EDIBLE LANDSCAPES

TOWARDS A MORE RESILIENT AND SELF-SUSTAINABLE AGRICULTURAL PROUCTION SYSTEM

TU Delft Faculty of Architecture
Department of Urbanism- Chair of Landscape Architecture

MSc Graduation Thesis

Graduation Studio: Flowscapes- Harvest Lab

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My parents Ashish Teli and Sonal Teli for providing me with the opportunity to come here and study and be able to learn and see a whole new world away from home. It wouldn't have been possible without their support and hard work. I shall remain ever so grateful to them. I would also like to mention my regards to Kairavi Gandhi for providing me with insightful suggestions for the graphics of my thesis.

Lastly I would want to thank my fellow classmates at TU Delft for the fun and happy times we had while studying together and the many laughs that I shall cherish.

ABSTRACT

The current structure of the food system lies at the center of a nexus of global problems, stretching from poverty to environmental degradation. The increase in food production needed to meet the anticipated demands of the near future cannot be achieved by simply extrapolating current trends in production and consumption. A continuation of the recent historical trends of expansion and intensification will undermine the very resource base on which the food system itself depends.[1]

The preservation of ecosystems and the future wellbeing of the human population are all centrally dependent on a structural transformation of the food system towards a sustainable and resilient state.[1]

Global food and agricultural production have increased significantly since the end of WWII spurred by a combination of population and economic growth along with technological and cultural shifts in production practices. Due to increases in population, wealth, and urbanization, the world has seen an overall increase in food demand, coupled with a shift in dietary preferences towards more resource-intensive foods.[1]

The Green Revolution played a significant role in establishing intensive agricultural production methods globally and shaping the reigning philosophies in mainstream agricultural practice. Global yields have steadily increased since the 1950s; there is more food produced today per person than ever recorded. Though widely credited with helping avert anticipated large-scale food shortages in the post-WWII era, the intensification practices brought on by the Green Revolution have also been critiqued for driving ecological degradation, unsustainable resource consumption, and entrenching dependency on non- renewable resources like fossil fuels.[1]

Recent trends and policies towards growing non-food crops, like biofuels and biomaterials, are leading to re-assignment of land and other base resources, resulting in less availability of these resources for food production. Funding for agricultural research and development is mostly available in higher- income nations, leaving lower-income nations behind. Research and development efforts have been focused on enhancing conventional production methods, with very little funding allocated to the development of sustainable agricultural techniques.[1]

Limburg, Netherlands is a place which has undergone layers of transformation resulting from the thriving coal industry where it became a rich province resulting in an active producing and distributing agent of coal across Europe. After the coal industry was replaced by fuels and gas there was a sharp decline in the Urban spur resulting into a rapid urban shrinkage which firstly divided the land distinctly into urban and rural topography and secondly gave it a potential to be transformed into a landscape which was at the forefront of agricultural production generating locally available goods and formulate smaller and more resilient food cycles.

PERSONAL POSITION

WORLD VIEW

Landscape is everywhere, it is here and also there. It is just understood in sequences of foregrounds and backgrounds. Landscapes are usually layered identities. They are formed by stacking multiple thresholds which each need to be addressed individually, holistically and at the same time collectively while designing/ formulating landscapes. Landscape architecture is very closely related and dependent on nature. I think a landscape architect should use nature, ecology as a living tool/mechanism, learn from the on-going natural processes taking place, respect it and include it as a given condition, adapt your design towards it and at the same time should always work with nature rather than degrading it.

AMBITIONS

At TU Delft I learnt the distinct identity which landscape architecture has as a profession. It is usually placed between architecture and urban design. The most fascinating discovery is that landscape architecture usually spreads along varied scales and it is my job to understand, solve and create a smooth transition through all these scales. Landscape architecture usually acts as a bridge which connects these two distinct commodities into one monolithic system which is reactive and responsive to changes around it. I have developed a liking and respect for ecology as a parallel network with which I intend to include and enhance with all my work. I have been fondly attracted to the natural processes and gradients of nature and would use landscape architecture as a platform to enhance and mimic these processes on the site.

FASCINATION

I came to TU Delft having a strong architectural background. I initially used to think of landscape as an architectonic system which is expressed by natural building materials. Learning landscape architecture in a more intensive and logical manner I have developed a curious eye for the ecological processes and the cycles of nature. I am also fascinated by the idea of modularity. For example, a forest is formed by collectively placing a single module (a tree) into various combinations interacting with the understory, which intern forms its own eco-system which is at the peak of resilience. I usually like breaking down a system into its very basic parts and then start re-arranging them to device new combinations and results, the possibilities are endless so in order to contain them I define parameters and rules which follow through the scales to make the design more coherent and adaptive to stress and external forces.

GOALS

The main goal of this thesis is to learn in detail about the natural processes and the gradients of nature. Question the order of interaction and then try to design a more resilient and self-sustaining entity. The second goal is to design with and for the people. The goal is to understand the needs of the occupant and use the local community to work with nature. Make people realize the importance of living with nature rather than degrading it.

“Think Global, act Local”.

HARVEST LAB

Each place has a distinct identity. This identity is usually associated with eminent flows which are generated through the activities taking place on the place. These flows are complex chains and systems which are closely related to humans, nature, topography and sometimes tectonic activities. Some of these flows are the reason why a specific place has a designated activity which takes place on it.

On the other hand, some flows are generated as a result of the activity. Harvest as a lab focuses on these flow systems. It aims to make each of these flow systems more resilient and close the loops more locally. This lab provides a complete freedom on deciding which flowscapes to address and helps understanding the flow networks which usually take place on a site.

The lenses of this lab is relatively free and is based on individual preference. The lab is called harvest cause the main aim is to focus and intern propose a design which understands and eventually improves a specific harvesting mechanism on the site. This degree of freedom to choose and combine these complex systems is completely given to the individual. In order to do that there is a definite level of research and analysis which needs to be done in order to understand these multiple systems and then a decision needs to made based on logical justification on why a specific flow cycle is more important than the other.

In the process of analyzing the site through the lens of flow mechanism it sub-consciously makes you aware of not only the movement patterns but also the existing conditions like soil, topography, water structure, green structure, agricultural structure etc. This lab promotes a back and forth process. The analysis done to understand one layer gives rise to questions and curiosities for the other.

I am focusing on the harvest of food systems. During my analysis I realized the potential which Limburg has in becoming a production hub forming more local flow systems using local communities. I thrive to design a more resilient and self-sustaining farming typology which works with nature. It is design by and for humans. The lab pushes me to question the existing processes of nature, agricultural production and human activity and intern provide a more holistic solution which on a regional and national level forms a design kit and helps in devising a policy which can be adapted which designing an agricultural production system to make it more local.

This lab helped me dive in deeper into the natural processes and gradients of nature. Limburg as a site had open arable land and had existing ecology in the names of Brunssummerheide along with all its stepping stones.

HARVEST LAB

This lab also looks into the historic cycle of the activities which took place in Limburg and the impacts it had on the landscape. Each of these eras transformed the landscape and with progression of time left behind a substantial transformed identity of the landscape which was then further changed up until the present times.

To conclude this lab gives a platform where it doesn't focus on only one flow system, it makes you understand and question the interaction of each of the existing systems and with logical analytical lenses helps you prioritize one singular lens and also helps you to discover the connects it has with the other flow mechanisms and where are the stress points and eminent thresholds which provide a start-point foundation to re-design and re-think what, where and how we occupy a specific place.

Few weeks into the analysis process I discovered these distinct patches of green which I couldn't give any value to. They didn't belong with any of the other green structures which had a value. I got curious and started analyzing the ecology and the arable farm lands and the connect they had with water. It was then that I knew that I wanted to work towards re-defining the idea of a farm and device a more resilient method of agricultural production, working with nature rather than degrading it. It was then when I decided to take Nico Tillie as my first mentor due to is elaborate and throe knowledge on ecology and the natural gradients which are formulated in nature.

INDEX

TABLE OF CONTENT

1.

INTRODUCTION

INTRODUCTION

Agriculture, unlike other industries, relies much on natural resources. In agriculture, land not only fulfills the role of a location factor as it does for manufacturing industry and other non-agricultural industries, but it is primarily an indispensable production factor.[2] This is especially true for arable farming, horticultural field crops and stock farming. Only in the case of modern operations involved in intensive animal husbandry and greenhouse horticulture, which are similar to industrial operations, does land mainly fulfill the function of location factor. Other so-called Ricardian factors \ including climate, soil fertility, supply channels (such as harbors) or distribution areas, also play an important role in agricultural production. A favorable natural background is an asset for a country's agricultural development.[2]

Traditional Dutch agriculture

Around the 1950s, the idea of farming in the Netherlands was very different and was mainly contained to small, mixed livestock and cereal farms. The average size of a farm parcel was not more than a few hectares. They mainly consisted of multiple parcels of land spread out along the land topography.

Livestock farming on arable lands

There has been a steady rise in the livestock farming typology in the Netherlands. The average livestock size was 13 in 1950, which grew to 160 by the year 2016. The number of farms practicing livestock farming was 44 farms in the year 2000. This rose up to 511 farms in 2016.

Netherlands is the second largest exported of produces in the world.[2] This meant a lot of revenue was generated as the result of this thriving agriculture industry. The export value of Dutch agricultural produce is 44.6 billion euros in the year 2017. This also had a benefit on the consumer scale. A household in Netherlands spends 11% average revenue on food as compared to 27% in 1970.

Current state of farming in NL

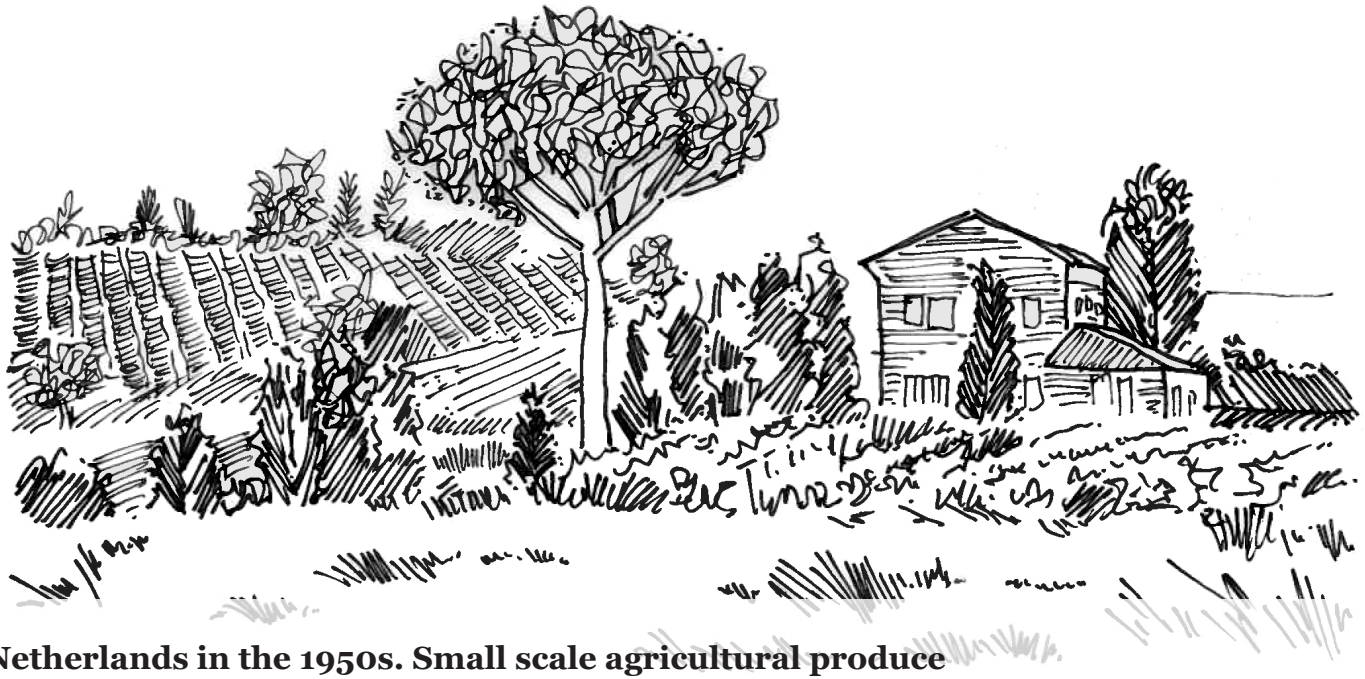
The current issue is that the number of farms in the Netherlands are constantly reducing and the average sizes of the farms in Netherlands are substantially increasing. This implies that the farmers practicing agriculture on the smaller scale are either forced to quit or are bound to work for bigger settings.

The problem is that a farmer needs to cultivate more produce in order to sustain as the cost of production and land cost has gone up and is still on a constant rise. Saying this 20-40% of farming households are struggling with incomes which is below the officially registered low-income thresholds. In 2012 the Dutch agricultural debt was 42 billion euros, which comes to around 60,000 euros per farm holding. This resulted in a sharp and steep decrease in the number of farms in the Netherlands. There used to be 410,000 farms in 1950 which came down to a mere 55,000 farms in 2017. This resulted into the fact that a major chunk of farmers was either forced to leave farming as a method to earn or had to resort to having a parallel method to acquire a stable income.

On an average 6 farmers exist each day. The local farming typologies posts a serious question for its future as the average age of farmers is 55 years and out of which only 40% of them have successors.

The current method of farming is also causing various set of problems and is the reason for the constant decline in soil quality, ecology, biodiversity and ground water pollution. The agro-chemicals are responsible for 25% of ground water pollution which causes a 15% decline in the indigenous plant species, animal species and soil fertility.

https://rolandlee.com/artwork/windmill-skies_500/



Netherlands in the 1950s. Small scale agricultural produce

Increase in the agricultural produce scale. The emergence of Farming communities

Current faming scenario. The average size of a farm is increasing and the number of farms are reducing

Land-use and tenure

The Dutch government has made shifts and alterations in their land ownership mechanisms in order to provide more methods and opportunities for a small scale producer (farmer) to be able to sustain and survive within this rapidly industrialized system of production.

The minimum duration for freehold lease arrangement is 6 years in the Netherlands. There is a new form of contract which was introduced called a very short-term lease contract for the farmers, helping small/medium farmers to get easy and ample land access.

The farmland prices increased up to 4.5 times between 1963-2018, as a result of which only 3% of the farms started controlling 52% of EU farmlands. This affected the total number of farms (under 10 hectares). There was a 56% decline in the number of farms from 59,310 farms to 26,190 farms. On the other hand, there was a sharp increase in the total number of large farms (over 100 hectares)[3]. They increased 3.5 times from 690 farms to 2390 farms. The average price of farmland in Netherlands today is placed 40,000-80,000 euro's average purchase price of 1 hectare. (63,000 euros in 2016).

Dutch agriculture ambitions

The Dutch agricultural system thrives to embrace a new more sustainable and resilient method of production mechanism. Initiatives need to be taken up and addressed across all the spectrum of production. Some of the more discussed and immediate applicable methods are:

• Citizens undertake harvesting. They become active actors in the production cycles.

• Dairy farms rather than functioning as a monoculture production system also encompass a hybrid method of cultivation which is aided by planting trees/herbs in the fields.

• Cereal farms produce is directed towards a shorter and local cycle of distribution. The produces are directly sold to the local bakers.

• Stakeholders and ownership agents needs to be more adaptive. Developing farms in which citizens become shareholders.

Driving forces in Dutch farming

There are definite actors and input systems which affect or trigger the change in the farming system, the factors which do so are:

• Technology

• Off shore farm employment (combined activities for farmers along with farming)

• Policy transformation/ re-adaptation

• Human capital (Flow of money)

• Demographics (Human occupancy and required agendas)

• Market structure
• Social setting
• Economic environment

Dutch farming figures

In the year 2007 there was a total of 1.91 million hectare of land which was used and cultivated as agricultural areas, which made the average size of a farming parcel to be around 25 hectares.

There were a total of 165,100 people working full-time in the agricultural industry, translating to 12.7 hectare which was maintained by 1 worker. The Dutch farming system was divided into 3 distinctive agriculture farming processes which were as follows:

59% Dutch farms were livestock farming on arable land

25% dairy farming

13% general field cropping

Ownership of farmlands

There was a very small diminishing ratio of sole holders for a small/medium scale farm entity. 5% of the sole owners were women, 44% of them were 55 years or older and only 4% owners were younger than 35 years. Above that 27% of the sole owners had/needed another gainful activity to generate parallel revenue.

With the advancement of technology, machines and the increase in the per square meter area production there was an 8% decrease in family labor from 2015 to 2019. The irrigation areas increased by 117% from 2015 to 2017.

Potentials and Opportunites

In the year 2007 there was a total of 1.91 million hectare of land which was used and cultivated as agricultural areas, which made the average size of a farming parcel to be around 25 hectares.

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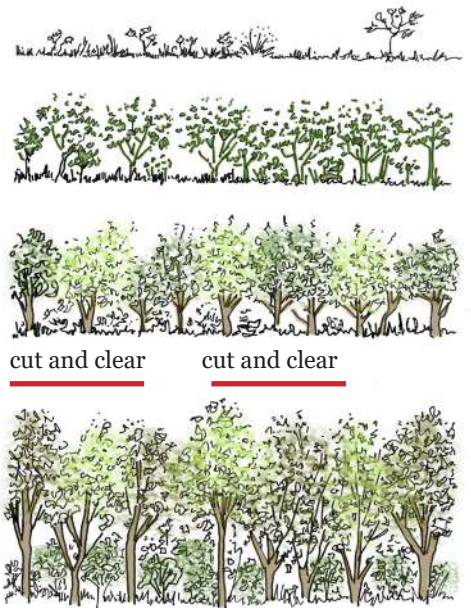
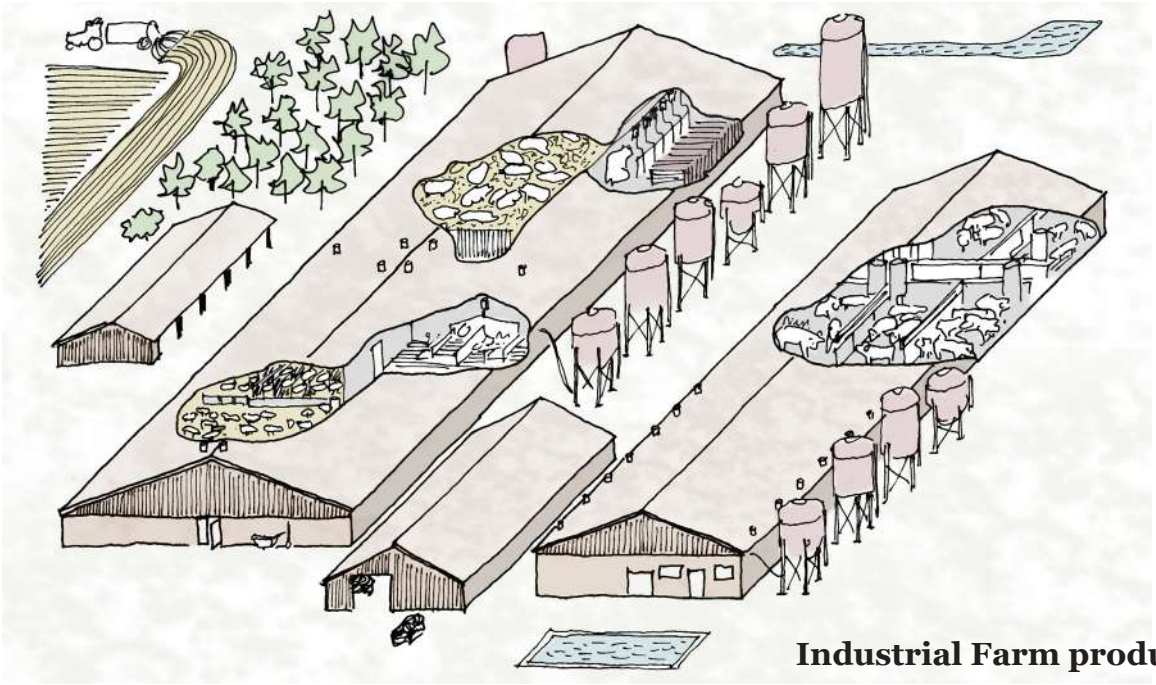


Monoculture Production- An orchard typology for agricultural cultivation



Industrial Farm production

Monoculture cropping- Wheat production Farm

Towards Polyculture cropping- Gradients and variations in Farm produce

LIMBURG, NETHERLANDS

The Municipality boundary of Limburg is located strategic, offering easy connectivity to the surrounding regions. North Brabant and Gelderland were located to the north, Belgian region of Liege around the southern and western corners, while Germany sit to its east. The area occupied had a total surface of 2.153 km2 and a controlled population of 1,100,000 people. Limburg was originally a part of Belgium up until 1893 where it joined with Netherlands.

Limburg was than captured by Celto-German people, which were the sole tribe which were defeated by Caesar. The empire under Caesar established two headquarters Coriovallum (Heerlen) and Trajectum (Maastricht). Maastricht became the center to acquire a seat as a bishopric in the low countries which was substantially short lived. This area became a house to a majority of Franks under the rule of Caesar.

In the medieval era, Trajectum was allied with the Dutchy or Limburg having Limbourg as the capital which was pre-dominantly a part of Belgium. The remaining powers were cherished and reigned on by the County of Hoorn, Dutchy of Juilich and Gelders.

The boundaries of Limburg were handed over to the empire of France along with the control over Belgium in the 1790. It was the French empire which created Lower Meuse a secluded province similar to the current size, which later on became part of Netherlands in 1815.

As the empire of Belgium divided in the 1825, the province of Limburg (Netherlands) allied with Belgium which was short lived and traded off for Antwerp in 1838.

Impact of mining industry

No longer than a century the mining industry had substantially affected and transformed the east end of South Limburg. As the initial pitheads surfaced, the agricultural region underwent a transformation and was replaced by a small settlement with its population not exceeding 20,000.

At the time of shutting down of the mining industry a total number of people which were at least 10 times the primary settlement had occupied the space, making it amongst the densest settlements in all of Netherlands, just shy of a few compared to Randstad which was located in the western part of the country.

The mining industry started a new supply chain and developed an effective network of railway and canal connectivity primarily built to cater to the transportation and distribution of the produce (coal) nationally and internationally.

The Juliana Canal was carved out specifically for this function between 1920-1930, along with a rail network stretching as long as 12 kilometers in length through the areas of Schaesberg and Simpelveld for the easy flow of employment. This line was known as a million line as that was estimated the cost of laying a million guilders per kilometer of track to make it function.

By 1940 a total of almost 800 internationals from over 10 different nationalities started referring to Kerkrade (the largest mining town at the time) as home.

Managements and communities were formed which started building settlements for the miners giving rise to mining colonies such as Lutterade. To avoid religious clashes and fights most of the miners working were Catholic.

Post mining industry impact

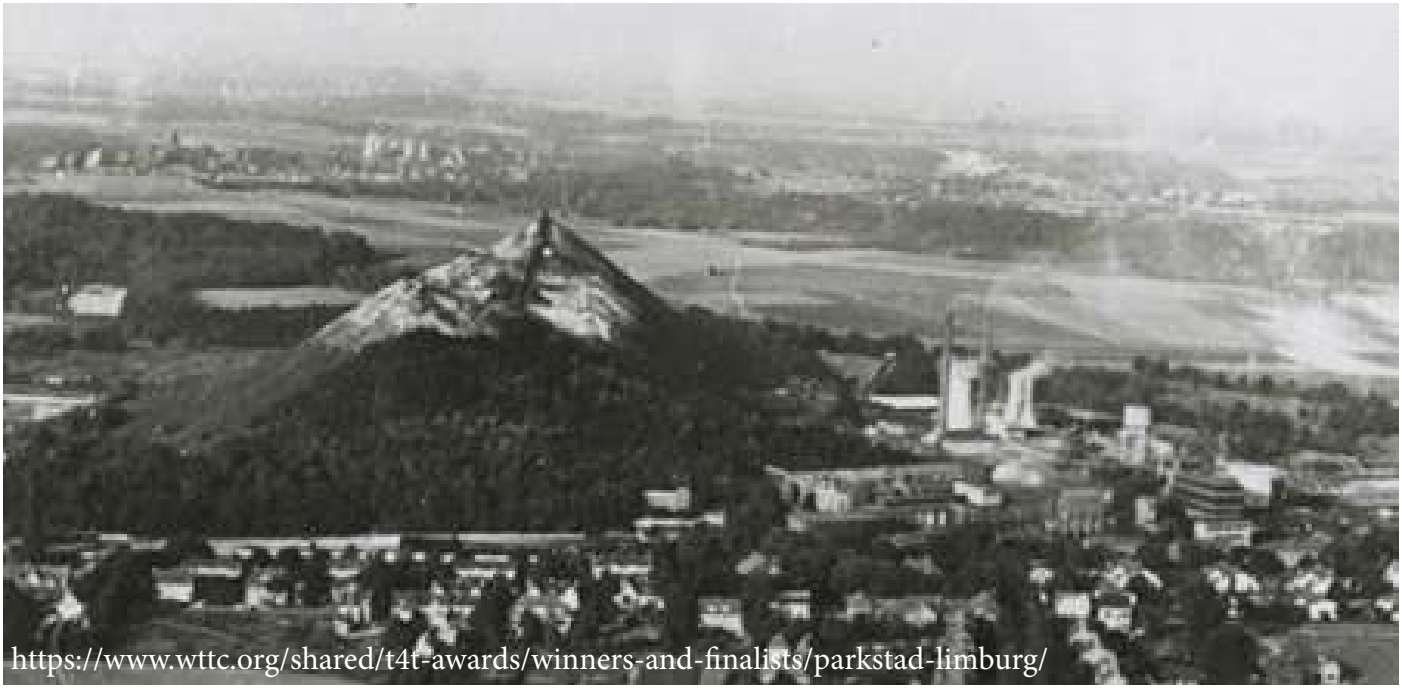
It was on December 18, 1965 the authorities announced the total collapse of the mining industry situated in Netherlands. This portrayed to have adverse effects on the employment figures, the society and the economic structures and culture within South Limburg as most of the mining industry flourished in the area. 70 Years of coal extraction had transformed the area completely and had started to be the densest populated area. The mining industry had provided Limburg with rich supply chains and a well-connected transportation (road and railways) which were mainly devised to supply the yielded coal to areas nationally and also internationally.

Early part of 1960s had around 60,000 miners who worked in producing coal. At its highest point in the industry around 80% of the settlements in the area of Limburg were directly or indirectly feeding off the benefits generated from the mining industry.
When the final mine shut in 1977, around 46,500 miners were laid off , over and above the 35,000 others whose jobs were linked to the supply industry, primarily building agencies and steel production. The massive population of unemployed miners found it extremely tough to relocate and transfer jobs as their solely acquired skill set was such that it only benefited the mining industry. By 1978 unemployment in Limburg was 3 times the total un-employment in all of Netherlands.

Landscape of Limburg

Limburg is located at the intersection and amalgamation of Netherlands and Belgium. Unlike the entire region of Netherlands, South Limburg isn't flat, it has substantial undulations. Vaalserberg (translating directly to a mountain of the region Vaal) is the un-argued high point of the region sitting in at 320 meters (1050 ft.) above N.A.P, which basically sits at 100 meters above the nearest village (Village of Vaals). It is at this very location that 3 different countries share their boundaries, thus rightly giving it the name of three-country-point.

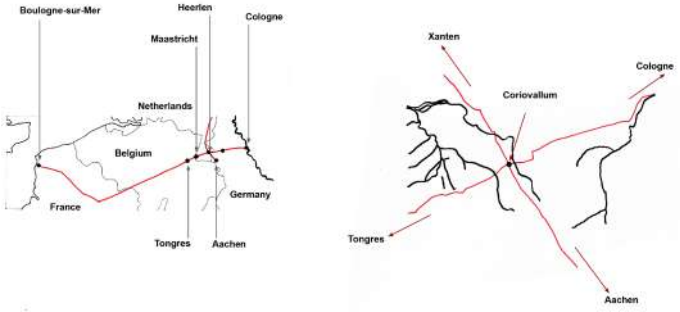
Many river systems run through the area of Limburg, Meuse being the main river which stretches the entire length running North-south. Most of the sub-surface situated in Limburg is a result of the continuous deposition of sediments from the river Meuse, which mainly are formed by river-bed clay, large deposition of stones and pebbles and an extremely fertile loess. The deposited stones are currently being mined and used for construction. Moving away from the river the soil consistence changes to sand and peat.



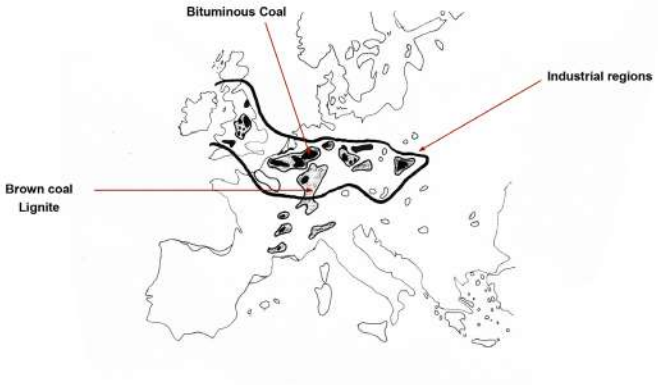
https://www.wttc.org/shared/t4t-awards/winners-and-finalists/parkstad-limburg/

https://dirkdeklein.net/2018/01/18/staatsmijn-maurits-dutch-state-coalmine/

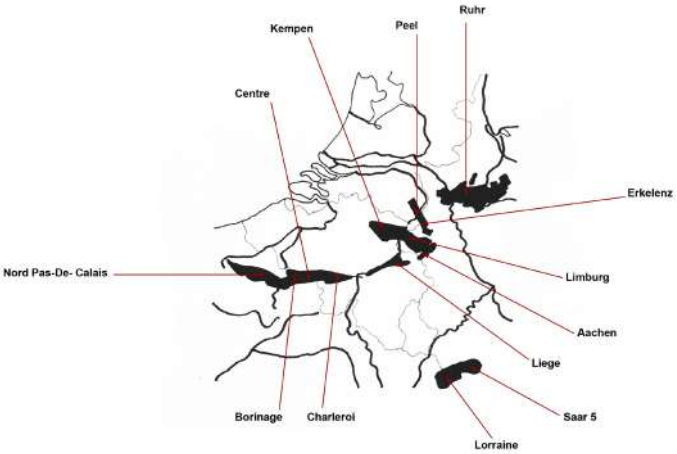
A Road networks- Historical connections



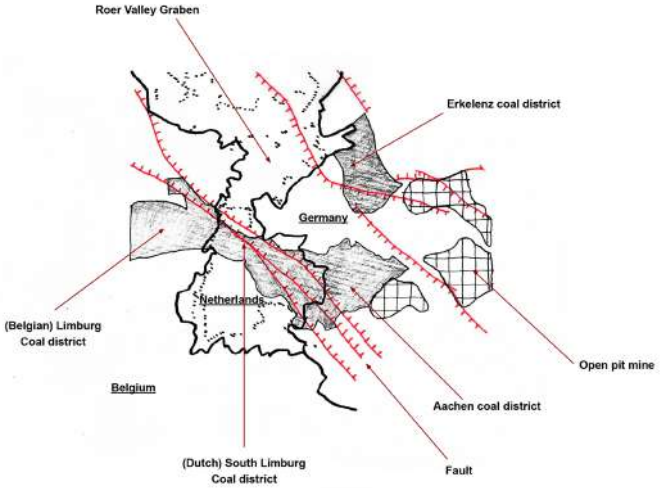
B Industrial Belt (North- West Europe)



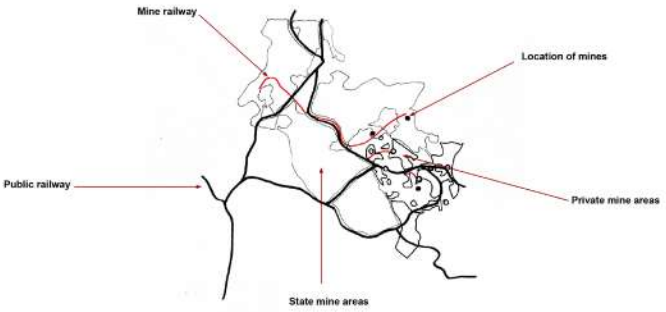
C Flow of coal industry Regional scale



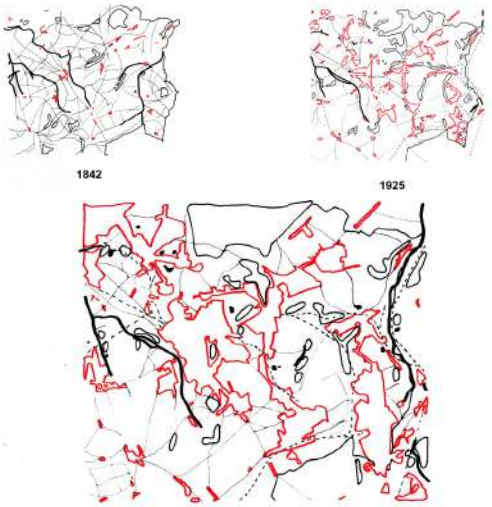
D Flow of coal industry NL, DE, BE



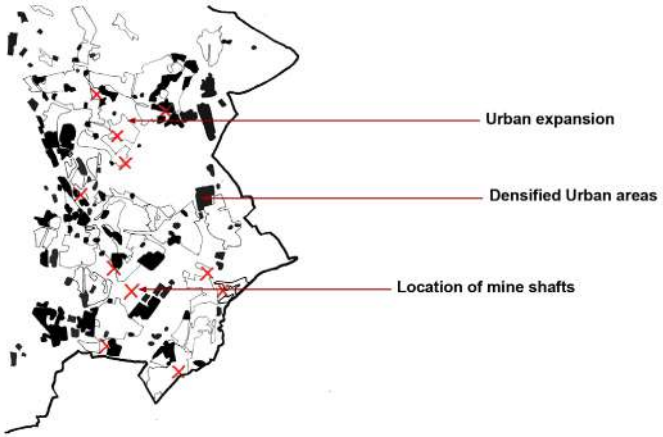
E Infrastructure/ mines (Limburg,Netherlands)



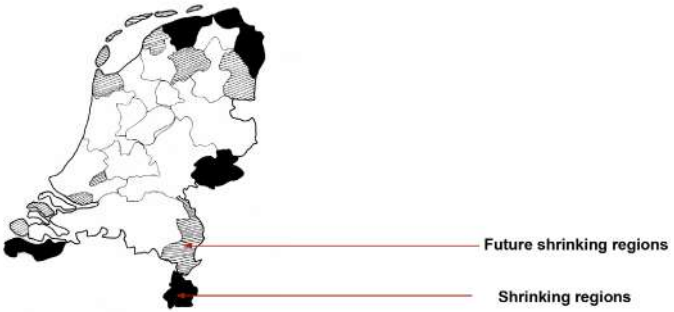
G Morphology Heerlen region



F City Expansion Impact of coal industry



H Urban shrinkage



A. The analysis shows the main infrastructure connections which were made through the old Roman center connecting all the important trade and production points. The analysis to the left shows the regional connection through France, Belgium, Netherlands and Germany. This was the main trade route and the production/ distribution network of bitumin coal.

B. The analysis shows the main industrial production belt of coal all along North-West Europe. The map highlights two main coal extractions which were active. The first one was the bituminous coal. Limburg, Netherlands and Germany were highly rich areas in the extraction of this specific kind of coal. The second was Brown coal lignite. Belgium and the areas close to France were highly rich in this specific coal extraction.

C. The map shows the main coal export and distribution belt of bituminous coal. Limburg was an active producer of coal and due to its location it has easy connections to the coal production/distribution belt which was the main supply mechanism for Europe.

D. This map shows that most of the coal extracted in Netherlands was along the tectonic movement lines which formed the plateau and the topography of Limburg. It also maps the coal extraction districts and the belt of production which connected Belgium, Netherlands and Germany. The movement of soil plates during the mesozoic era generated the abundance of coal availability in the region.

E. With the thriving coal industry in Limburg, Limburg soon became one of the richest places in the Netherlands. New coal mining colonies were made for the workers to stay. The overall architecture of Limburg was more richer than most of the places in Netherlands at that time. For the effective movement and distribution of coal new railways tracks were made which provided swift transport. Juliana canal was specifically made along the river Meuse for swift export of the coal produce. The overall infrastructure of Limburg was strengthened during this period.

F. The mining industry generated revenue making the entire province rich. The urban expansion was at a boom. New colonies for the workers were seen to be built around the mining shafts. These communities also had allotment gardens and enough access to green. Cities were expanding as alot of people wanted to move to Limburg and associate themselves to the mining community. Trade and commercial settlements along with heavy industrial expansion were all seen during this era.

G. As mentioned earlier there was a rise and steady expansion and urban densification which took place in Limburg. As seen in the map compared from 1842 to 1925 the red structures (City) was seen to have expanded steadily and when compared to 1968 there is a massive boom of expansion and urban spur.

H. The map shows the areas in Netherlands which face Urban shrinkage. Most of the shrinkage is seen to be happening around the borders.

CONTEXT

The current production methods applied to achieve production (farming) have caused substantial negative side effect: emissions of pesticides and soil degradation into the environment, decline of bio-diversity and landscape values, large water and energy consumption, the neglect of animal well-being, and accumulation of wastes.[4]

Problem Statement

The current farming networks/cycles (agriculture) in Netherlands is far from being sustainable and is constantly degrading the nature and its surrounding ecology while continuing to be dis-connected from society, transforming production spaces erratically to maximize yield.

Sub Problem Statement

The agricultural production mechanism is far from being resilient and self-sustainable. Farms still use a mono-culture cropping method to generate yield, exhausting the soil of specific nutrients.

Open arable farms use cattle and meadows which contribute to the increase of nitrate contents in the soil.

The production system is being industrialized where the number of farms are reducing and average size of an individual farm is increasing, making it difficult for the smaller local farmers to survive and sustain themselves with a decent living standard.

Research Question

What is the role of a landscape framework in providing a more self-sustainable and resilient farming network to promote/en-vision new production methods to mitigate these negative side-effects of productions and formulate synergies and a coherent design strategy which is in charge for the shift in production network, ecology, society and space in Parkstad, Limburg?

Keywords: Self-sustainable farming, resilient farming networks, production, ecology, space and society.

Secondary research enquiries

a) What are the benefits of a more self-sustainable and resilient production cycle?

b) How can nature and ecology be improved using agriculture rather than degrading it ?

c) What is that shift in spatial strategies to design a more coherent layered stack for a resilient agricultural production module ?

d) How can the agricultural production be re-directed and re-defined back to a local community scale where the production/distribution cycles are more close looped and shorter ?

Design Goals

Landscape framework

• Transforming/re-directing the idea of a production mechanism (farm networks).

• Understanding agricultural production and its impacts on a site scale, community scale and regional scale.

• Re-thinking a farm as a system, deciphering its flow chains of production, distribution and social interaction.

Design intent

Self-sustainable and resilient farming networks

• Re-orientation of the production system towards a more sustainable agriculture using agroecological farming strategies in order to formulate a more regenerative, circular and resilient production cycle.

• The shift from the on-going farming profiles to a method to a more resilient agricultural produce which works with nature rather than degrading it. (using nature as a tool).

Space

• With the on-going urban shrinkage in Parkstad, Limburg there are a distinctive accumulation/ creation of un-planned/unpremeditated spaces. These spaces are the most ideal parcels of land which are promising start-points to tangent and re-direct the production cycles to a more local scale typology formulating shorter and more close loop food cycles.

Society

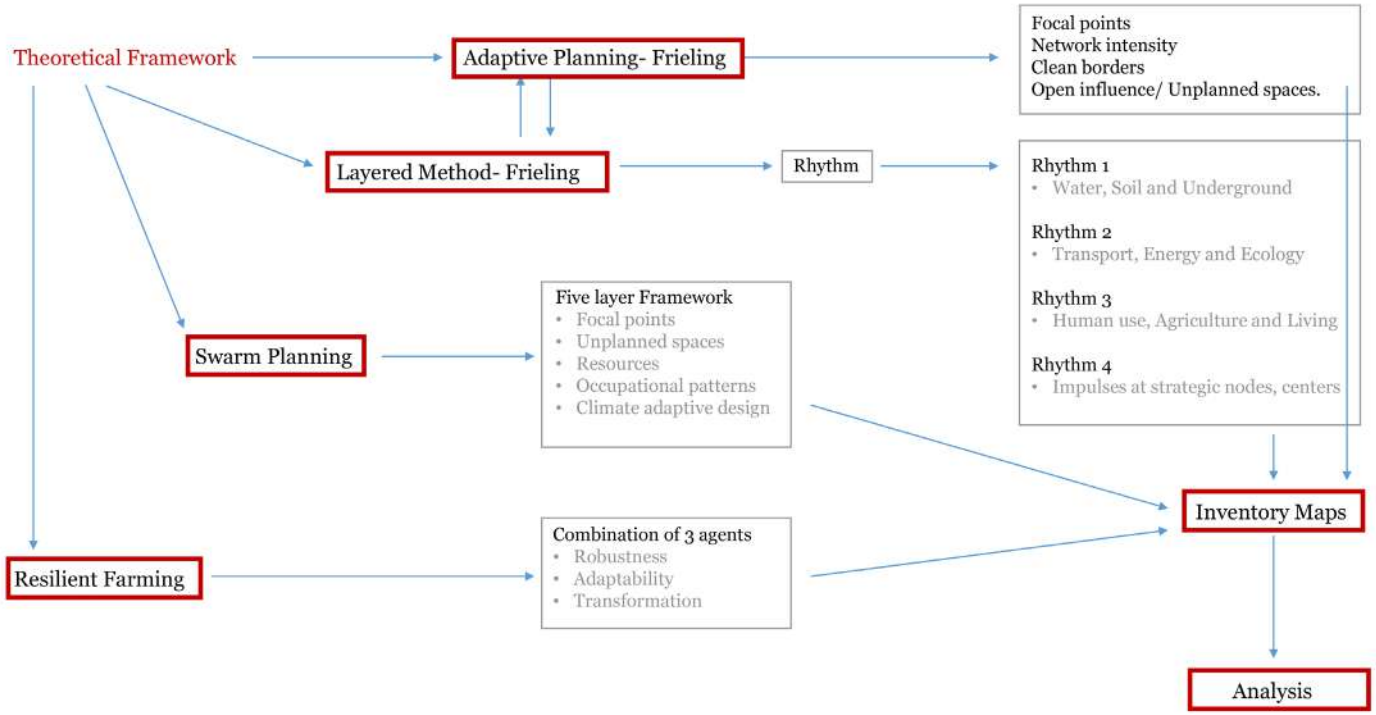
• Social farming and community based development strategies.

2.

FRAMEWORK

FRAMEWORK

THEORETICAL FRAMEWORK



METHOD USED


Method
Scenarios
Farming and Living
Processes
Ecology
Formation of Terrain (Morphology) in relation to water systems and land
Farming and its connection to the topography
Gradients
Arable Land
Agroecology
Agroforestry (Food forests, Urban Food Forests)
Permaculture
Analog Forests
Climax Forests
Care Farms and Social Farming strategies
Resilient and Self-sustainable Farming
Pattern Study
Disconnect between built and un-built environment surrounded by un-identified green structures within Limburg
Case Studies

LANDSCAPE FRAMEWORK

Layered Method - Frieling

The layer approach by Frieling consists of 3 different time-frames which are known as rhythms.

The Rhythm of the first layer focuses on water, soil and underground.[5] The time frame for this system to reach completion takes centuries.

The rhythm of the second layer focuses on transport, energy network and ecology. This rhythm takes around 100 years to reach completion.

The rhythm of the third layer focuses on patterns derived from human use and landscapes, which direct their attention towards heritage, agriculture, economic functions, recreation and living mechanisms. The time frame for completion is 20-50 years.

According to Den Hoog

The rhythm of the fourth layer focuses on impulses at strategic points (nodes, centers) which help in formulating and re-defining additional focal points. The time frame for this zone is 5-20 years.

The layer approach has proven to be a good base for adaptive planning, which is a result of integration of all the rhythms.

Spatial Elements Derived from the Layer Approach

1. Underground: Water system and soil.

2. Networks: Ecology, water and energy.

3. Occupation: Human use/ different functions focusing on heritage, agriculture, economy and recreation.

Layer approach used to design the regional plan of Groningen was broken down into smaller systematic policies which revolve around A-biotic, Biotic and occupational elements all guided towards the projected future land use.[5] The matter of the fact is that only 2% land area is allowed to change for a designated function which spans over a time-frame of 13 years.[5]

According to the theory a minimum of 30% of the area should be allowed to change/adapt to Climate change.[5] This acts as the buffer threshold which adapts to the influence of varied external forces.

Case Study

Groningen, Netherlands.

Adaptive Planning

Adaptive planning aims to adjust existing standards which are defined.[5] This system specifically focuses its attention to climate change and gives utmost importance to focal points and nodes. The more specific aims are focusing on the availability of natural resources. These parameters give rise to a system which is used to decipher this on-going transformation.

This system thrives off:

Focal points

Network intensity

Clean borders

Open influence/ Unplanned spaces.

Swarm Planning

Swarm planning is a complex adaptive system linking time dynamics to specific spatial elements. Swarm planning functions on a five-layer framework which consists of:

- Focal points
- Unplanned spaces
- Resources
- Occupational patterns
- Climate adaptive design

It establishes a severe and intimate connection between time and space by breaking down the cycle into 24 hours (day), 7 days (week), 12 years and 76-81 years.

Swarm planning is also undertaken using a stack of various layers all functioning in-sync amongst each other.

Layer-1
Substratum (100-500 years)

• Dealing with physical effects of climate change
• Modernizing the water management system[6]

Layer-2
Networks (50-100 years)

• Strengthening position of Netherlands amongst the overall international networks.
• Controls growth patterns of mobility networks.[6]

Layer-3
Occupation (25-50 years)

• Accommodation of spatial claims and shrinkage in relation to the values and attractively.[6]

For the success of this module to function all these layers have to be in-sync have to function as one major system creating a sense of coherence in-between them.

Coherence

Create synergies between interventions which can be further broken down into conditional spatial planning which intern facilitates spatial planning syntaxes.

Swarm planning guides its framework towards solving and catering to the regional scale by assisting change in the spatial land use and provide an evolution of autonomous and resilient developments.[7]

Key elements of Swarm Planning

The whole to its parts

• Create strategic nodes
• Improve adaptive behaviors of individual elements.

Layers

Complexity in concepts
• The connection between time and space
• New synergies and combinations for a more resilient organization

Application

Above we mention the layers. These layers can further be broken down into various sub-layers which can be understood using different levels.

Layer 1
• Road networks
• Common transport networks

Layer 2
• Production network
• Consumption network
• Domestic network

Layer 3
• Network/ territory of urban development

Resilient agricultural systems

With the current method of farming in the Netherlands there is a strong decline in the soil quality and lack of attention to ecology. The scale of production has also progressed towards a more industrial setting rather than a smaller more community and socially driven production mechanisms. What Netherlands needs is a more self-sustainable and resilient farming method where farming is done using nature as a tool. (Farming with nature).

Resilience in a farm entity is required because it makes the system more adaptive to environmental mishaps, provides a more varied cropping pattern with integrated irrigation infrastructure, creating more flexibility to credit providers. Resilient farming also provides a farmer with crop insurance and formulates a shorter more effective supply chain, providing safe usage and transportation for the surplus crop yields.

Resilient farming can be achieved by the creating a stable structure which can be achieved by combining 3 main agents:

• Robustness
• Adaptability
• Transformation

Resilient farming also looks into two conditions: Private goods and Public goods. Private goods are the produce which is acquired from the farms. So it has to do more with the production cycles, distribution cycles and surplus crop safety.

Public goods have more to do with the natural ecology, the existing biodiversity and the task of improving and enhancing these existing green structures.

Private goods are mainly focused towards the production of food and generating bio-based resources, while the Public goods are mainly focusing on maintaining natural resources, respecting the animal welfare, increasing the attractiveness of rural landscapes and promote tourism.

Robustness

Farming systems which can withstand stress. Natural calamities like flooding and droughts which can't be prepared for.

Adaptability

Changing the compositions of inputs in the production cycles, understanding the instability of markets and provide effective risk-management.

Transformability

Significantly changing the internal structure of farming based on the feedback and farming technology advancement.

Enhancing Resilience

- Diversity
- Modularity
- Openness- well-connected systems
- Tightness of feedbacks
- System reserves- creating reserve stocks

Yields of Resilient Farming

Yields in resilient farming can be increased by practicing a more adaptive and sustainable harvesting mechanism which involves a better crop management policy generating more crop protection webs which are a result of accurate nutrient management and water management.

Case Study

Family farms Veenkolonien

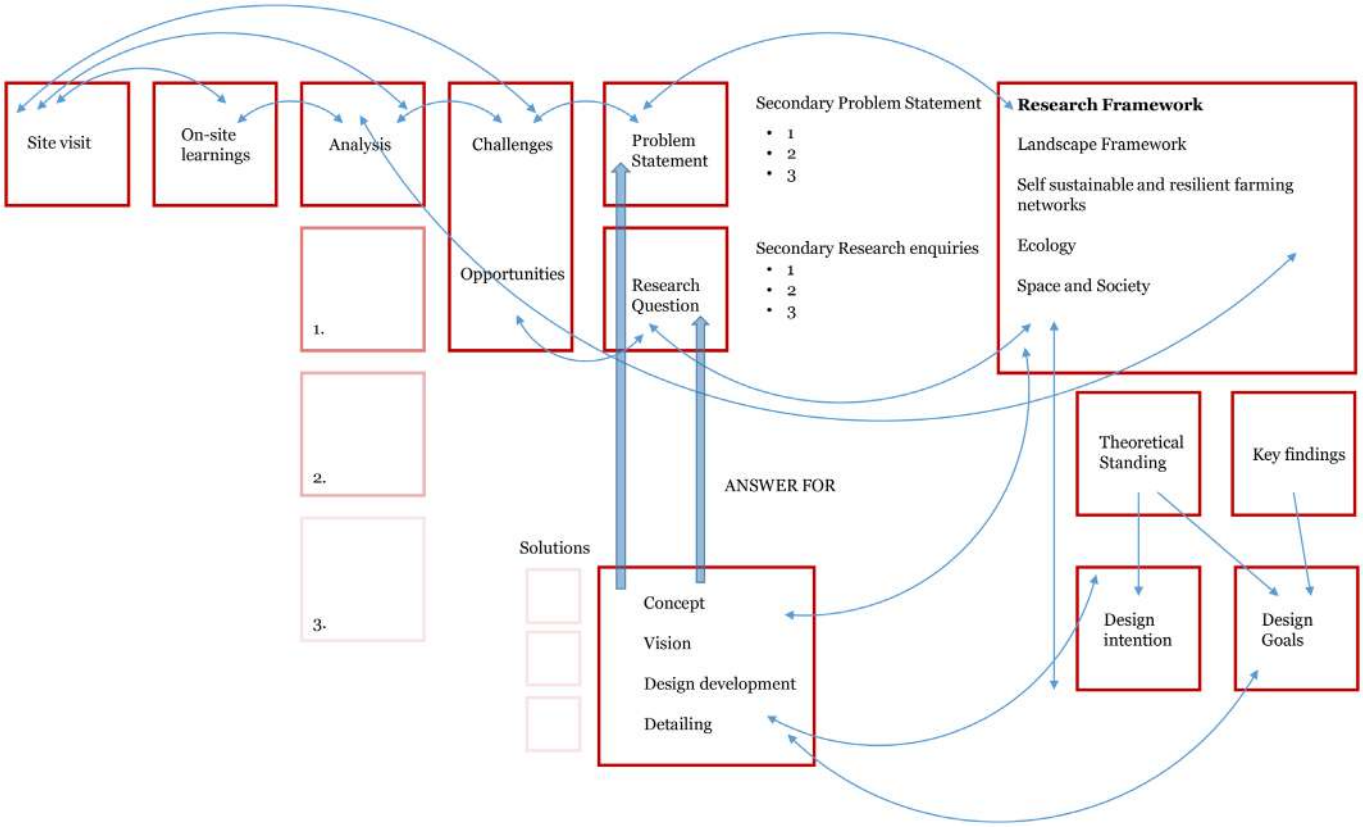
Role of humans in Resilient Farming

Humans influence the land and manipulate it according to his/her needs. They seem to be missing that sensitivity towards ecology, biodiversity etc. So the first role would be become more sensitive to the ecological interactions and processes.[8] The role of a human can be further categorized on basis of:

- Spatial Scale
- Systems
- Landscape (Topography)

This intern makes the human realities as 'intangible' and 'tangible' which focuses on conservation/regeneration of ecological interventions and enhances the urge to have a varied and holistic program and adaptive processes.

