handel-och-marknad/priser-och-marknadsinformation-for-livsmedel/nyhetsbrev-pa-tal-om-jordbruk-och-fiske (hämtad 2022-02-03)

Jordbruksverket. (2013). Väsentligt samhällsintresse? Jordbruksmarken i kommunernas fysiska planering. Rapport 2013:35. Jordbruksverket. Sweden. https://webbutiken.jordbruksverket.se/sv/artiklar/ra1335.html (hämtad 2022-02-03)

Lepore, Juan. Pablo & van Caloen, Nicholas. (2017). Agroecology in Cuba. [Film]. Adapted, Produced and Directed by: Juan Pablo Lepore and Nicolas van Caloen. Collective Documetal Semillas. Argentina-Cuba. https://www.youtube.com/watch?v=jShKWeoqkiU (hämtat 2022-09-05)

Livsmedelsverket, Jordbruksverket och Statens veterinärmedicinska anstalt. (2021). Förlag till arbetsplan. Uppbyggnad av Livsmedelsberedskapen inklusive åtgärder vid en bristsituation i livsmedelskedjan. Livsmedelsverket Dnr 2021/01533 Jordbruksverkets Dnr 6.9.17-06450/2021, SVA:s Dnr SVA 2021/254

Montgomery, David R. & Biklé, Anne. (2016). The hidden half of nature: the microbial roots of life and earth. W.W. Norton & Company. New York & London. USA & UK.

Nilsson, Sven G; Franzén, Markus & Pettersson, Lars B. (2013). Land-use changes, farm management and the decline of butterflies associated with semi-natural grasslands in southern Sweden. Nature Conservation 6:31-48. https://doi.org/10.3897/natureconservation.6.5205 (hämtad 2022-01-21)

Panagos P, Barcelo S, Bouraoui F, Bosco C, Dewitte O, Gardi C, Erhard M, Hervas De Diego F, Hiederer R, Jeffery S, Lükewille A, Marmo L, Montanarella L, Olazabal C, Petersen J, Penizek V, Strassburger T, Toth G, Van Den Eeckhaut M, Van Liedekerke M, Verheijen F, Viestova E, Yigini Y, authors Jones A, editor. (2010) The State of Soil in Europe : A contribution of the JRC to the European Environment Agency's Environment State and Outlook Report– SOER 2010 . EUR 25186 EN. Luxembourg (Luxembourg): Publications Office of the European Union; 2012. JRC68418

Region Skåne. (2017). Skånes Livsmedelsstrategi 2030. https://utveckling.skane.se/publikationer/strategier-och-planer/skanes-livsmedelsstrategi-2030/ (hämtad 2022-07-37)

P. Neilson, Ronald; F. Pitelka, Louis; M. Solomon, Allen; Nathan, Ran; F. Midgley, Guy; M. V. Fragoso, Jóse; Lischke, Heike; Thompson, Ken. (2005). Forecasting Regional to Global Plant Migration in Response to Climate Change, BioScience, Volume 55, Issue 9, September 2005, Pages 749–759, https://doi.org/10.1641/0006-3568(2005)055[0749:FRTGPM]2.0.CO;2

Shiva, Vandana. (2008). Soil not oil: Climate Change, Peak Oil and Food Insecurity. South End Press. Cambridge. USA.

Shiva, Vandana. (2016). Who really feeds the world? The failures of agribusiness and the promise of agroecology. North Atlantic Books. Berkeley, California. USA.

Slätmo, Edling, Norderhaug, & Stenseke. (2012). Jorden vi ärvde. Den svenska åkermarken i ett hållbarhetsperspektiv. Kungl. Skogs-och Lantbruksakademiens Tidskrift (no.6). http://www.ksla.se/wp-content/uploads/2012/11/KSLAT-6-2012-Jorden-vi-aRvde.pdf (hämtad: 2022-01-24)

Smith, P.; D. Martino, Z; Cai, D. et al. (2007). Agriculture. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Sveriges Miljömål. (2022). Ett rikt odlingslandskap: Jordbrukets utveckling. Elektronisk källa. https://sverigesmiljomal.se/miljomalen/ett-rikt-odlingslandskap/jordbrukets-utveckling/ (hämtat 2022-08-20)

Tickell, J & Harell, R. (2020). Kiss the Ground. [Film]. Directed by Joshua Tickell & Rebecca Harrel Tickell. Documentary. Santa Monica, California. Benenson Productions. Netflix Inc.