METHODOLOGICAL FRAMEWORK



The Methodological Framework explains how the learnings and discoveries are translated to the site in form of a design vision, concept, details and creates a platform for discussion and reflection of the entire thesis program. This is the backbone structure which is used all throughout the thesis. The advantage of this framework is that it promotes the idea of going back and forth as the evolution of a thesis is a circular process and not a linear one. This framework provides guidance towards linking the research frameworks to the design vision.

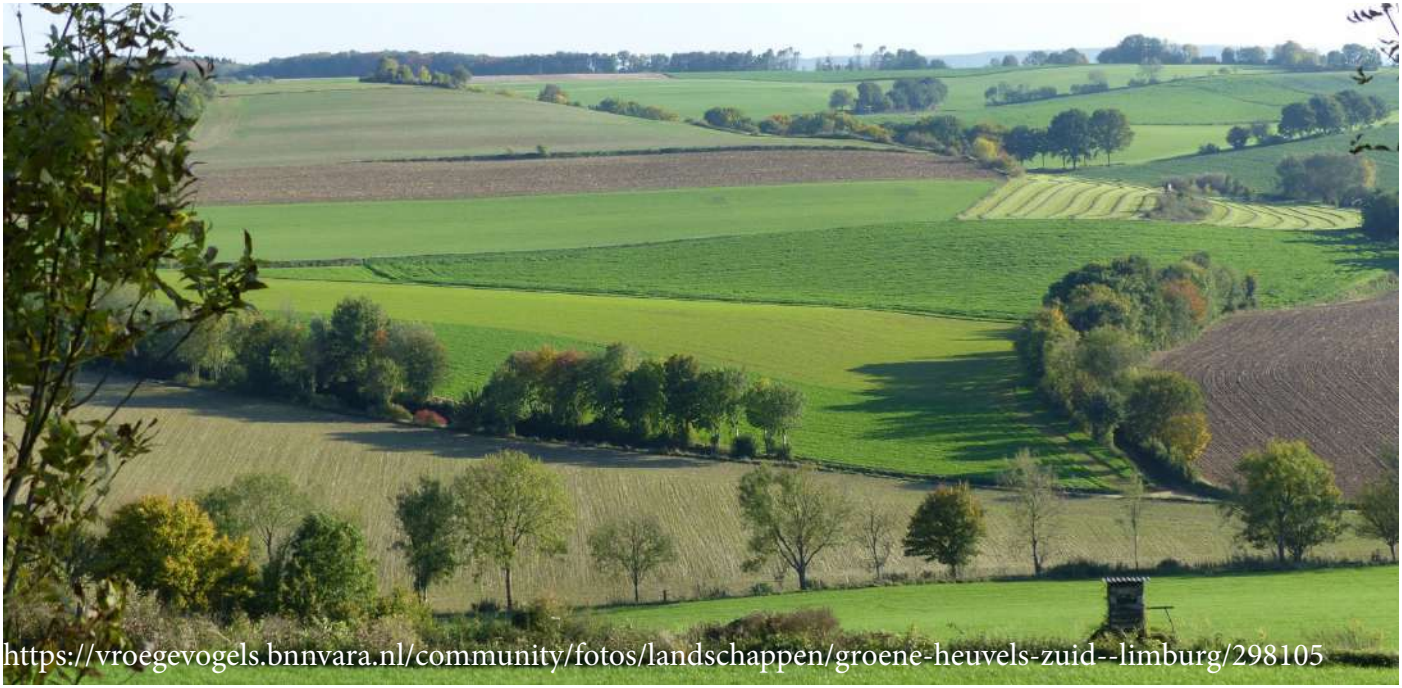
The first step is the site visit, this generated on-site learnings which were then tested using inventory maps which gave rise to definate challenges and opportunities. These challenges then formed a Problem statement which defined a Research question which was then understood by conduction research and learning about new methods and theories. The important learnings from these theories were then translated and adapted to Limburg, Netherlands. They formed the design tools which were used to generate a design vision and a concept. The design goals thrive towards providing an answer for the research question. This entire system is an adaptive framework. A new finding or hypothesis shall guide you to link the theory much better to the design solution.

3.

ANALYSIS

http://www.witte-lelie.com/en/villa-white-lily-netherlands/omgeving/

http://www.witte-lelie.com/en/villa-white-lily-netherlands/omgeving/



https://vroegevogels.bnnvara.nl/community/fotos/landschappen/groene-heuvels-zuid--limburg/298105

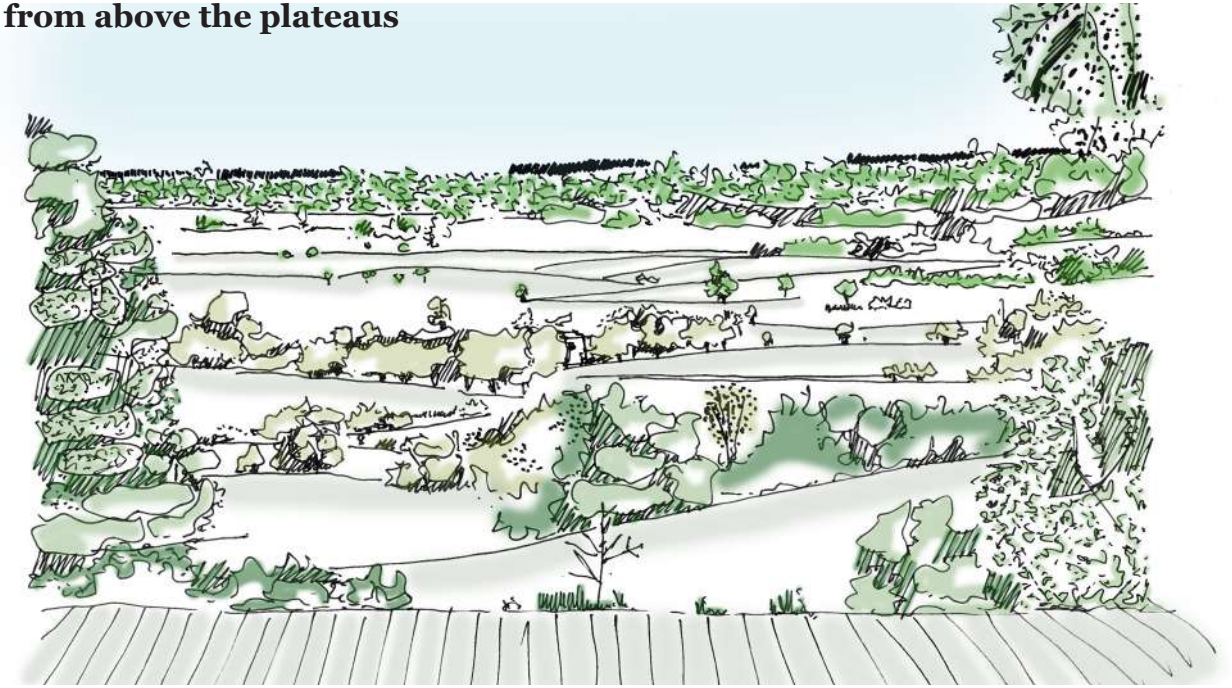
http://sustainabletop100.org/zuid-limburg-hill-country-in-autumn/

Overview of the Landscape Typology- Limburg, Netherlands

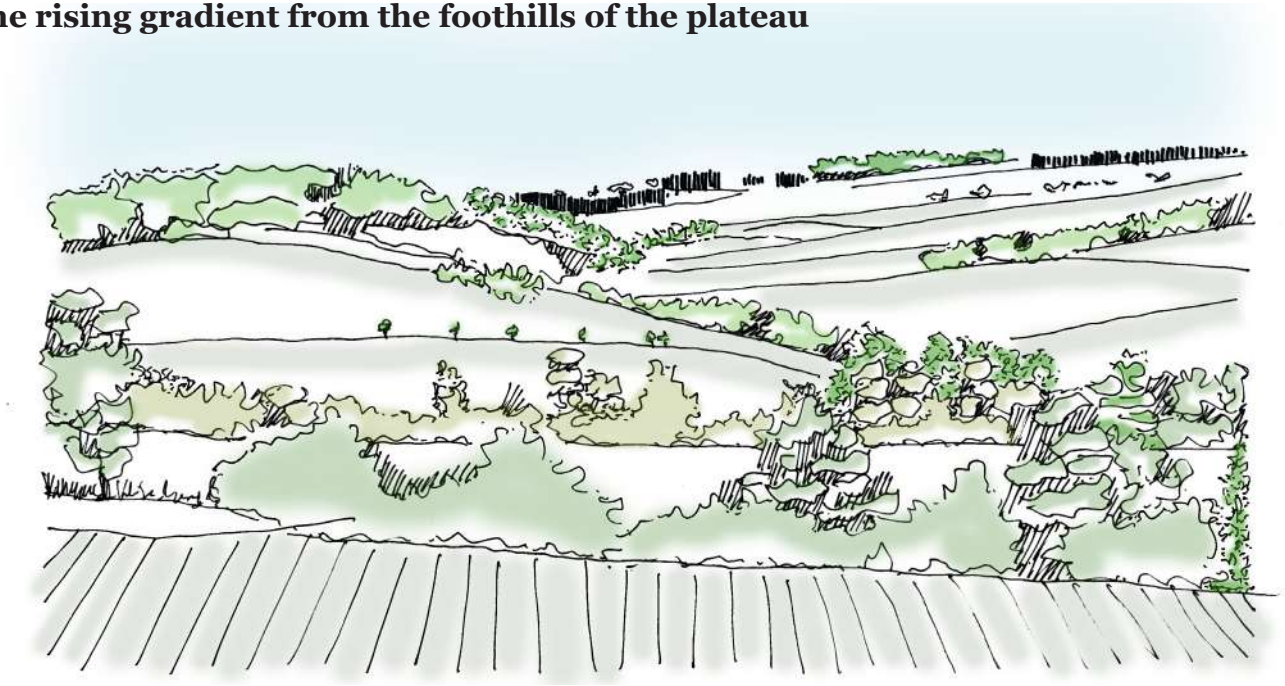
The landscape of Limburg went through constant changes through the different eras in time right from the romans, medieval, industrialization, mining, post mining and urban shrinkage. Each of this change modified landscape and adapted it to their current usage. The remains of the existing landscape were then used as trigger points to formulate new variations in the landscape.

The current scenario of limburg shows a typology where there is a strong disconnect between the urban settlements and the rural landscapes. The urban shrinkage has created these distinct pockets of un-defined green structures. The infrastructure lines formulate a divide between built and un-built. There are open arable lands on the slopes and near the plateaus. The water systems run along the valleys defining natural brooks which then connect to the ecological layer. Biodiversity is seen thriving in the brunssummerheide. The old mining areas have now become neighbourhoods or green spaces. There is existing silver-sand mining quarries which are active forming a distinct new typology. The arable lands have formed smalelr farming communities which fall under the rural municipality and the two centers Heerlen and Kerkrade are the most developed urban areas which fall under urban municipalities.

A view from above the plateaus



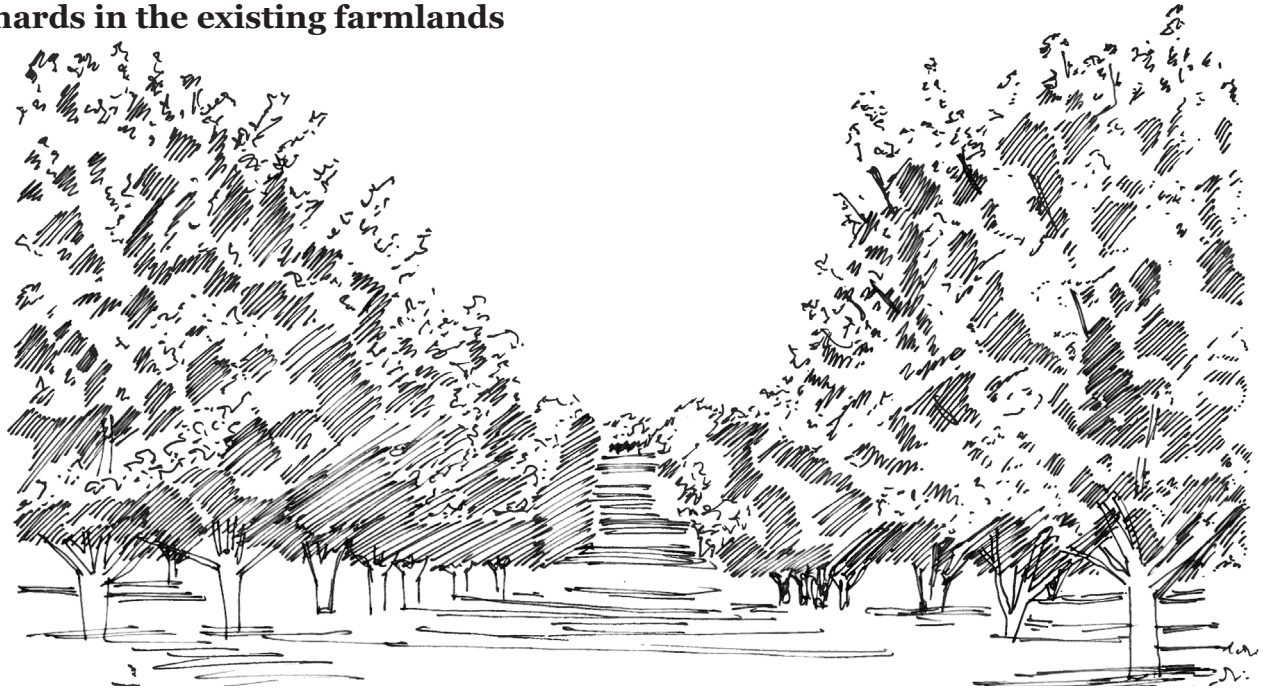
The rising gradient from the foothills of the plateau



Natural Brooks

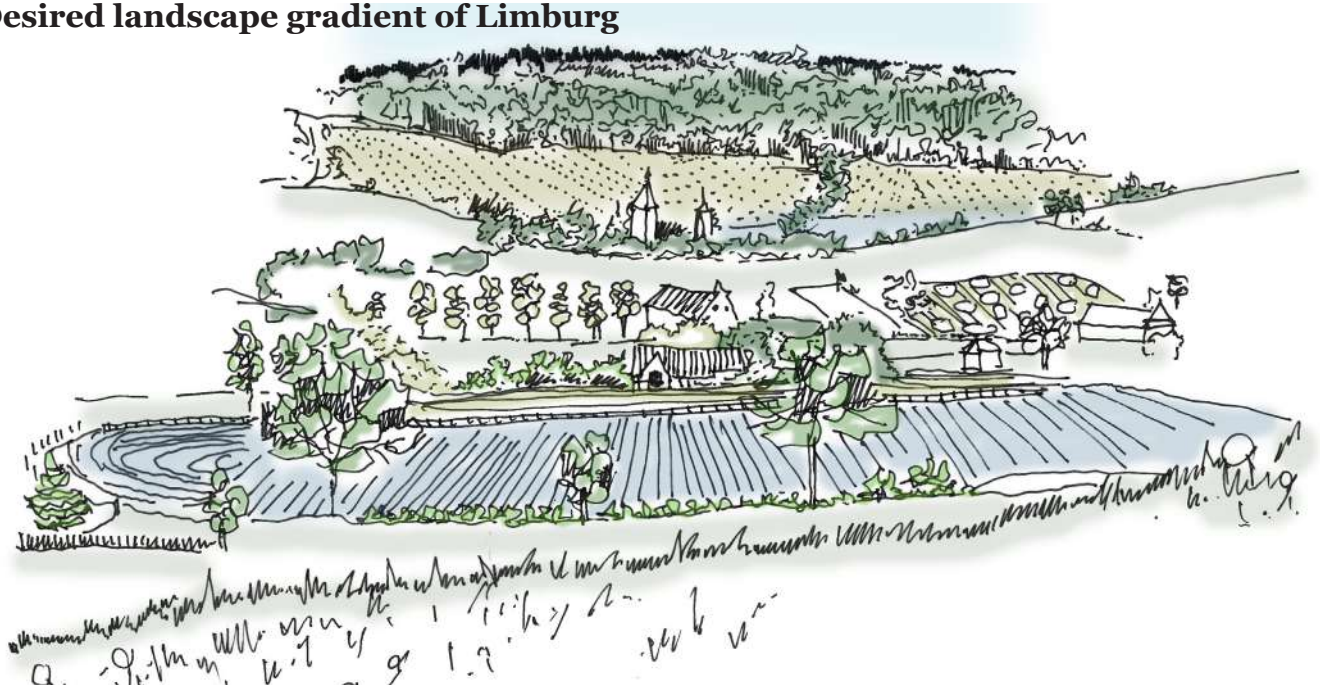
Brooks near the castles/ mansions

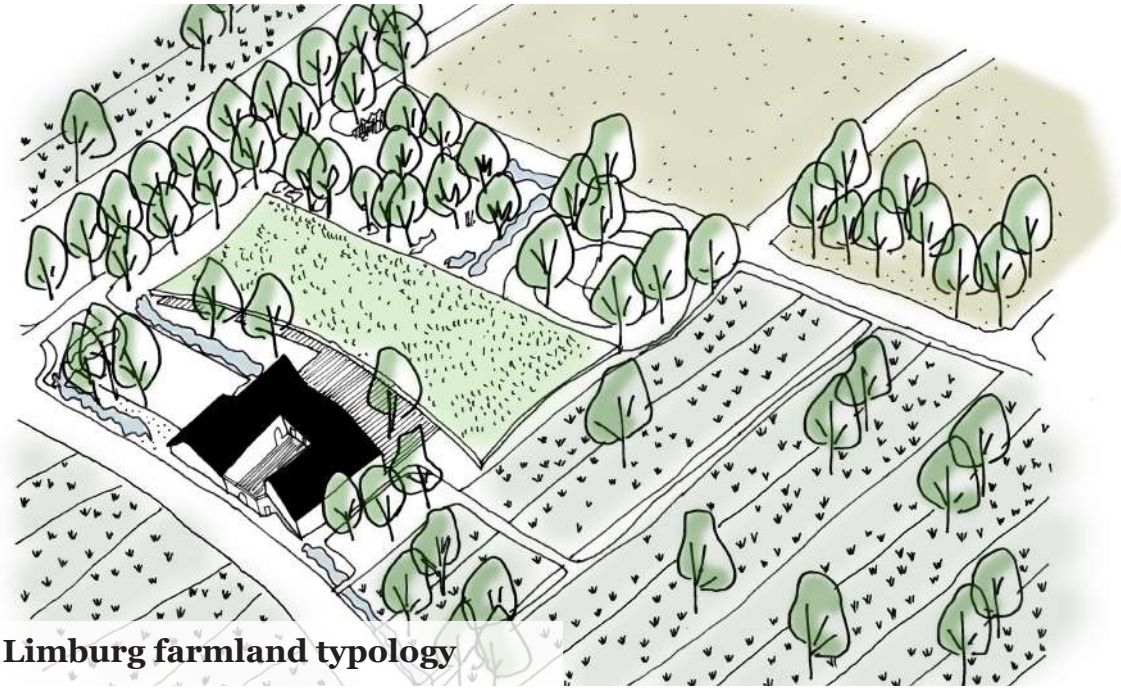
Orchards in the existing farmlands



Forest and native ecology- brunssummerheide

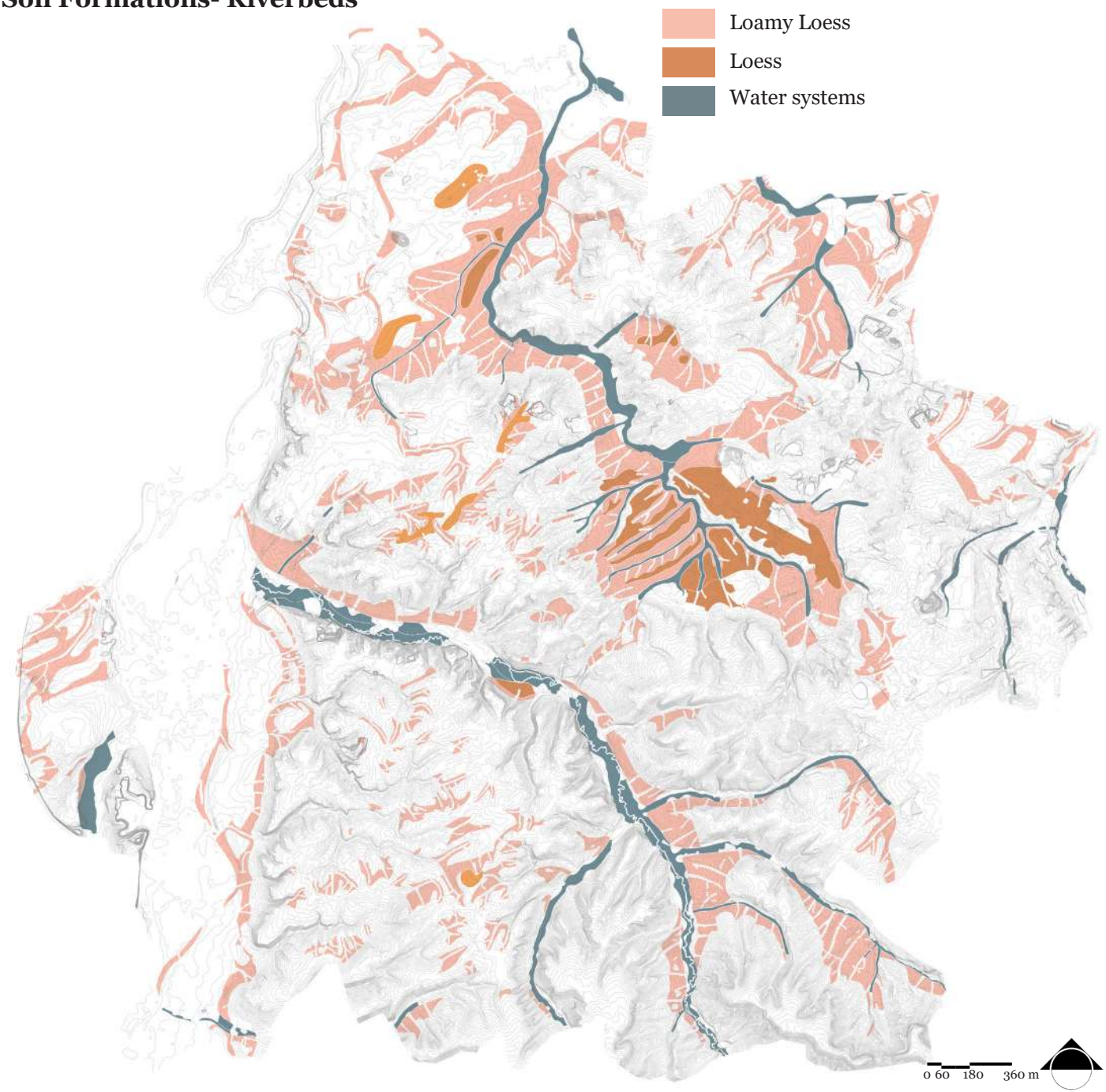
Desired landscape gradient of Limburg



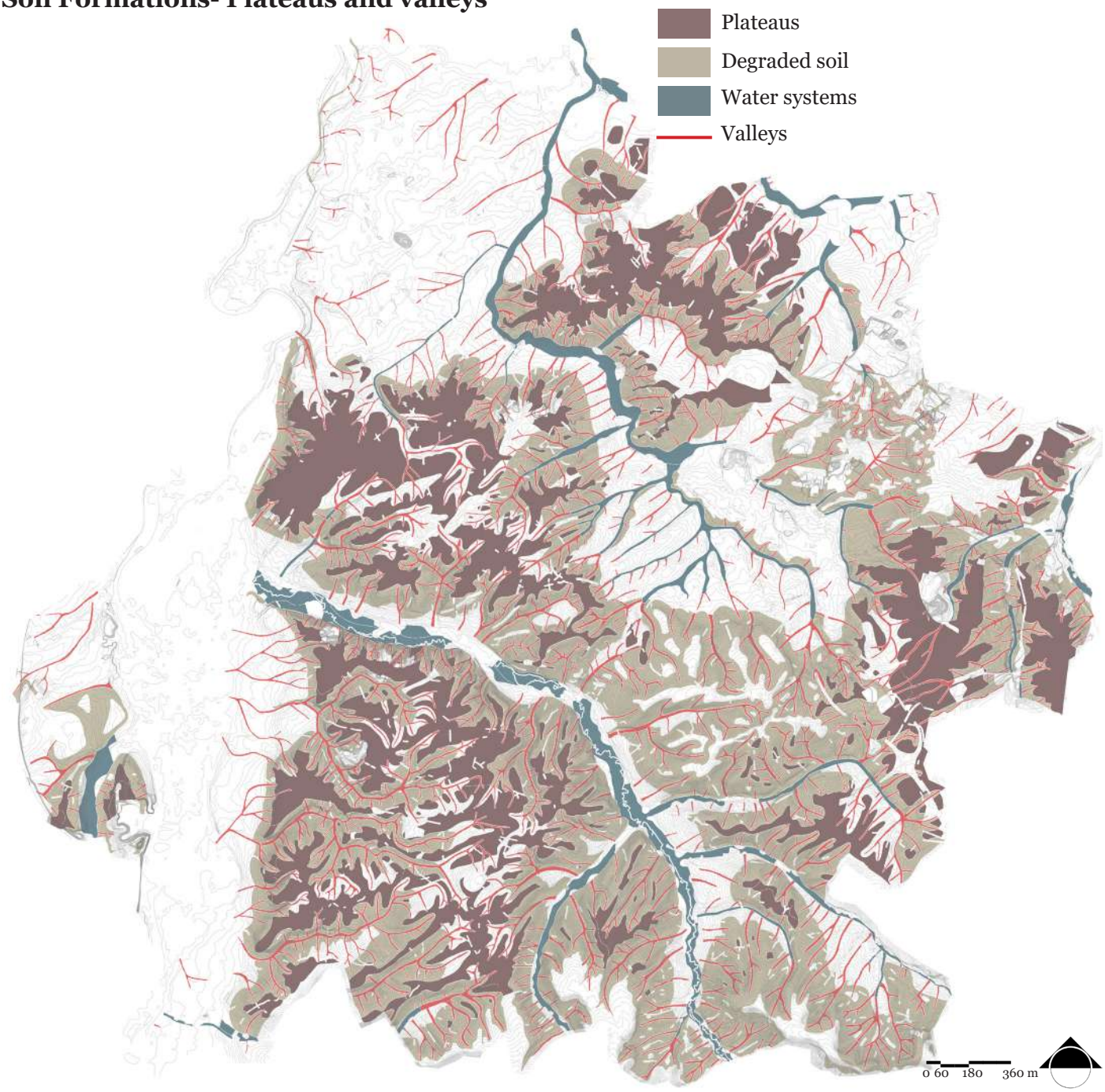


Classical Limburg farmland typology

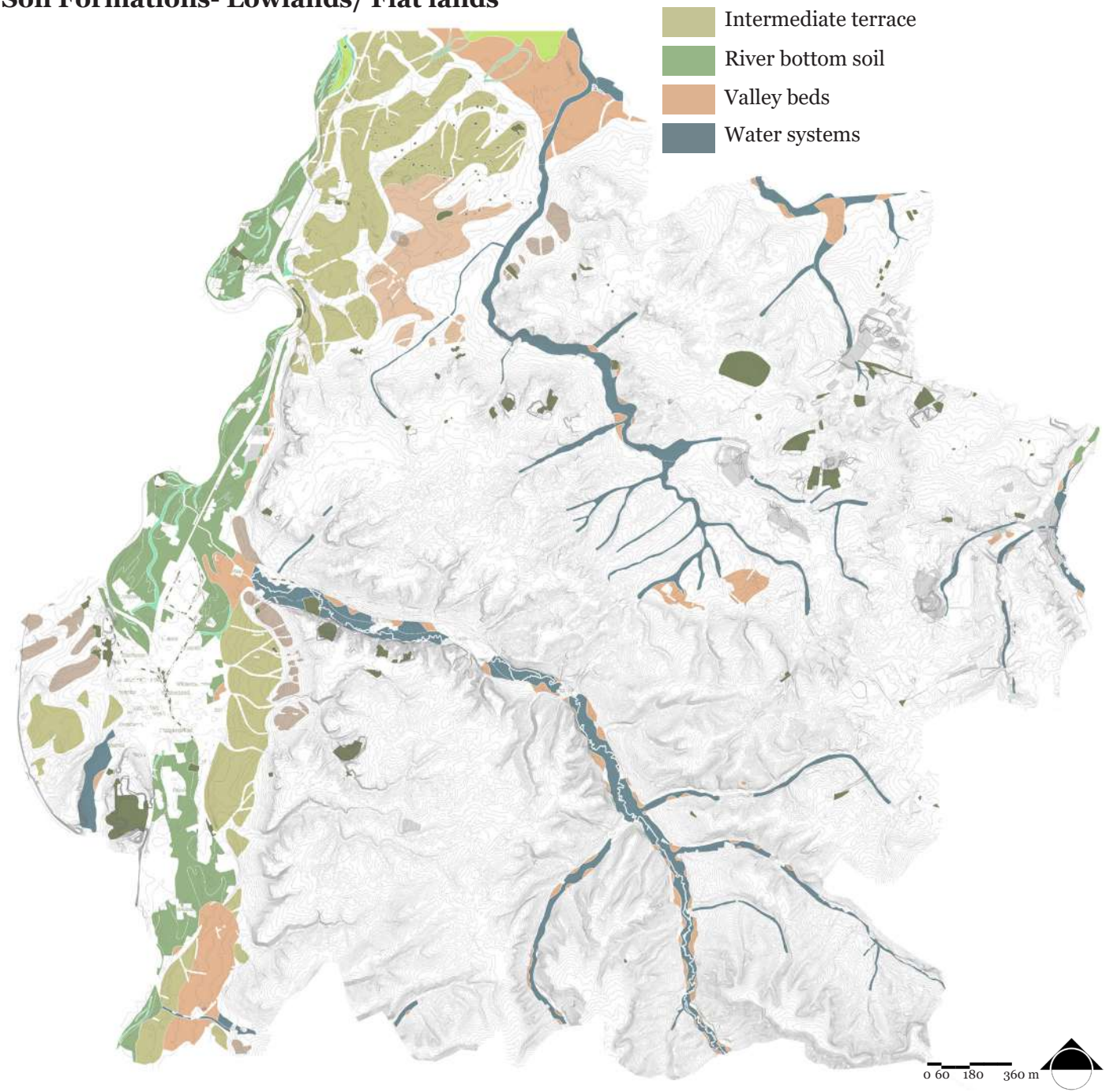
Soil Formations- Riverbeds



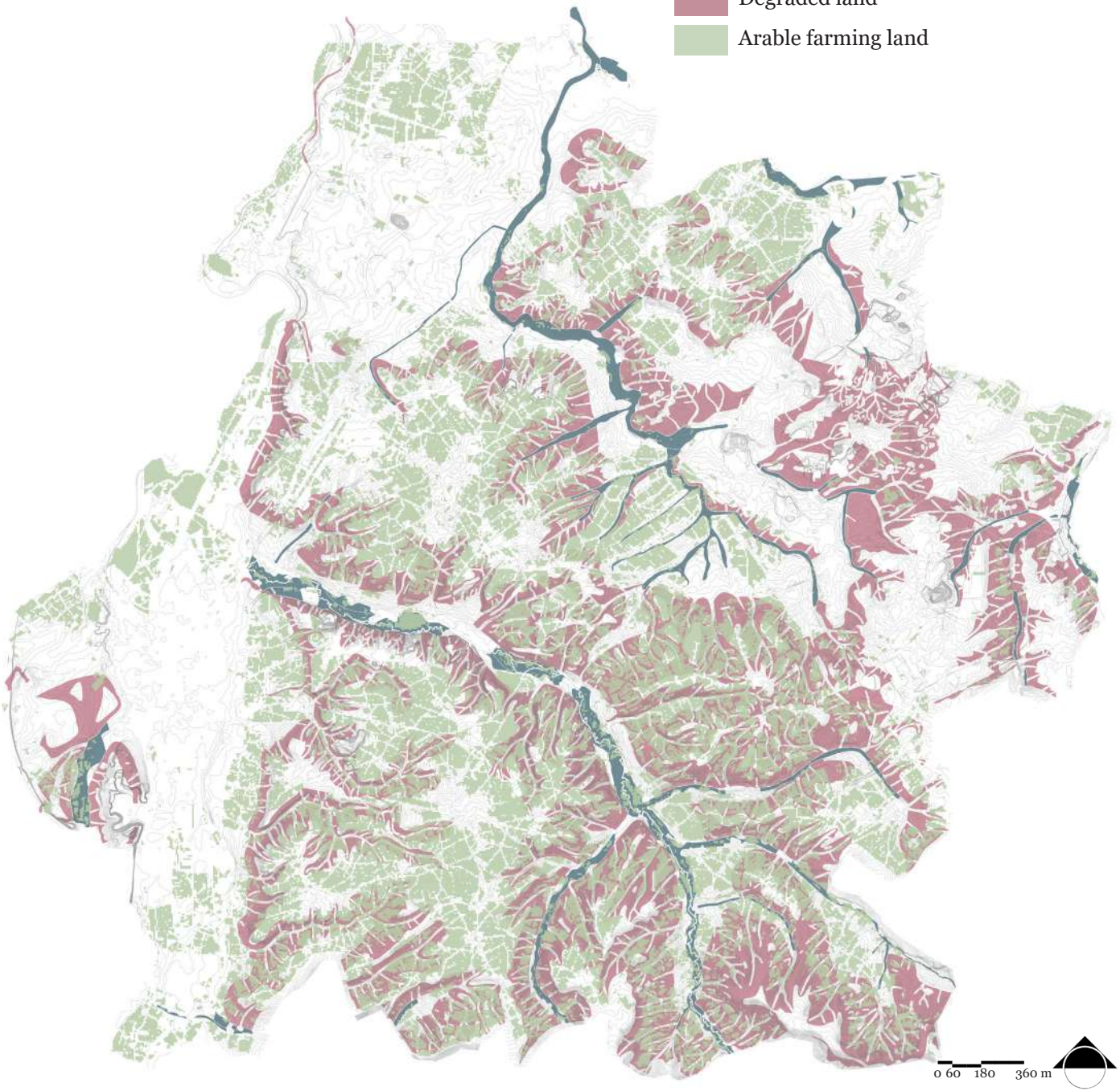
Soil Formations- Plateaus and valleys



Soil Formations- Lowlands/ Flat lands



Soil degradation and arable farming

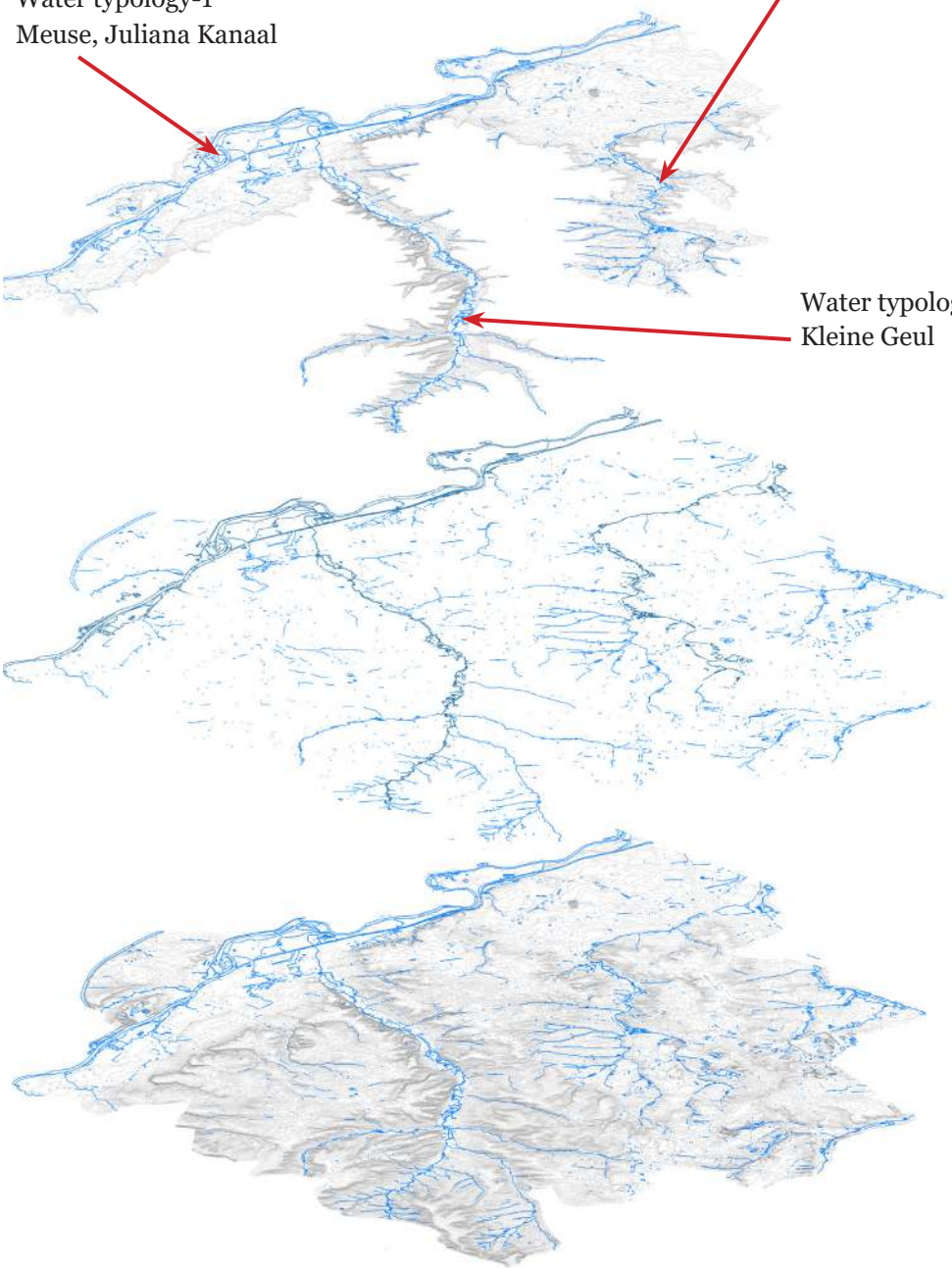


Water Systems

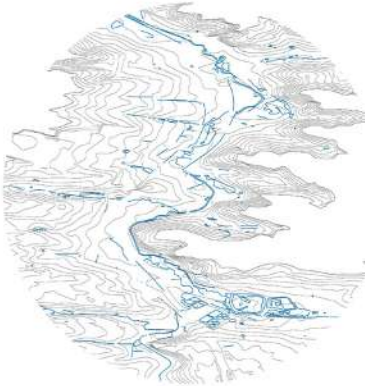
Water typology-1
Meuse, Juliana Kanaal

Water typology-2
Geleenbeek

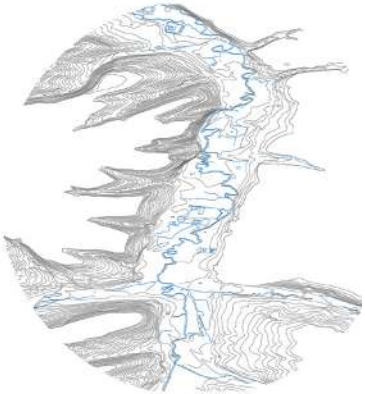
Water typology-3
Kleine Geul



Water system through
Flatland and valley slope



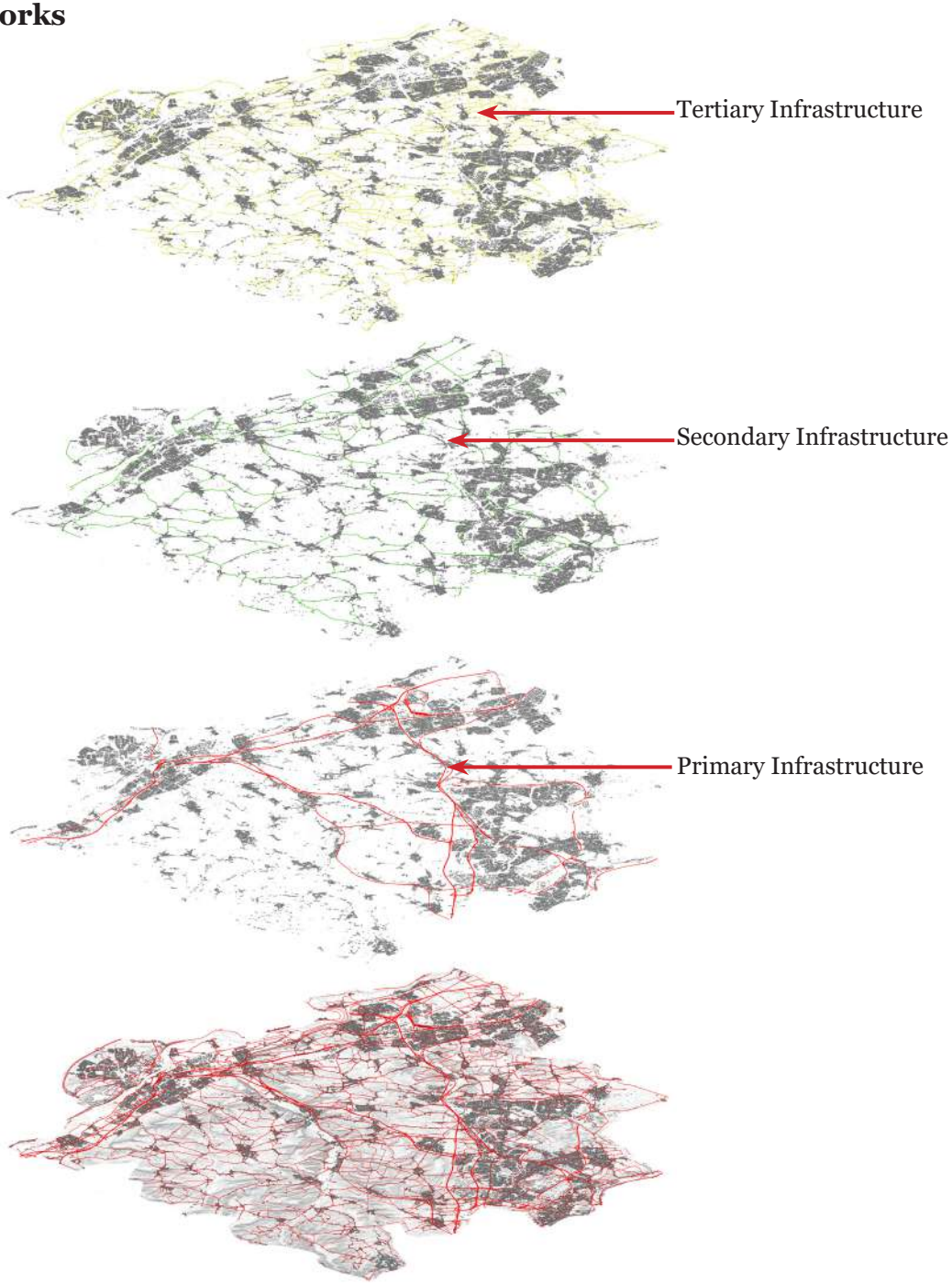
Water system through valley



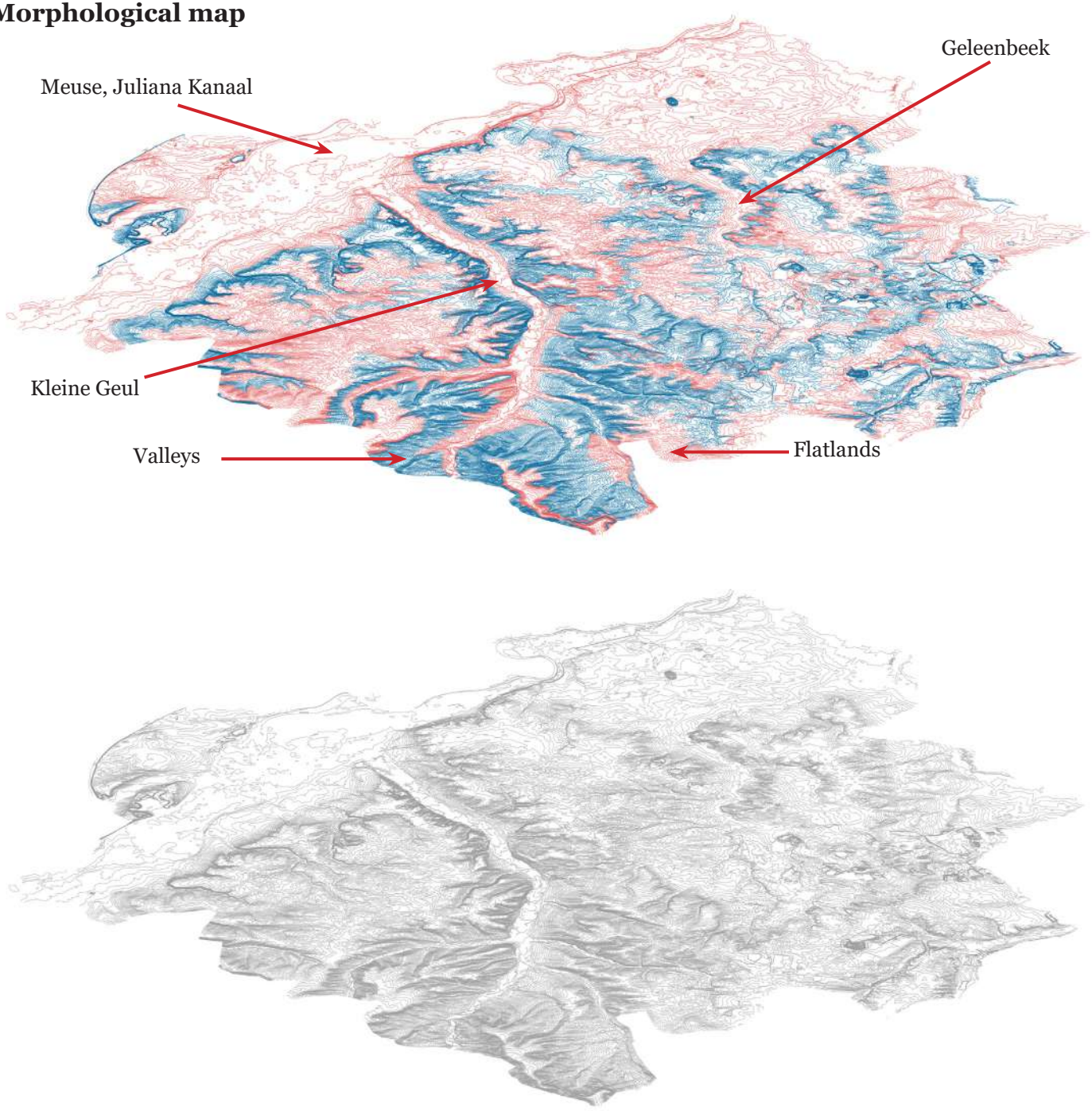
Water system through Flatland

Existing arable lands and its connection to ecology

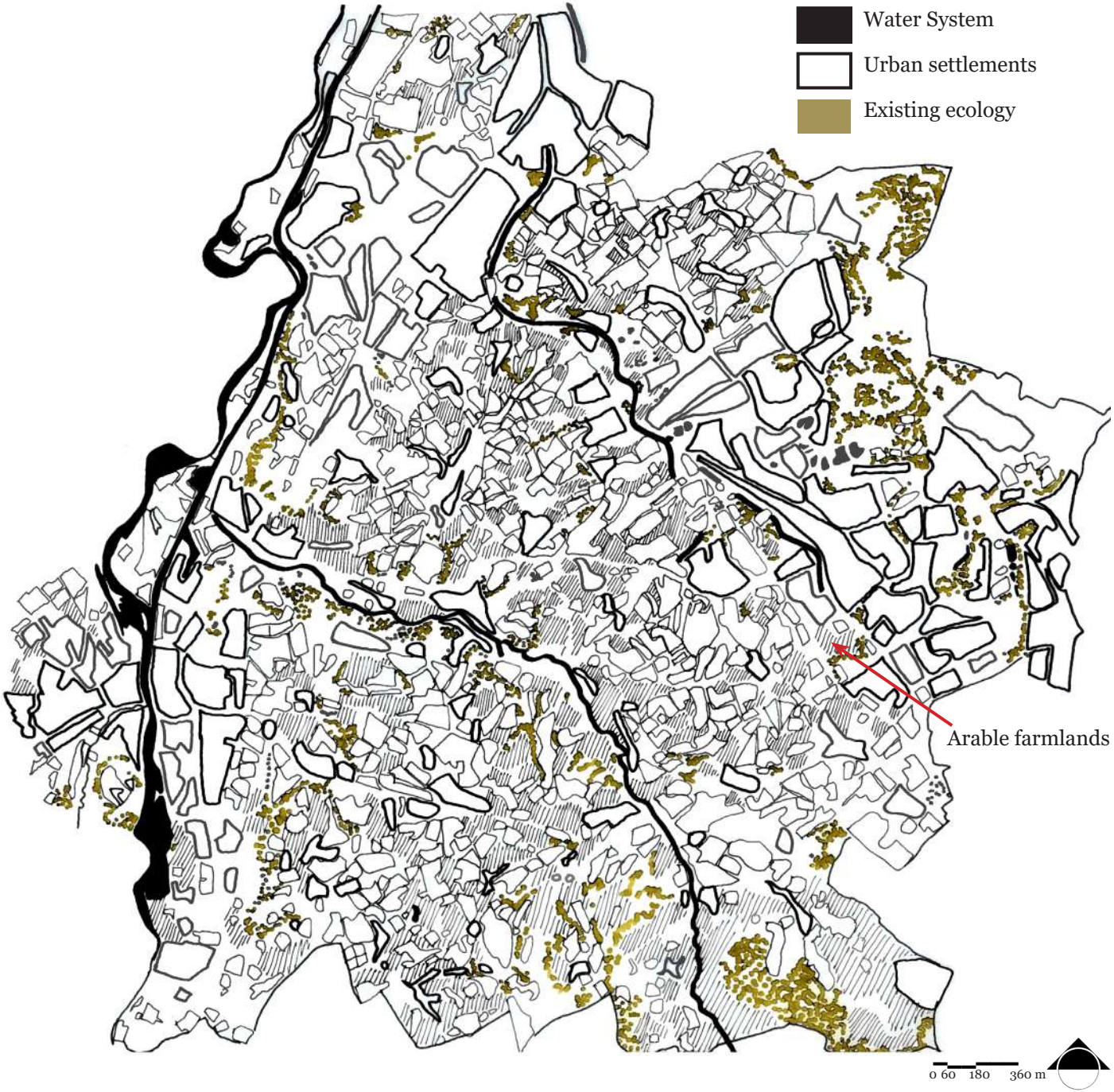
Infrastructure networks



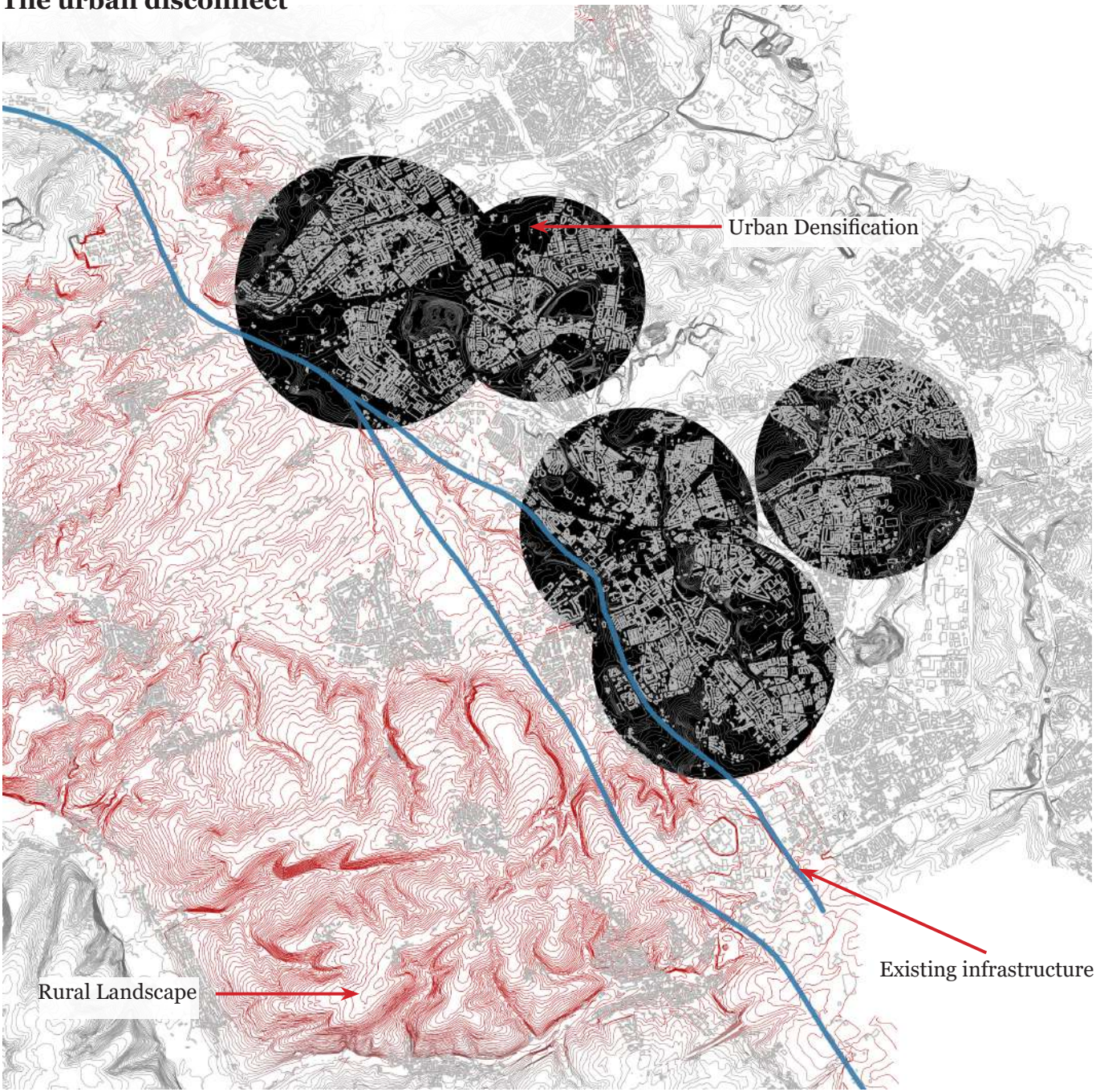
Morphological map



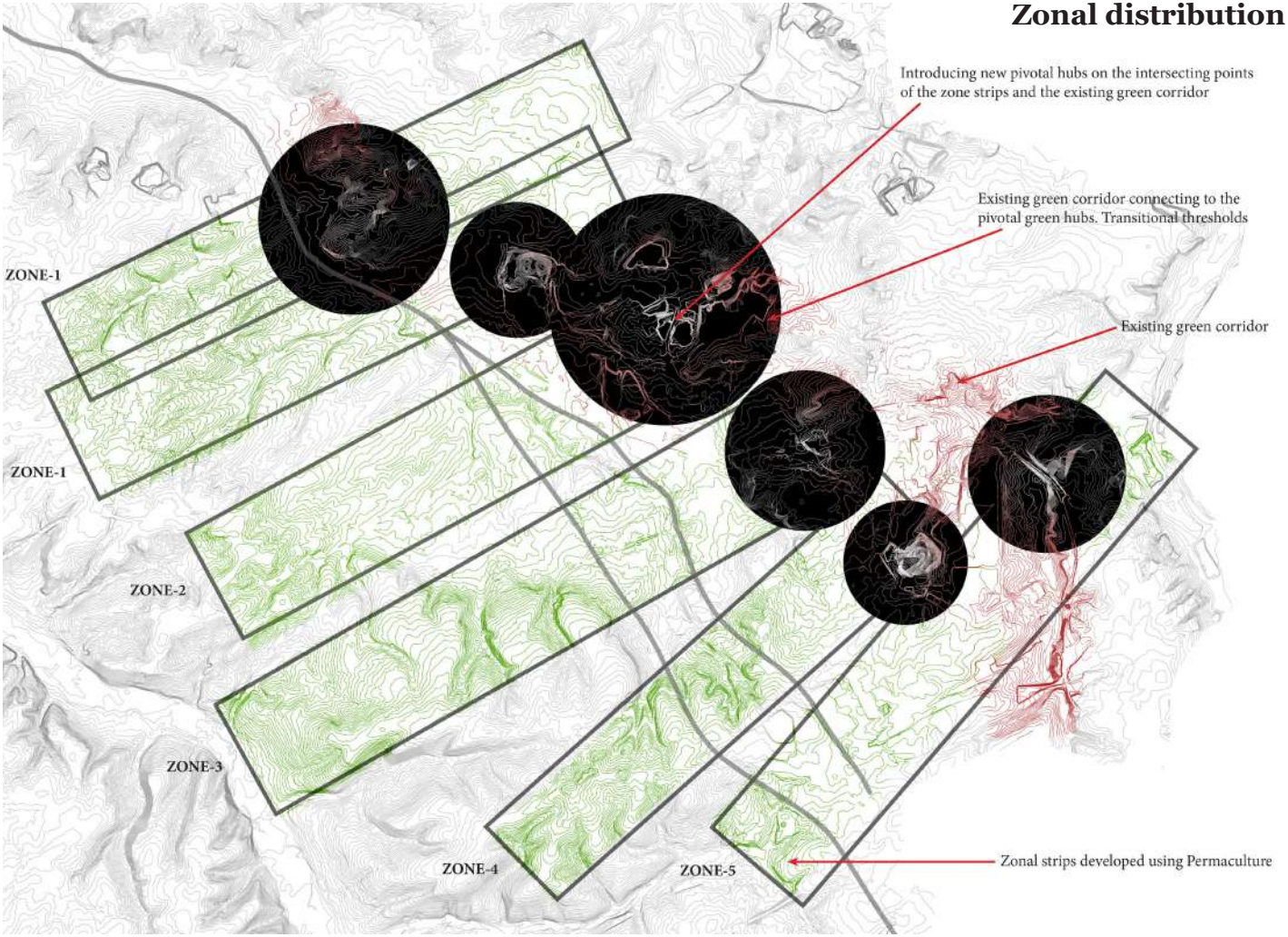
Human use- Activities



The urban disconnect

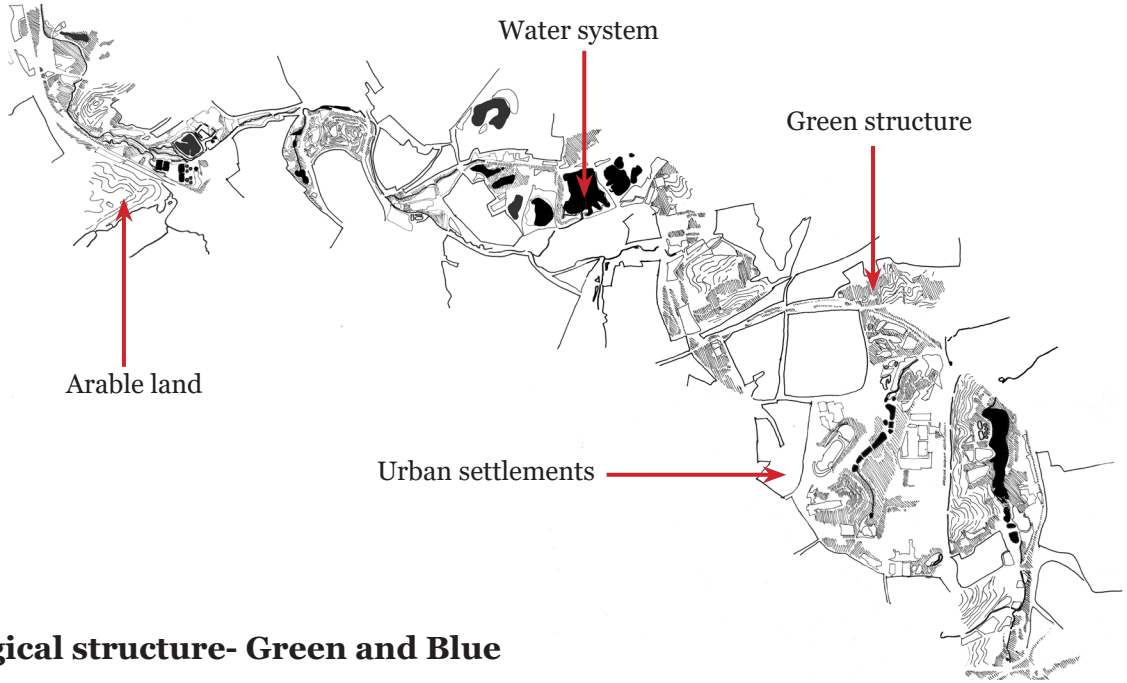


Zonal distribution



The analysis above highlights the existing ecological structure which is marked in red. The aim of this analysis was to stich the gap between the urban and rural settings. To understand the many different possible scenarios the map was deciphered into smaller zones, each having a distinctly different combination of green structure, built environment and open arable land. Each of these zones were connected to the existing green ecological structure and the Geleenbeek.

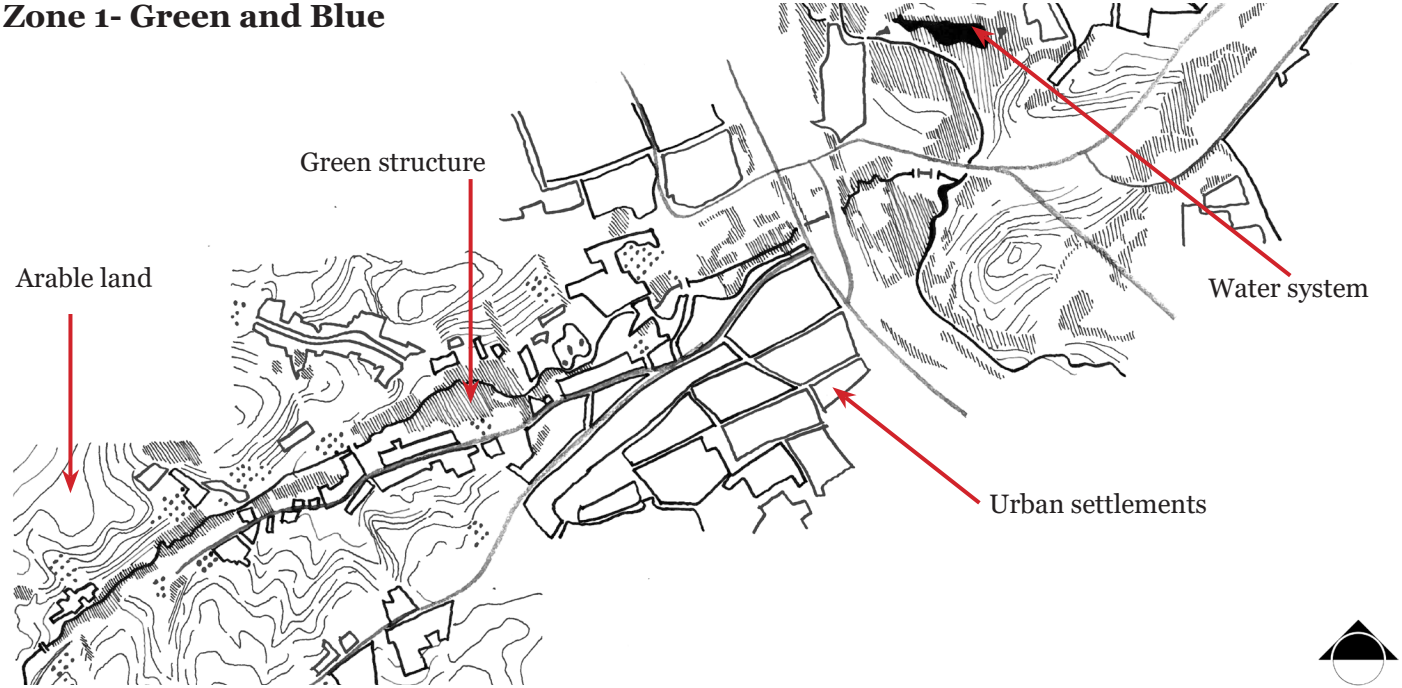
The intersecting points of each of these zones started acting as pulsating nodes which were all weaved together using ecology and connect to water. The existing infrastructure was marked to understand the connection possibilities to these nodes.



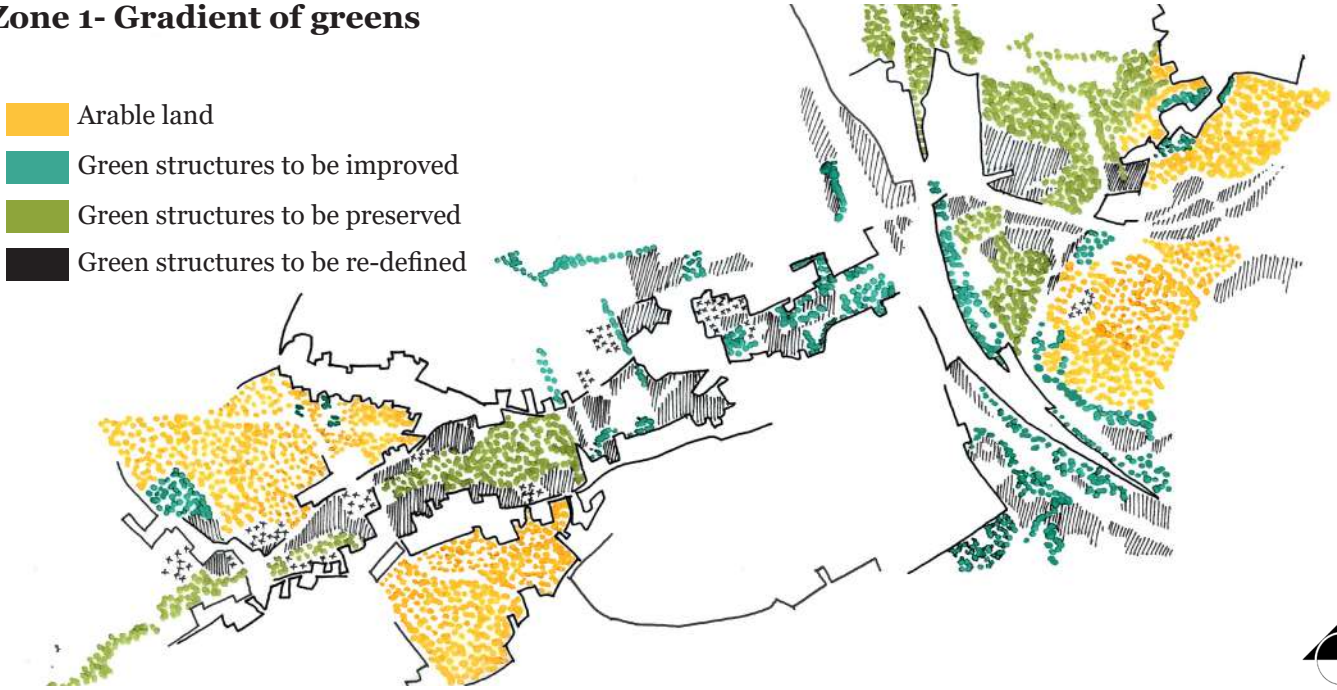
Ecological structure- Green and Blue

Ecological structure- Gradient of greens

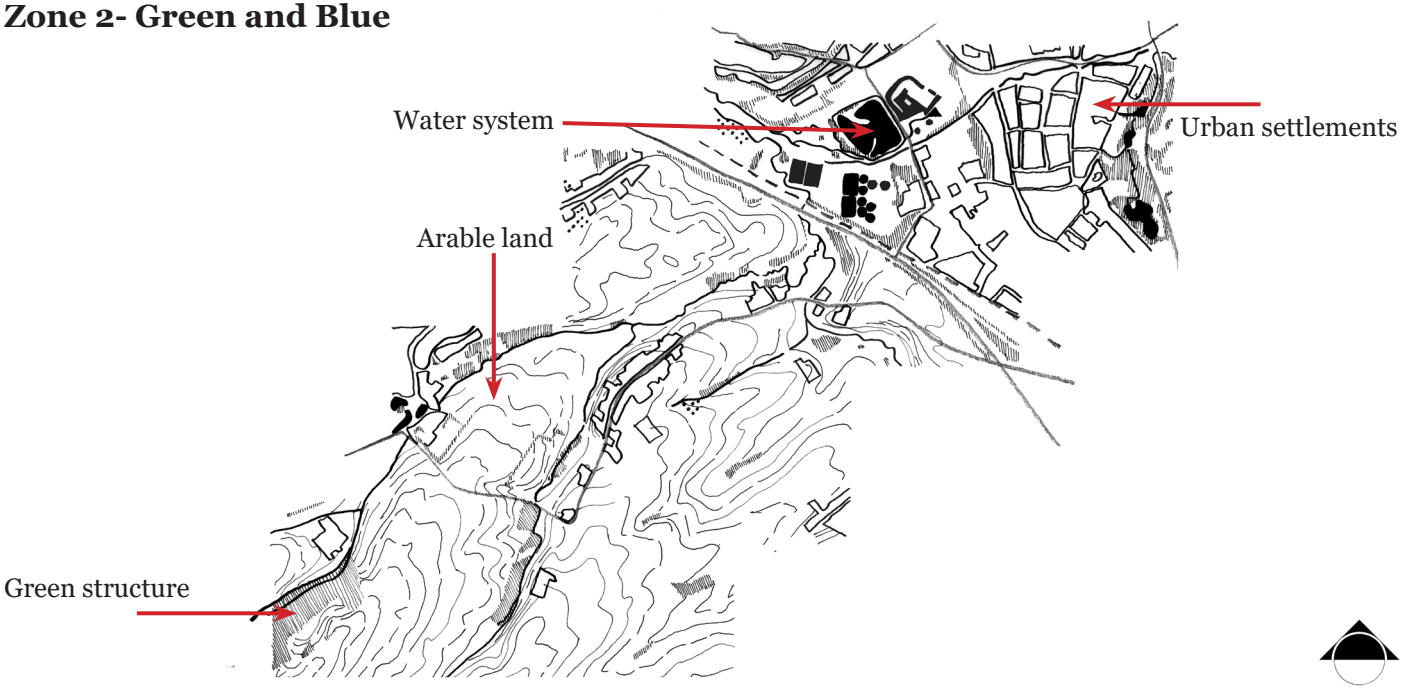
Zone 1- Green and Blue



Zone 1- Gradient of greens

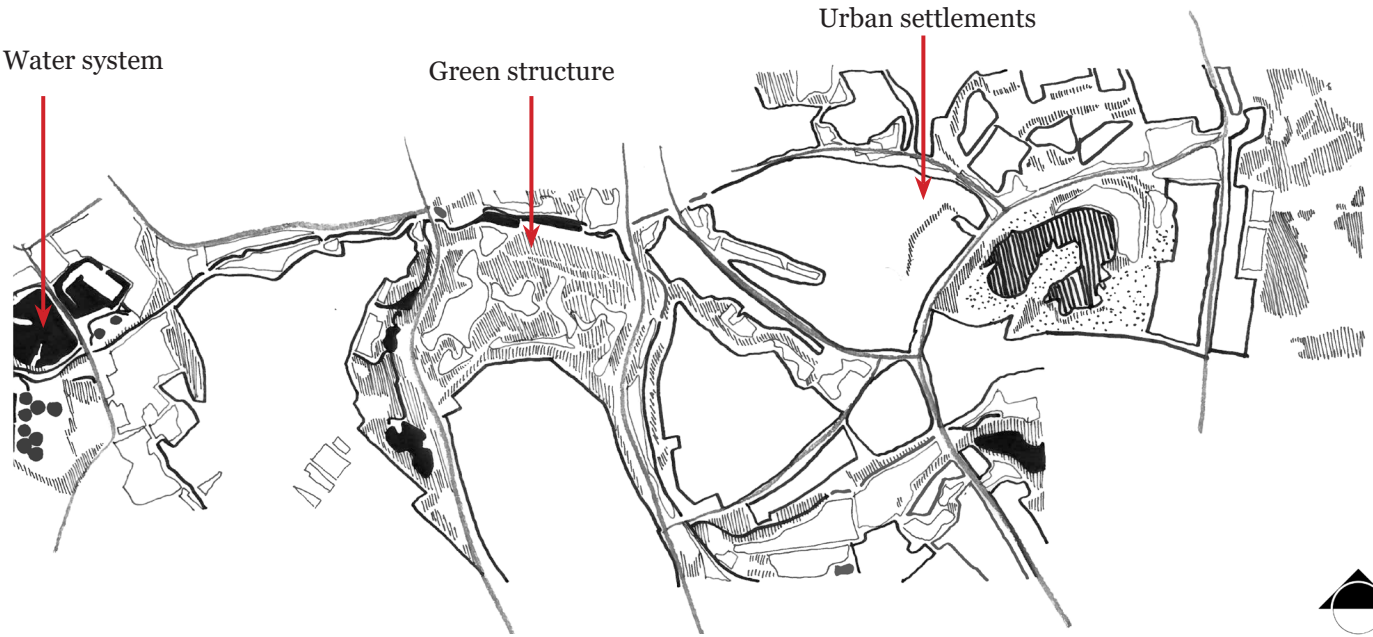


Zone 2- Green and Blue



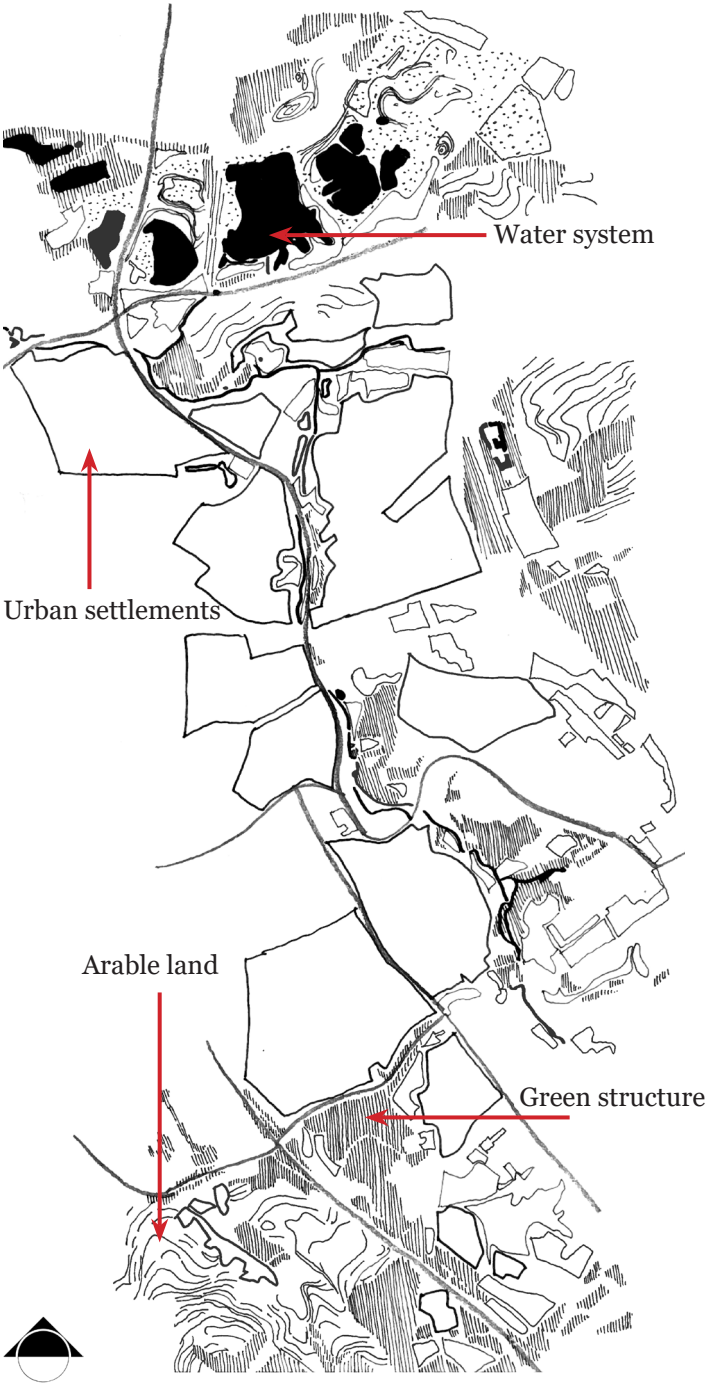
Zone 2- Gradient of greens

Zone 3- Green and Blue

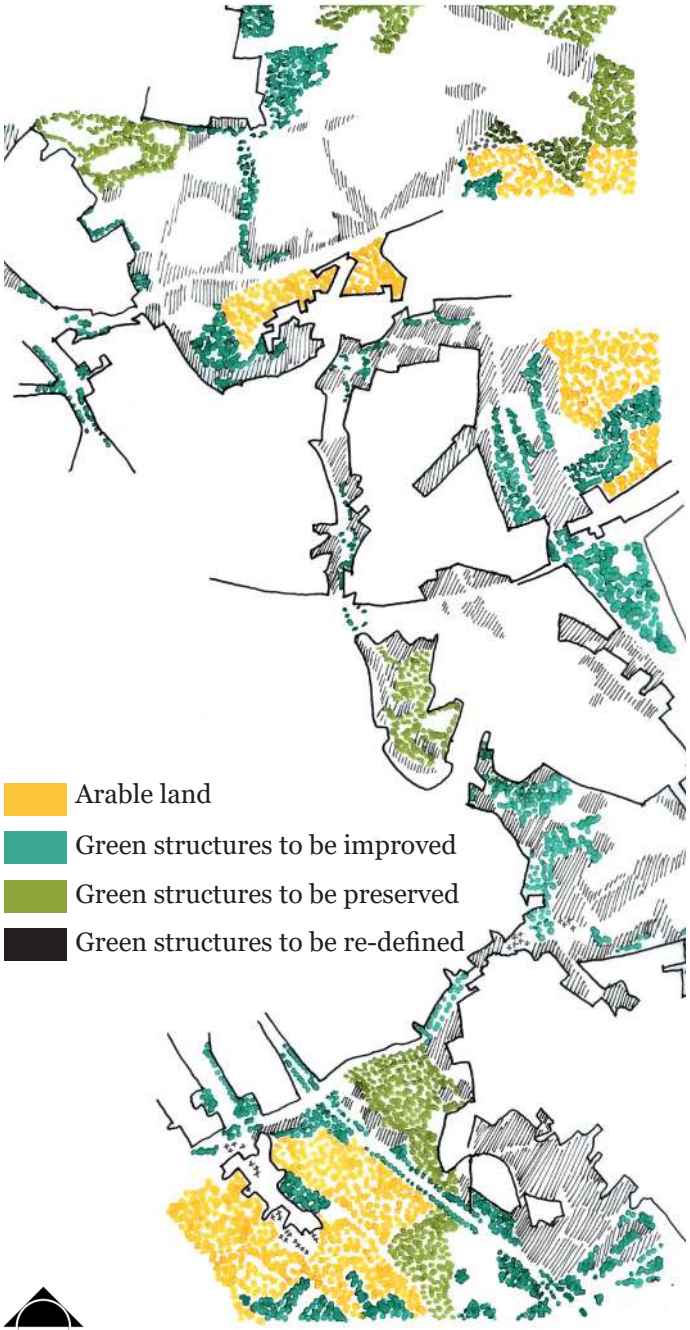


Zone 3- Gradient of greens

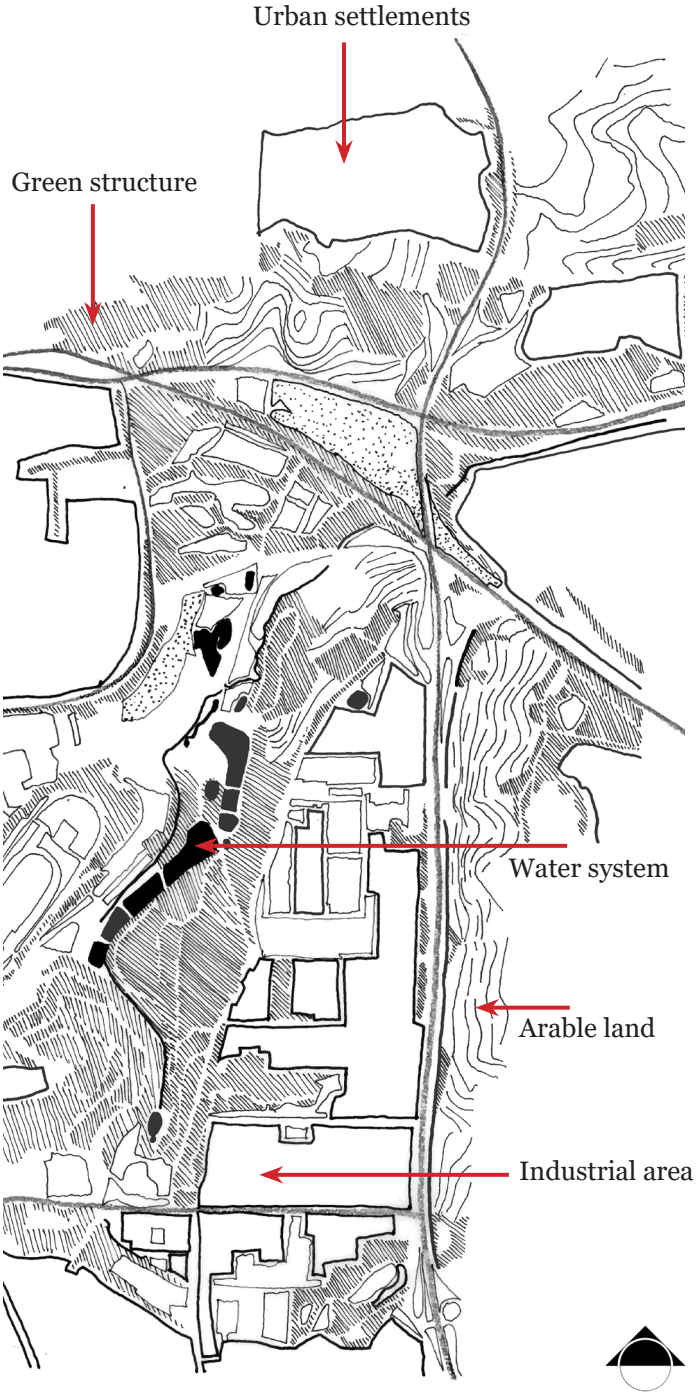
Zone 4- Green and Blue



Zone 4- Gradient of greens

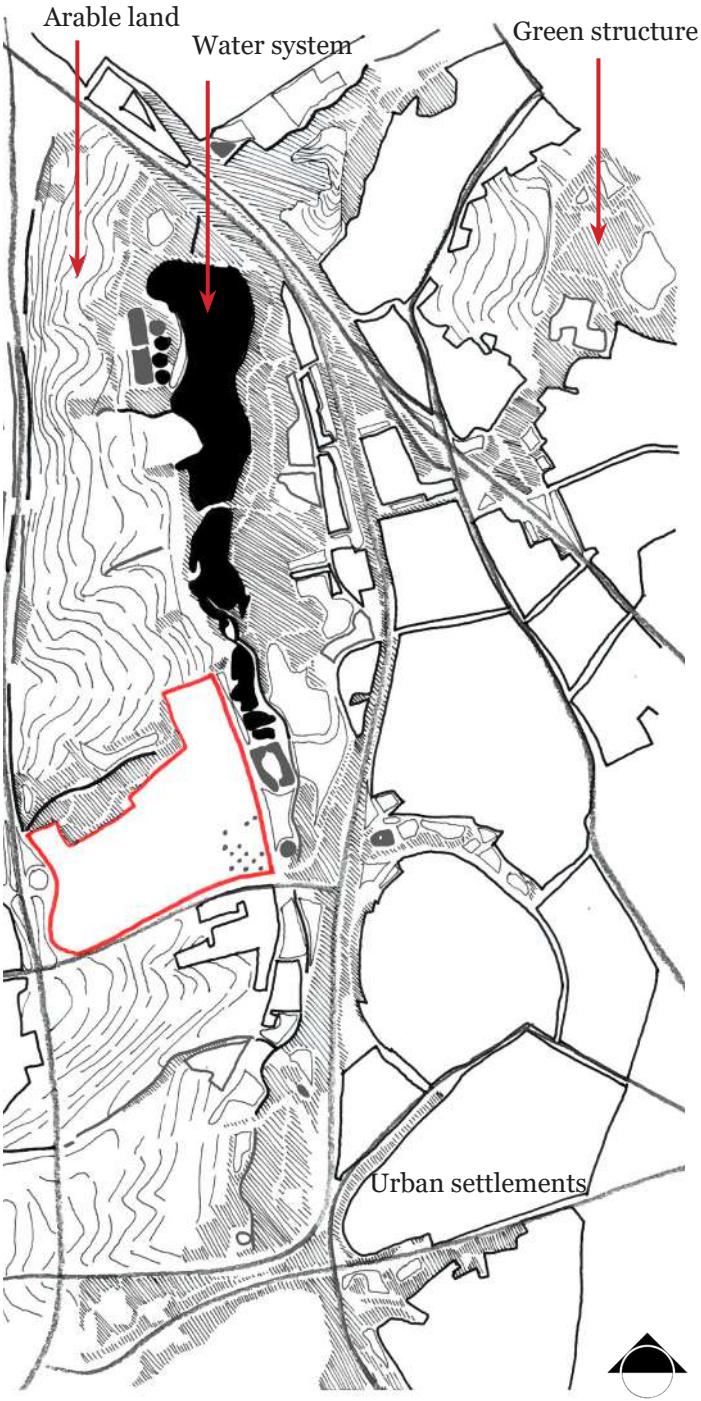


Zone 5- Green and Blue

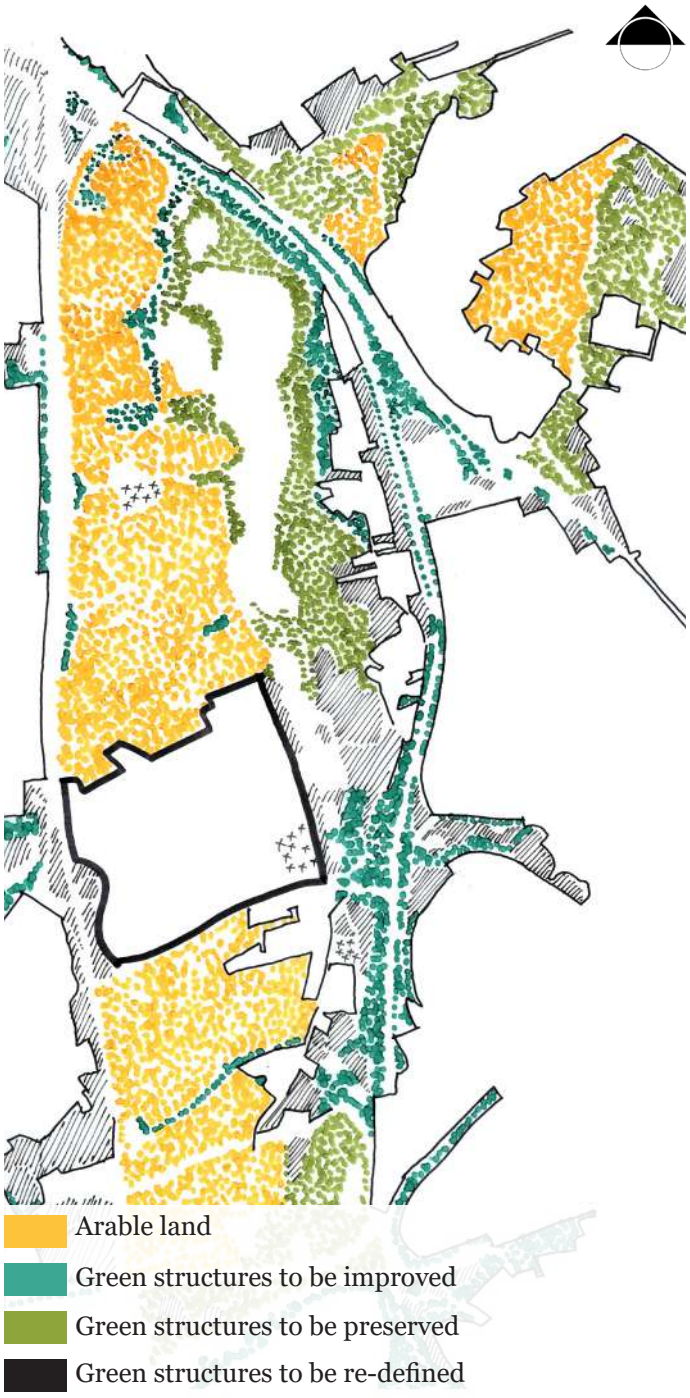


Zone 5- Gradient of greens

Zone 6- Green and Blue



Zone 6- Gradient of greens

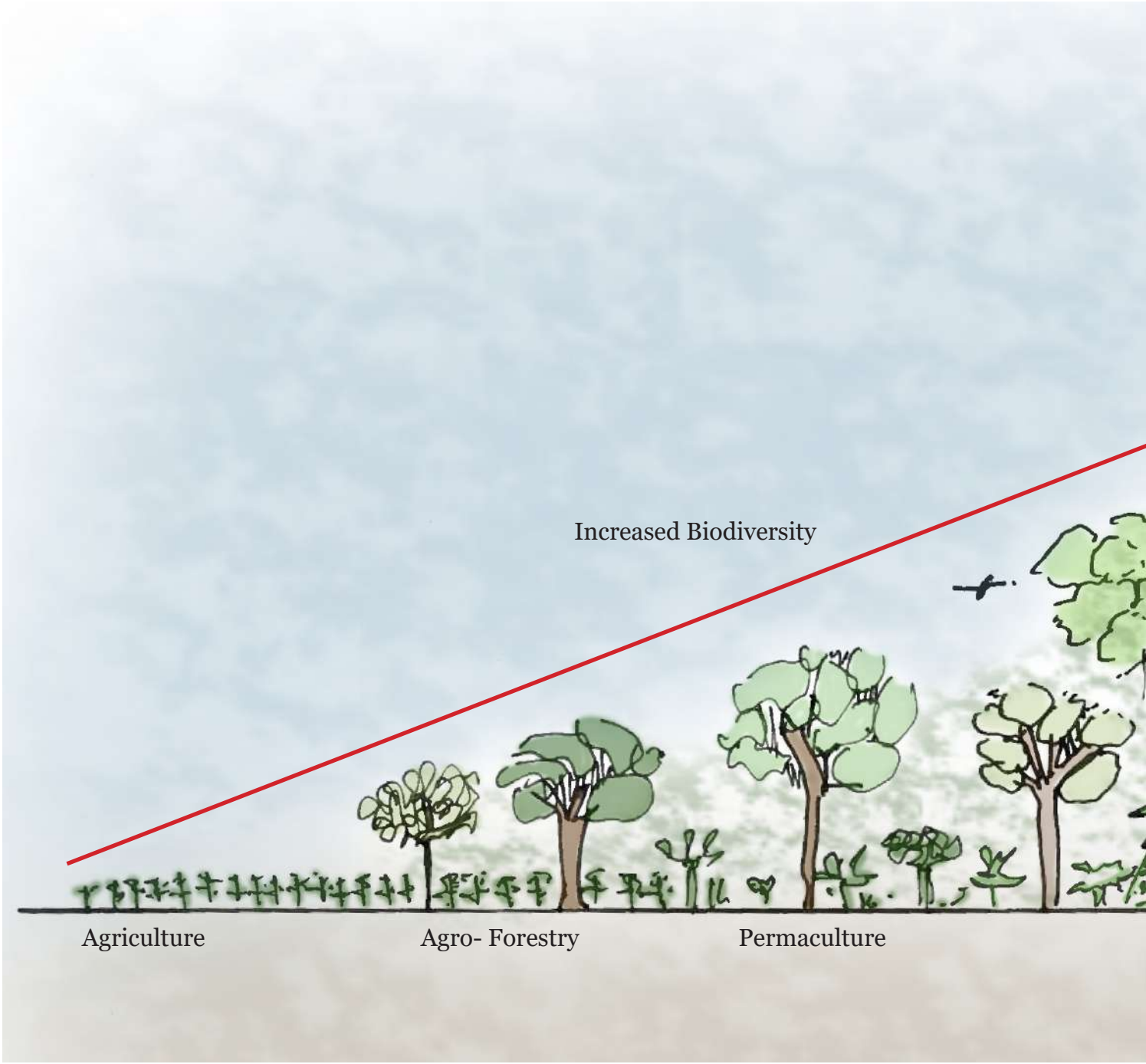


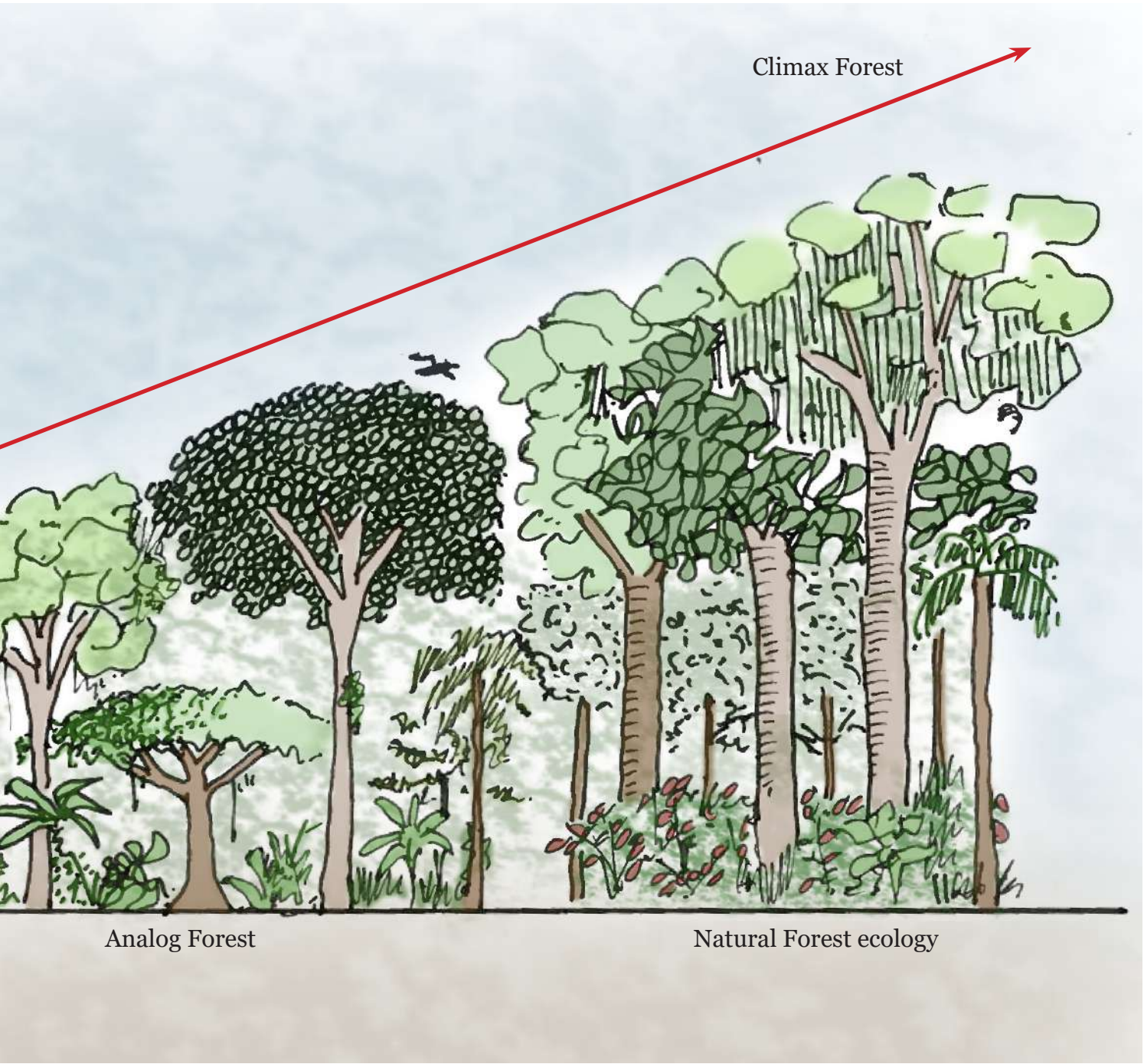
4.

DESIGN PRINCIPLES

DESIGN PRINCIPLES

PLANTING GRADIENT




Climax Forest
Analog Forest
Natural Forest ecology

DESIGN PRINCIPLES

Agroecology

Agroecology as a design module system which focuses on transforming the industrial method of production back to a more local and neighborhood scale. This method also promotes the societal interaction and is a method which guides towards a more community based development which produces food more sustainably.

It focuses on the interaction between people and nature, thus structuring a more nature inclusive farming arrangement. Agroecology thrives to understand and include all the elements of food production, processing and distribution of food. By doing this it provides a rich diversity of vegetables, grains, livestock and fruits.

In this way Agroecology is a contrast to the industrial agricultural model. In agroecology the focus is on:

- Knowledge
- Resources
- Wishes of farmers
- Wishes of citizens

They prioritize shorter food chains and local/ regional market keeping into consideration:

- The cultural tasks
- Landscape preservation
- Strengthening the local community
- Animal welfare
- Health (Care farms)

By doing so it is very responsive to societal demand for a more sustainable social form of farming.

Agroecology as an independent functioning system which tries to integrate crop production, shaded areas and ground covers. Above all it tries to replenish and regenerate soil conditions.

Land for Agroecology

Agroecology strengthens the locally available resources, markets and improves the relation between citizen and nature. It also is a key tool for Landscape preservation, enhancing and saving existing biodiversity, creates a more countryside like living environment and acts to be an active agent in nature regeneration.

Agroecology can be achieved by:

- Circular agriculture
- Bio-dynamic farming
- Permaculture
- Regenerative agriculture

The general age group of farmers practicing Agroecology farming are:

54% under the age of 40 years
26% between 40-49 years
29% over 50 years

The majority of farmers doing agroecology are women (55% women participation)

The produces generated using agroecology can be sold in the local farm shops, by developing a box delivery system and by promoting a self-harvesting system which is maintained by the consumers themselves.

System to acquire land for Agroecological farming

• Leasing land from environmental organizations

• Local/regional authorities

• Estate owners

• Policies of opening operational farms (including the existing small/medium farms)

land ownership for agroecological farms

• 13% of new farmers produce, cultivate goods on lands owned by them.

• 15% are multi-annual lease contracts

• 72% contracts are the contracts which are on an agreement for less than a year

• Crowd funding systems- 'De Nieuw Ronde' (New Round)

• Consumers having collective fund-raising to buy land of a local famer which shall be paid off by the farmers over a year.

• Land becomes a property of consumers with farmers paying rent to work and cultivate on it.

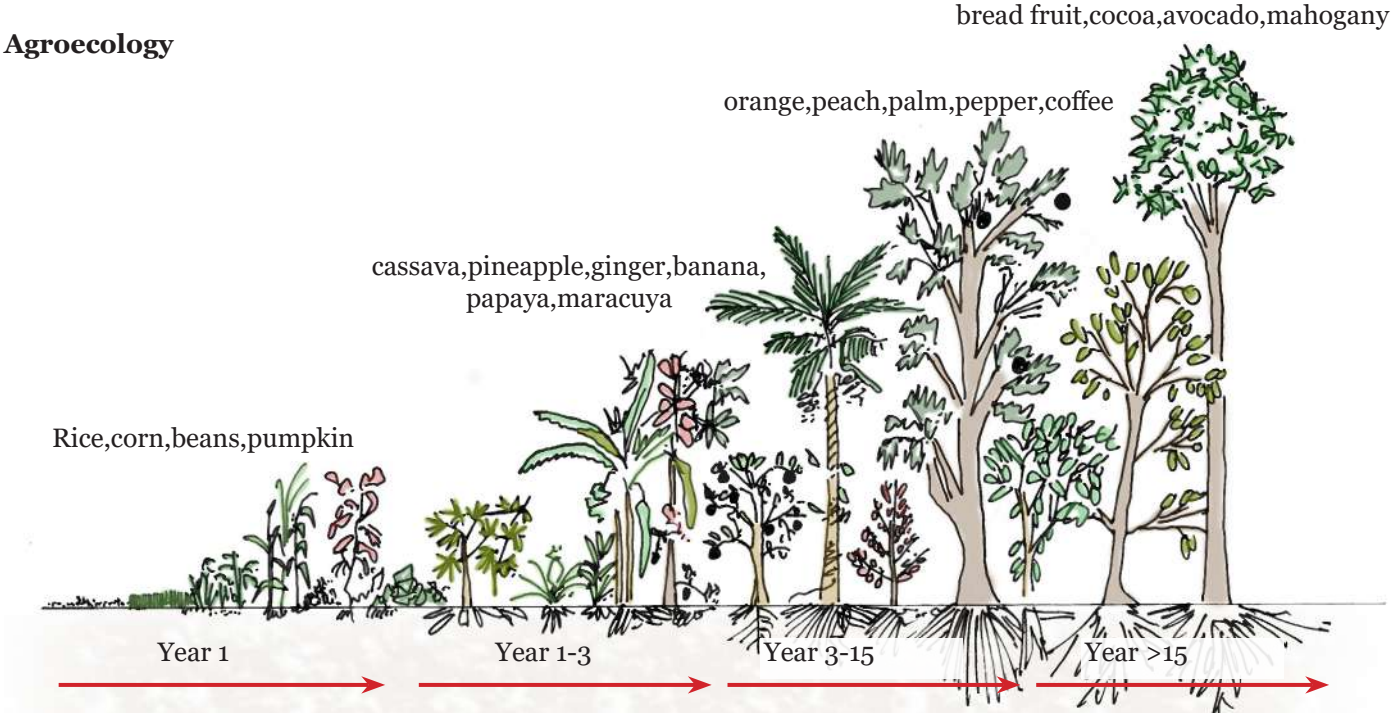
• Farm buildings bought up by the citizens, Example Veld en Beek

• Cow sharing policies to strengthen and reform a resilient consumer network society.

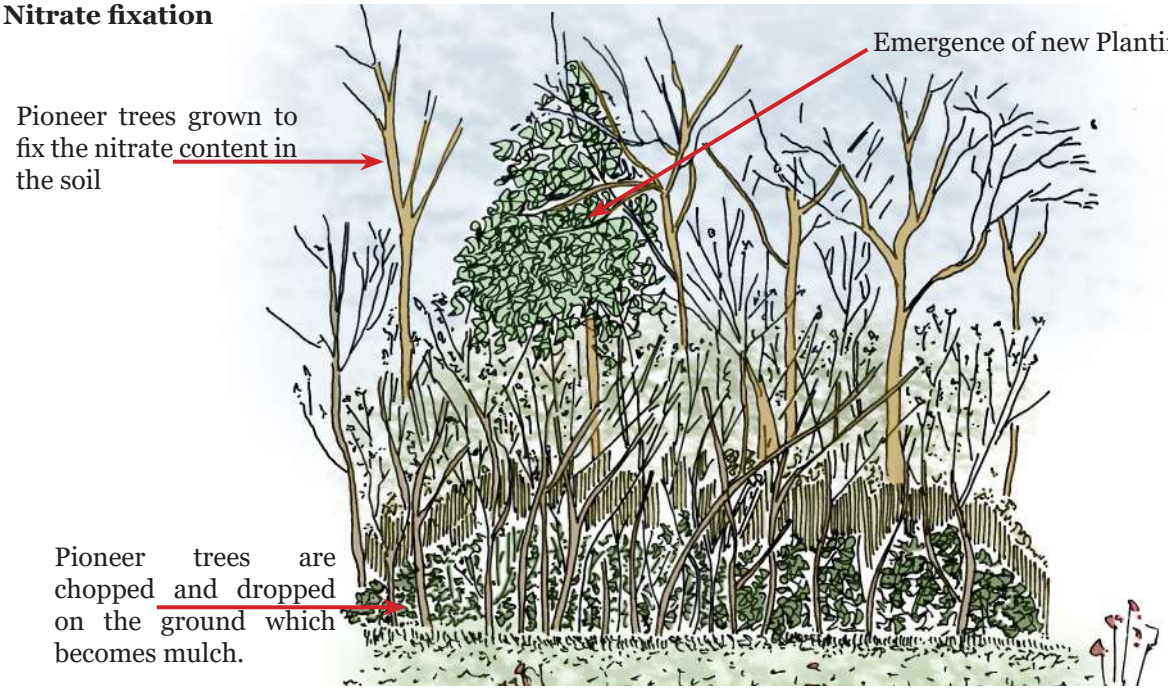
https://aseed.net/successful-agroecology-case-studies-sikkim-india/

http://www.panna.org/blog/our-future-agroecology

Agroecology



Nitrate fixation



Agroforestry

An agroforesty has a gradient which includes and enhances a more vertical biodiversity. This is the reason why agroforests are usually placed between shaded agricultural systems and permaculture. These forests promote specific plants and animal's mutualism. They always resort to a monoculture tree culture to deliver their produces. They are comprising of three planting gradients from ground up which are trees, crops and shrubs.

They usually try to enhance and transform the given landscape frame into a 3D complexity system and it focuses more on returns and profit yields not at the cost of sustainability. This is carried out by practicing a more resilient form of agriculture and production mechanism.

Food forests fall under the category of agro forestry. The art of production foods using forests. They try to bridge the gaps between production and ecology (Main aim of Permaculture).