Viljoen, André; Bohn, Katrin; Howe, Joe. (2005). CPULs Continuous Productive Urban Landscapes: designing urban agriculture for sustainable cities. University of Brighton. Oxford, United Kingdom. https://library.uniteddiversity.coop/Food/Continuous_Productive_Urban_Landscapes.pdf (hämtad 2022-01-24)

Wallander, Håkan (2015). Jord. Funderingar kring grunden för vår tillvaro. Bokförlaget Lagenskiöld. Stockholm.

timelines

Britannica. (2022). Origins of agriculture. https://www.britannica.com/topic/agriculture (hämtat 2022-08-20)

Ghode, Helena. (2017). Så blev traktorn en del av lantbruket. Tidskriften LAND. LRF Media. https://www.landlantbruk.se/sa-blev-traktorn-en-del-av-lantbruket (hämtat 2022-08-20)

SVT Nyheter. (2015). 9 av 10 jordbruk borta på 25 år. https://www.svt.se/nyheter/vetenskap/9-av-10-jordbruk-borta-pa-25-ar (hämtat 2022-08-20)

Unsworth, John. (2010). History of Pesticide use. IUPAC: International Union of pure and applied chemistry. https://agrochemicals.iupac.org/index.php?option=com_sobi2&sobi2Task=sobi2Details&catid=3&sobi2Id=31 (hämtat 2022-08-20)

World History Encyclopedia. (2022). Agriculture Timeline. World History Publishing. United Kingdom. World History Foundation. Canada. https://www.worldhistory.org/timeline/Agriculture/ (hämtat 2022-08-20)

agroforestry & permaculture

Agroforestry Sverige. (2022). Agroforestry – en gammal jordbruksmetod som återintroduceras. Website for the swedish association of agroforestry. https://agroforestry.se/agroforestrysystem/ (hämtad juni 2022)

Altieri, Miguel A. (1995). Agroecology: The Science of Sustainable Agriculture. CRC Press. Taylor & Francis Group LCC. Boca Raton. USA.

Eksvärd, K.; Björklund, J.; Danielsson, M.; Eksvärd, J.; Hansdotter, H.; Holmdahl, J.; Jansson, J.; Kjellberg, O.; Klingberg, P.; Korhonen, A.; et al (2016). Mångfunktionella Lokala Odlingssystem Etablering av Modern Agroforestry i Sverige 2012–2016; Örebro Universitet & Inspire Action & Research AB: Örebro, Sweden, 2016.

Fukuoka, Masanobu. (1985). The Natural Way of Farming: The Theory and Practice of Green Philosophy. Japan Publications. Tokyo & New York.

Holzer, Sepp. (2004). Sepp Holzer's Permaculture. Permanent Publications. Hampshire. United Kingdom.

Bane, Peter. (2012). The Permaculture Handbook. Chatto & Windus. London. New Society Publishers. Gabriola Islands. Canada.

Delshammar, Tim; Alexandersson, Erik; Qviström, Mattias; Jansson, Märit; Palsdottir, Anna Maria; Gunnarsson, Allan ; Rännbäck, Linda-Marie & Rämert, Birgitta (2013). Stadsodling – reflektioner och perspektiv från SLU Alnarp. Alnarp, Sweden: (LTJ, LTV) > Institutionen för landskapsarkitektur, planering och förvaltning (f.o.m. 130101), Sveriges lantbruksuniversitet. Landskap, trädgård and jordbruk : rapportserie ; 2012:31

Jacke, Dave; Toensmeier, Eric. (2005). Edible Forest Gardens: Volume 1: Ecological Vision and Theory for Temperate Climate Permaculture. Chelsea Green Publishing Company. White River Junction, Vermont. USA.

Shepard, Mark. (2013). Restoration Agriculture. Acres U.S.A. Austin, Texas. USA.

Shaffer, Christina; Eksvärd, Karin; Björklund, Johanna. (2019). Can Agroforestry Grow beyond Its Niche and Contribute to a Transition towards Sustainable Agriculture in Sweden? Sustainability 2019, 11, 3522. doi:10.3390/su11133522

Swanson, William. (2020). How Much Land Does It Take To Feed One Person – Online Calculator. Permaculturism. https://permaculturism.com/how-much-land-does-it-take-to-feed-one-per son/ (hämtat 29/7-2022)

The Soil Association (2019). The Agroforestry Handbook: Agroforestry for the UK. Soil Association Limited. Bristol .United Kingdom.

Weiss, Philipp. (2022). Nötodlarens handbok. Hälsingbo Skogsträdgård. Sweden.