Urban Forestry

A recent survey showed that planting trees in allotment (individual plot) gardens and community gardens can improve recreational services and also formulate a new layer of production scenario using Nut/ Fruit trees.[9]

Urban forestry consists of Food forests and Urban food forests.

Type of Forestry

- Alley cropping (agroforesty)
- Allotment gardens
- Community gardens
- Edible forests
- Edible urban greening
- Forest farms
- Nut tree plantations
- Permaculture
- Orchard
- School gardens
- Riparian buffers (Brooks)
- Riparian vegetation

This various forestry's are carried out on a wide and vivid range of scales, ranging from a town, urban setting, city all the way down to a single house.

Food Forest

Food forest can be defined as the skill (art of growing food) in a way that it replicates nature.[9] It thrives to create a multi-vertical layer of perennial and annual plants to promote and speed up ecological processes in nature and transform the area eventually into a Natural Forest.

Food forests help in carbon sequencing, nitrogen fixation and nutrient cycling.

A food forest in an urban setting is commonly referred to as an Urban Food Forest. These forests consist of a multi-story planting gradient which includes perennial plantations and converts Monoculture food production system

into a Polyculture food system.

It aims to have a deliberate integration of trees with agricultural crops and livestock either simultaneously of sequentially. They involve non-food trees as well as food trees. The targeted results are not only from the trees but also from a forest like system which it forms.[9] These gives rise to a diverse vegetation composition giving it a definite structure enhancing the ecological processes and intern triggering a flow of nutrient cycle.

Plant support species along with food production trees to boost the productive species. A system is deviced where pioneer support species are planted in order to achieve a stable canopy. These support species are grown specifically for nitrate fixation. They absorb the nitrogen from the soil and once achieved are cut down and dropped in the soil which sets a platform for the production trees to grow and settle.

Food forests are also enriched by the presence of animals. They graze and maintain the soil and at a same time provide manure which intern increases the potency of the soil on which the production trees shall be planted. The most common example is to use chicken/ ducks to maintain the food forest. They are the most effective land leveling and clearing agents.

Types of Food Forests

- Household gardens
- School gardens
- Therapeutic gardens (Care Farms)
- Community food forests

Gradient in Food Forests

The trees here are imagined to be a part of a broader food system which is fueled by multi-story food systems.

Planting Gradient for Food Forests

1. Food trees
2. Food trees with other food production units
3. Food systems with food trees
4. Multi-story (Trees and shrubs) food systems with specific food trees
5. Multi-story food system with unspecific trees
6. Food system with unspecific trees

Urban Food Forest

They try to encompass a wide range of different food tree systems and production using:

- Street trees
- Orchards
- Multi-story planting
- Polyculture system (Food trees in Urban landscapes)[9]

It aims at improving food security and they further combine and integrate themselves with other elements of urban agriculture. They mainly only have food producing trees which are planted all across the landscape. They increase the landscape multi-functionality and create a definite provision of food safety and is a key

natural element to contain storm water run-off.

From the above mentioned gradient an urban food forest would consist of (1), (2), (3)

From the above mentioned gradient an agroforest would consist of (3), (4), (5), (6)

Case Study

Holma Forest Garden, Sweden

Permaculture principles in integrated agroforest within a woodland system.

http://mdml.co/portfolio/beacon-food-forest-signage/

Food Forest

Overstory
Semi-dwarf Fruit Trees- Black Locust

Midstory
Hazelnut- Service Berry- Dwarf Fruit Trees- Elderberry- Siberian shrubs

Understory
Gooseberry- Currents- Asparagus- Rhubarb- Herbs- False Indigo

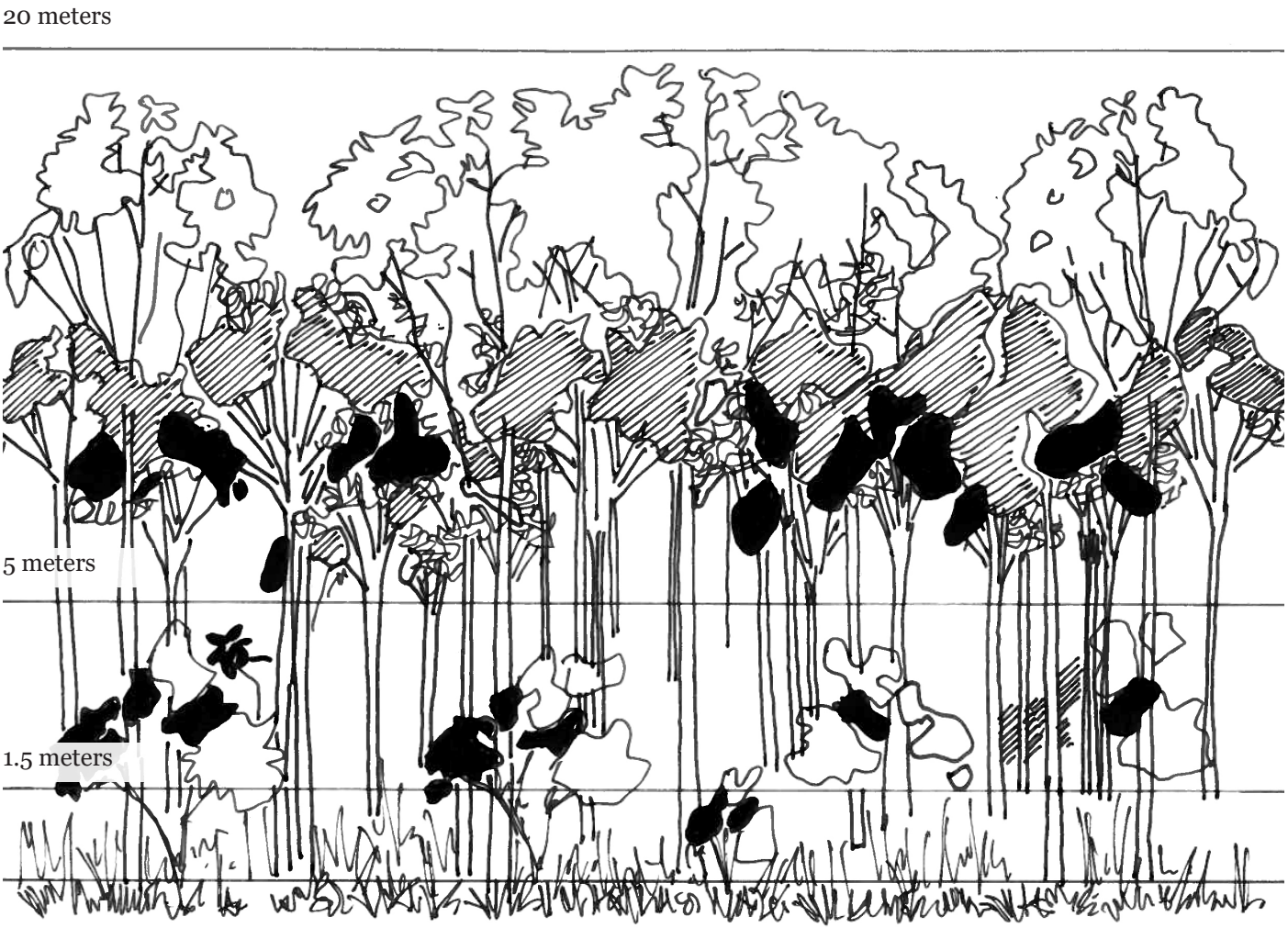
Ground Cover
Strawberry- Nasturtium- Clovers

Vines
Grapes-Winter hardy kiwi- Hops

In swale
Daylilies- Comfrey

Linear Food Forest

Perennial trees and plants located along the slope



Planting growth mechanics- Chop and drop

Community Gardens

Food trees/shrubs planted along the boundaries of an urban farm (community garden).[9] This helps in creating a multi-functional buffer which is more resilient to contaminated aerosols and they provide a barrier and a screen for the crops from the wind. Moreover, food trees also improve the astatic value of an urban farm.

Food trees also provide shade, block views from the outside and create a sense of enclosure for relaxation.[9]

In case of a farm setting farmers prefers to plant fruit trees on the boundaries which promote a more synergistic interaction between trees and livestock to control the competition between the trees, at the same time providing fodder when reforesting the former agricultural land.[9]

In this sense planting fruit trees within a community garden start creating spaces for locals to produce food and formulate a more interactive and interdependent connection to nature. While in the case of a large scale allotment garden it is better to use the fruit trees as installations which gardeners can use to grow food and intern form a more literal connection to nature creating a societal/communal relationship.[9]

A community garden is more about improving the relationship between the neighbours rather than laying importance to the produce. It is a mechanism where the community works together to establish stable condition for maximum yields. A community garden gives each of the occupants an equal sense of ownership and it makes an individual responsible to take the effort to help maintain and enjoy the yields together as a community rather than as an individual dwelling.

Allotment Gardens

Community Gardens

Permaculture

Permaculture as a system is primarily a compilation of design ideation which focuses its prime attention towards systematic thinking, imagining and literally translating patterns and self-sufficient resilient aspects extracted from the surrounding micro eco-systems. It proves to be a synergy to generate regenerative agriculture, community based development and circularity.

Australian Permaculturist David Holmgren who was at that time a student (graduate) at Tasmanian College of Advanced Education's Department of Environmental Design of Bill Mollison who is considered the father of Permaculture, together coined the existence of Permaculture as a design system in 1978.

The word Permaculture is a word having a Latin origin which literally translates to "permanent agriculture" but was commonly interpreted as "permanent culture". This was the case as societal involvement and participation were at the center of this process in order to achieve and formulate a "pure" self-sustaining system which was originally inspired by Masanobu Fukuoka's natural farming philosophy.

Permaculture as a system had many sub-functional areas of study which were collaborated to function as one monolithic system. These systems were mainly inclusive of ecological design, regenerative production, adaptable design, environmental value and execution.

It also lays its lens of focus on effective water management strategies within sustainable architecture, creating resilient and self-dependent habitat systems and production mechanisms inspired by nature (ecology) and their original ecosystems.

It was mentioned by Mollison that Permaculture has more of a philosophical stand-point where the mindset should be towards working alongside nature rather than invariably degrading it. He said that rather than thoughtless interventions and aimless labor we should think based on thoughtful observations generated by observing plant behaviours and animal responses rather than imagining them as a singular aspect of design.

The word Permaculture equals to Perma + Agriculture = Permanent Agriculture. This method embarks and adapts circularity and self-reliance when addressing production issues. This system thrives to mimic nature, mainly forests with its ecology and translates the learnings to a design problem while urging to work with natural processes to achieve design goals. Permaculture works in-sync with nature improving it rather an harming it.
Permaculture is closely related to production, where this production is achieved by having a more resilient planting gradient. Permaculture works on the system of providing minimum input and let nature be the active maintaining agent.

Permaculture also focuses towards maximizing

yields of a place by practicing eco-stacking where each layer in the system is interconnected and interdependent on each other for nutrients and development. The advantage of this process is that in an adverse case where one of the gradient fails to deliver its targeted produce it can depend on the other agents and actors to still make the system a closed entity.

Permaculture's second to main agenda is a close ecological consideration which can be achieved by:

- Ecotones
- Ecological succession
- Zones for human intervention
- Ecological harvest

According to Geoff Lawton permaculture is an ethical design system which in a way can also be defined as Eco-system modelling. By doing so it increases the biodiversity and also increases the generation of biomass, which forms the base for productivity.

Permaculture works on 3 principles:
- Earth care – Relation to nature (Mimicking nature)

- People care- Food access and crop insurance

- Fair share- Surplus produce sharing systems and synergies.

https://theunitedfarmsofamerica.com/blogs/united-farms-of-america/top-5-ways-permaculture-can-improve-your-farm

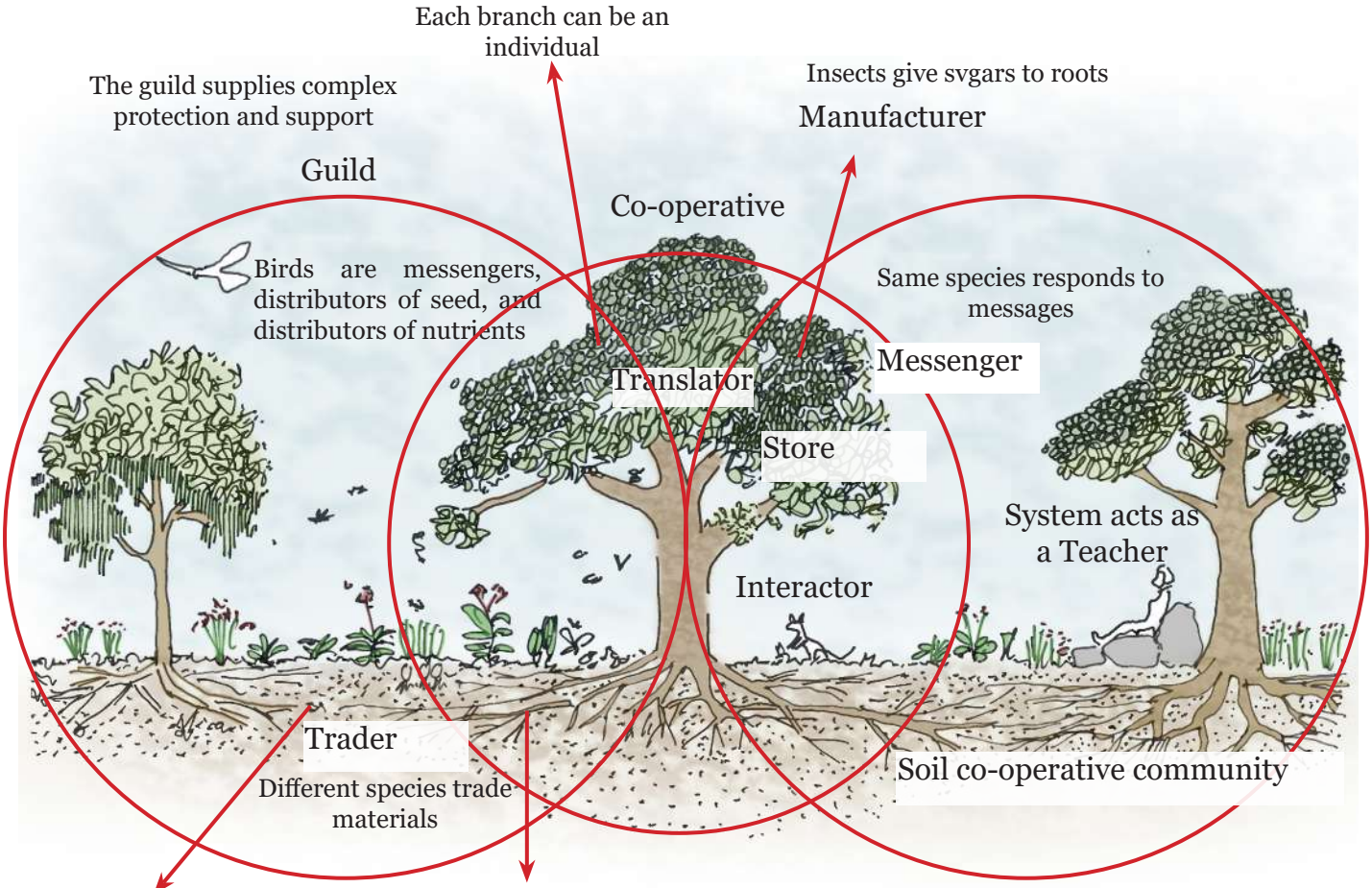
www.fondation-louisbonduelle.org

https://in.pinterest.com/pin/422916221256184422/?lp=true

Energy and gasses enter and are changed

Materials leave in a changed form

Energy and gasses leave in a changed form

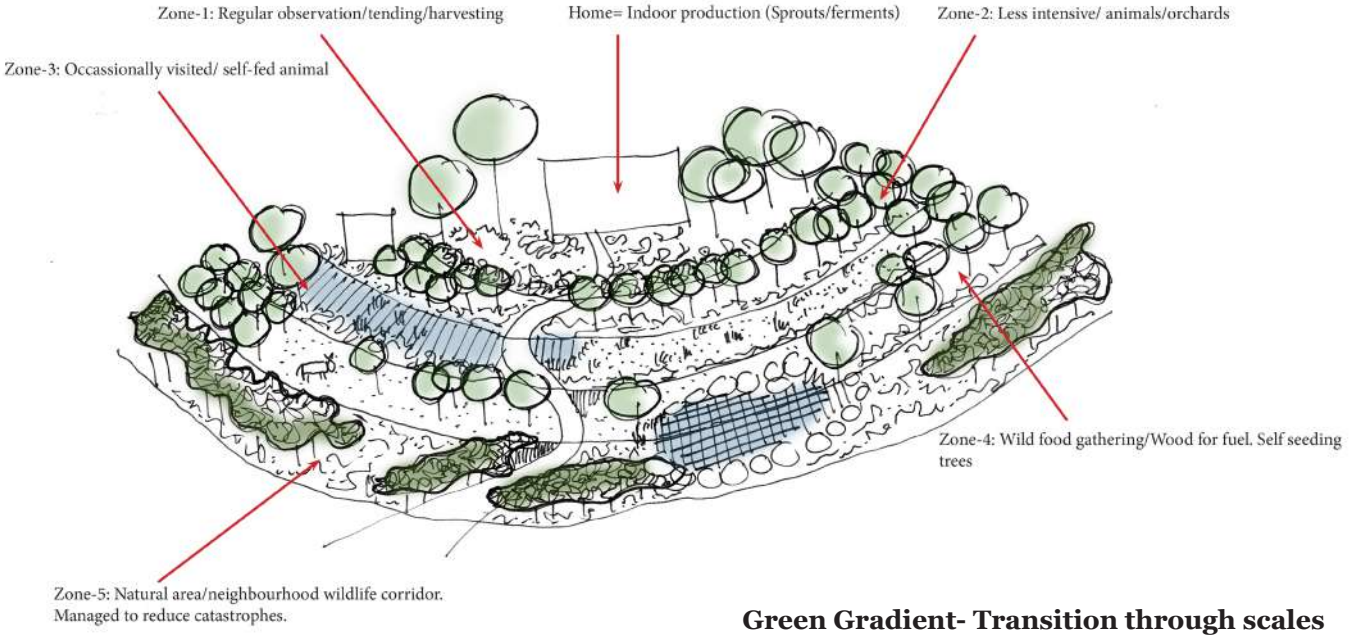


Animals are interactors, and messengers, and distributors of nutrients

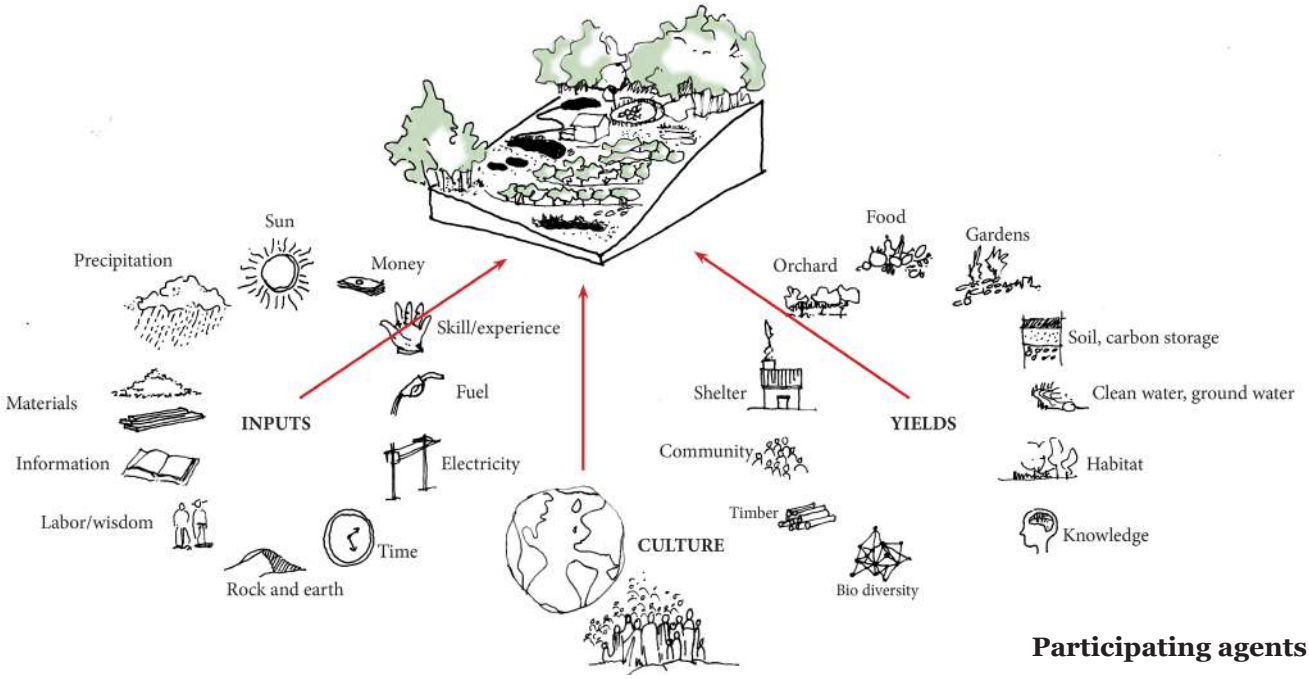
A guild is a community of plants and animals. Trees controls health and breeding of browsers.

Chemical messages to the same and other species

Permaculture cycle

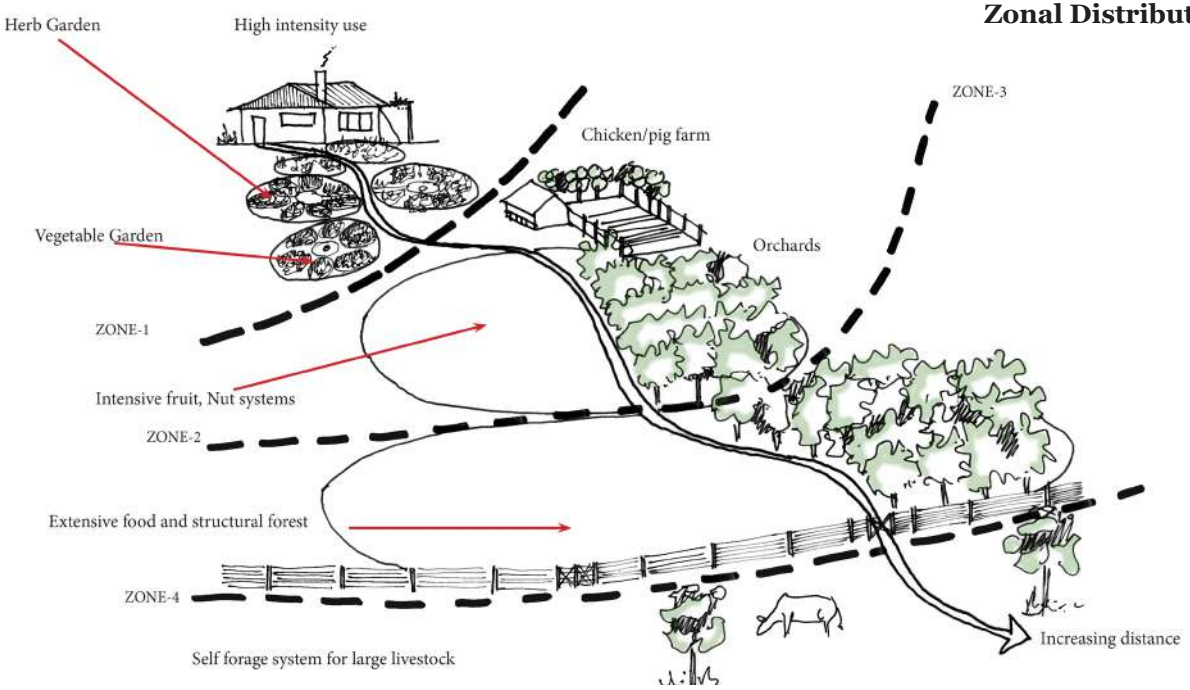


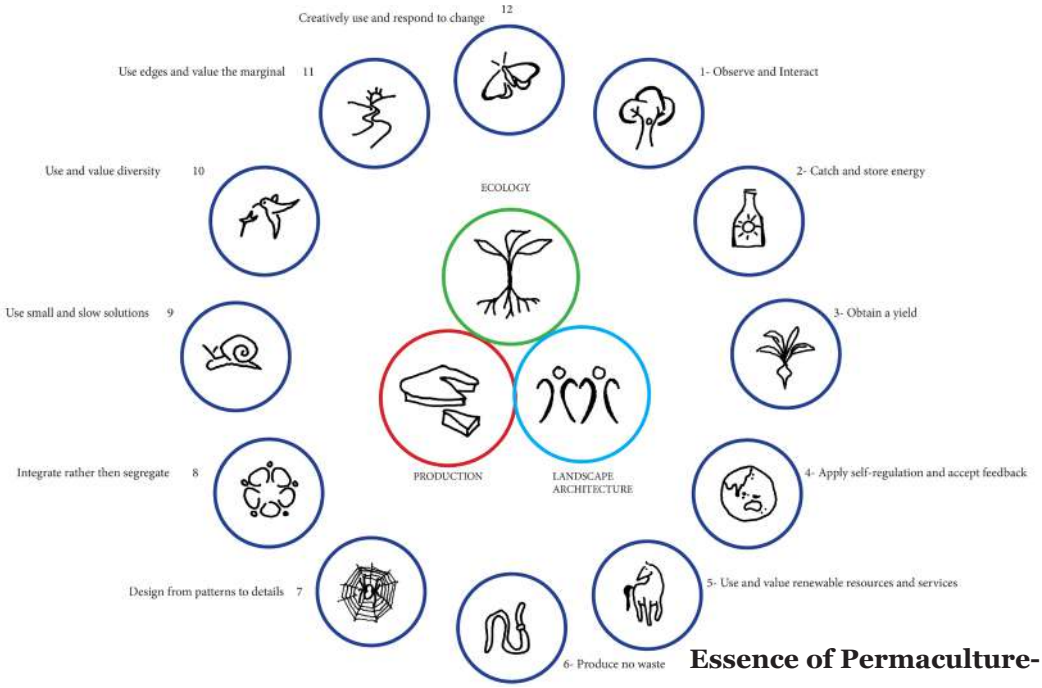
Green Gradient- Transition through scales



Participating agents

Zonal Distribution





Essence of Permaculture- David Holmgren

Ecotones

Ecotones are the transitional thresholds between the gradient of AGROECOLOGY. They usually occur when the formation goes from one definite system to the other. They are the patches which have a significant biodiversity. They also help in creating and defining a micro-habitat for the place, trying to make it self-sustaining.

These ecotones (edge-effects) are usually created within an agricultural patch which are completely self-sustainable. These thresholds define and form ecological corridors which enhance productivity and also provide a smoother transition from a particular method to the next stage of natural succession. The best example of an ecotone is the forest edge. It starts to define a micro-climate for the area and at the same time has a definite vegetation structure.

Thus ecotones would thrive best between agricultural and forest patches.

Factors affecting Ecotones

There are many agents which could hamper the threshold and shift the impact it has on the system. These factors are as follows:

- Scale of system
- Design itself
- The landscape on which it is designed
- Distribution and patterns
- Micro-climate
- Plant species

Ecological Succession

The word ecological succession was mentioned before what does it really mean?

Ecological successions are nothing but biological communities naturally evolved over time. They help in enhancing the biomass production and intern increase plant species richness.

They can start from an early stage. They can start from a degraded land convert it into a grassland which eventually is transformed into a climax forest. In the case of agriculture, the landscape accelerates maturity in existing gardens and non-timber forestry to enhance bio-diversity

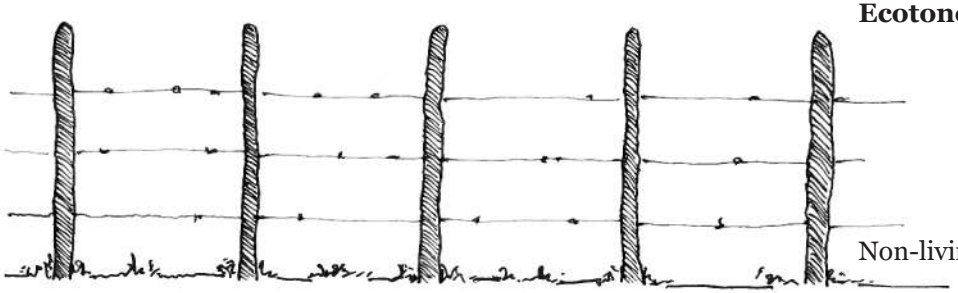
Analog Forests

The sense of succession in an analog forest is focused on the socio-economic benefit it yields from the system. The main aim of succession in analog forests is to prevent forests to reach the climax stage. They urge to form a bio-regional forest having a monoculture tree system which is dependent on the temporal conditions and also speeds up the process of natural regeneration. Agroforests are converted to Analog forests using these ecological successions.

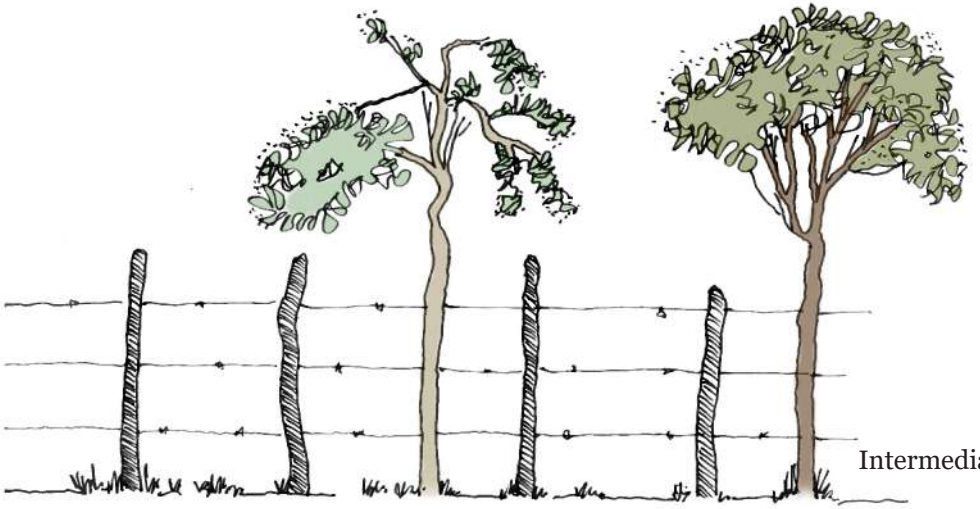
Types of Plantations

- Traditional Polyculture
- Commercial Polyculture
- Shaded Monoculture
- Unshaded Monoculture

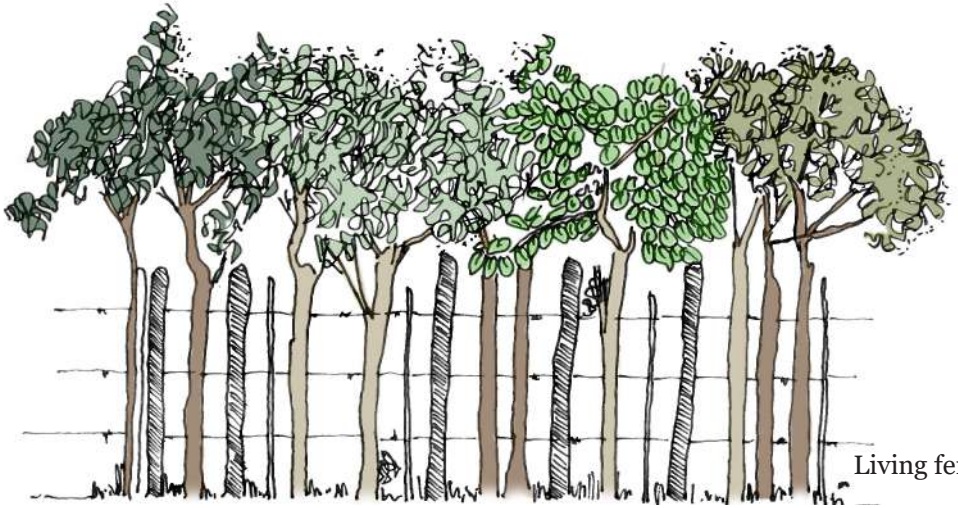
Ecotones- Edge Effect



Non-living fence posts



Intermediate Planting



Living fence post

Care Farms

Care farming is a method of farming which uses the module of a farm not only for a production purpose but also thrives to include the idea of health care and social bonding with active participation of communities.

Care farms also have environmental benefits of reviving the native ecology of the space, devising a more co-operative and interactive method of production which improves soil conditions rather than degrading it, which briefly sums up to a multi-functional agriculture typology.

Care farms connects and links agriculture with health and tries to encompass social services, in other words Care farms improve physical, mental and social well-being of an individual.

The number of Care Farms are constantly increasing, making this a method which has caught a lot of attention. There were 75 Care farms in 1998 which grew to becoming more than 1000 farms by 2009. These care farms have a varied arsenal of clients. In 2005 there were approximately 10,000 clients in Netherlands, where each of these Care farms had a revenue generation of 73,000 euros per farm.

In these words, a Care farm is an active agent in formulating organized ecology, promotion social movements and provide a possible shift from the more industrial method of production. In this aspect a Care farm focuses its study and research on transitional studies.

Care farms are part of a commercial farm typology which are usually formulated within an agricultural landscape. They are mainly defined as an independent entity to promote mental and physical health. It does this by using various farming activities.

There are a varied range of activities which can be carried out on a care farm. Some of the more successful ones are traditional farming work, horticulture land maintenance work and animal based activities.[10] They cater to a varied range of audiences as well. They mainly focus their agendas towards people with Autism, learning/ physical disabilities, dementia, mental illness, disaffected youth, substance miss-use and offenders.[10]

The funding mechanisms for these farms can be procured from various sources mainly being charitable/private domains, local authorities with contracts, health care organizations, probation services and income generated from sale of farm produce.[10] They also work towards strengthening the environmental well-being by making it more peaceful and creating a judgement free environment creating a sense of freedom and promote social interactions.

Case Study

Jagtlust graveland

Stiching de werdkerigheid

Citarum, Indonesia

Community based Social Farming

Community based social farming focuses on active participation in form of inputs and policies from the local communities and it is focusing mainly to increase the revenue generation for the farmers, in other words farmers well-being.

Social farming is a form of sustainable farming in rural areas which take advantage of plants and animal resources with the main goal channelized towards recreation, including and promoting social services, health care services, providing a therapeutic environment which also spreads education and make people aware of its benefits.[11] This type of farming benefits the entire community and is only developed using locally available resources.

Most of the activities taking place for social well-being are undertaken on farms, based on the individual/temporary needs of people. Social farming also provides interaction with nature, where it uses nature to influence the physical, psychological, spiritual health of an individual. Social farms are very closely linked to care farms. There are various types of farms having vividly different functions. Some of them are:

The farms which are linked with public institutions which are co-financed by the state.[11] These farms have their concentration on a specific activity: Health care using agriculture. They also have multiple financing means. The funding can be acquired by public structures; they could be voluntary or could be received from social co-operatives.

Case Study

Oaza pod Lasem

Kul Kul farm, Bali

Nature inclusive Circular Farming

In order to be sustainable and resilient in the way we produce our food we need to move more towards a Circular food system. This system can be achieved by effectively using/managing natural resources (soil, biodiversity and water). The other important step forward is to optimize the food waste and reduce it as far as possible, intern providing a less pressure system on the environment.

Circular farming diversifies, adapts and minimizes waste and maximizes production, helps in reducing the carbon footprints and encourages a sharp reduction in the input costs needed for production. The best method to approach this phenonmenon is to divert and direct the production entity towards a more resource-efficient farming system “Agroforestry”. This system values circular and short food chains which achieves all its yields by practicing nature-inclusive agriculture. The start point of these agroforests can be done by re-using the abandoned agricultural spaces. It also focuses on the idea of “let nature do the work”.

Case Study

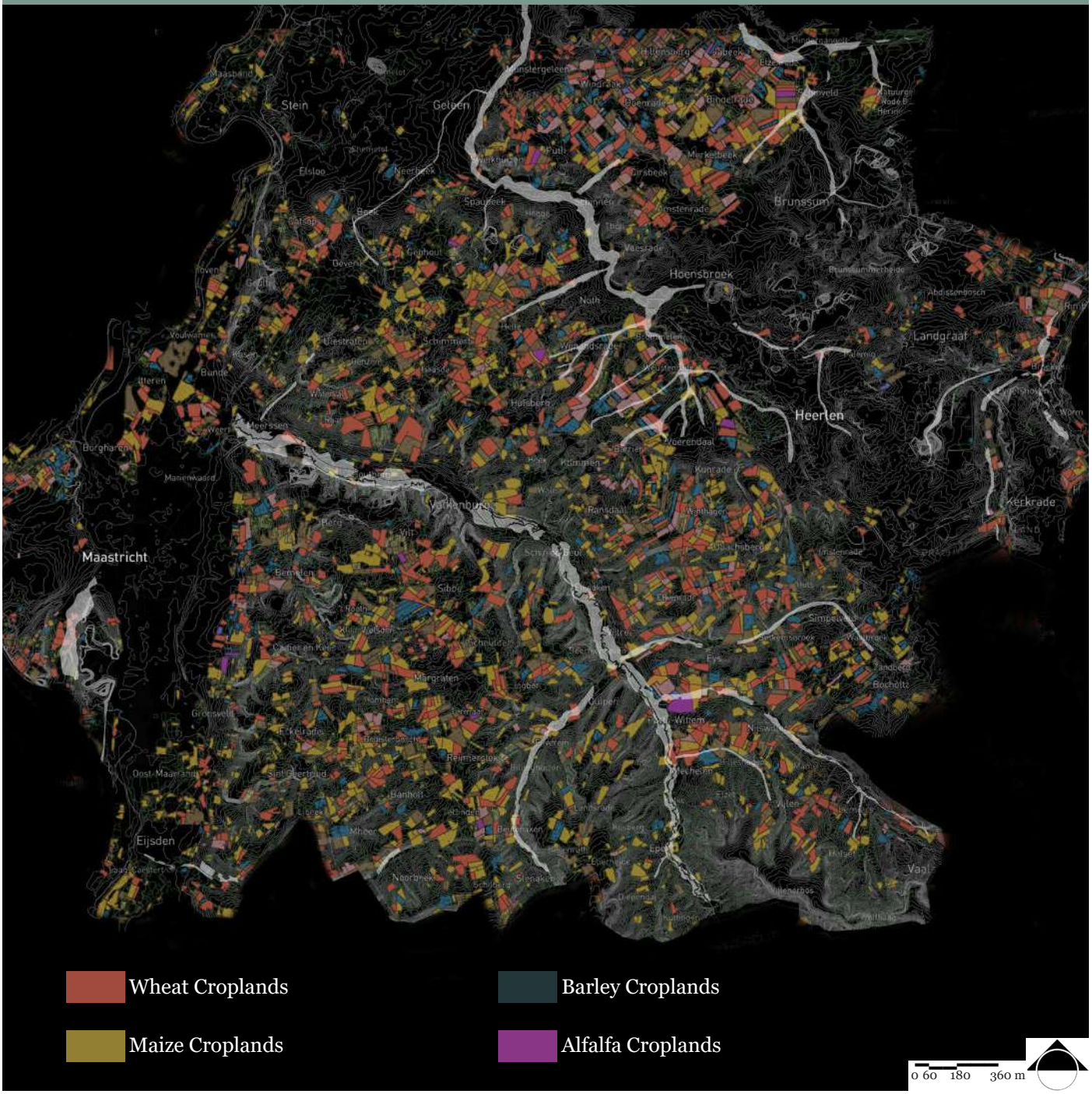
Hoeve Biesland, South Holland

5.

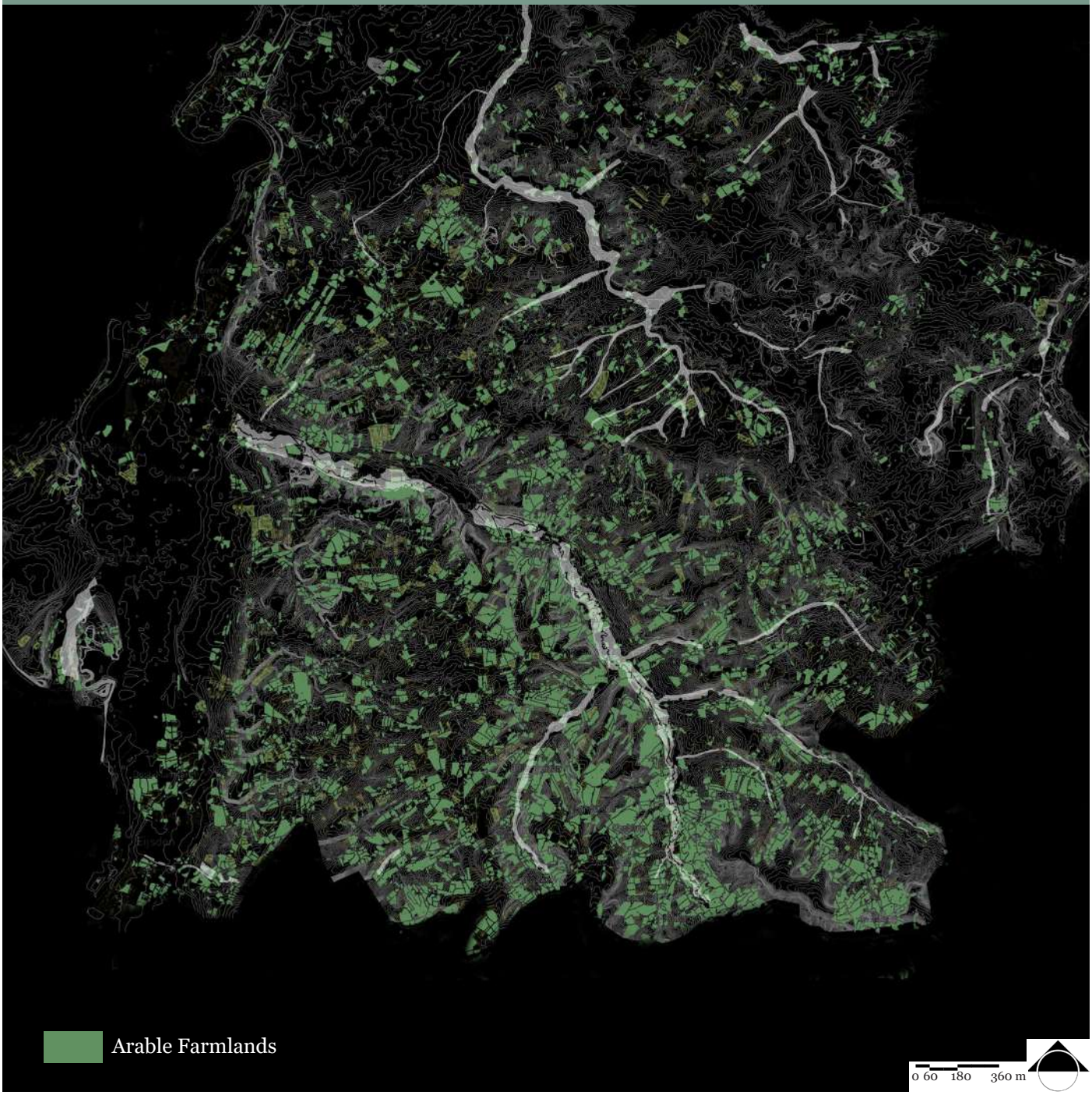
DESIGN VISION

DESIGN VISION

CURRENT CROP YIELDS IN LIMBURG



CURRENT MEADOW LANDS IN LIMBURG



DESIGN KIT- Matrix of planting synergies

Food trees only

Orchard, Street Trees

Associated fields
Urban foraging, gardening

Function
Health

Synergies
Fruit + beautification

Food trees with other food units

Urban park, educational garden

Associated fields
Permaculture,civic agriculture

Function
Job creation

Synergies
Fruit + social interaction

Food system with food trees

Home garden, intercropping

Associated fields
Gardening

Function
Beautification

Synergies
Profit generation + land regeneration

Multistorey with foo

Communit forest gard

Associate
None

Function
Soil format

Synergies
Fruit + win air polluti + shade an

Trees and crops on boundary

Scenario
Boundary

Ideal output
Multi-functional buffers

Community Gardens

Trees and crops in Groups

Scenario
Grouped

Ideal output
Educational garden

Community Gardens

Trees and crops unknown

Scenario
Unknown

Ideal output
Inter-cropping

Forest Gardens

Public access
Community Gardens

Agricultural parks

Trees and Li boun

Scenario
Boundary

Ideal outp
Fruit trees i
Pastures

food system
od trees

y garden,
en, farm

ed fields

tion

s
adbreaker+
on control
d privacy

vestock on
dary

ut
in

Food system with un-identified trees

Community garden, agricultural park

Associated fields
None

Function
Wood material

Synergies
Biodiversity+ Wood material+ carbon sequestration

Trees and Livestock unknown

Scenario
Unknown

Ideal output
Silvipasture

Trees in a Group

Scenario
Grouped

Ideal output
Orchard

Trees, Livestock and crops in group cluster

Scenario
Grouped

Ideal output
Eco-village

Trees with no pattern

Scenario
Unknown

Ideal output
Greening

Trees, Livestock and crops unknown

Scenario
Unknown

Ideal output
High-rise Farms

What the World needs

By 2050 demands shall rise to feed a total of two billion more people. How can it be done without degrading nature ?

https://www.nationalgeographic.com/foodfeatures/feeding-9-billion/

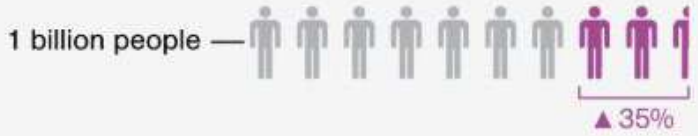
Faces of Production

All around the world, small scale local farmers are the key link in feeding the world. These are a few of the men and women responsible for that effort.

https://www.nationalgeographic.com/foodfeatures/feeding-9-billion/

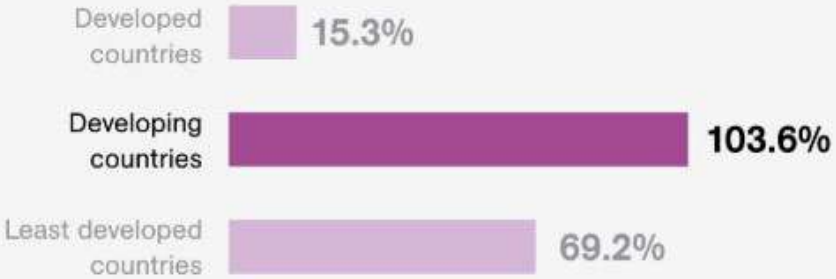
A World Demanding More

By 2050 the world's population will likely increase by more than 35 percent.

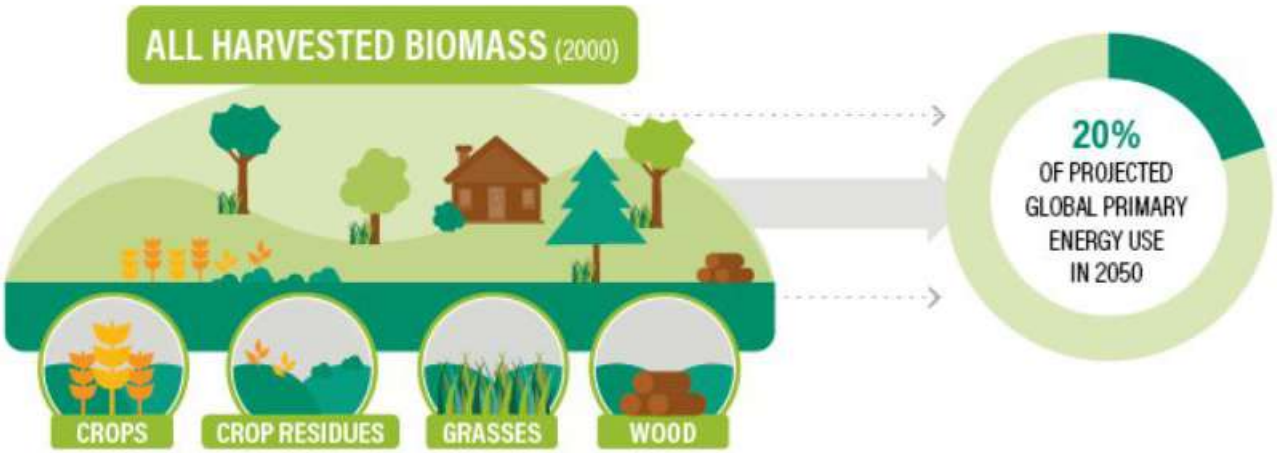


To feed that population, crop production will need to double.

Why? Production will have to far outpace population growth as the developing world grows prosperous enough to eat more meat.

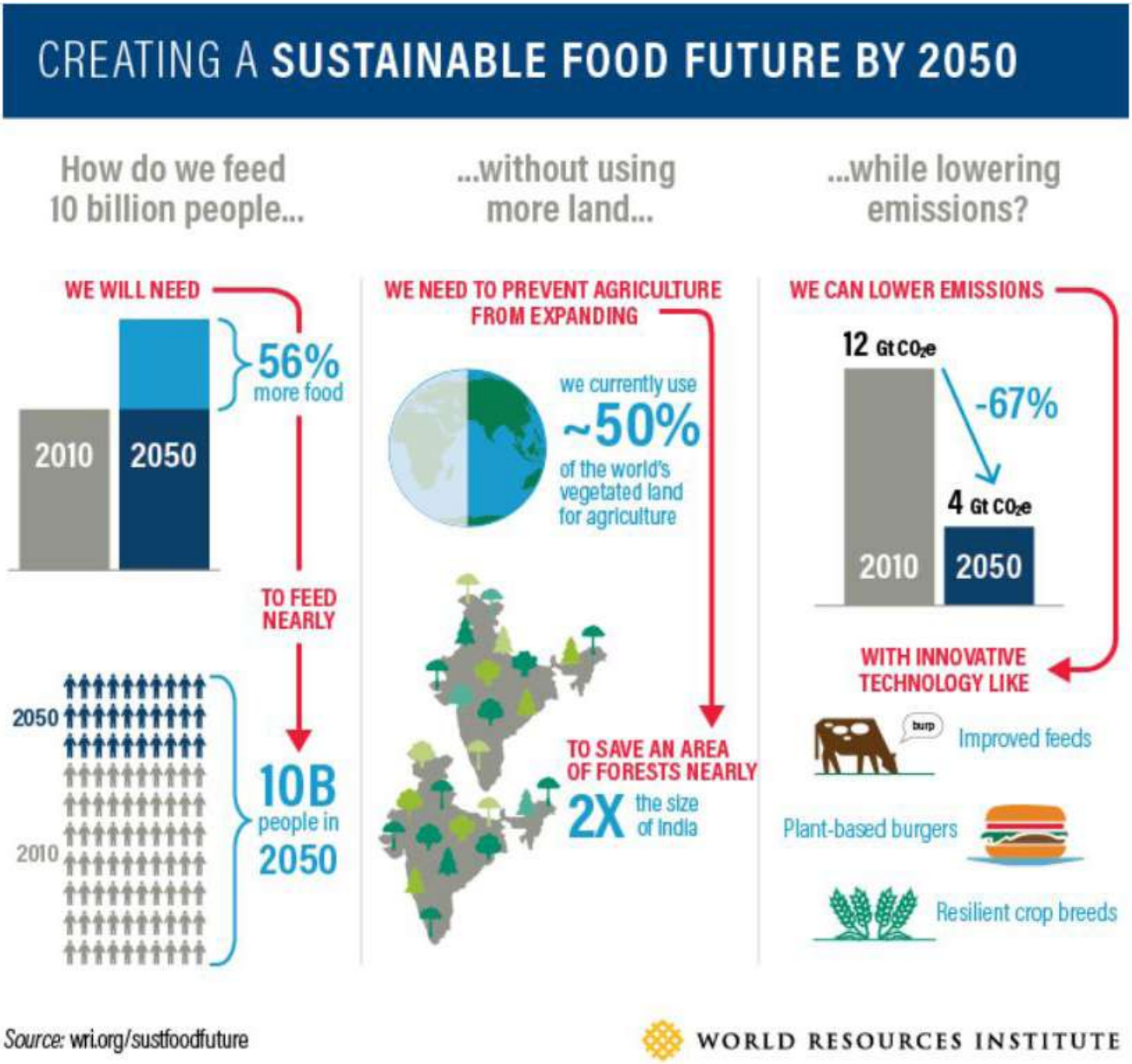


All of world's harvested biomass would supply only 20% of global energy needs in 2050

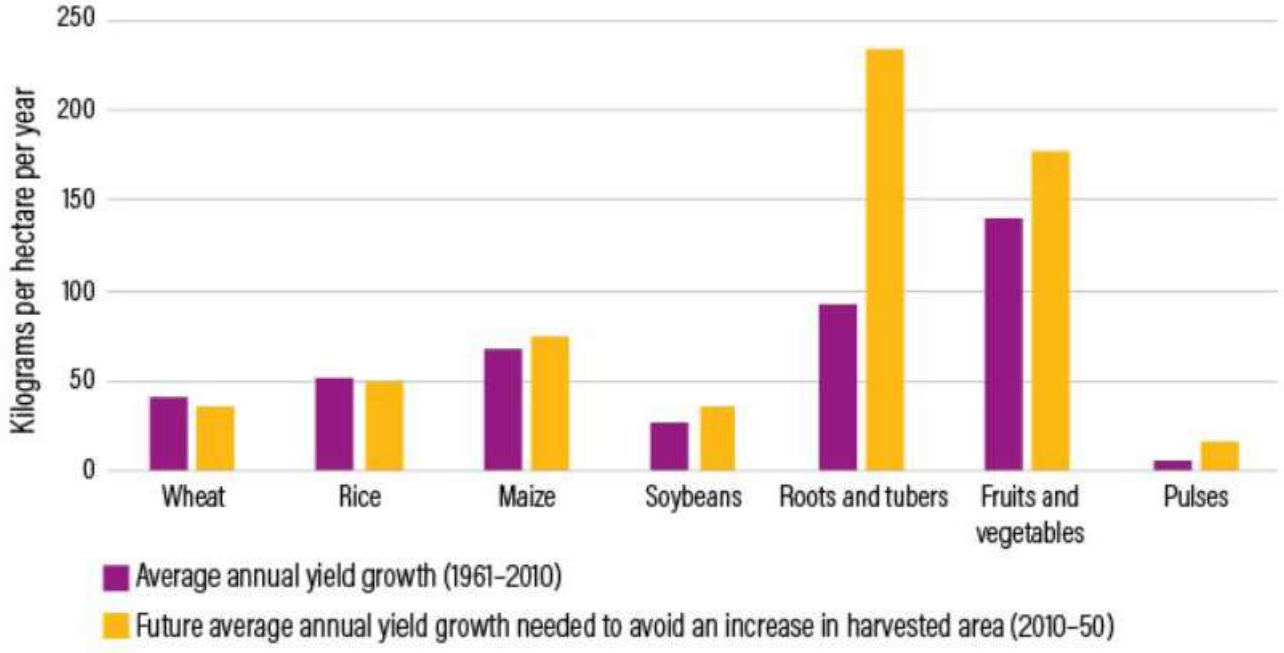


Note: Assumes primary to final energy conversion for biomass is 24% lower than for fossil energy.
Source: Authors' calculations based on Haberl et al. (2007); IEA (2017); and JRC (2011).

WORLD RESOURCES INSTITUTE


CREATING A SUSTAINABLE FOOD FUTURE BY 2050
How do we feed 10 billion people...
...without using more land...
...while lowering emissions?
WE WILL NEED
56% more food
2010
2050
TO FEED NEARLY
2050
2010
10B people in 2050
WE NEED TO PREVENT AGRICULTURE FROM EXPANDING
we currently use ~50% of the world's vegetated land for agriculture
TO SAVE AN AREA OF FORESTS NEARLY 2X the size of India
WE CAN LOWER EMISSIONS
12 Gt CO2e
-67%
4 Gt CO2e
2010
2050
WITH INNOVATIVE TECHNOLOGY LIKE
burp
Improved feeds
Plant-based burgers
Resilient crop breeds
Source: wri.org/sustfoodfuture
WORLD RESOURCES INSTITUTE

Future yield growth in many crops will need to be higher than in the past to meet projected food demand on existing agricultural land



Source: GlobAgri-WRR model, WRI and ACE analysis based on Alexandratos and Bruinsma (2012).

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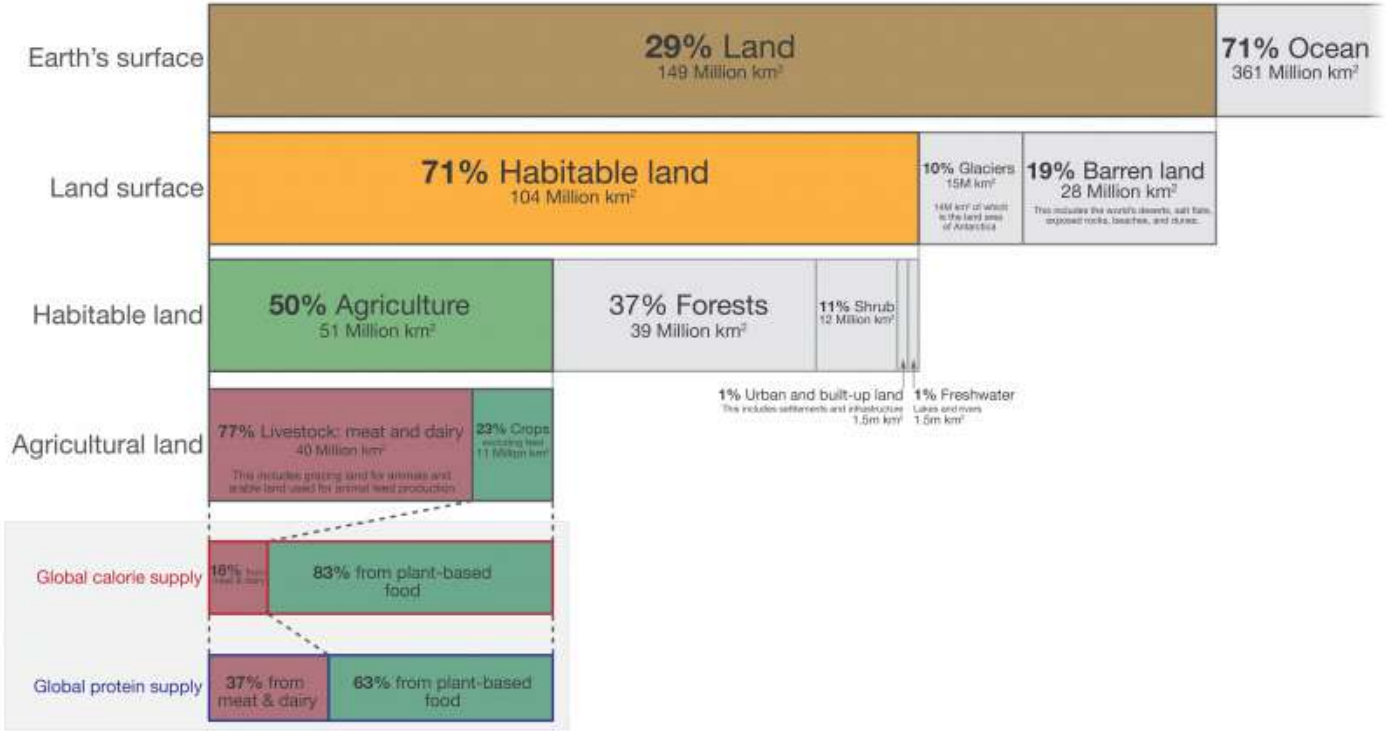
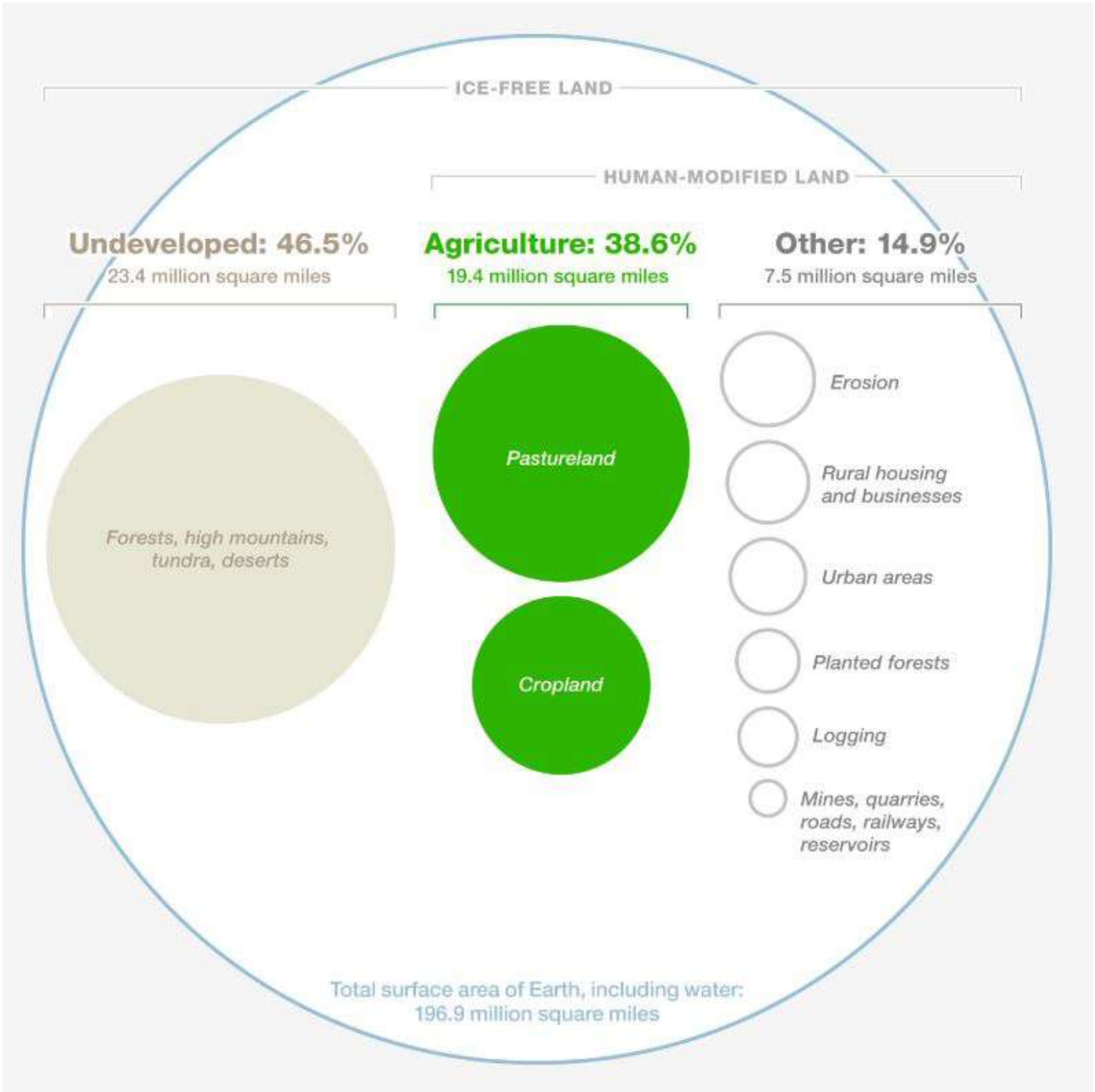
Global land use for food production



Data source: UN Food and Agriculture Organization (FAO)

OurWorldinData.org – Research and data to make progress against the world's largest problems.


THE GLOBAL STATE OF
AGRICULTURE
POPULATION IS EXPANDING & FOOD PRODUCTION MUST RISE
1927
2 Billion
1960
3 Billion
1987
5 Billion
1999
6 Billion
2011
7 Billion
2050
2011
GLOBAL FOOD PRODUCTION MUST INCREASE 70% BY 2050 TO MEET OUR NEEDS.
Annual Cereal production must rise by 42%.
Annual beef production must rise by over 100%.


ICE-FREE LAND
HUMAN-MODIFIED LAND
Undeveloped: 46.5%
23.4 million square miles
Agriculture: 38.6%
19.4 million square miles
Other: 14.9%
7.5 million square miles
Forests, high mountains, tundra, deserts
Pastureland
Cropland
Erosion
Rural housing and businesses
Urban areas
Planted forests
Logging
Mines, quarries, roads, railways, reservoirs
Total surface area of Earth, including water:
196.9 million square miles

AGRICULTURAL POLLUTION

Land environmental damage is a result of intensive farming

The food industries (mainly animals) are responsible for the generation of a total of 1.5 million tons of waste (manure) each day, which if compared to humans is 3.5 times more. The major issue faced here is regarding the storage, disposal and re-use of this excess animal waste. The main reason for this is that storing this waste forms a breeding ground for organisms which generate and release pollutants.

Causes of land degradation

Pesticides and fertilisers

The translation of pesticides sprayed while yielding crops when transfer to animals contribute majorly towards land pollution. Disposal of these pheromones into water systems severely harm and degrade the native aquatic life and create null-zones. They are also responsible for the degradation of soil structure's increasing the nitrate levels and robbing the soil of its capacity to retain water exposing them to substantial erosion.

Improper disposal of waste

Agricultural production with its industrialized scale is also amongst the big players responsible for generation of waste. Mass density livestock grazing results in accumulation of waste. Fertilizers used to enhance crop yield and prevent crop infection always end up mixing with the surface water run-off increasing pollution.

The unfiltered accumulation of animal waste degrades soil and interrupts with the water tables and meddle with human well-being. This leads to production of bacteria's which than spread a greater extent each time this scenario occurs.

Livestock deforestation

Livestock farming is responsible for occupying 84% of all available arable land along with promoting de-forestation to acquire more land. Previously 80% of the forest degradation was the result of high demand rise in the food industry. Forest act as the green lungs of the planet fixing carbon emission are being degraded way faster than anticipated as a result of which carbon foot-prints are steadily rising.

Effects of intensive farming on land use

Habitat destruction

Forest degradation is a severe issue which is created as a result of excess food demands. 20 million acres of green is lost in order to cater to that. The most vivid species of plants and animals are seen to be living in forests who end up homeless as result of this slaughter of forests, thus exposing them to exitinction.

Chemicals within ecosystems, food chains and environments

Glyphosate is the primary ingredient used to execute forest degradation and land acquirements for farming.

After de-forestation and clearing the second wave of chemicals are sprayed on. Animals consume these toxins and start a chain of transfer through the food cycle which results in excess quantities of waste collection.

Loss of natural resources

Pioneer species which take years to grow and stabilize are cut down in order to provide access to farming creating a void in the departments of research and medicine. It also affects many local communities which are dependent of animal harvesting for food.

The costs of factory farming – how land degradation and pollution impacts investors

Polluted lands are also responsible for driving potential buyers for that specific piece of land. There is small ignition of realization about the harmfulness of this act and the definite effects of fertilizers used in harvesting. As mentioned earlier a portion of this is released in the water tables and others harm the soil structures degrading them and exposing them to soil erosion. They also reduce the potency of the soil in yielding crops, reducing the cost of the land and increase the hazard of crop failure and food harvesting.

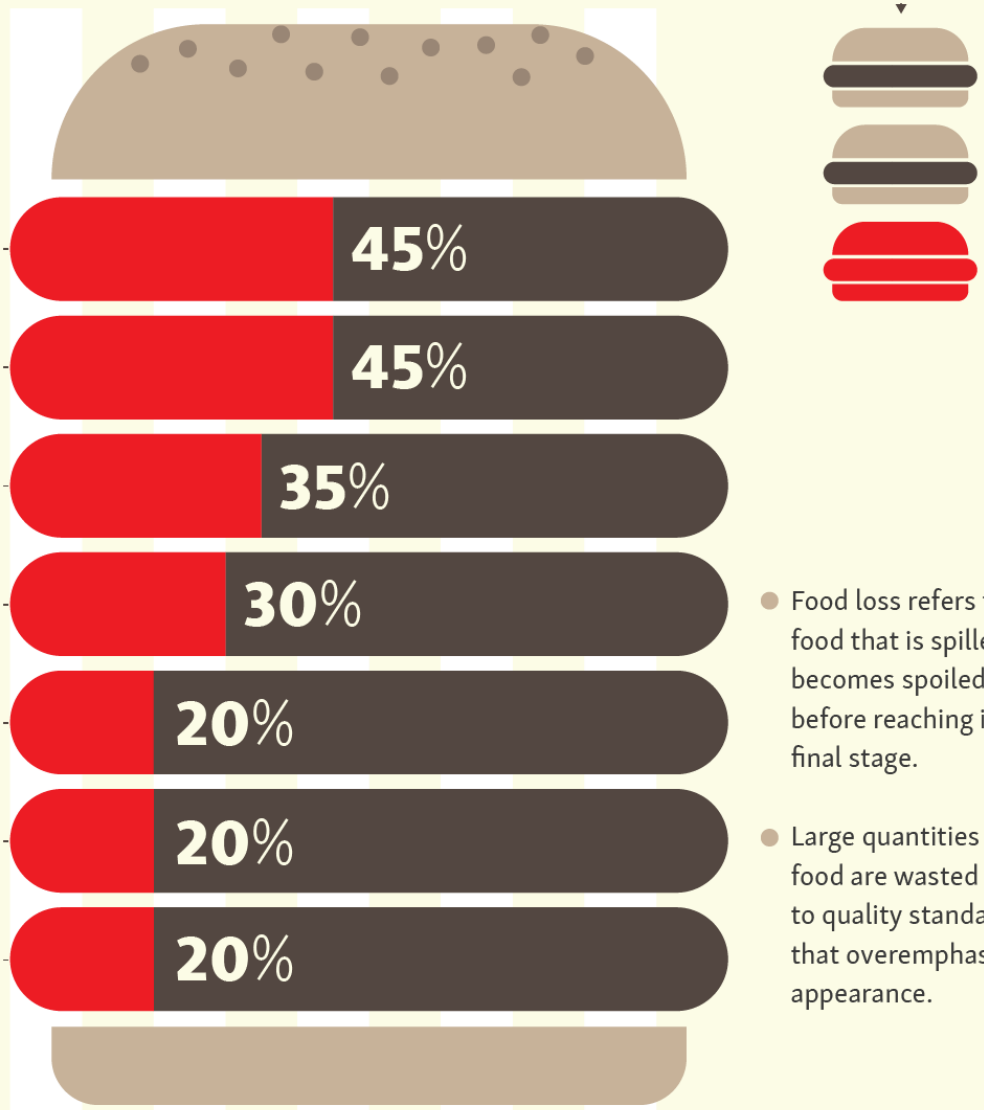
Communities are understanding the value of having an easy access to a green structure around them and are thus starting to protest the idea of land degradation in the process of generating a yield.

As we speak we are losing valuable parcels of land under green canopy. We lose a total of 20 million acres of ecology annually which is similar to 30 soccer fields each passing minute. Most of the haphazard execution of forests are due to the rise in food demands over the years. Over the year's various laws have been implemented around the world to protect and save the scary rate of forest depletion, hopefully not too late.

https://helpsavenature.com/prevention-of-land-pollution

Global Food Waste

Approximately 1.3 billion tons of food is lost or wasted every year. That is about **one-third** of all the food produced for human consumption in the world.

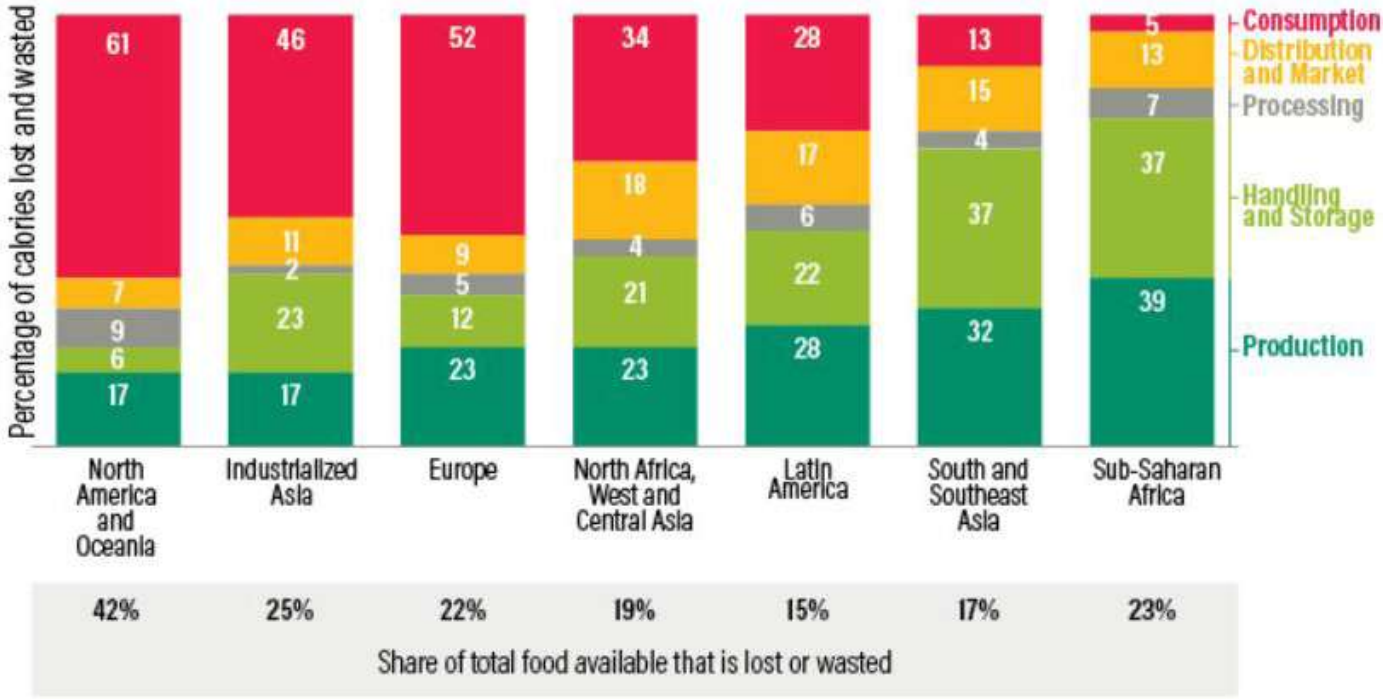


- Food loss refers to food that is spilled or becomes spoiled before reaching its final stage.
- Large quantities of food are wasted due to quality standards that overemphasize appearance.

RadioFreeEurope RadioLiberty

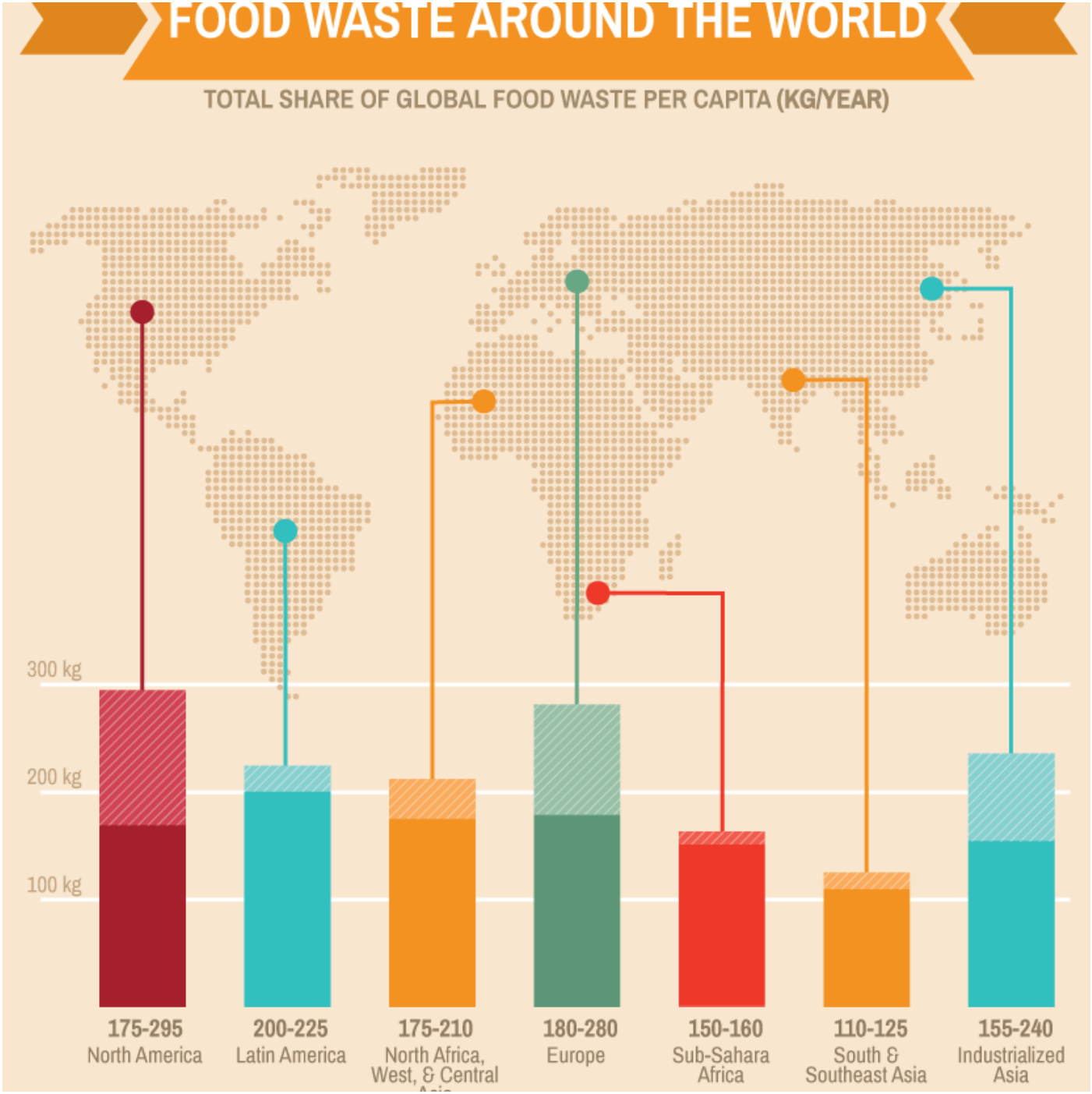
C. Coelho | Source: FAO

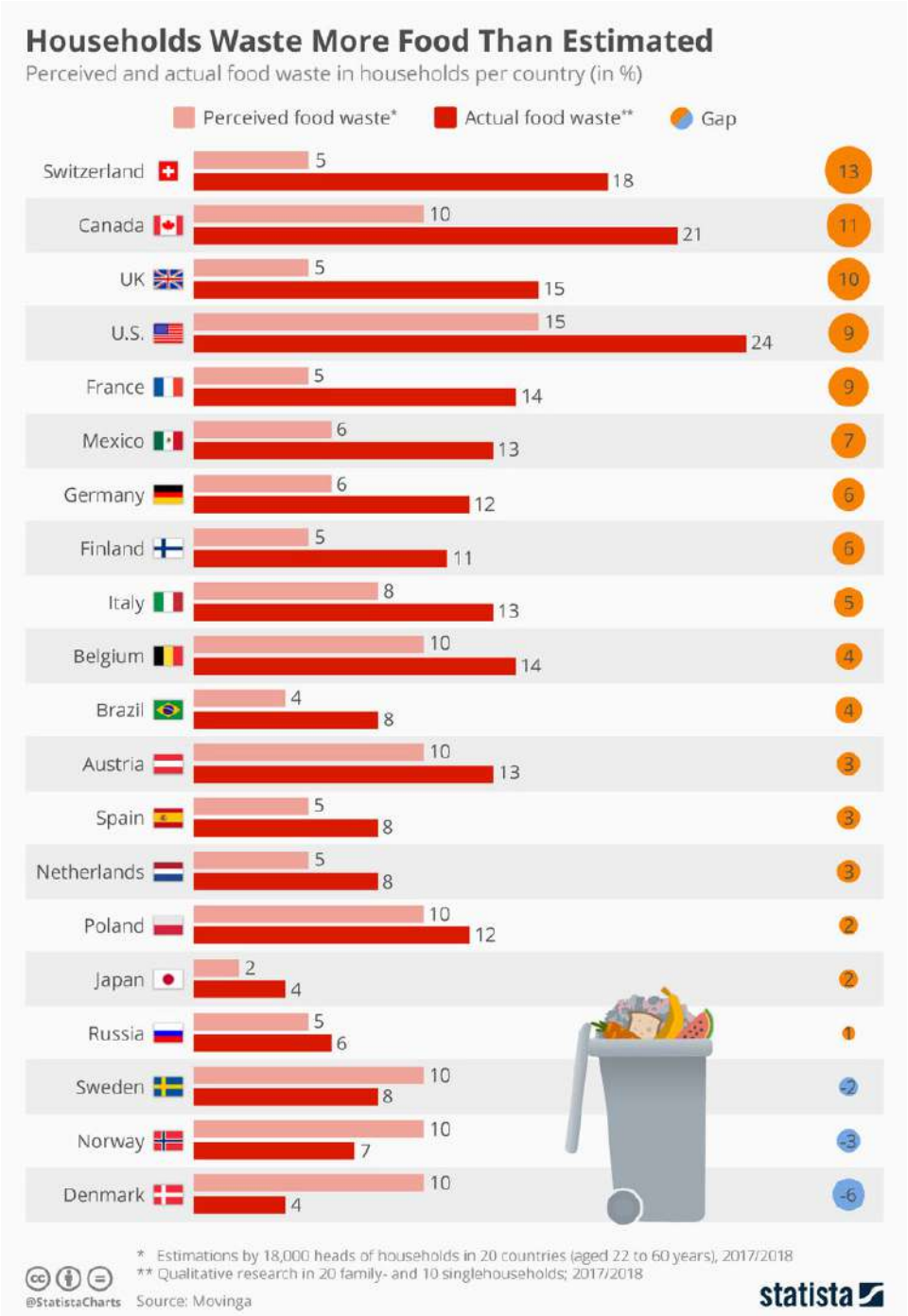
Where food loss and waste occurs along the food supply chain



Source: WRI analysis based on FAO (2011b).

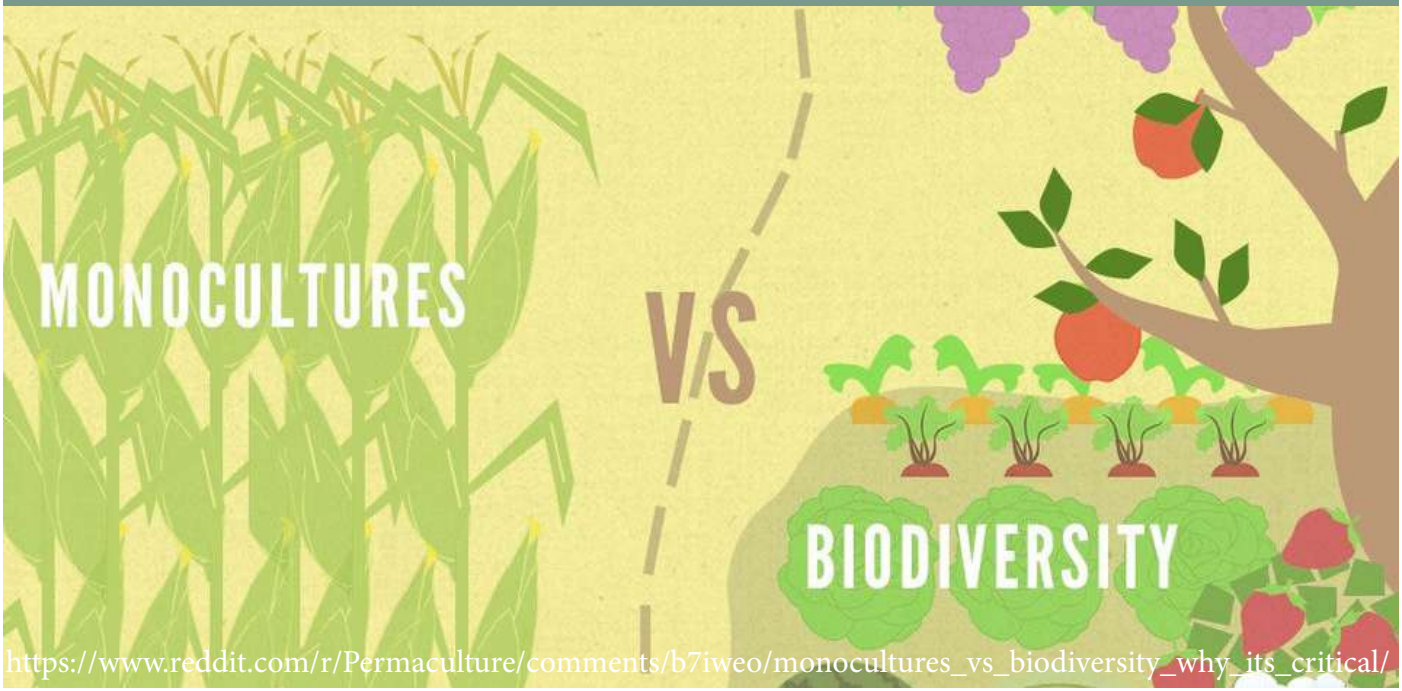
WORLD RESOURCES INSTITUTE


FOOD WASTE AROUND THE WORLD
TOTAL SHARE OF GLOBAL FOOD WASTE PER CAPITA (KG/YEAR)
300 kg
200 kg
100 kg
175-295
North America
200-225
Latin America
175-210
North Africa, West, & Central
180-280
Europe
150-160
Sub-Sahara Africa
110-125
South & Southeast Asia
155-240
Industrialized Asia


Households Waste More Food Than Estimated
Perceived and actual food waste in households per country (in %)
Perceived food waste*
Actual food waste**
Gap
Switzerland 5 18 13
Canada 10 21 11
UK 5 15 10
U.S. 15 24 9
France 5 14 9
Mexico 6 13 7
Germany 6 12 6
Finland 5 11 6
Italy 8 13 5
Belgium 10 14 4
Brazil 4 8 4
Austria 10 13 3
Spain 5 8 3
Netherlands 5 8 3
Poland 10 12 2
Japan 2 4 2
Russia 5 6 1
Sweden 10 8 -2
Norway 10 7 -3
Denmark 10 4 -6
* Estimations by 18,000 heads of households in 20 countries (aged 22 to 60 years), 2017/2018
** Qualitative research in 20 family- and 10 singlehouseholds; 2017/2018
@StatistaCharts
Source: Movinga
statista

A SHIFT TO PERMACULTURE FARMING

INSIDE PERMACULTURE



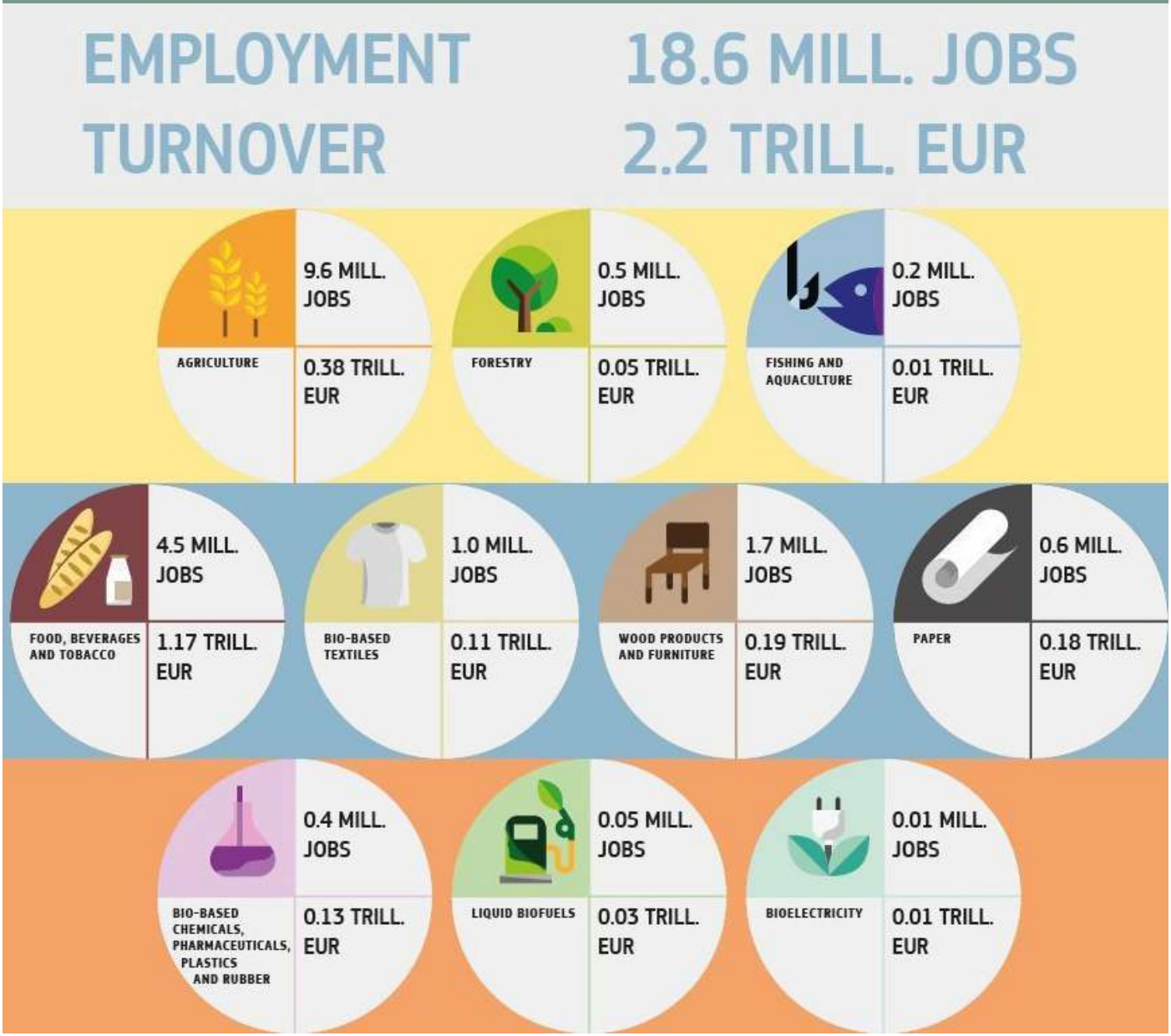
https://www.reddit.com/r/Permaculture/comments/b7iweo/monocultures_vs_biodiversity_why_its_critical/

http://www.cultie.com/published/2017/5/8/cultivate-permanence-the-relatively-unknown-benefits-of-permaculture

https://grocycle.com/permaculture-farming/

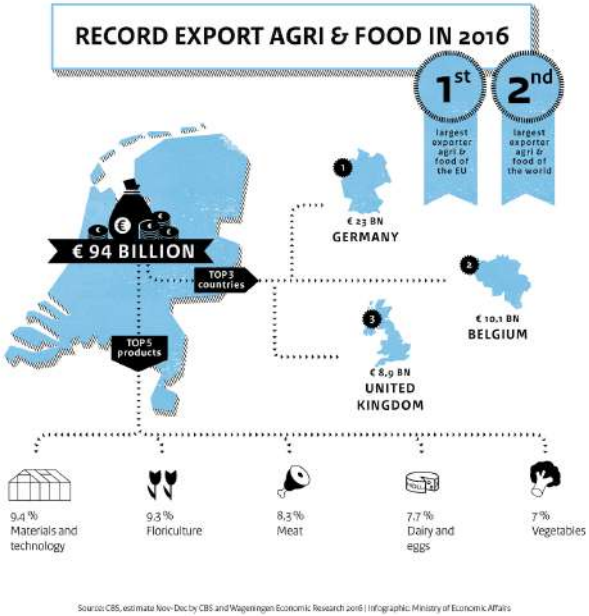
https://grocycle.com/permaculture-farming/

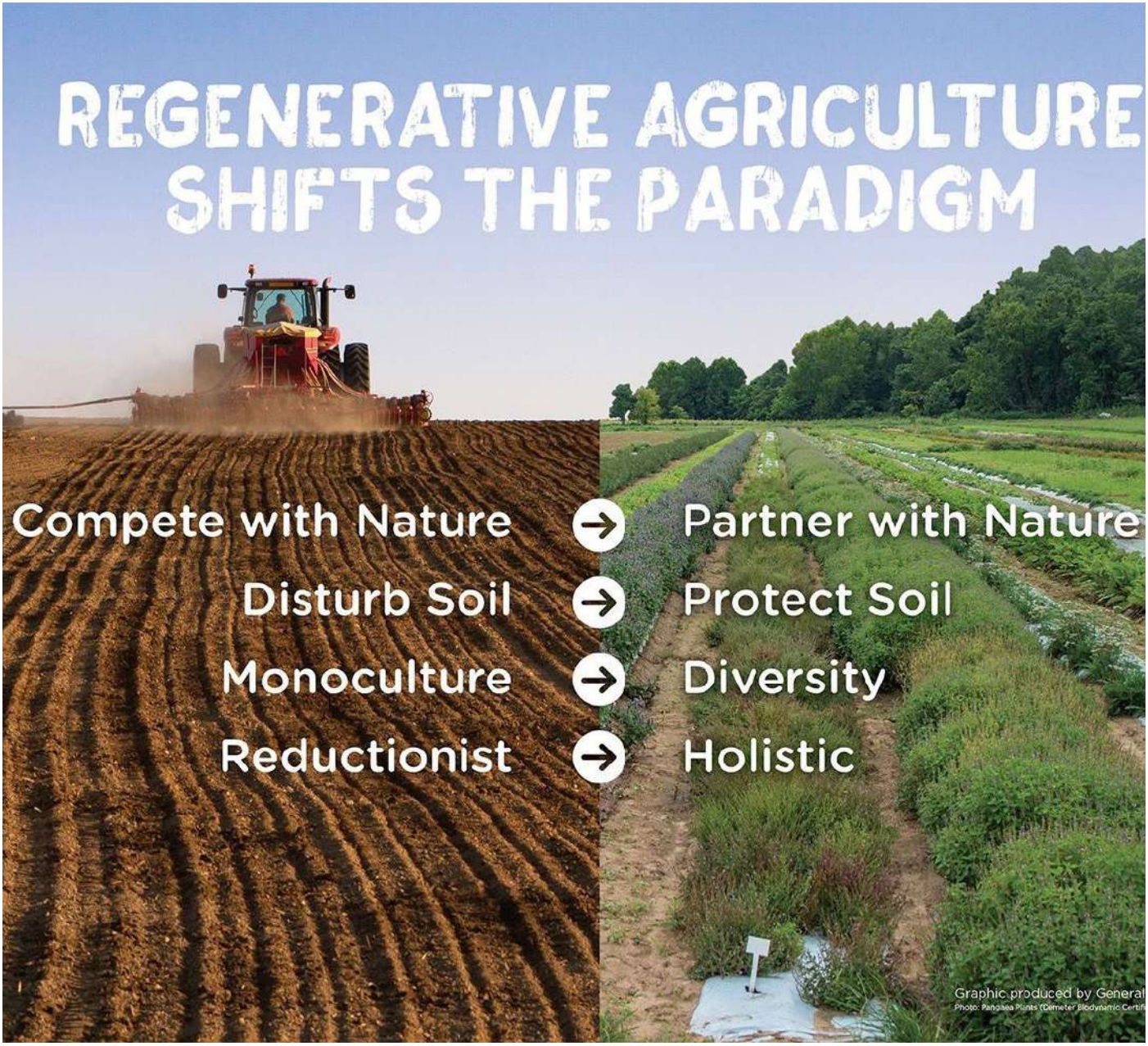
THE CURRENT EMPLOYMENT TRENDS EU



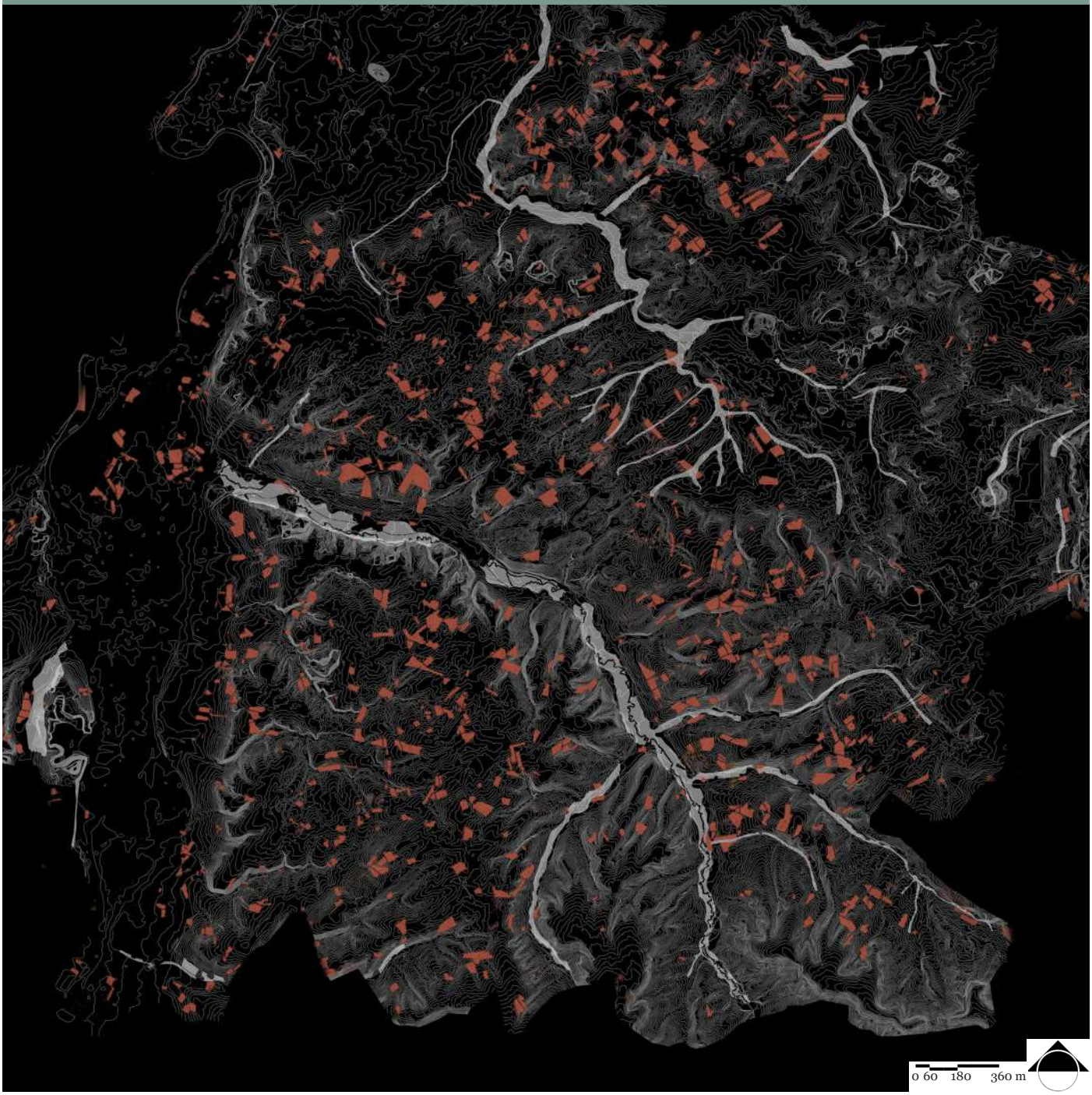
DUTCH AGRICULTURAL TRADE

DUTCH AGRICULTURAL TRADE




REGENERATIVE AGRICULTURE
SHIFTS THE PARADIGM
Compete with Nature
Partner with Nature
Disturb Soil
Protect Soil
Monoculture
Diversity
Reductionist
Holistic
Graphic produced by General

TARGETED CROP YIELDS IN LIMBURG



WHEAT

• The average wheat yield in **2019** was **9.6 tons per hectare**. This showed a steady **rise of 9%** from the previous years.

• The gross wheat yield per year was **1.2 billion kg** in **2019** which was rapidly **increased** by **17.6%**

• **1 Acre** of wheat can at max produce **50 bushels** of wheat.

• **1 bushel** of wheat can be converted into **42 pounds** of **while flour.**

• **1 bushel** of wheat can be converted to **60 pounds** of **whole wheat flour**, which means that **1 acre** of wheat can be refined into **3000 lbs**. of **whole wheat flour**.

• **1 lb**. of **whole wheat flour** can be transformed into **4500 loaves of bread**.

• An average man needs **2000 calories** to feed himself, which accounts to **2 loaves** of bread per day per person.

• **1 acre of wheat** (50 bushels) could be enough to sustain **2250 people** for a day, or **6 persons** for a **whole year**.

• **Netherlands** cultivates **6,000,000 bushels** a year and they mainly **export** it to **Belgium** and **Germany**.

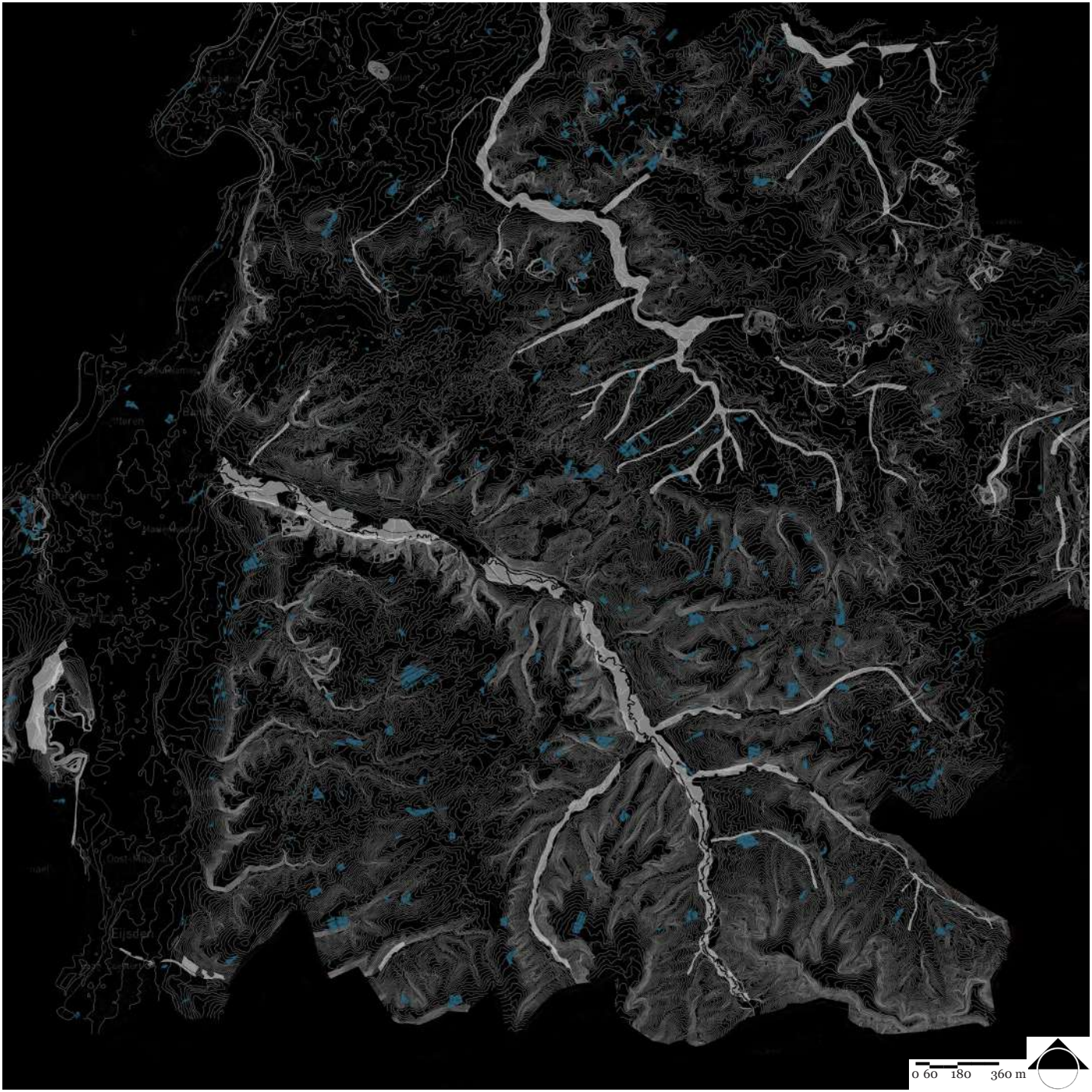
• **Average wheat yield** in **Netherlands** initially **9 tons per hectare**, and over a period of time **10-11 tons per hectare (after several years)**.

• **Cost of planting wheat** is **150 euros per acre**.

• **1 bushel sells** for **7 euros**.

• **Average growth period** of wheat is **7-8 months**.

http://californiawheat.org/california-wheat/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BARLEY

• The **average yield** of **barley** was **7.4 tons per year** in the year **2019**, which showed an **increase** of **6%** over the previous year.

• The **gross yield of barley per year** was **0.2 billion kg**, which shows a **reduction of 2%** from the previous years.

• **Barley production** in the year **2017** was **204,450 (per 1000 tons)**

• The **combined yield of barley** is **5 tons per hectare** (annually).

• In a time of **5 years** it can be as much as **6.2 tons per hectare**.