Weiss, Philipp. (2018). Skogsträdgården: Odla ätbart överallt. Hälsingbo Skogsträdgård. Sweden.

Karlsson, Mikael. (2021). Konsten att hugga träd och ha skogen kvar. Ljungbergs Tryckeri. Klippan. Sweden.

Yeomans, P.A. (1954). The Keyline Plan. Waite & Bull. Sydney. Australia.

maps, documents and statistics

Boverket. (2022) Typer av ekosystemtjänster. https://www.boverket.se/sv/samhallsplanering/sa-planeras-sverige/planeringsfragor/ekosystemtjanster/olika-typer-av-ekosystemtjanster/ (hämtat 2022-07-04)

Lunds Kommun. (2021). Planprogram för Råången (Östra Torn 29:8 m.fl.). Samrådshandling 2021-08-06. PÄ 04/2019. Lund: Lunds Kommun. Sweden.

Lunds Kommun. (2018). Lunds Kommuns Översiktsplan. https://lundskommun.maps.arcgis.com/apps/MapSeries/index.html?appid=ac1324c0e56a4729a5bb8143ff9c3d3c (hämtat 2022-10-25).

Macotrends. (2022). U.K. Urban Population 1960-2022. Macrotrends LCC. https://www.macrotrends.net/countries/GBR/united-kingdom/urban-population (hämtat 2022-09-05)

Projektkontoret Lund NE/Brunnshög. (2012) Kulturmiljöprogram för Lund NE/Brunnshög. Preleminärbilaga juni 2012. Lund. Sweden.

Stadsbyggnadskontoret Lund. (2013:1). Fördjupning av översiktsplanen för Lund NE/BRUNNSHÖG. Lund: Lunds Kommun. Sweden.

Stadsbyggnadskontoret Lund. (2013:2). Rampogram för del av Östra Torn 27:13 m.fl. Lund: Lunds Kommun. Sweden.

Statista. (2022). Sweden: Urbanization from 2011 to 2021. Statista. https://www.statista.com/statis tics/455935/urbanization-in-sweden/ (hämtat 2022-09-05)

Sönnichsen. (2022). Leading oil-producing countries worldwide in 2021 (in 1,000 barrels per day). June 2022. Statista. https://www.statista.com/statistics/237115/oil-production-in-the-top-fif teen-countries-in-barrels-per-day/ (hämtat 2022-09-05)

World Population Review. (2022). Nordic Countries 2022. World Population Review. https://world populationreview.com/country-rankings/nordic-countries (hämtat 2022-09-05)

World Population Review. (2022). Wheat Production by Country 2022. World Population Review. https://worldpopulationreview.com/country-rankings/wheat-production-by-country (hämtat 2022-09-05)

agricultural history

Kungliga Lantbruksstyrelsen. (1971). Översiktlig gradering av åkermarken I Sverige. PM. Planeringsenheten.
Länsstyrelsen Halland. (2020). LstN Klassad jordbruksmark. Utdrag ur länsstyrelsernas Geodatakatalog. ID: 609ac272-4dcb-4138-865c-46fc2760ef0c. https://ext-geodatakatalog.lansstyrelsen.se/GeodataKatalogen/?querystring=uuid=(609ac272-4dcb-4138-865c-46fc2760ef0c)&site=DefaultUser&expandrecord=true (hämtad 2022-07-18)
Länsstyrelsen Skåne (1). Kulturmiljöprogram: Jordbrukets landskap. https://www.lansstyrelsen.se/skane/besoksmal/kul turmiljoprogram/kulturmiljoprogram-skanes-historia-och-utveckling/kulturmiljoprogram-jordbrukets-land skap.html (hämtad 2022-01-12)
Länsstyrelsen Skåne (2).Skiftesreformer och jordbrukets rationalisering. https://www.lansstyrelsen.se/skane/besoksmal/kulturmiljoprogram/kulturmiljoprogram-skanes-historia-och-utveckling/kulturmiljoprogram-jordbrukets-landskap/skiftesreformer-och-jordbrukets-rationalisering.html (hämtat 2022-07-27).
Montgomery, David R. (2007). Dirt: the erosion of civilizations. University of California Press. Berkeley, Los Angeles, London.
Steel, Carolyn. (2020). Sitopia: How food can save the world. Chatto & Windus. London.
Steel, Caroyln. (2008). Hungry City: How food shapes our lives. Chatto & Windus. London.
Riddersporre, Mats. (1995). Bymarker i backspegel: odlingslandskapet före kartornas tid. Trelleborg: Swedala. Sweden.
Åberg, Alf (1953). När byarna sprängdes. Natur och kultur-serien, 99-0132198-0 ; 20. Stockholm: Natur och kultur. Libris 7228031. ISBN 91-27-00362-0

graphics & design

Illustrations & all graphic work: Hugo Settergren

Icon images at pages; 12,13,20,21,22,26,30,31,34,44,45,48,49,52,,64,65,70,71,72,114,115,119,122,123,128 :**Flaticon.com** (and modified by the author).