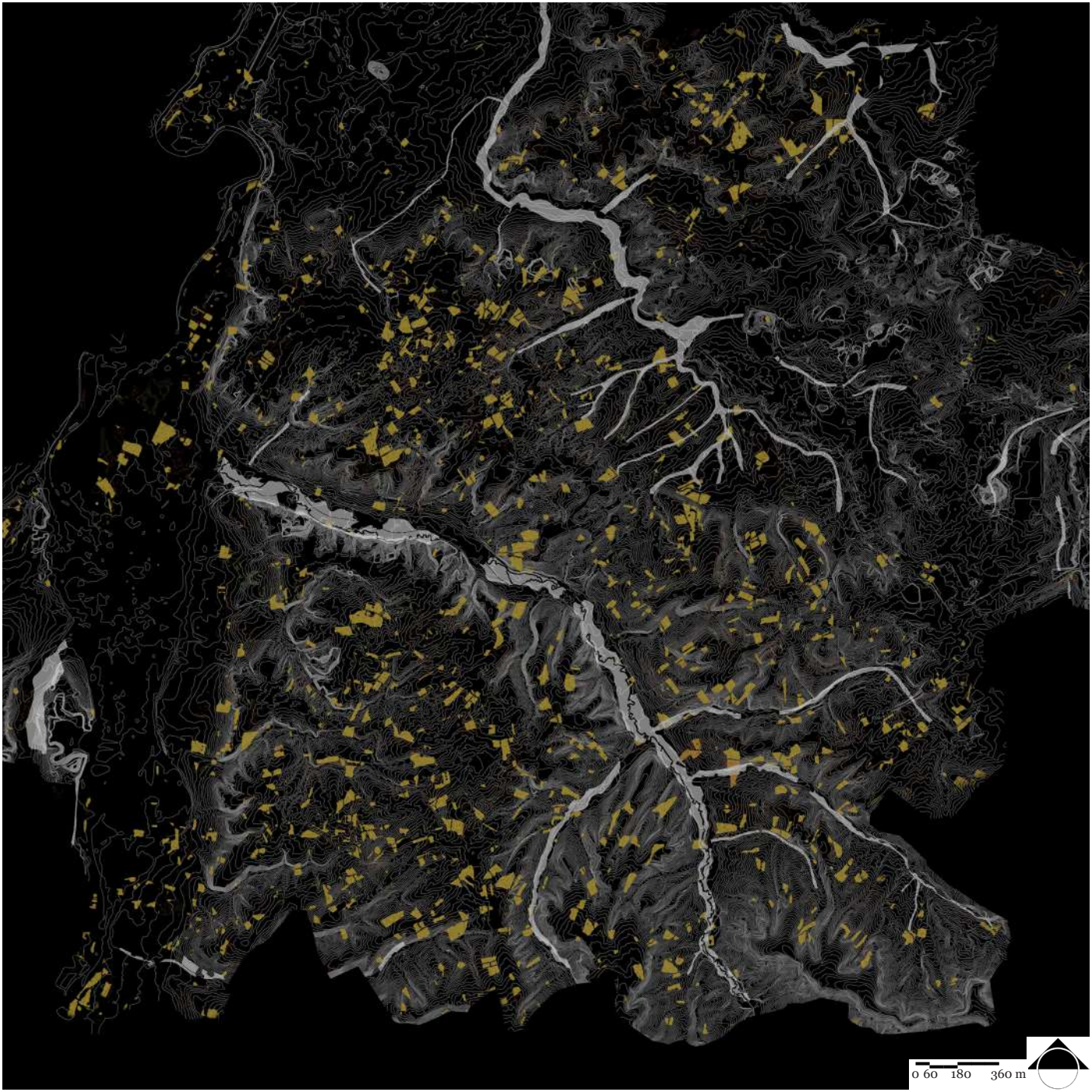
• Average **spring barley** yields up to **40-60 bushels per hectare** with an average of **48 bushels**.

• The **selling rate** of **1 barley bushel** is **3 euros**.

• **Barley ripens** sooner than wheat (**60-70 days**).

https://in.pinterest.com/pin/119063983874955497/

https://www.123rf.com/photo_69908888_barley-farm-in-summer.html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MAIZE

• **1 Acre** of **maize plantation** can yield up to **10 to 20 quintals of corn**.

• In **1 hectare** it is possible to plant **36,000 plants of maize**.

• **10 kg. seeds** are enough to **plant maize across 1 acre**.

• A **maize farm** can **yield** up to **600 kernels of corn per year**

• **1 acre** can yield on an average **196 bushels of maize**.

• **176 bushels** is the **average yield annually**.

• A total of **40 bags of corn** can be filled up from **1 acre** of maize plantation.

• **1 bushel of corn** can be sold for **3 euros**.

• **Netherlands** produces a total of **116,711 tons** of maize **annually**.

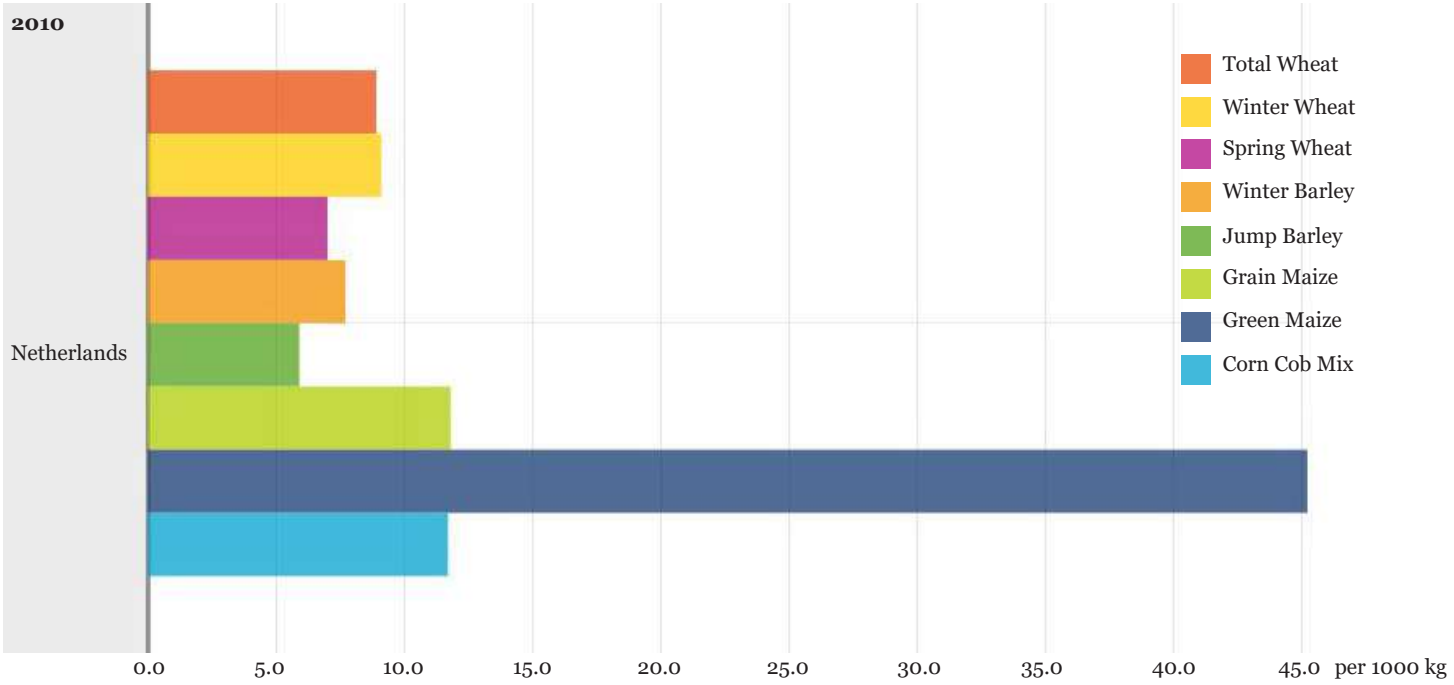
• The **duration** of a maize crop yield is **110 days**.

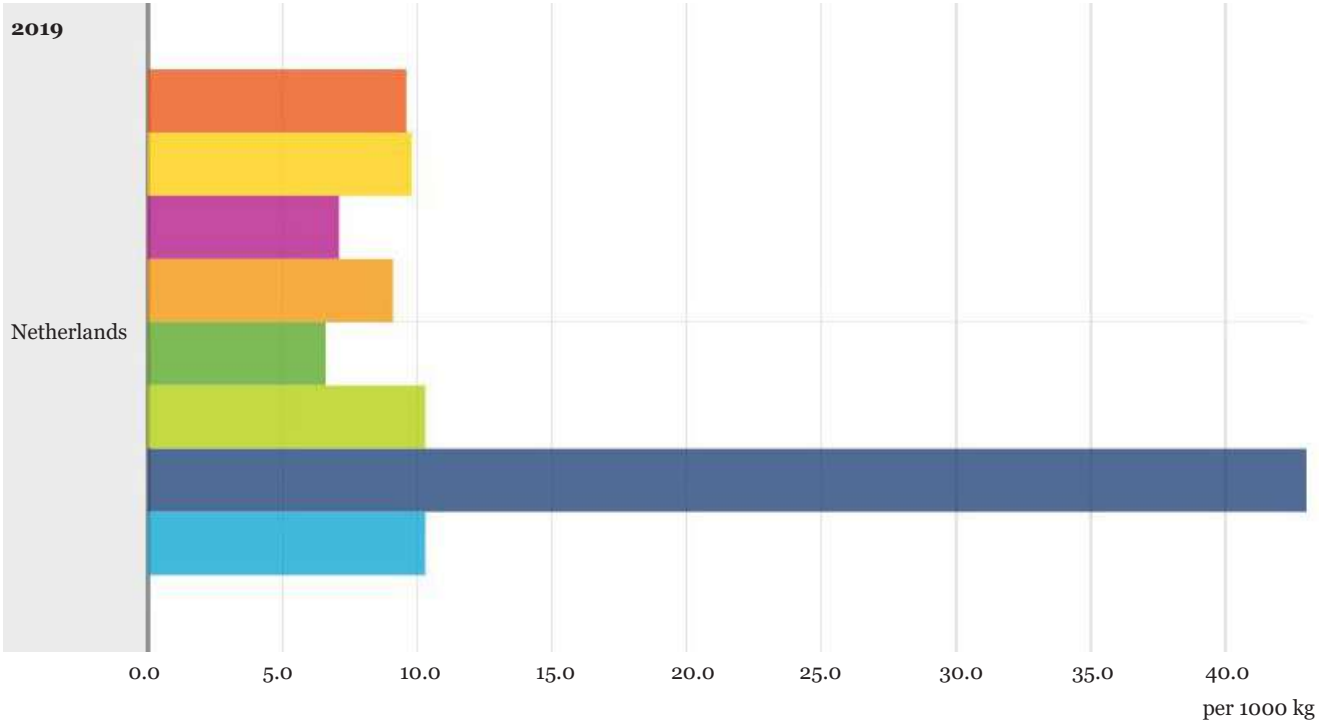
https://in.pinterest.com/pin/167266573633639176/

https://www.freepik.com/free-photos-vectors/corn-field

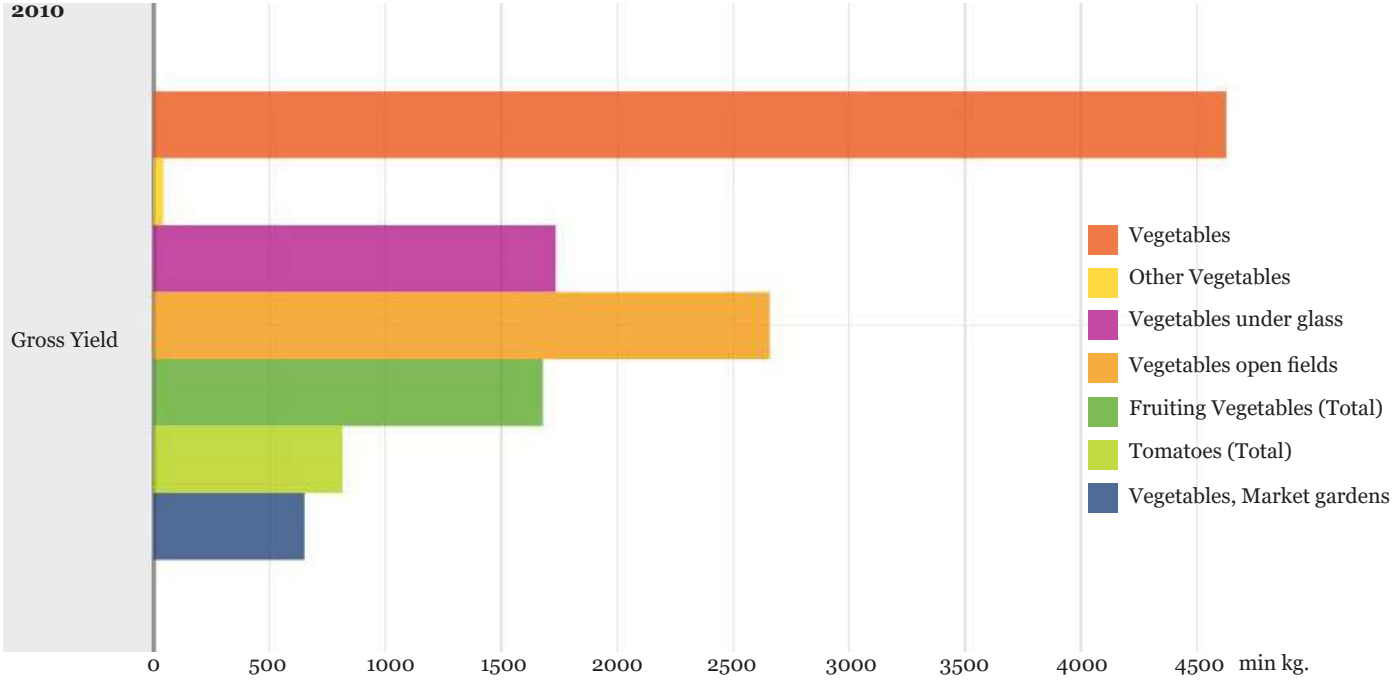
Conventional Farming- Current yields

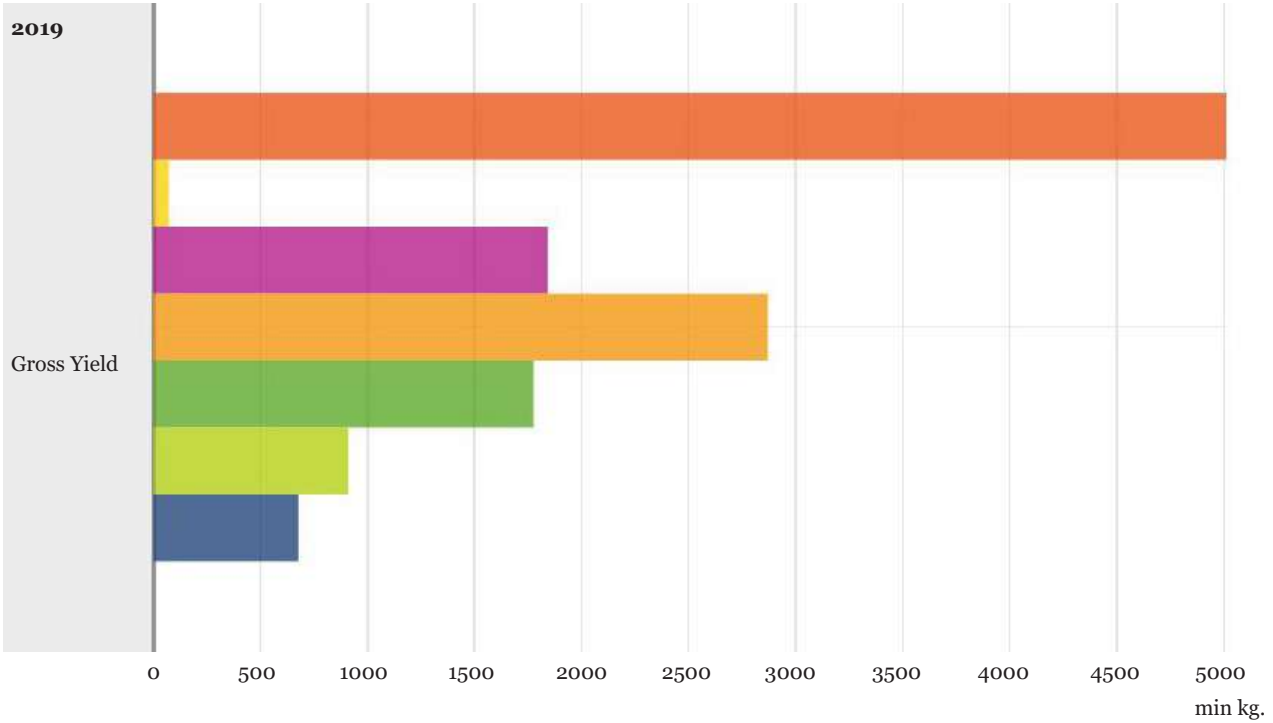
Gross yields per Ha. - Arable crops





Vegetables; yield and cultivated area per kind of vegetable





The shift from Conventional to Organic Farming

Farmers who venture into the method of ***organic farming*** are fairly open to admit the ***decline*** they face in their ***yields***. There are substantial documentations backing up this phenomenon (yield decline).

This ***yield gap*** faced during the transition is fairly ***temporary***. The ***transitional period*** considering organic farming is usually ***3 to 5 years***. Beyond this threshold an organic crop yield can ***compensate*** up to ***85 to 90 percent*** of yields when paired up with ***conventional farming.***

Once this farming mechanism stabilizes and is recognized the yields generated within this system can be ***sold*** for a more ***premium price*** bracket. This additional influx of money can ***compensate*** the ***reduced yields*** and can provide a ***substantial profit leverage***.

As time passes the yield gaps are often negligible if not similar. Perusing ***organic farming*** the stability and ***health*** of the ***soil*** is drastically ***improved*** when tallied with the later (conventional farming).

The ***abiotic*** and ***biotic*** qualities of the soil are improved to a substantial level when compared to where it started from. This method usually ***promotes natural processes*** and help enhance the current natural conditions by delivering a more spatially stable soil structure.

In conclusion shifting to organic farming can initially cost a ***10-20% yield reduction*** as compared to the traditional farming methods but on a longer run proves to be more environment friendly and help accumulating more profits.

The yields generated using this ***organic farming*** method cultivate food which has ***higher nutritious values*** and are grown using next to ***negligible usage*** of ***pesticides*** and fertilizers providing a greater impact on society as compared to the later.

Organic farming has lesser impact of the fragile environment around it and they intern help improving it. On the other hand, ***conventional farming*** comes with an arsenal of negatives some of the few being ***loss of ecology, land degradation*** and acute effects on the ***micro ecological culture*** of the place which houses all the ecology surrounding it. These harmful effects of farming are not only limited to the field of agriculture. They stretch outward and also affect water systems by allowing ***fertilizers*** to run slowly into the ***river***.

Organic farming can revive and enhance the ***native species richness*** by ***35%***. The effect on biodiversity is further enhanced as the percentage of arable land field areas show constant increments.

Organic farm yields sell for a ***higher value*** which is almost ***30-40%*** more than the conventional counterpart. This is because people are ready to pay a more premium value for such produces. This almost functions as a thank you note for the farmers who end up enhancing the land quality.

To put this to perspective the average ***maize yield*** achieved using ***organic farming*** is ***18% lesser*** than the yields on a conventional farm. These yield fluctuations are usually seen to be ranging from 5-40%. Other example is the ***tulip bulb yield***. They end up generating a yield which is ***16% lower*** than its later. Cash crops like ***sugar beet show 5% reduction*** and ***ware potatoes show 25% yield reduction.***

A ***conventional farmer*** can yield up to ***6-10 tons of wheat per hectare*** conventionally while an ***organic farm*** practicing farmer can yield only up to ***3-4 tons of wheat per hectare.*** Conventional milk farmers yield 8 tons of milk per year while an organic fed milk farm can only generate 5 tons of milk.

Organic farming provides ***more job opportunities*** for ***smaller scale farmers*** and also reduces the constant exposure to harmful chemicals such as pesticides and fertilizers.

Planting and maintaining organic crops are also cheaper as compared to traditional farming. ***1 hectare of organic produce demands a farmer to spend 850 Euro*** annually whereas that same ***1 hectare of conventional crop costs up to 980 Euros per annum***.

Example
Organic carrots: € 2.55/lbs
Regular carrots: € 1.40/lbs

Organic tomatoes: € 2.00/each
Regular tomato: € 1.25/each

Organic lettuce: € 2.60/lbs
Regular lettuce: € 2.15/lbs

Organic apples: € 1.23/each
Regular apple: € 0.90/each

Organic green grapes € 3.00/lbs
Regular green grapes: € 1.99/lbs

Organic brown eggs: € 4.54/dozen
Regular: € 2.45/dozen

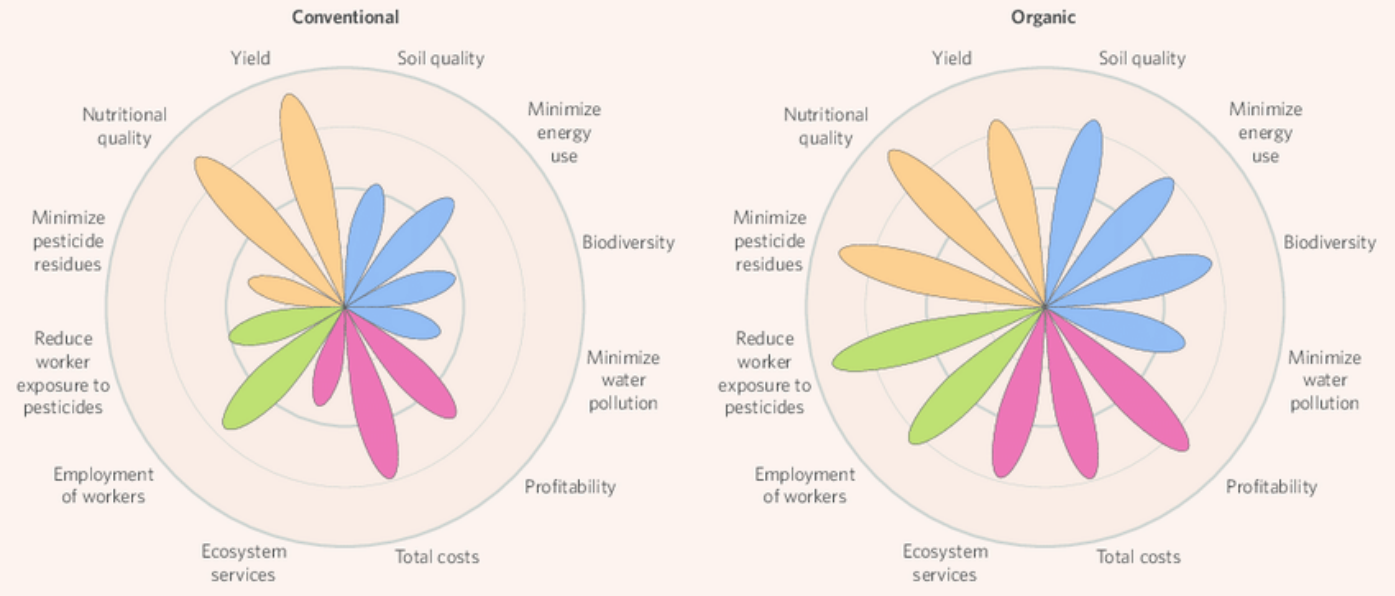
Organic whole wheat bread: € 0.25/ounce
Regular whole wheat bread: € 0.10/ounce

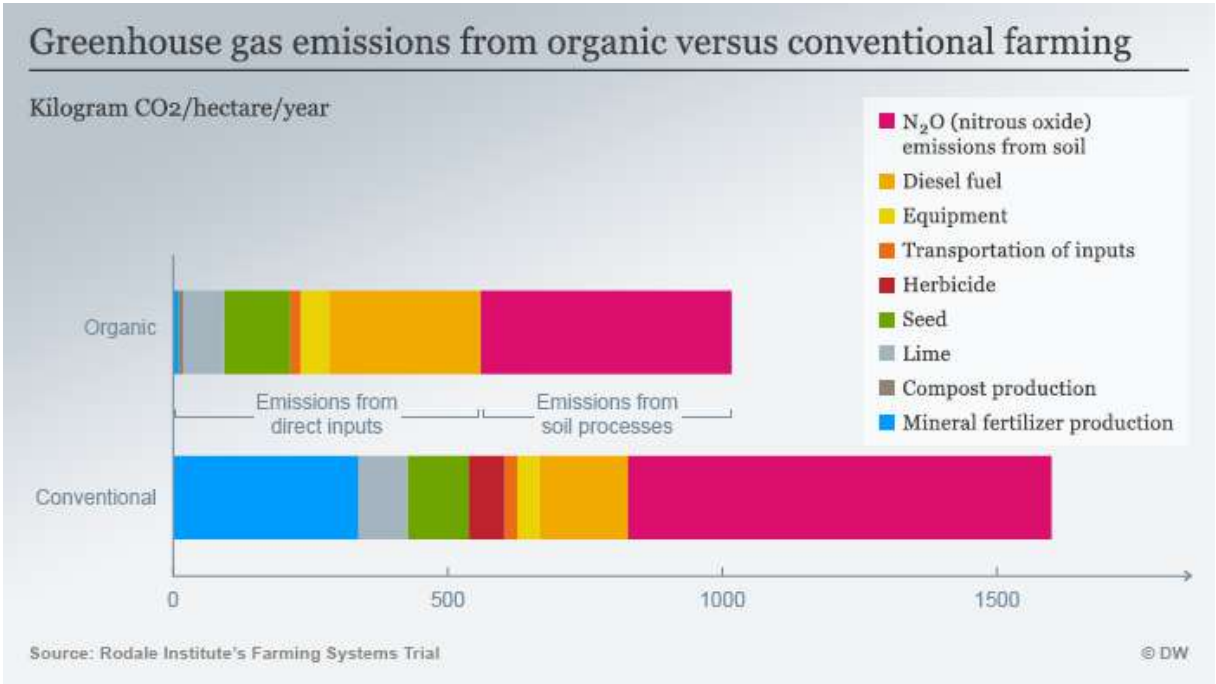
Organic Cereal: € 0.40/ounce
Regular Cereal: € 0.17/ounce

Main area of focus while shifting from conventional to organic farming should be

- Yields
- Ecology
- Soil stability
- Water management
- Energy conservation
- Greenhouse gas emission

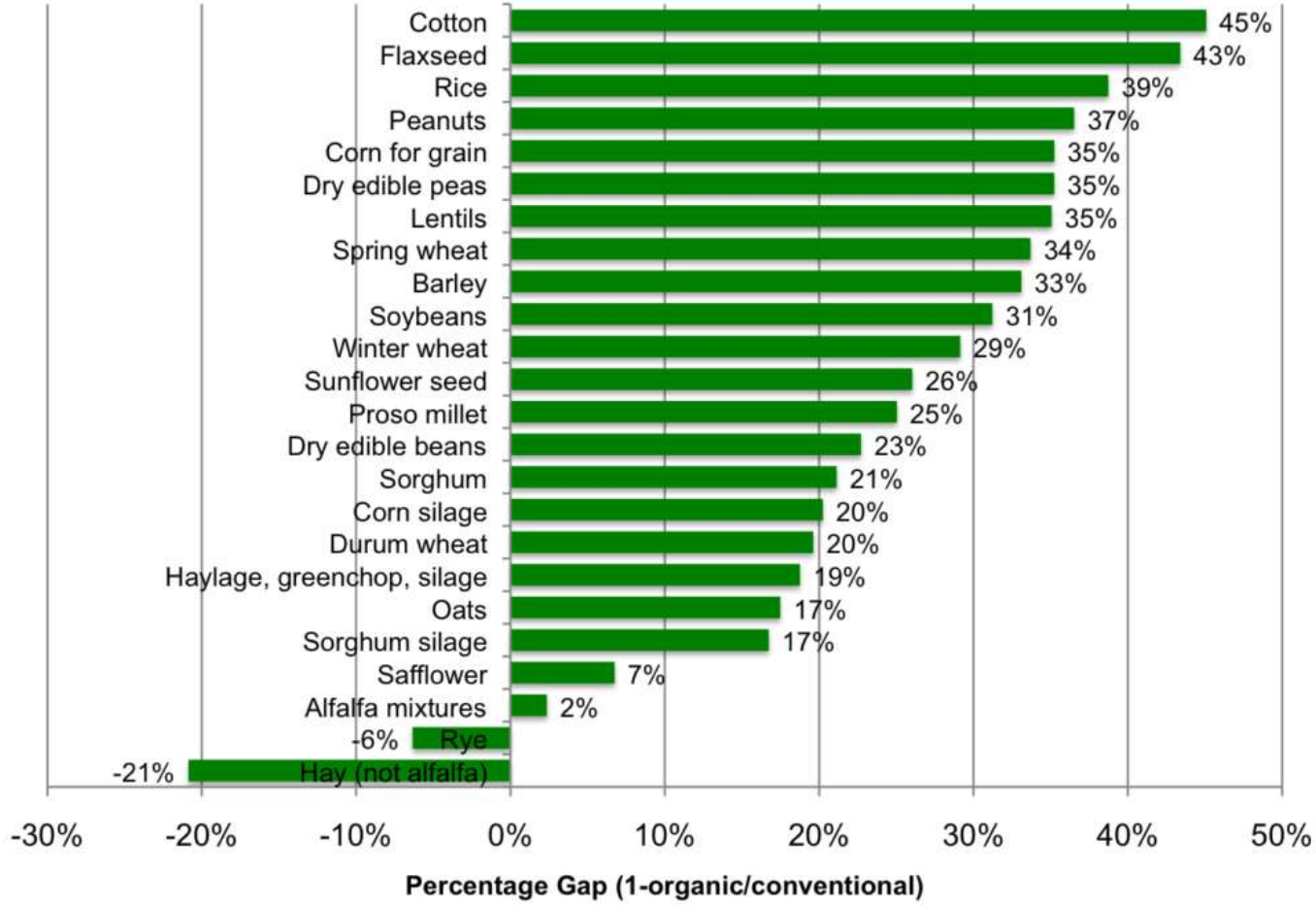
The Comparision/ Evaluation



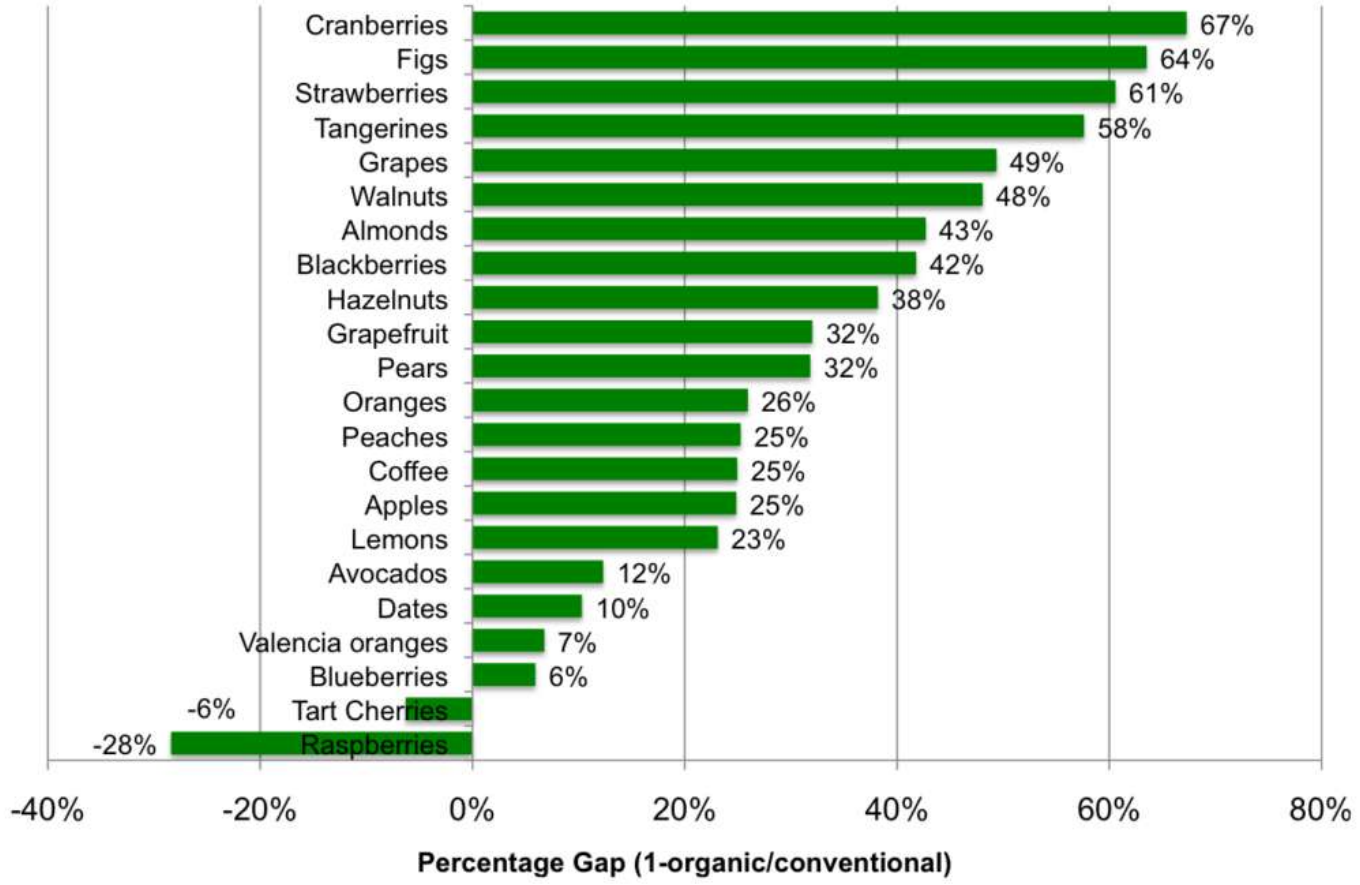


Yield Gaps- Conventional Farming/Organic Farming

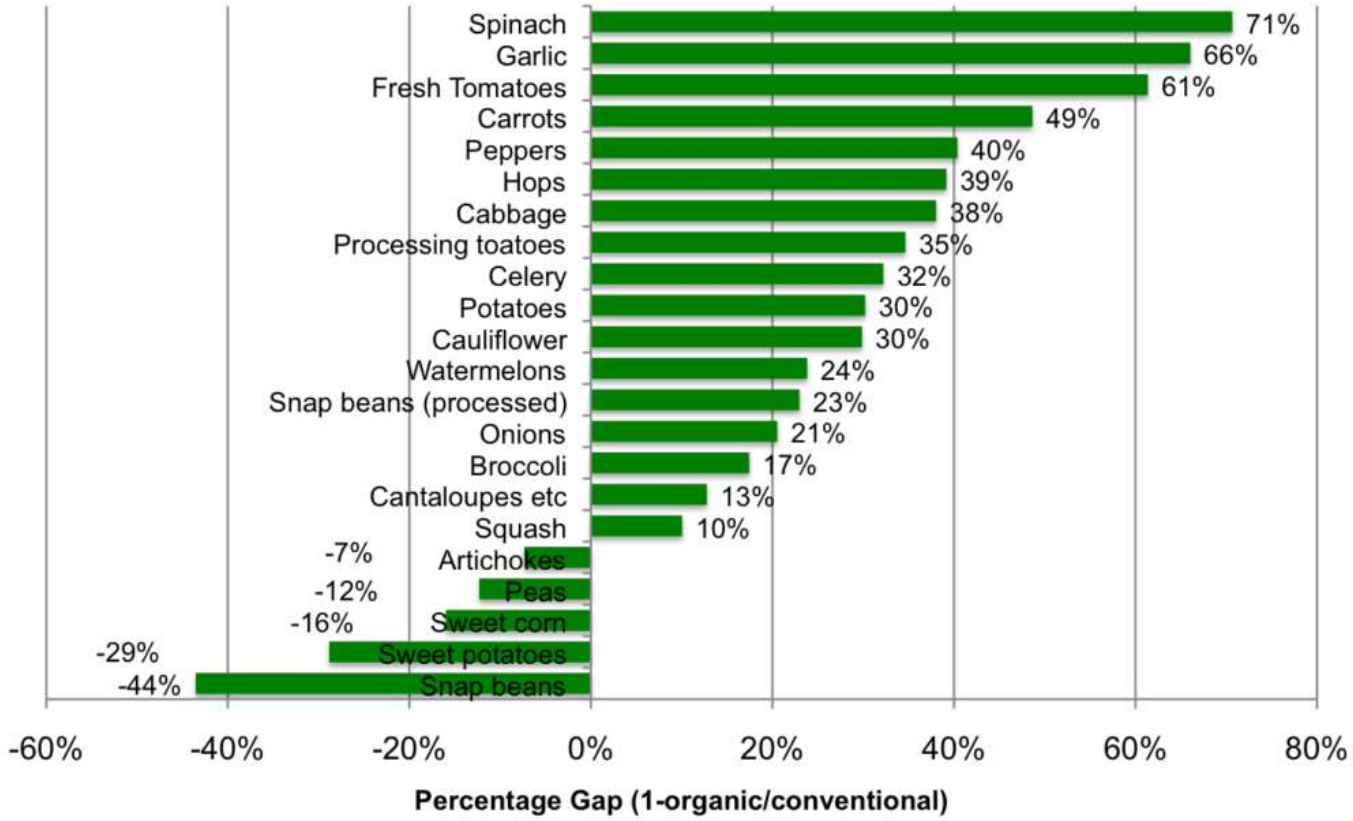
Organic yield gaps for row crops, 2019.



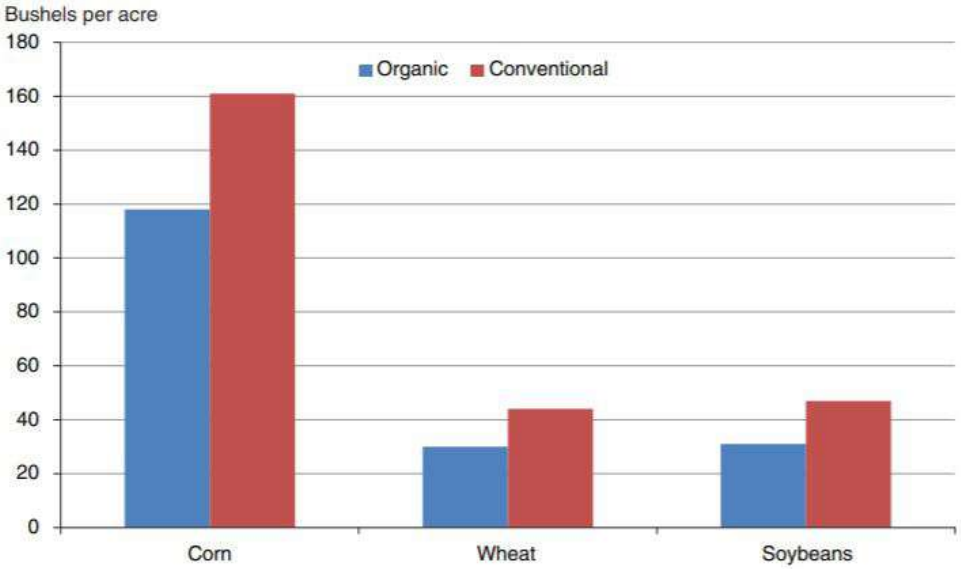
Organic yield gaps for nut and vine crops, 2019.



Organic yield gaps for vegetables, 2019.

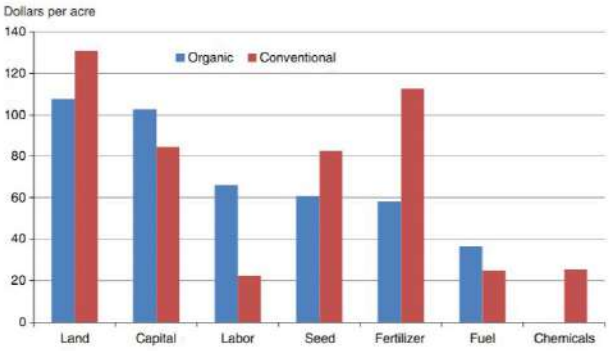


Organic and conventional corn, wheat and soybean yields



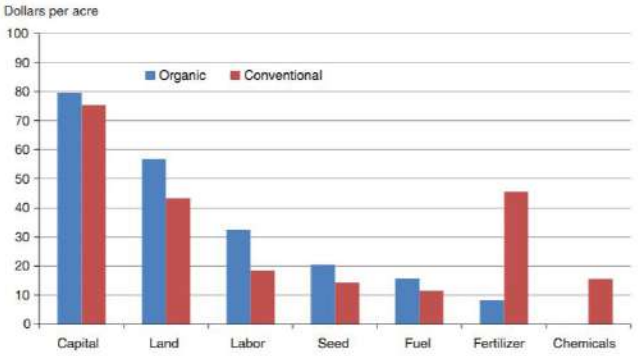
Source: USDA, National Agricultural Statistics Service, 2011 Certified Organic Production Survey and Crop Production: 2011 Summary.

Cost per acre of organic and conventional corn production by input



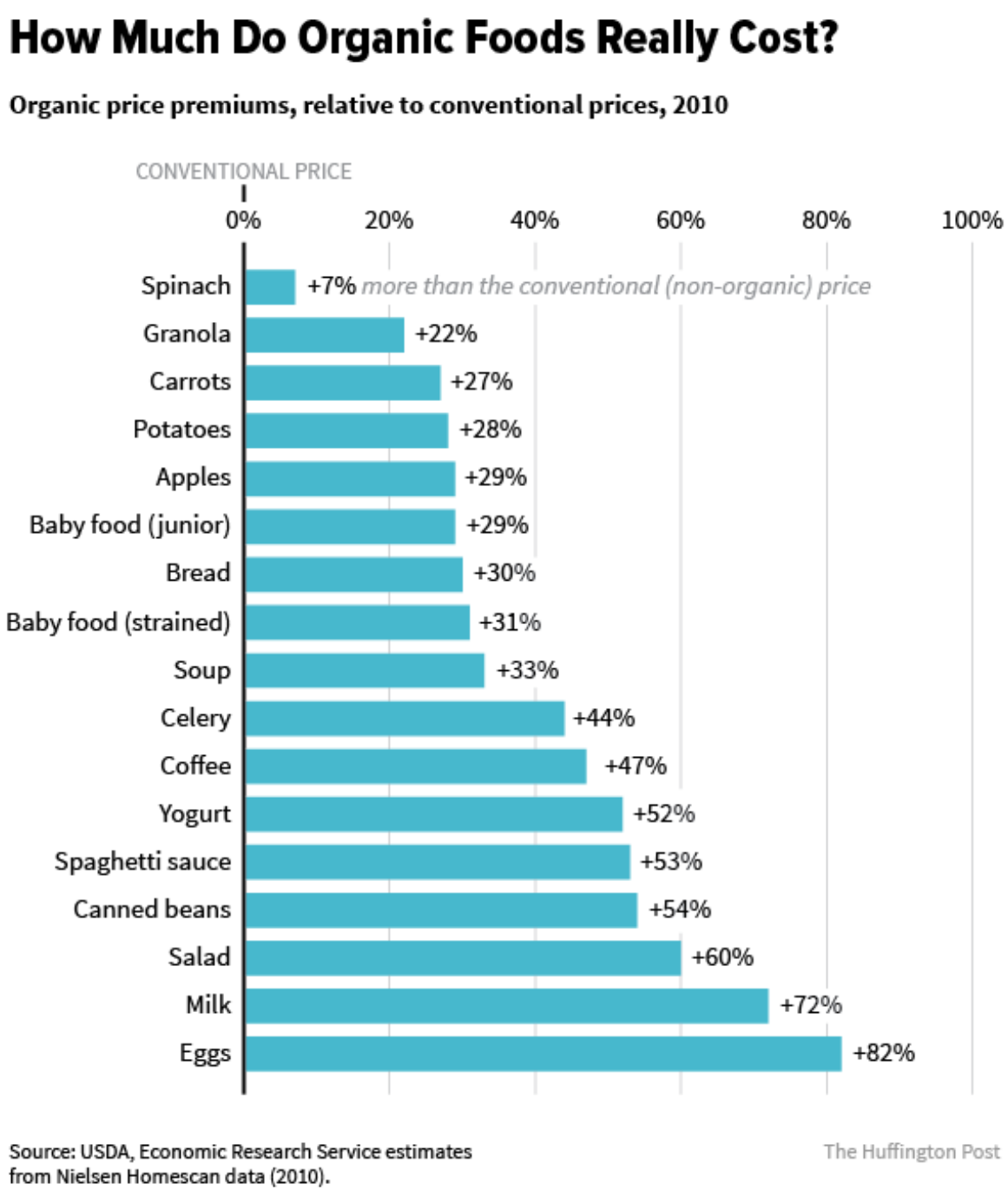
Note: Organic input costs are ordered from highest to lowest. Labor includes hired labor and unpaid labor costs.
Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service, 2010 Agricultural Resource Management Survey.

Cost per acre of organic and conventional wheat production by input

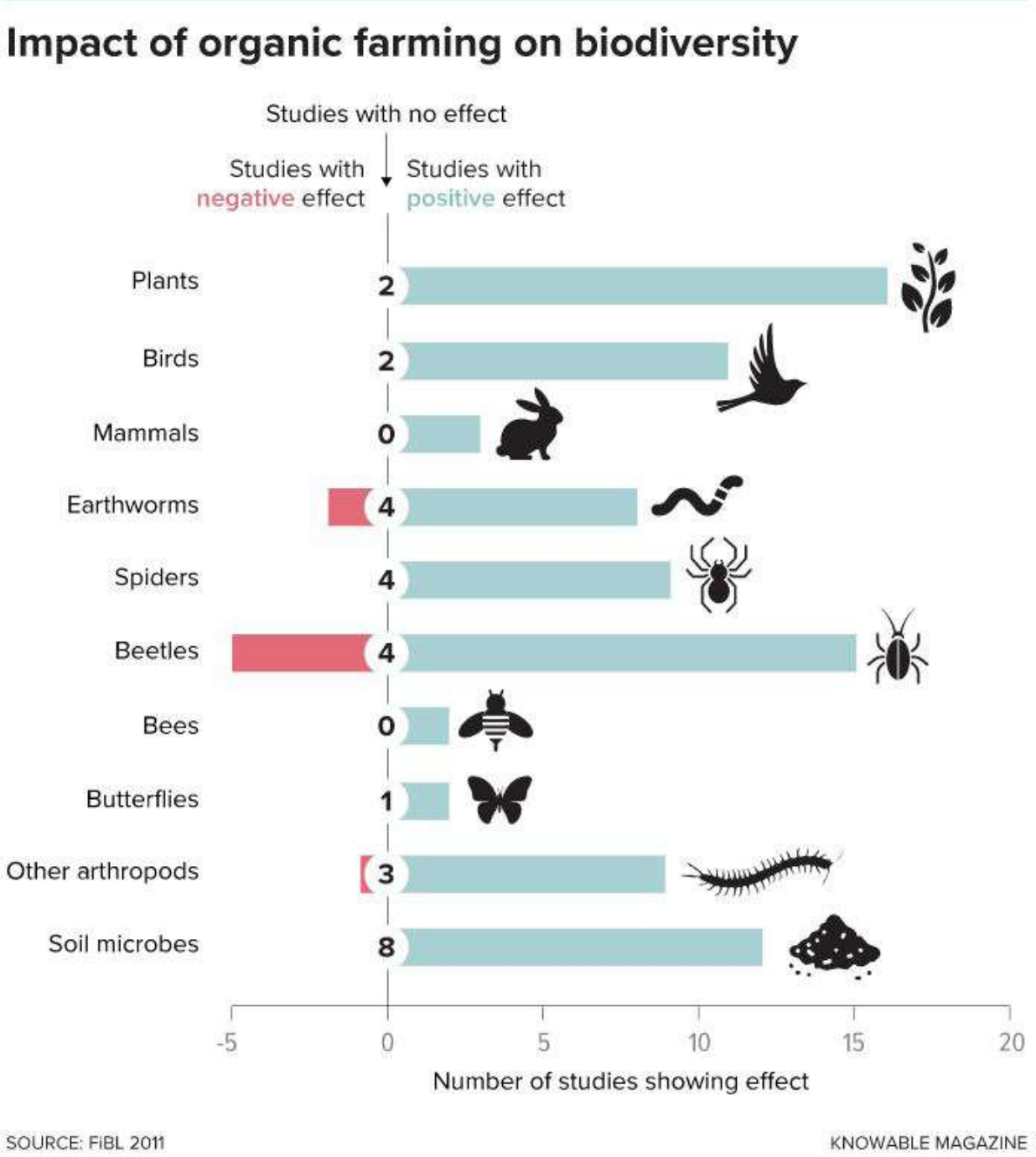


Note: Organic input costs are ordered from highest to lowest. Labor includes hired labor and unpaid labor costs.
Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service, 2009 Agricultural Resource Management Survey.

Organic Yields- Selling Costs



Organic Farming- Impact on Biodiversity



Environmental impacts of farming

Organic claims to be more environmentally friendly. Swedish Food Administration report shows it falls short in 39 out of 53 reviewed aspects. Conventional farming outperforms organic more often than the reverse.

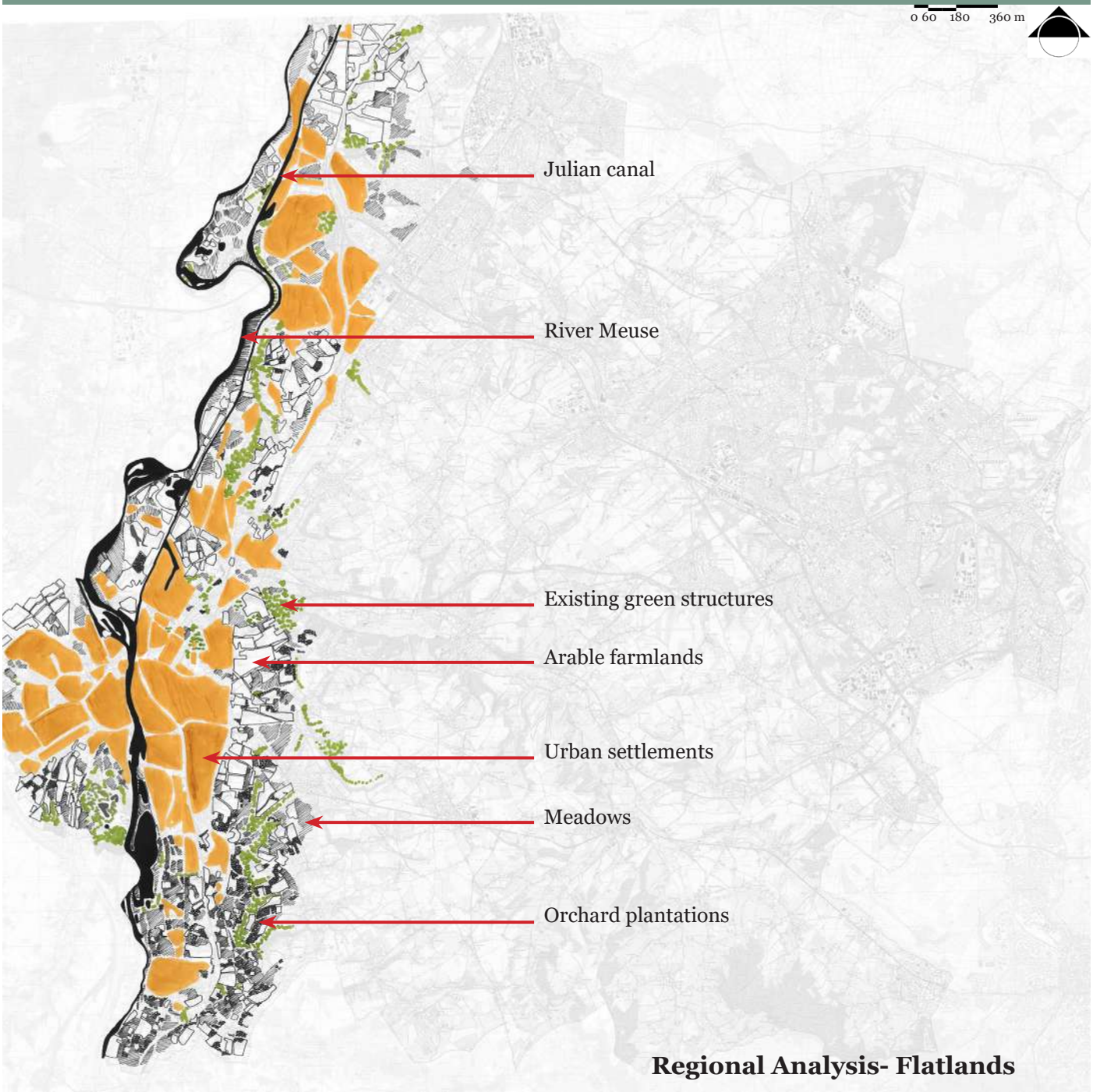
Equal | Organic better | Conventional better

	Climate	Over-fertiliz.	Acidifi-cation	Eco-toxicity	Energy use	Land use
Milk	32	6	6	5	9	13
Beef	5	7	3	9	3	4
Pork	4	6	4	4	4	5
Chicken	4	6	4	4	2	5
Eggs	2	3	2	1	2	2
Fish	4	3	4	3	3	0
Grains	21	11	10	12	18	9
Veggies	13	4	4	9	8	2
Fruits	22	4	4	2	9	2

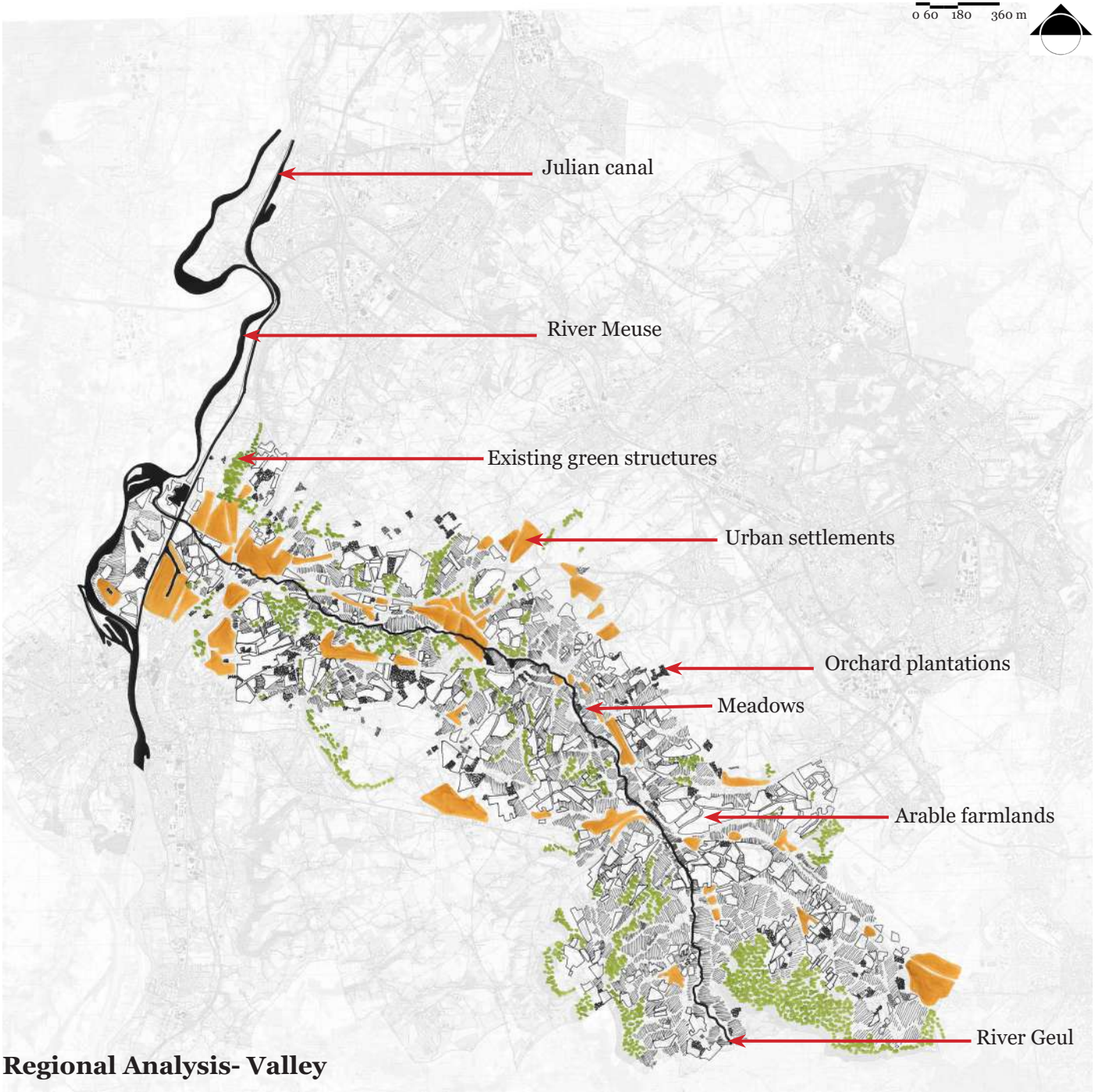
Use of resources and other environmental effects compared per unit weight of each farming product. Numbers signify nr of studies reviewed.
Source: Svenska Livsmedelsverket, Report June 2016, part 2

Presented by Thoughtscapism

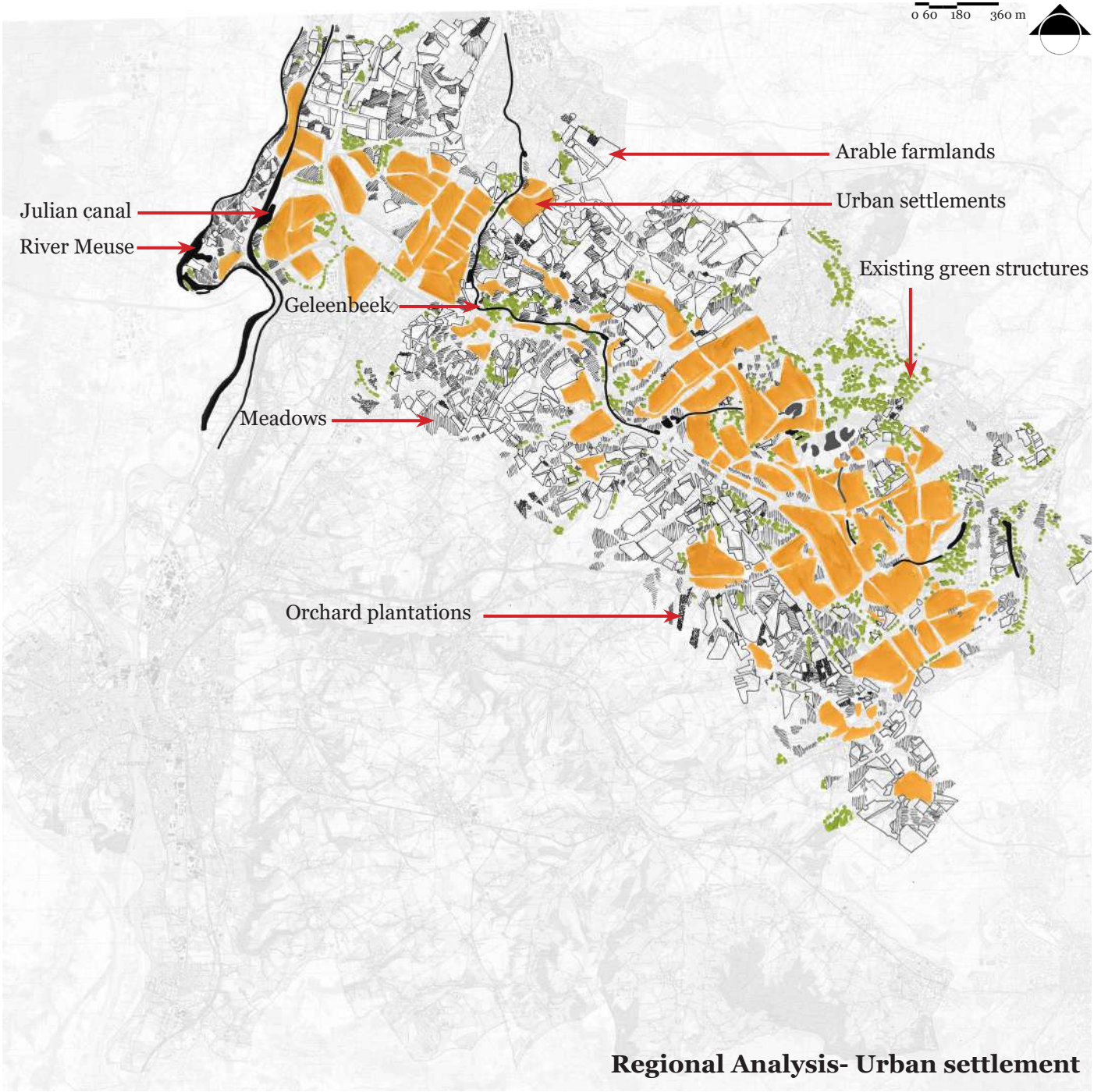
The existing landscape qualities of Limburg



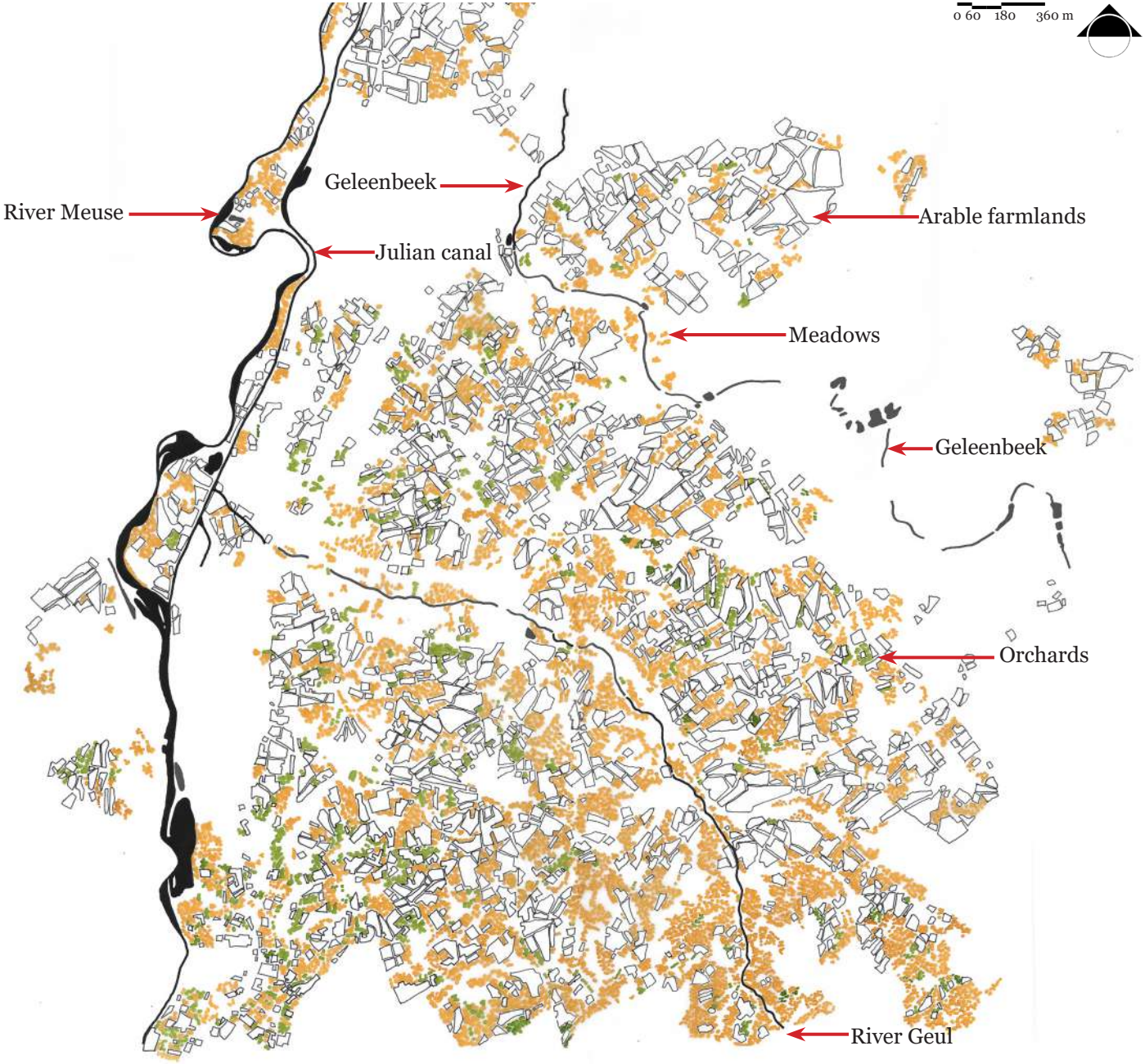
Regional Analysis- Flatlands



Regional Analysis- Valley



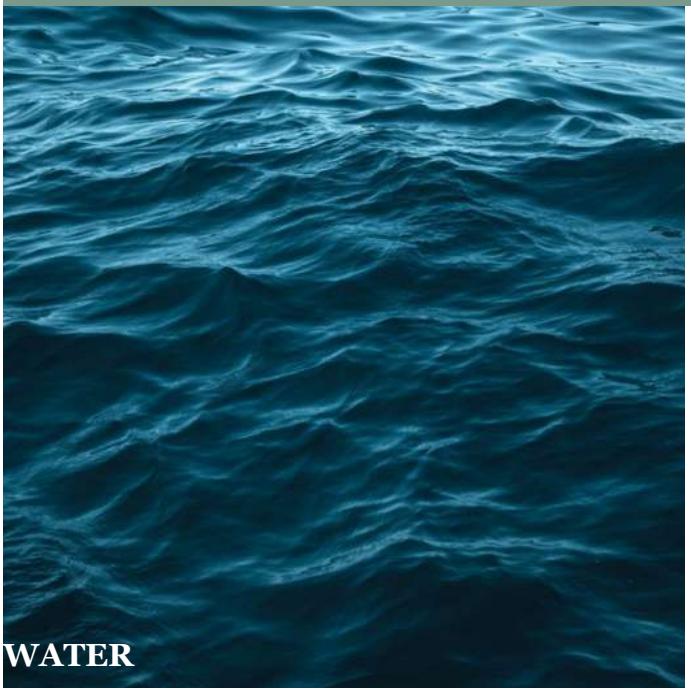
Regional Analysis- Urban settlement



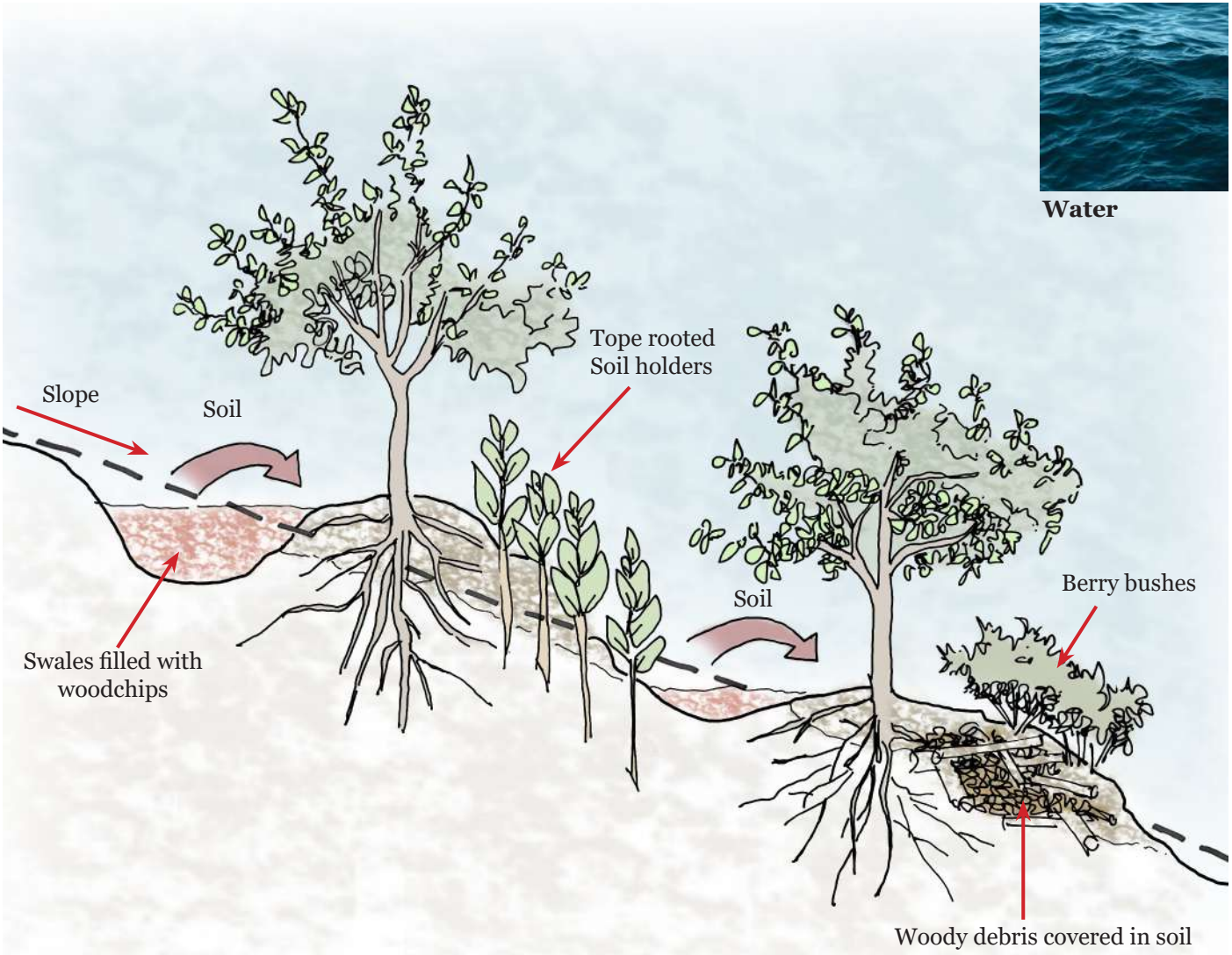
Regional Analysis- Farm Structures, Limburg

Regional Analysis- Green Structures, Limburg

Conclusive Regional Problems- Areas for improvement



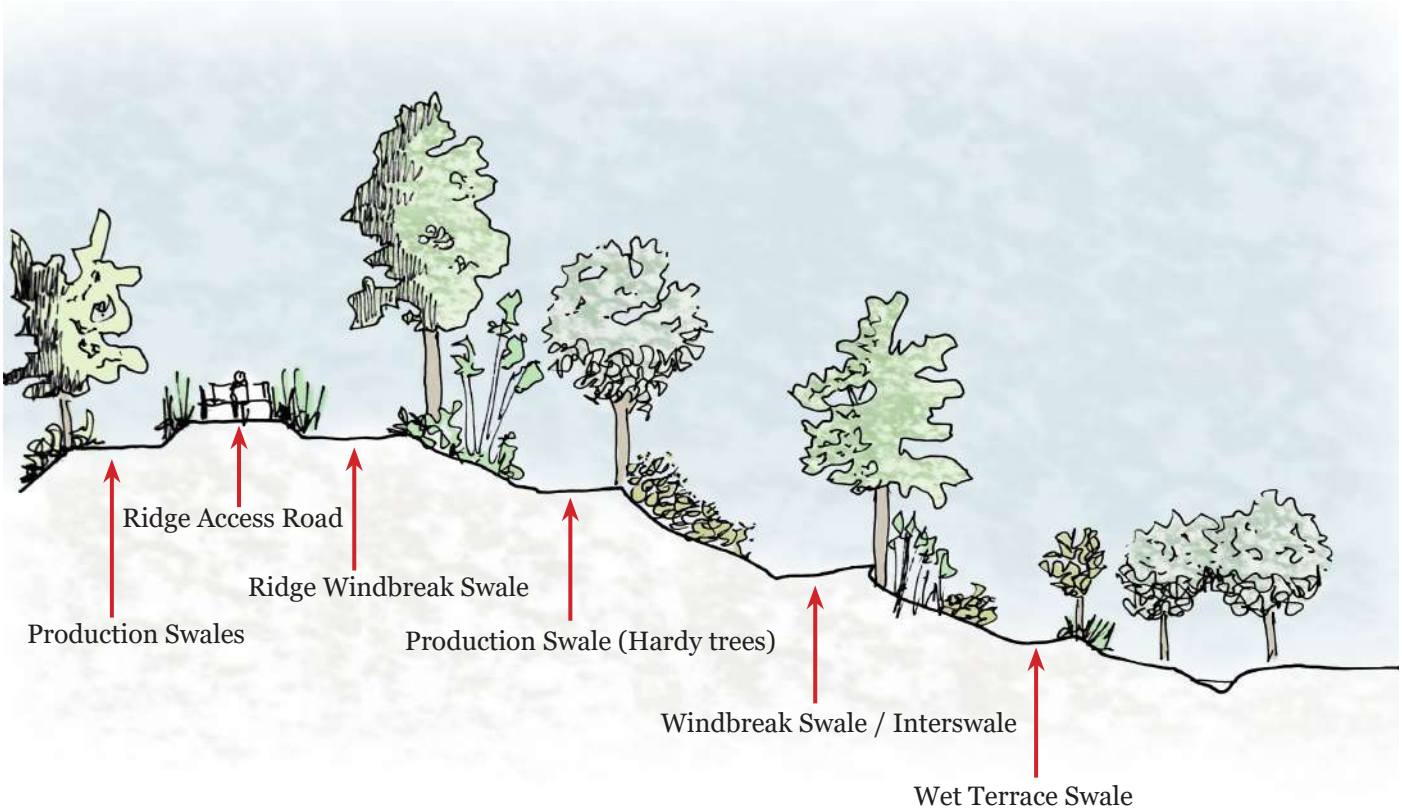
Swales to prevent soil erosion and water contamination



Limburg as a site offers a lot of land modulation, which is subjected to a lot of surface water run-off. This sketch shows one of the possible solutions to initially slow and further more purify the water flowing down from the plateaus to the brooks. The system shown works on the principle of cut and fill. A small portion of land is dug out forming a small continuous ditch which is referred to as a swale. The soil is than stacked in front of the swale. There are series of plants which are planted in these newly defined mounds to retain soil and thus preventing it from being washed away. The system is effecting in re-directing water flow and intern improving the quality of water.

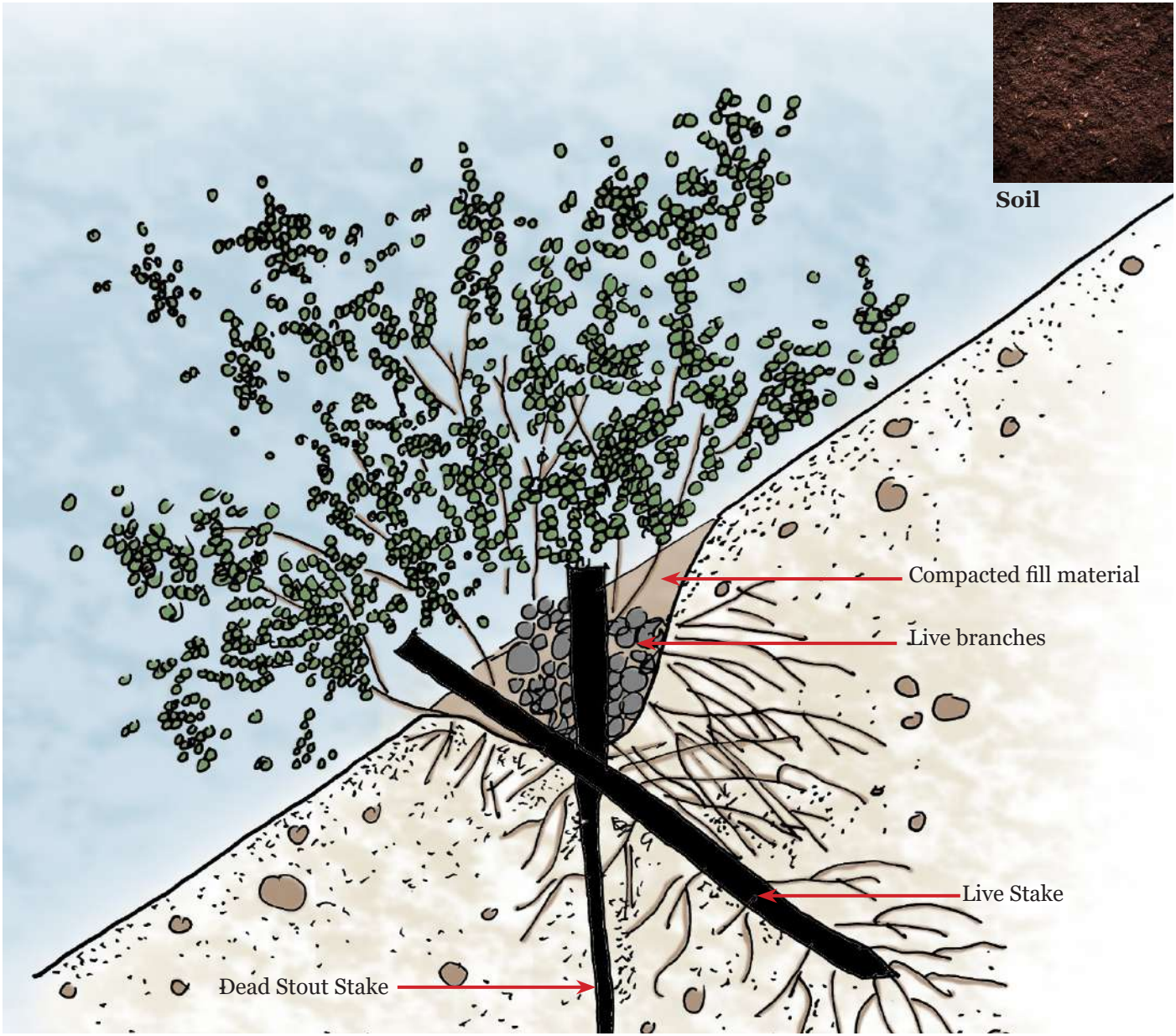
Sectional profile for efficient water management

Water



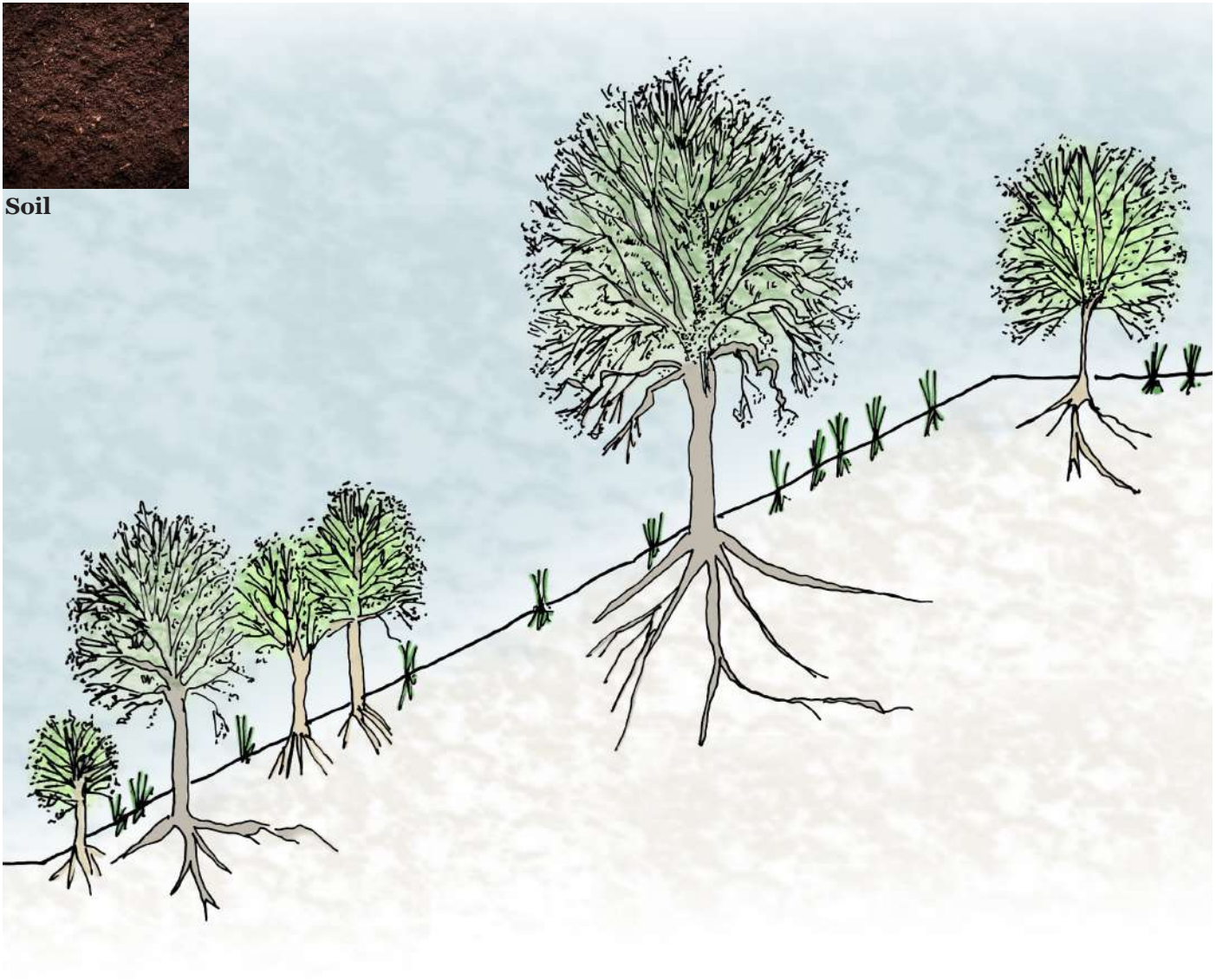
The section above shows the various layer of terracing which can possibly take place on a slope. These terraces individually house different functions and collectively also amalgamate to form a holistic system. The lower level terraces usually have swale as this is the last layer before the access to a native water stream. The swale above the lowest terrace acts as a wind breaker which is usually planted with trees which absorb the high speed winds which can cause harm to the smaller planted species. The terrace above this functions as a production swale. The swale is located right below the movement terrace which is usually the top most layer as it needs to remain dry.

Soil retention- Plant anchoring



The diagram shows a system for soil retention which is known as plant anchoring. The diagram show the various elements used plant a shrub. Two stacks are driven inside the soil confirming a firm grip for the plant roots once planted. The top layer of the soil where the shrub is planted is usually filled with compacted fill material to ensure that the plant isn't washed away by soil erosion.

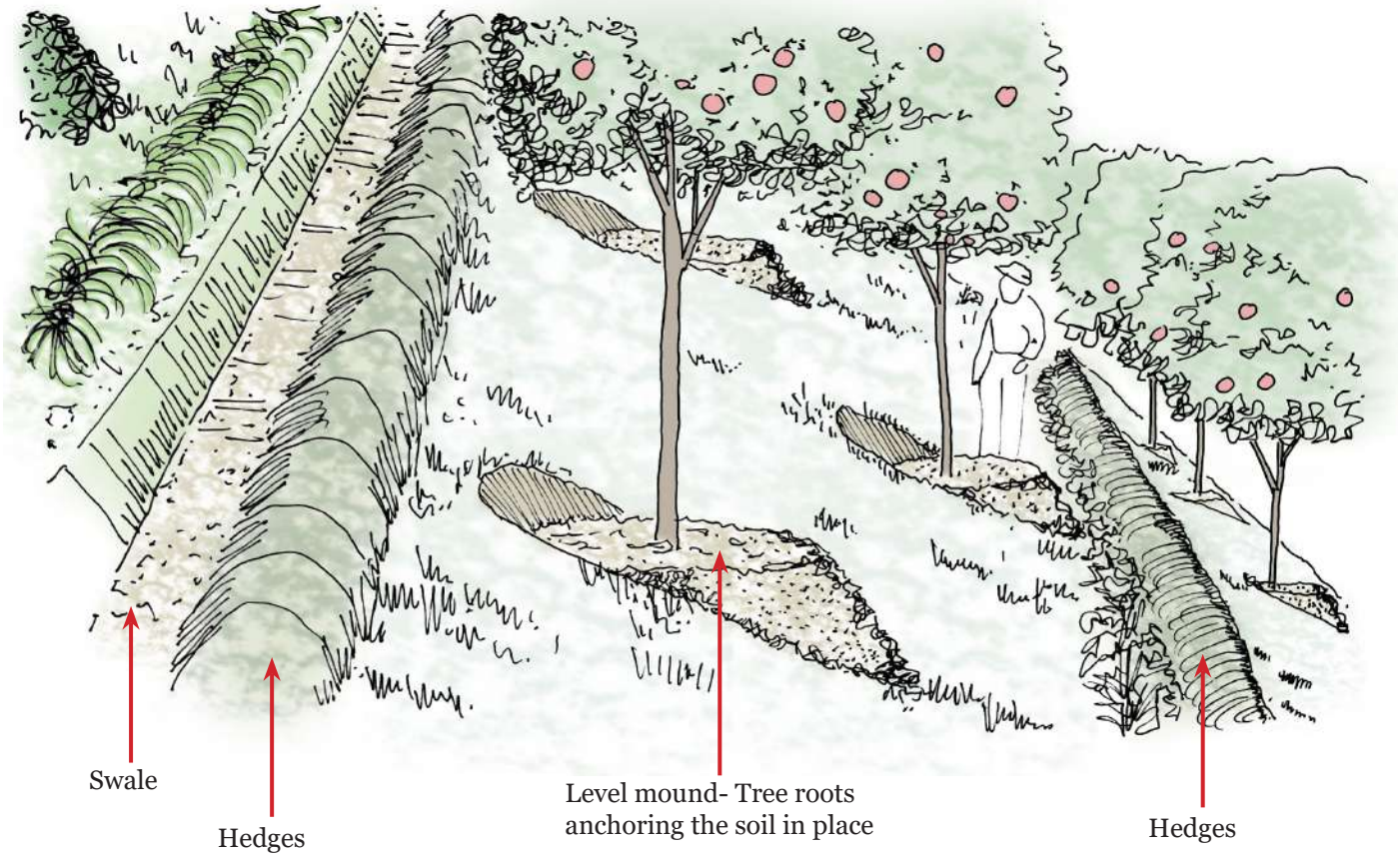
Trees as soil anchor- Planting Gradient



The section shows how soil retention technique using plants anchoring function on a larger scale. This technique can be planted all along the slope to ensure crop safety of crops planted on slopes. The gradient of plants is such that larger trees with deeper roots area planted close to the beginning of the slope exponentially reducing as they go down along the slope.

Orchard Plantation on sloped typology

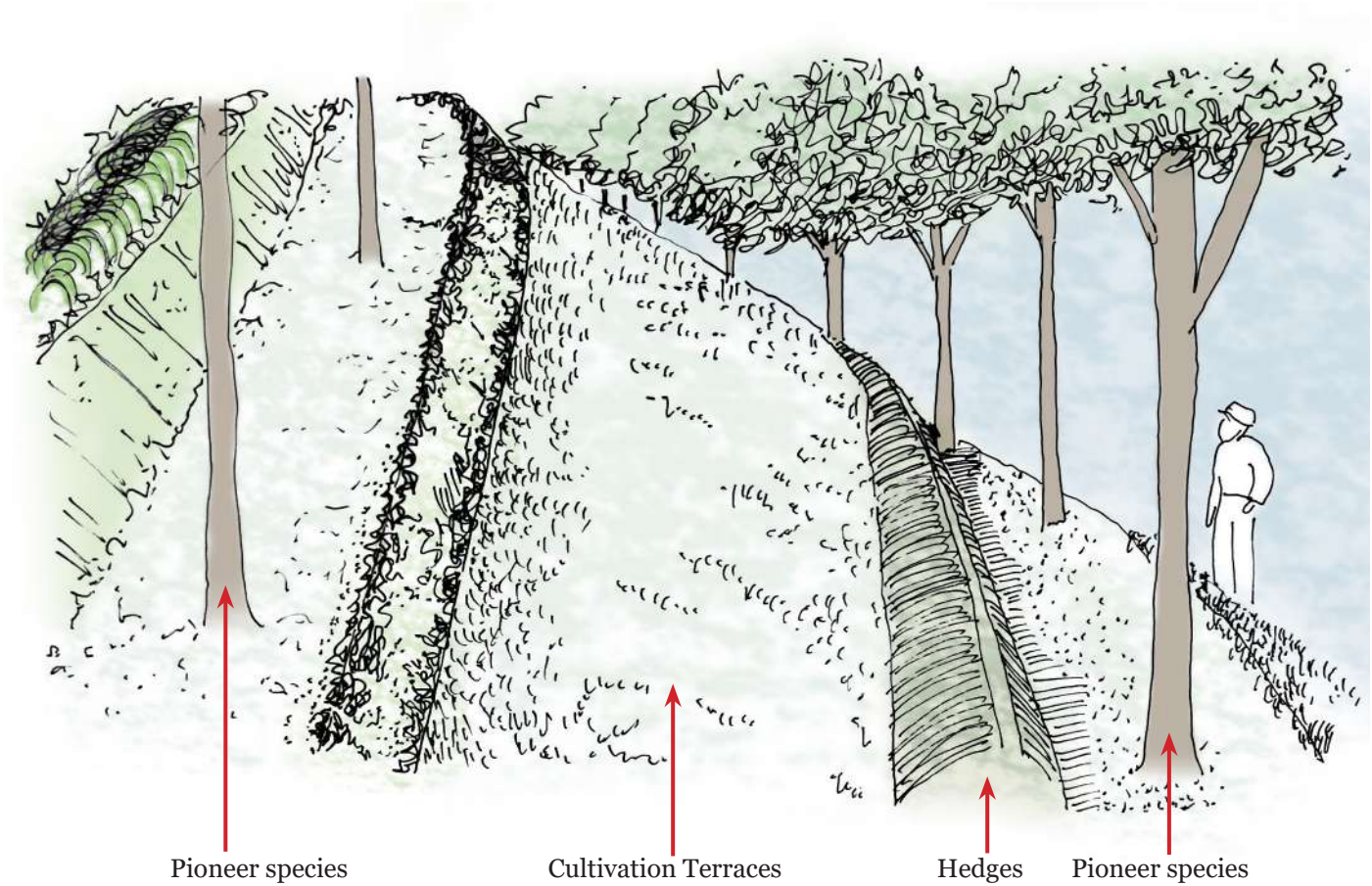
Soil



The section prolife shows the planting strategy for an orchard on a sloped terrain. The first step shown is to make swale on the higher grounds which shall redirect the flow of water to the sides leaving the areas which has the plantation relatively dry. There is an added layer of hedges along the swale to prevent soil erosion. The areas where the trees are planted are made into flat terraces which are further elevated.

Pioneer species planting to stabalize cultivation terraces

Soil



The section profile shows the system where pioneer species are planted to retain soil and are used to device terraces. These pioneer species have deep wide spreading roots which shall anchor themselves firmly, and as a result shall start retaining the soil around it. These retained soils are than leveled and transformed into terraces. These trees are than transplanted or cut down when the terraces are stable.

Forest garden

The sectional profile shows the planting gradients used in defining a forest garden. There are multiple layers each defining a specific functional contribution on the micro scale to formulate a monolithic planting system which is multi-layered. The hierarchy of planting is solely based on the interdependence of adjoining plant species.

Forest garden- Planting palette

Ecology

The planting palette of a forest garden consists of various nutrition providing entities. The lowest is the Rhizome / Vegetable layer which is then followed by Herbaceous layer which provides nutrition's to the berry plants and shrubs. These form the ground layer, which is further covered under a canopy of fruit trees and large fruit bearing trees.

Edible Forests

Nutrition

As the name suggests this is a hybrid typology which attracts ecology and regeneration of nature along with having a multi-layered nutrition extracting system in form of berries, nuts and fruits. It works alongside nature improving the conditions rather than degrading it.

Conclusion- Masterplan/Shared Cultivation

Proposed Regional Master Plan

The proposed masterplan is based on the idea of defining common structures which run in-between the existing farm structures providing a new layer of production which also works with nature to attract ecology and form a mesh like structure acting as a stepping stone for ecology connecting the existing natural reserves (current green structures).

The first step of this masterplan is to connect the existing green structures almost forming a buffer and a ring around the arable farmlands. These structures are than connected to a broader ecological corridor.

The second step is to form these finger like structures which are shared cropping networks which run through the farmlands which intern connect to the natural reserves and merge with the existing forest structures.

These commons also provide a newer set of crop yield over and above the existing yields in the farms, slowly converting the monoculture farming into a more multi-layered polycultural farming where ecology and production are functioning together improving not only the current state of farming but also providing a vision for a new possible farming typology.

In conclusion the masterplan tries to blur the distinction between production and ecology and uses Permaculture as a designing tool to further detail out and resolve this distinction.

Common Typology- Shared Cultivation

The commons farming structures are defined as an area which is shared by two distinct farm owners and is planted, maintained and cultivated by them together.

The main function of these structures is to provide primararily a crop safety network in case of a crop failure. These structures are also used to broaden and add distinct yields to over and above their existing crop yield. The common structures are usually successful as they provide a sense of ownership to all those involved in forming it and promotes a sharing environment where farming work together rather than against each other.

The commons are usually also an area where smaller daily use vegetables are planted which have shorter yielding periods so the crop cycles in these structures are more varied and immediate. These common structures on the site are formed using the existing elements on landscapes, such as high-stem orchards and hedge rows. These common structures also attract ecology and they define their own micro eco-system which increases the diversity of flora and fauna on the site. These common structure between two farms is than connected to a broader network of commons which has been shown in the proposed masterplan.

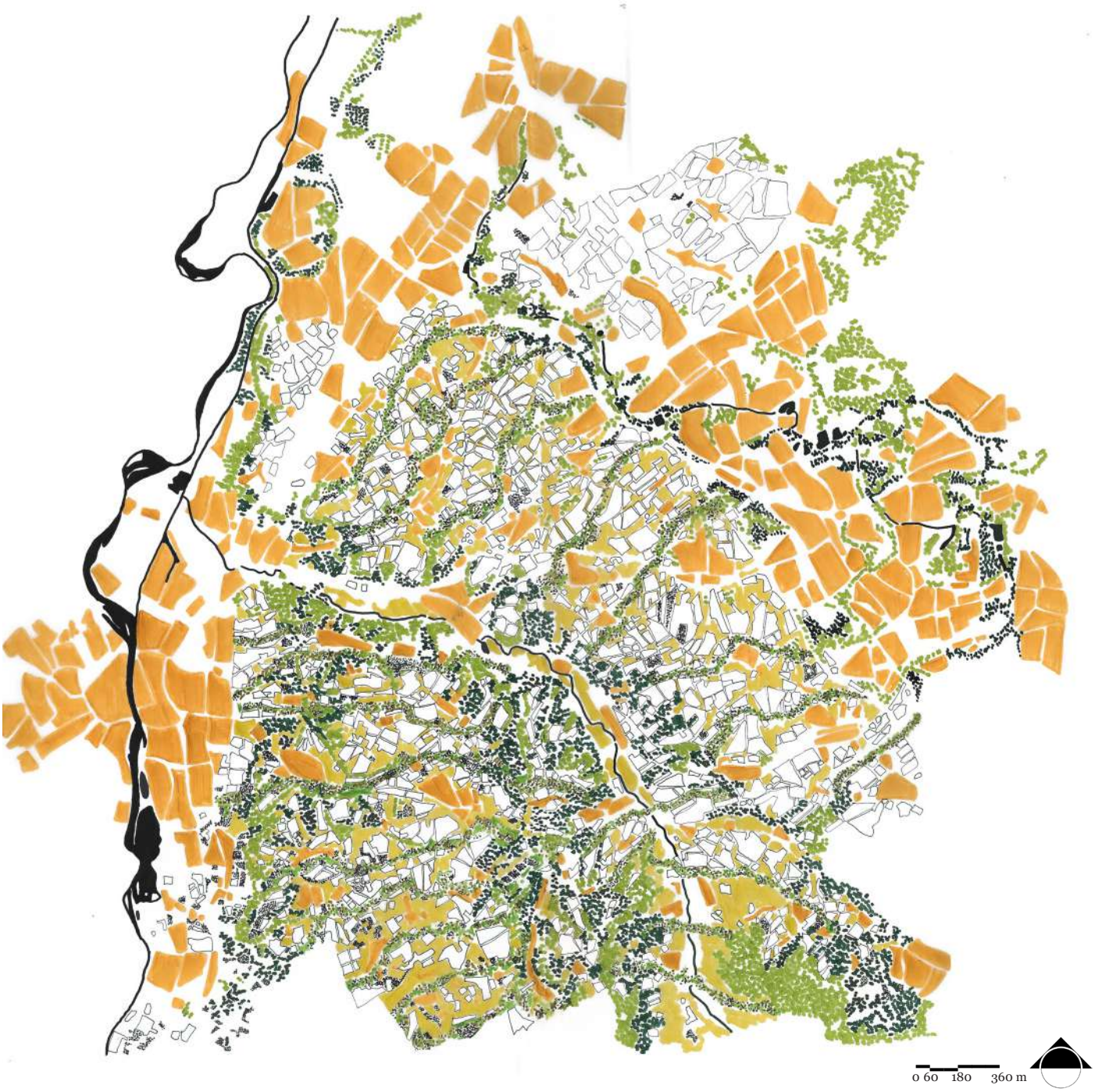
There are walking paths, public domains (Leisure areas) and forest strolls defined inside these structures which further add an extended layer of functionality to the existing function of the commons network.

6A.

DESIGN ELABORATION

DESIGN ELABORATION

Proposed Regional Master Plan



Commons Typology- Shared Cultivation

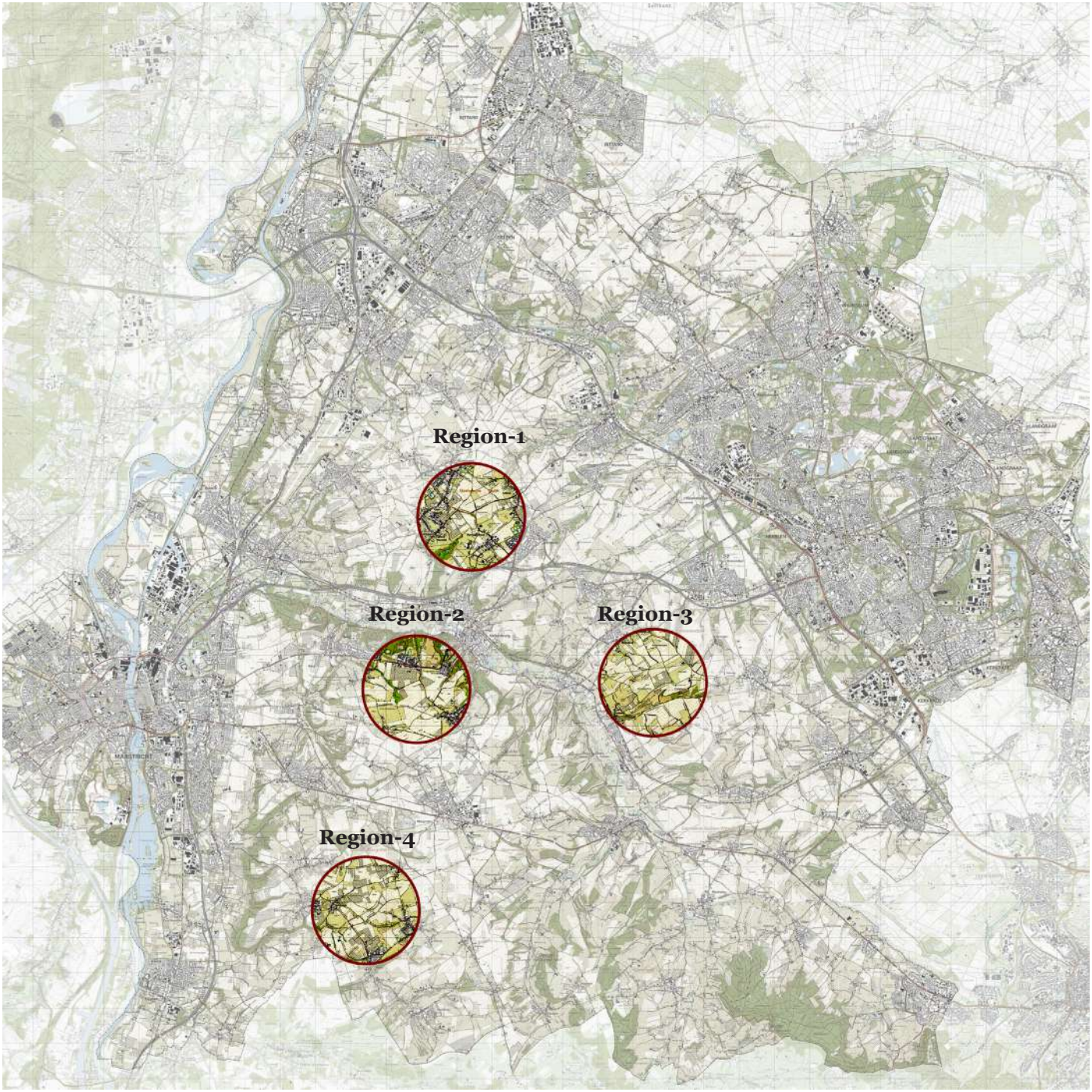
Commons typology- Shared Cultivation Elevation

Commons typology- Shared Cultivation Section

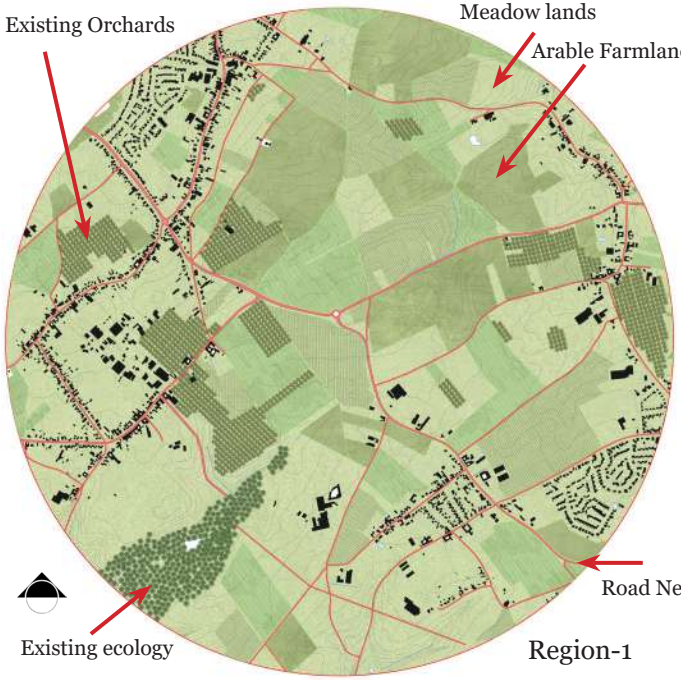
Cultivation of crops under proposed edible forest canopies

The image shows the imagined scenario where you have cultivation taking place below a canopy. As seen in the image the farm structure seamlessly merges with the common structure blurring the threshold between them. There are mud tracks shown within it which can further be imagined as transit road networks which run through all the structures formulating a continuous connection through the whole network.