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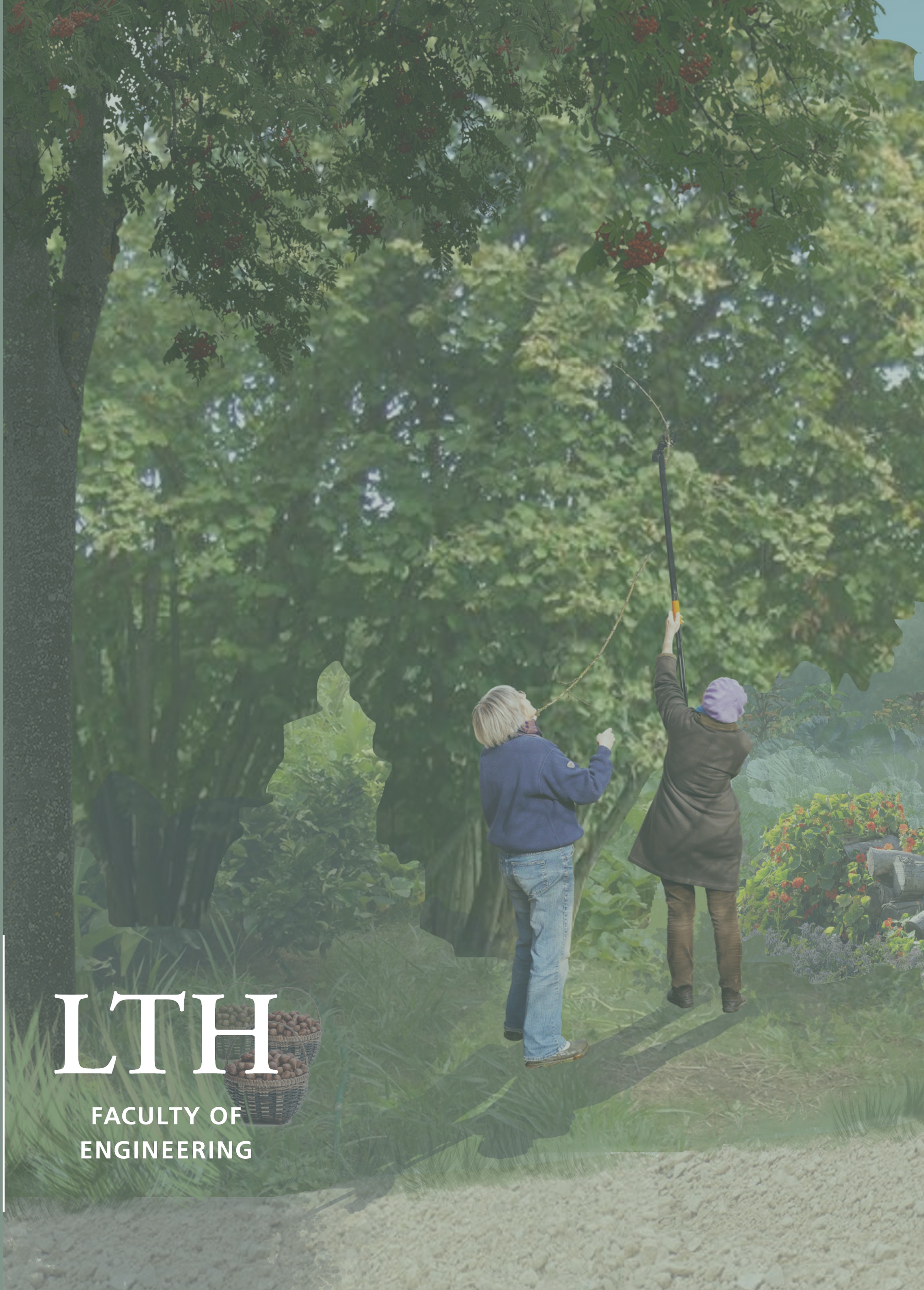

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