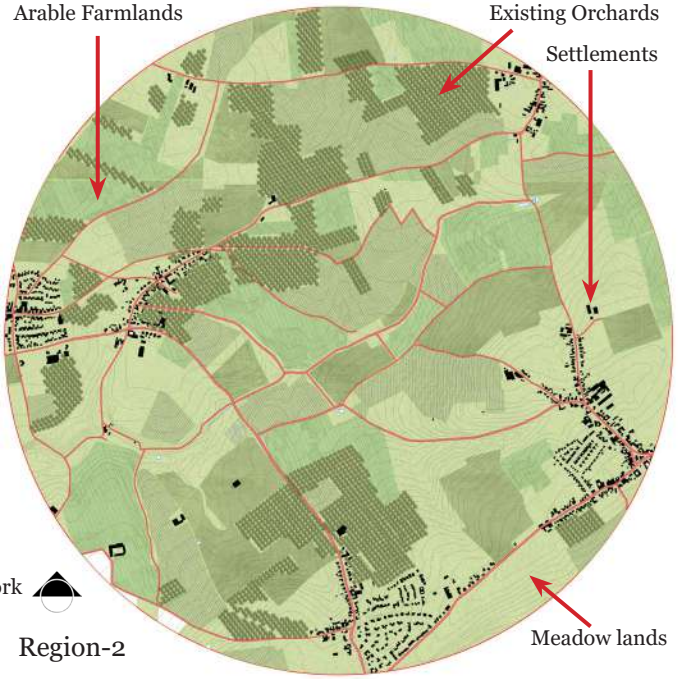
Areas for detailed design elaboration



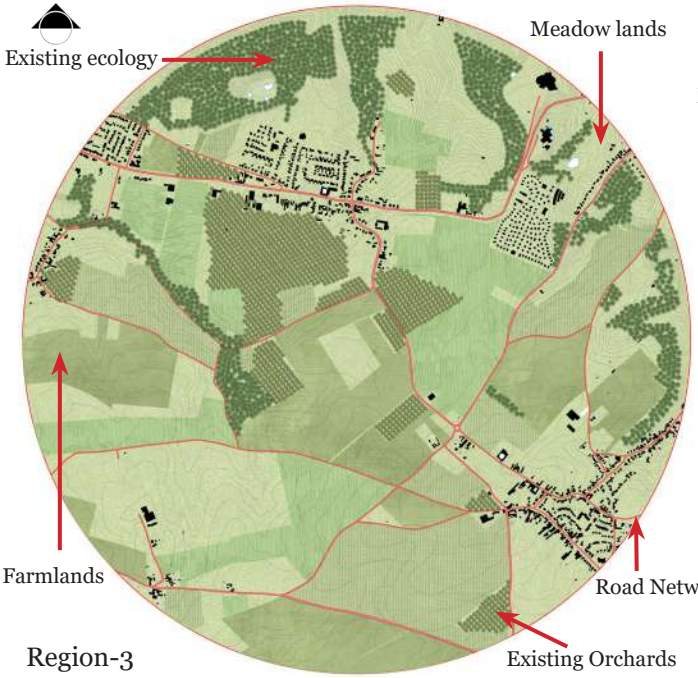
Existing Landscape Typology



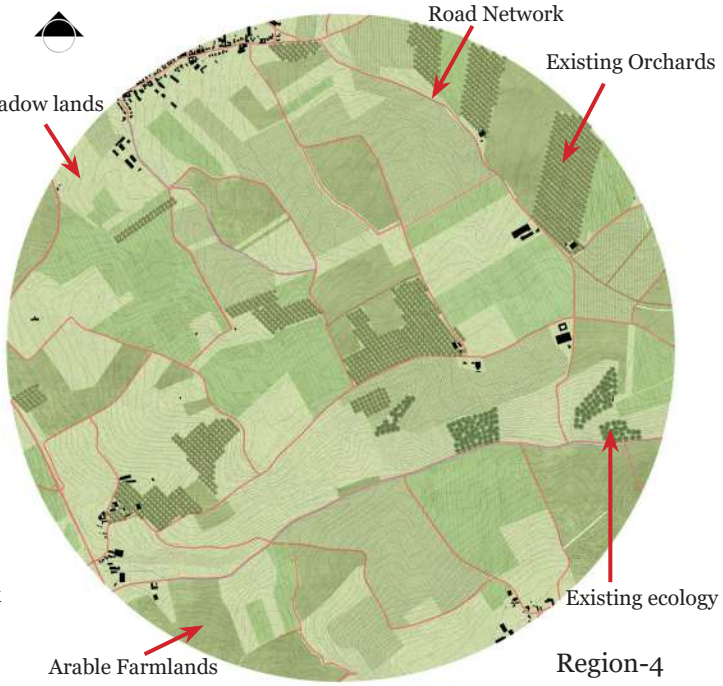
Region-1



Region-2



Region-3



Region-4

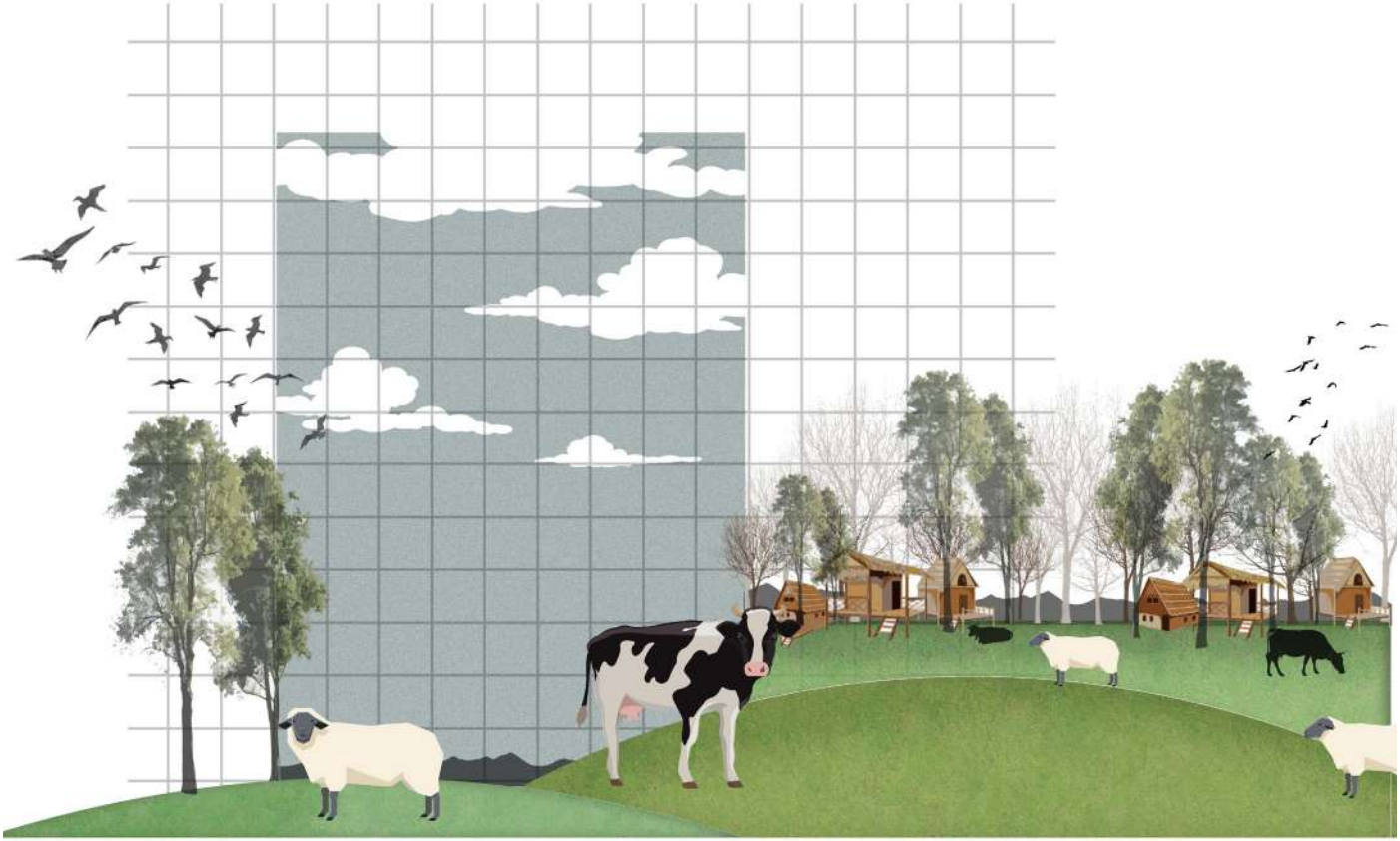
Existing High Stem Orchards

The illustration shows the existing orchards which are spread all around all around the selected regions. Limburg as a region is known for its high stem orchards. These orchards form an important element of the genius loci of Limburg. These orchards are usually a monoculture type and are seen frequenting near the old castles and along the slopes leading to the brooks mainly planted to prevent soil erosion

Arable Farming- Rural Landscape

The farmlands form a distinct feature of the rural landscape of Limburg. They are also the separating elements which divide the settlement structures. Crops like wheat, barley, maize sugarbeet and potato are amongst the commonly yielded crops in the area. The illustration tries to capture this landscape quality which shall function as a synergy to improve the proposed regional vision of the area.

Open Meadows

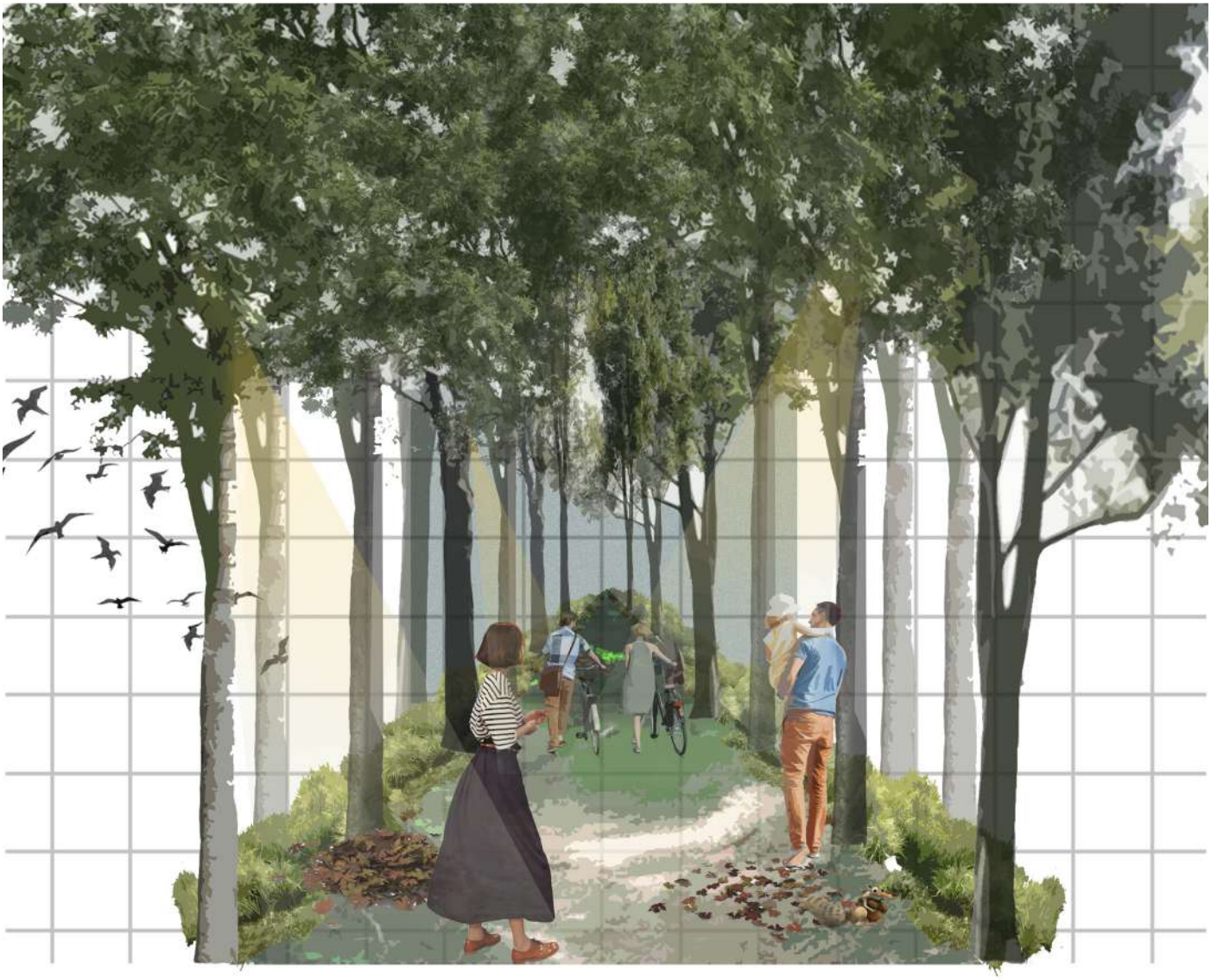


Amidst the Farmlands of Limburg are these open patches of lands which feature cows grazing and are one of the most important entities defining the horizons seen from Limburg. These open meadows are seen emerging frequently between farmlands and are also ample in the valleys. These are the areas which are responsible for the rise of nitrate levels in Limburg.

Green Stuctures- Existing Ecological Corridors

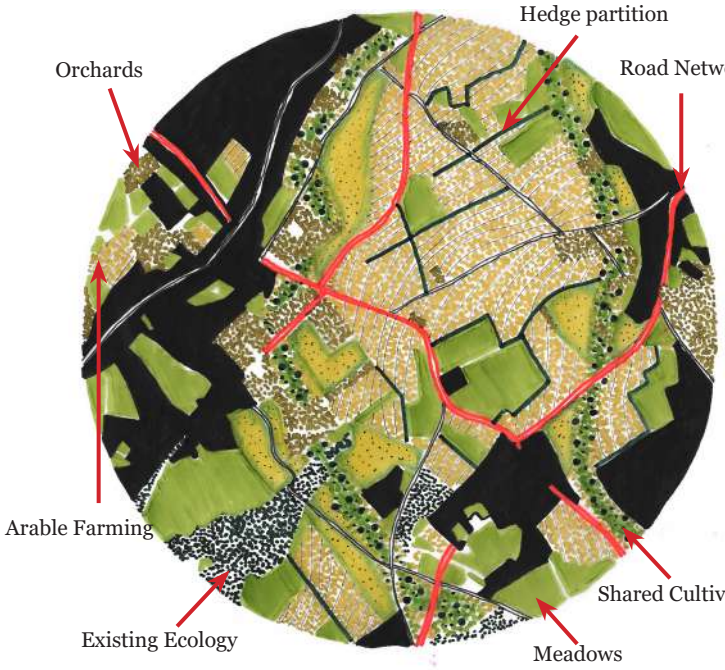
As analyzed earlier there are existing green structures spread across Limburg. These structures are seen to be pushed toward the sides of Limburg and project a massive void in the central areas where arable farming takes place. The forest structures provide a perfect environment to create micro eco-systems using flora and fauna. These structures shall be the starting and ending points of the common structures

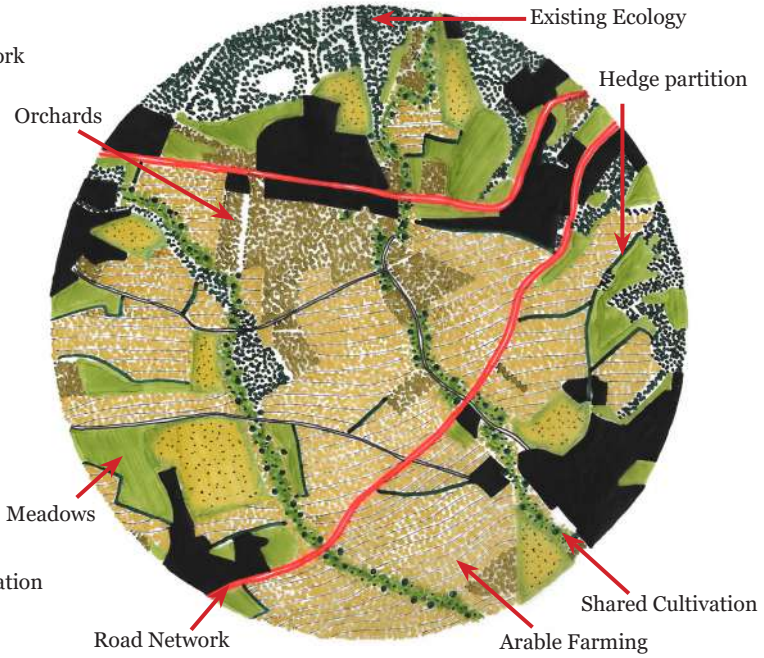
Natural Reserve- Forest trails

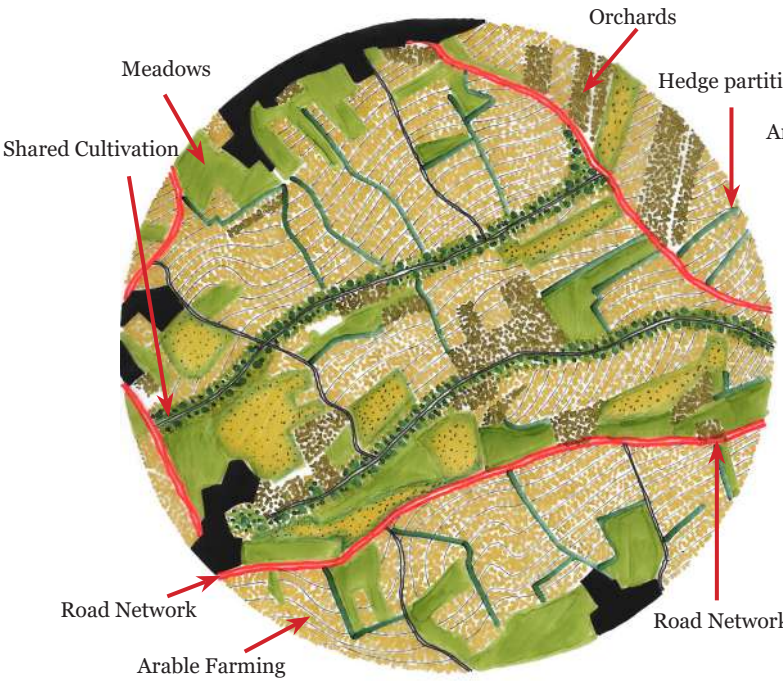


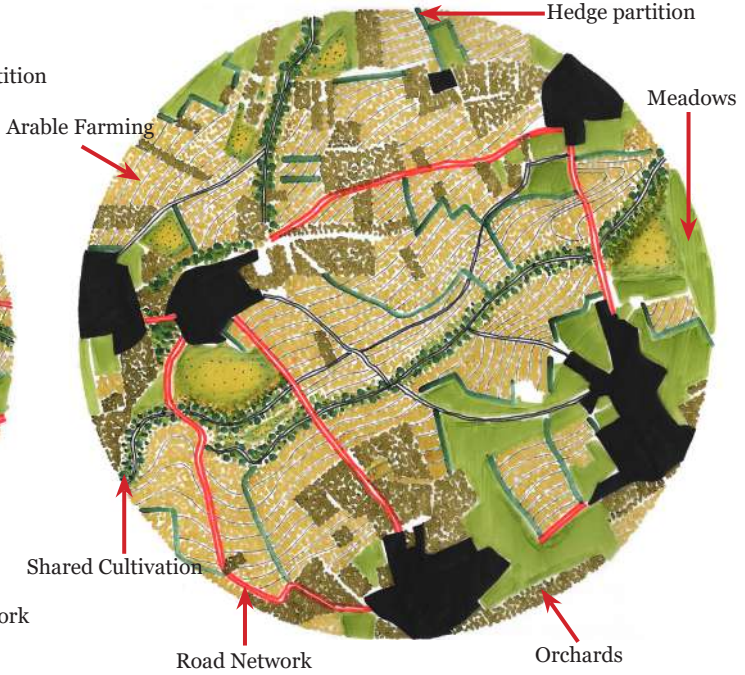
Certain areas on the site are announced to be Natural Reserves. The biggest of them being the Brunssummerheide. These areas are regions which cannot be transformed further. They have trails and mountain bike paths going through them. They form the best combinations of ecology with leisure. These natural reserves are further used as an synergy to achieve a similar kind of spatial value within the proposed forest structures through the commons.

Conceptual sketches- Design evolution









Envisioned farming outcomes

http://www.costaricajourneys.com/permaculture-costa-rica/

https://in.pinterest.com/pin/351984527104684511/

https://civileats.com/2016/03/16/how-carbon-farming-reverse-climate-change-eric-toensmeier/

https://permacultureapprentice.com/permaculture-water-management/

Bluring the thresholds- Farms fading into the commons

The above illustration shows the threshold condition where the farmlands meet the commons. The main focus is on blurring the transition. This is achieved by changing the planting gradient from a crop yield to a shrub right into a forest canopy. High stem orchards and hedge rows give this space a Limburg character.

A walk through the commons.

The above illustration depicts a walk through the commons. The character of the commons captures the planting qualities of a forest to enhance ecology and has an added function of production due to the orchards and berry shrubs. Bicycle paths and walking stroll paths provide a public domain to these commons making it more interactive with the surrounding.

The broader connections

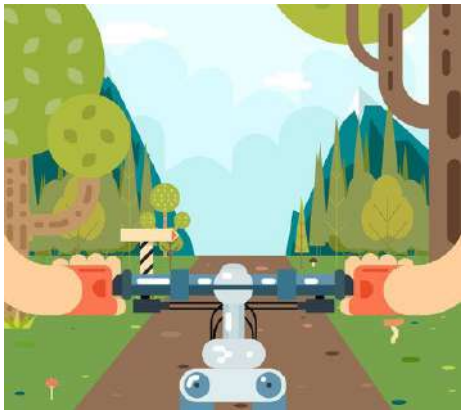
The illustration shows an aerial frame of the possible overall common structures. It shows how the location of the common structures are strictly dependent on the scale and scenarios where farmlands intersect each other. The staggering nature is achieved in order to break the line of sight making the journey through the common an experiential transition through the farmlands.

Applying Synergies on the existing Landscape Typolgy

Arable Farming

Orchard Plantation

Forest (Ecology)

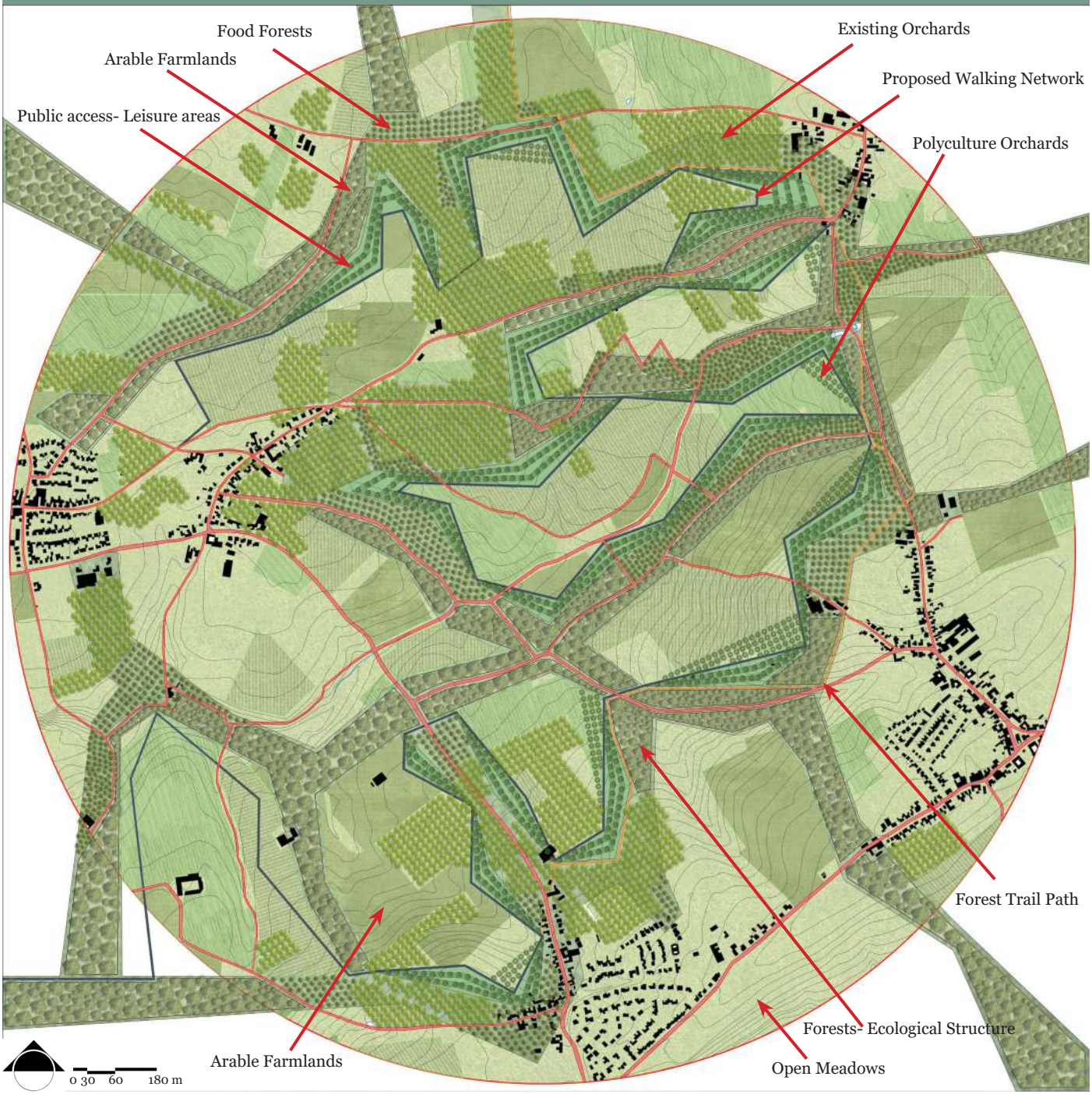


Natural Reserve

Adaptive Farming Typology- Region 1

Regional Transformation- Proposed design strategy

Intended Solution

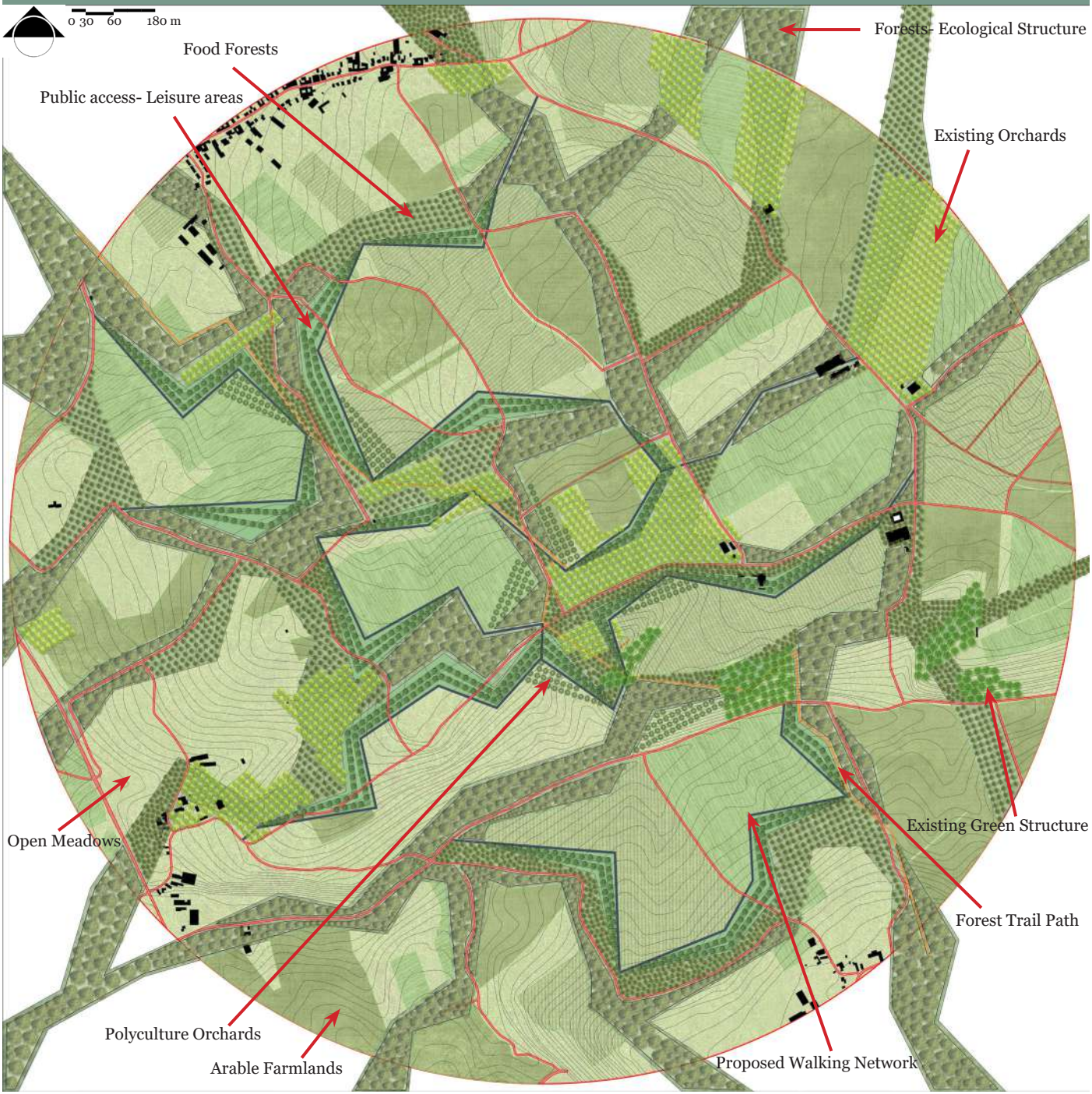


Intended Solution

Intended Solution

Intended Solution

Intended Solution



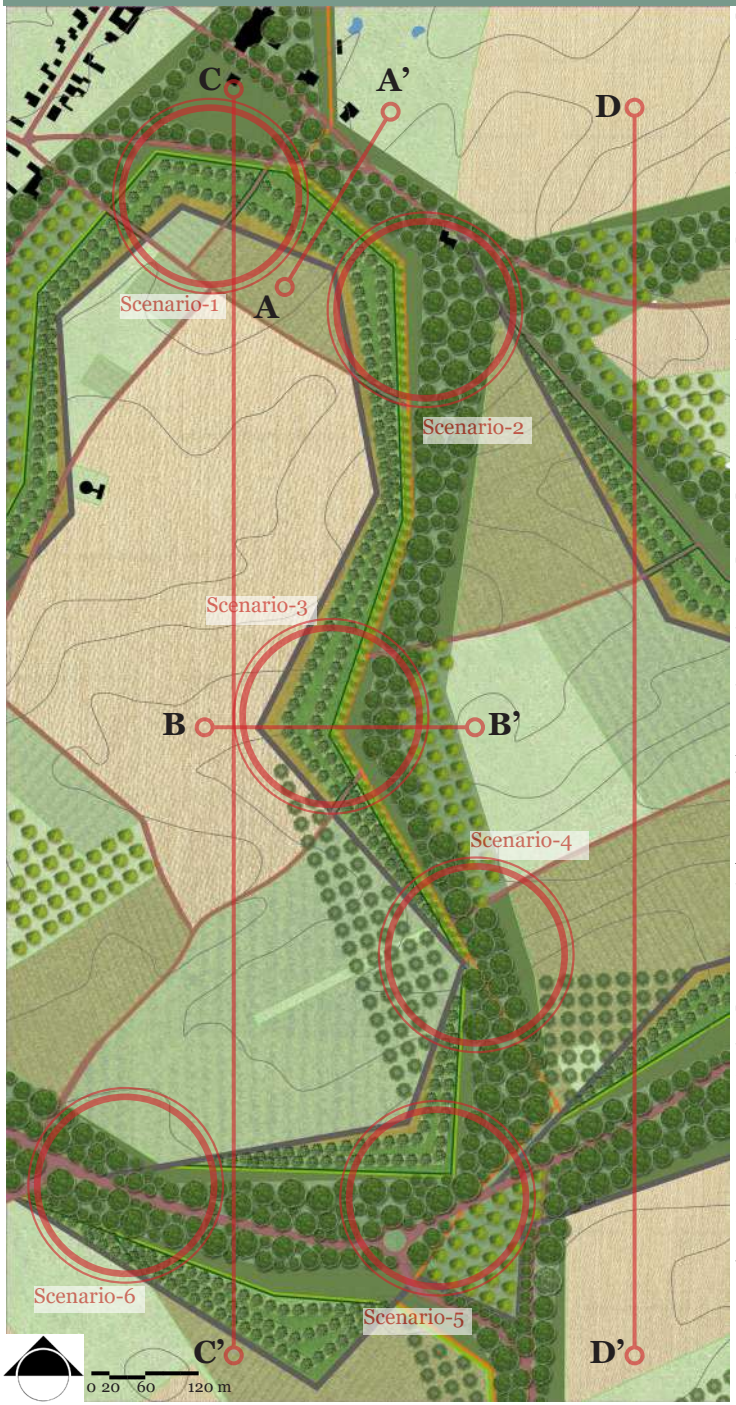
Intended Solution

6B.

DESIGN DETAILS

DESIGN DETAILS

Understanding Shared Cultivation



The detail zoom in area elaborates the common structure running through the farmlands. The common structure is developed using the system of Permaculture, thus making it resilient and self- sustainable. The shape and form of this shared cultivation is solely dependent on the location and current farming set up of the area.

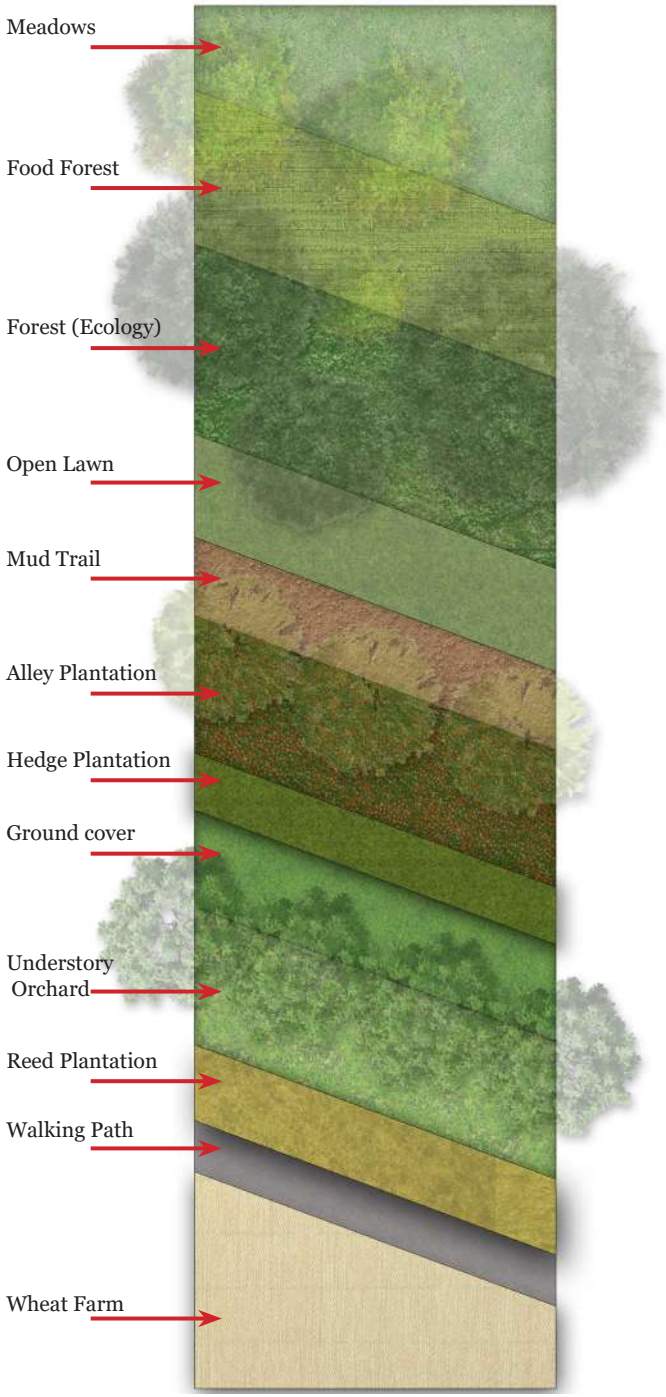
There are some distinct synergy functions which are added over and above production. The first intervention is a walking path at the periphery of the farmlands which provide public access through the farmlands. This pathway is tucked in between farmlands vegetation on one side and Reed plantations on the other giving it a unique experience through wilderness.

There are set of public domain networks which are seen connecting different area within the common structure. These areas have shrub and berry plantations as their understory and house a carefully planted row of orchard trees which can be accessed by the visitors. This gradient is than connected to a forest trail which is sitting in the heart of the proposed forest network which is at the core of the commons. Considering the fact that a forest takes years to settle and become resilient they initially are planted as food forests.

Another important feature of this common structure is that it uses the existing high stem orchards present in the area and maximizes the yield potentials by introducing newer species of plantation.

The existing road networks are further connected using these walking paths giving multiple options for the end user to explore. Considering the fact that these common structures are possible only when two individual farmers release a small percentage of their land as a common area there are areas within the existing farms which are planted with Polyculture orchards which basically help stabilizing their incomes and help in crop yield recovery by providing a new yield extracted from these fruit orchards.

Planting Gradient- Shared Cultivation



The varied planting gradient of the shared cultivation is what makes this system a Polycultural multi-layered entity. The scheme shows the standard gradient which takes place between one farmland till it connects itself to the other.

The gradient is defined taking into consideration the native function it tries to house. The gradient is defined such that it not only focuses on production but also provides an added value in the form of ecology and Leisure. This commons structure thrives of human experience and human interaction with nature.

The first gradient is grasses, which than is connected to the layers of ground cover and vegetable plantations. This acts as the lowest base of the planting pyramid. This ground covers are than merged with shrubs and berries bearing plants which along with production also acts the first stop for ecology.

The shrubs are than transformed into ornamented orchard plantation, which has shrubs below to enhance the yield extracts. This is than connected to high stem orchards and medium sized trees which run along in an alley enhancing the linearity of the composition. These orchards than meet with the forests which are the heart for the ecological emergence. This is the highest point of the planting gradient and functions as the core area.

The forest trees than are transformed into a more hybrid system where there are orchard food production trees which are planted along with the pioneer species to transform the area a food forest. The last gradient is the polycultural orchards which function as the thresholds to the farm structure.

The planting gradient is also adapted to the human activities taking place through the commons. The planting gradient provides a platform for enhanced interaction of humans with the surrounding ecology.

Sectional Profiles

Section AA’

Section CC’

Sectional Profiles

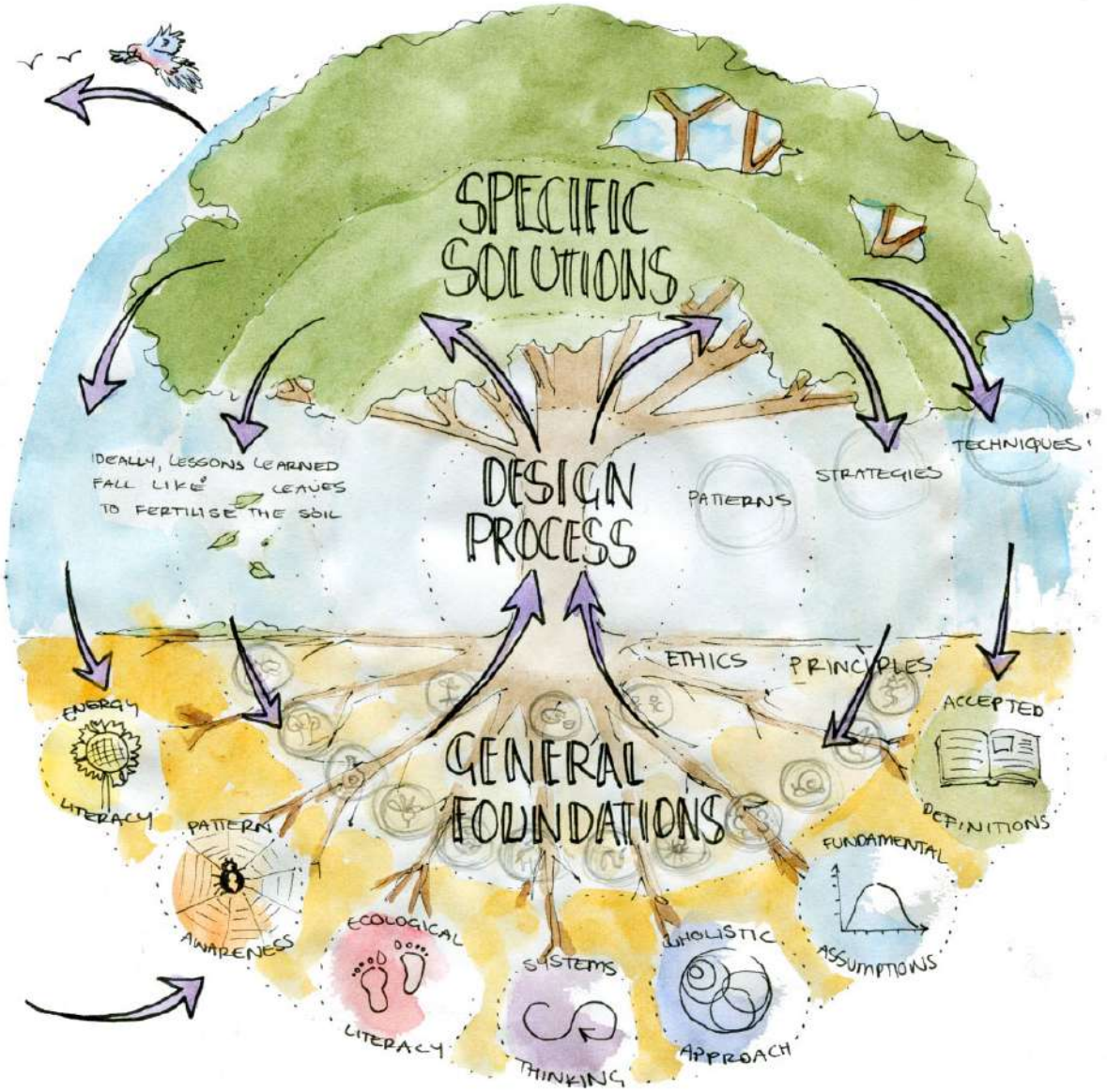
Section BB’

Section DD’

Application of Permaculture Principles

https://dribbble.com/shots/4101653-Permaculture

https://www.pinterest.co.uk/pin/120331239888825165/



The Permaculture Tree (Take Three) by Dan Palmer for www.MakingPermacultureStronger.net
Illustrated by Brenna Quinlan (@brenna_quinlan)

According to the Essence of Permaculture there are 12 key design aspects possible which can be used to generate design ideations. All these principles can directly be translated into daily life cycles which can help create more sustainable, regenerative environments.

The 12 principles are as follows:

• Observe and interact *(Sight)*

• Catch and store energy. *(Contain)*

• Obtain a yield. *(Achieve)*

• Apply self-regulation and accept feedback. *(Restrict)*

• Use and value renewable resources and services. *(Value)*

• Produce no waste. *(Reduce)*

• Design from patterns to details. *(Improvise)*

• Integrate rather than segregate. *(Combine)*

• Use small and slow solutions. *(Consistency)*

• Use and value diversity. *(Accept)*

• Use edges and value the marginal. *(Thresholds)*

• Creatively use and respond to change. *(Adapt)*

There is a possible direct translation of these systems to our daily lives, we just need to accept change and keep an open mindset.

Observe and interact *(Sight)*- The eye has a keen sense of memory. Sight can trigger emotions and can visualize idealistic scenarios. The more we observe the more we learn. Sight acts as the first trigger point, embrace it.

Catch and store energy *(Contain)*- There is a definite balance in the universe which keeps things in order and allow co-existence. Energy is not necessarily quantifiable, emotional stability and positivity is also considered as energy. Try to achieve a sense of harmony with the surrounding.

Obtain a yield *(Achieve)*- For the method of Permaculture, yields are at the center of its priority. A more varied yield generates a better functioning system. Learning the importance of nature and its diversity is also a yield. Respecting nature and adjusting yourself within it, at the same time providing ideas and solutions to improve the current setting is a mind-set yield which intern contributes in designing solutions which improve physical yield.

Apply self-regulation and accept feedback *(Restrict)*- Restrictions enhances performance. The more controlling the surrounding the harder we think to formulate the ideal solution. Inquire, feedbacks are nothing but scenarios which we haven't considered or ignored all along the way.

Use and value renewable resources and services and produce no waste *(Value)*- The key ingredients to achieve sustainability. Sustainability starts from within and is also a relative term, so trigger a change and educate

the resulting benefits to the people around you. In sustainability waste is also considered as an important synergy.

Design from patterns to details *(Improvise)*- Observe patterns and details in nature. Nature is the best teacher, understand the why and then adapt, translate eventually generating the same.

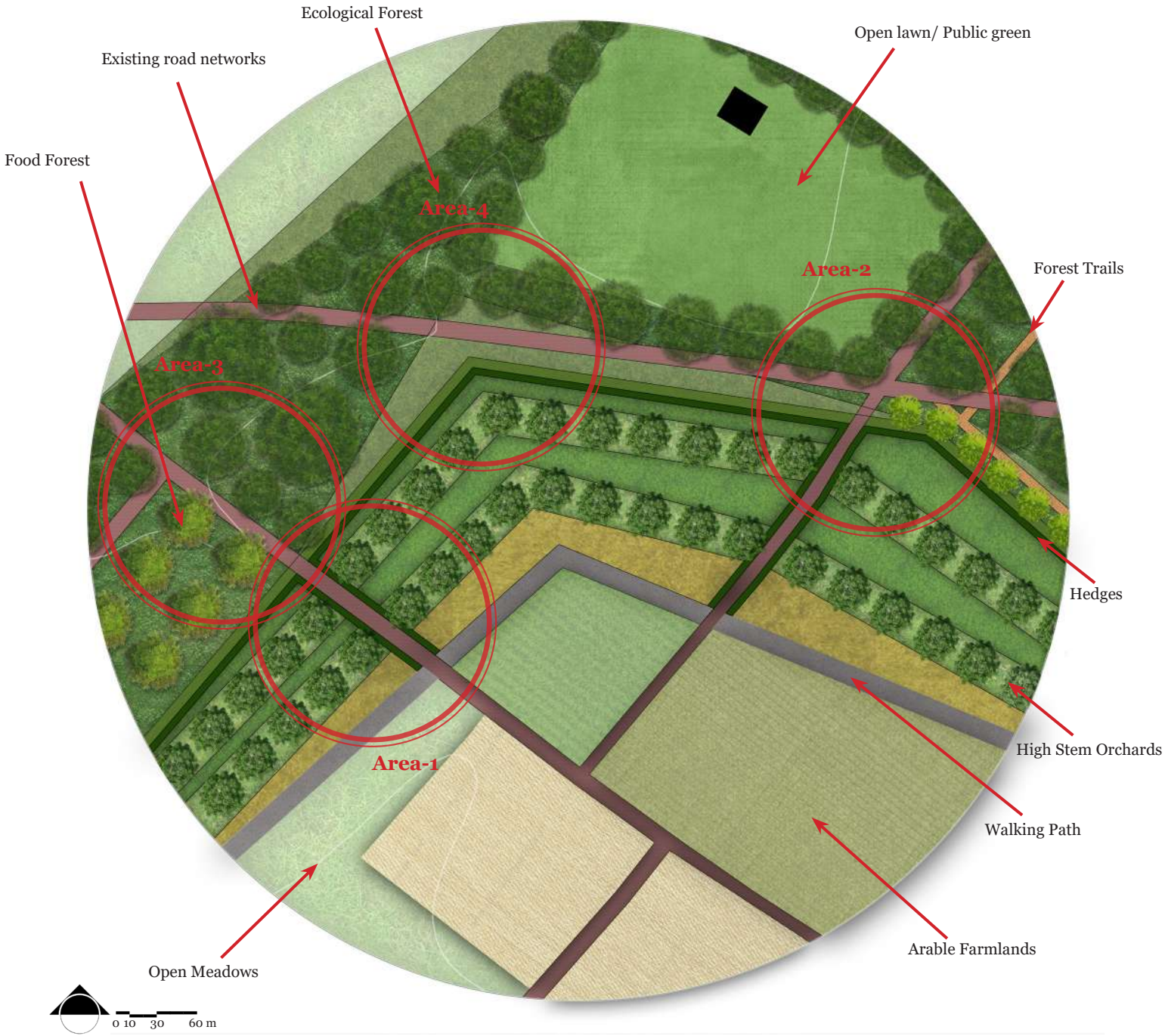
Integrate rather than segregate and use and value diversity *(Combine)*- Integration opens up opportunities towards various synergies. The combinations of newer systems and policies creates a platform for exploration and drift which is the key ingredient to Permaculture. Integration can be in terms of natural processes such as adapting to a multi-layered planting grain to increase the variation of plant palette, at the same time integration can also be a mind-set of working with others. Community building is the most successful result generated through integration.

Use small and slow solutions *(Consistency)*- It is important to first gauze upon the potential bandwidth each individual has before initiating interventions using Permaculture. It is important to identify the level of complexity which can be handled by a single person before choosing complex solutions which are sustainable. This will only reduce the net sustainability generated towards the end. For this, the preferred path taken should be to think big but achieve that big using multiple sets of smaller solutions. First it's easier to control these smaller interventions and second if a lot of people so small changes the resultant outcomes are large. Sometimes there is a need of large solution's which are immediate. Break them down, understand and decipher them using smaller modules which are more resilient and have the potential to instantly swapped and replaced in case of failures or set-backs.

Use edges and value the marginal *(Thresholds)*- As mentioned earlier Ecotones and edge- effects are amongst the most important thresholds in permaculture. A system works in perfect sync within itself, friction is created where two systems meet each other. Generating innovate solutions for these intersection points results in formulating harmony which stabilizes the overall interaction. Permaculture urges us to consider not only here but also presume its expansion and consider what happens there. The transitions should be well thought off and should provide a seamless experience of continuity. It is at these intersection points where most of the diverse ecology is found and these ecotones are the areas which provide a more diverse layer of production mechanisms.

Creatively use and respond to change *(Adapt)*- Creativity opens up corridors for change and lets us step outside out comfort zones in order to explore and understand possible ideations for a problem. Acceptance is an important aspect here. We need to accept the current scenario and use our minds to create a more resilient solution which not only solves the problem but also improves the surrounding in that process.

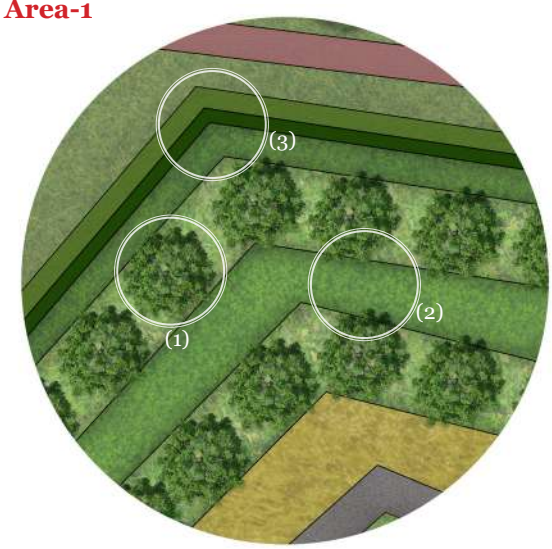
Permacultural intervention Scenario-1



Applying the Permaculture principles

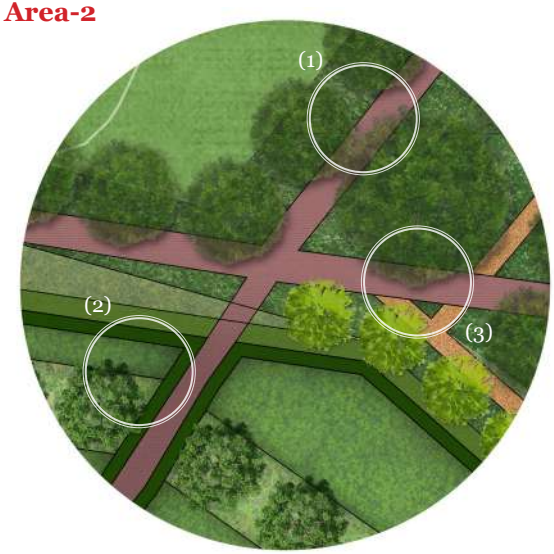
(1)
(2)
(3)

Area-1



- Obtain a Yield (1)
- Design from patterns to detail (2)
- Use edges and value margins (3)

Area-2

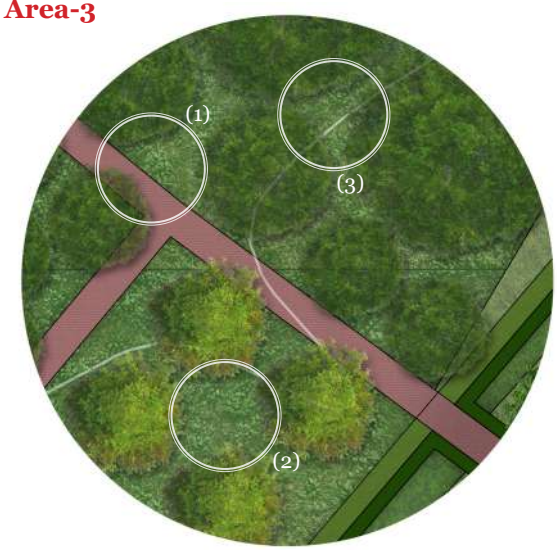


(1)
(2)
(3)

- Observe and interact (1)
- Apply self-regulation (2)
- Integrate rather than segregate (3)

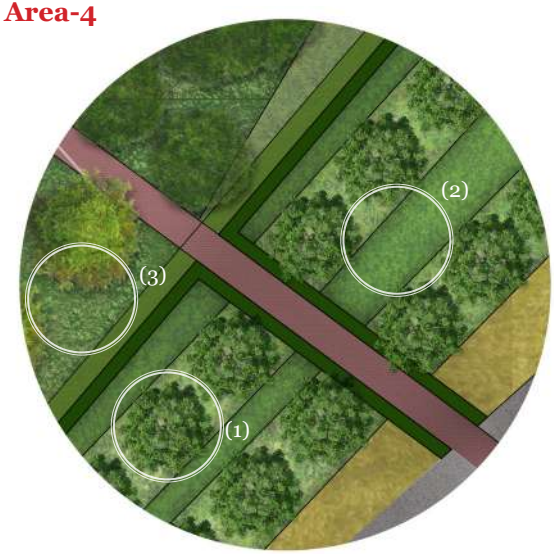
(1)
(2)
(3)

Area-3



- Use and value renewable resources (1)
- Produce no waste (2)
- Use and value diversity (3)

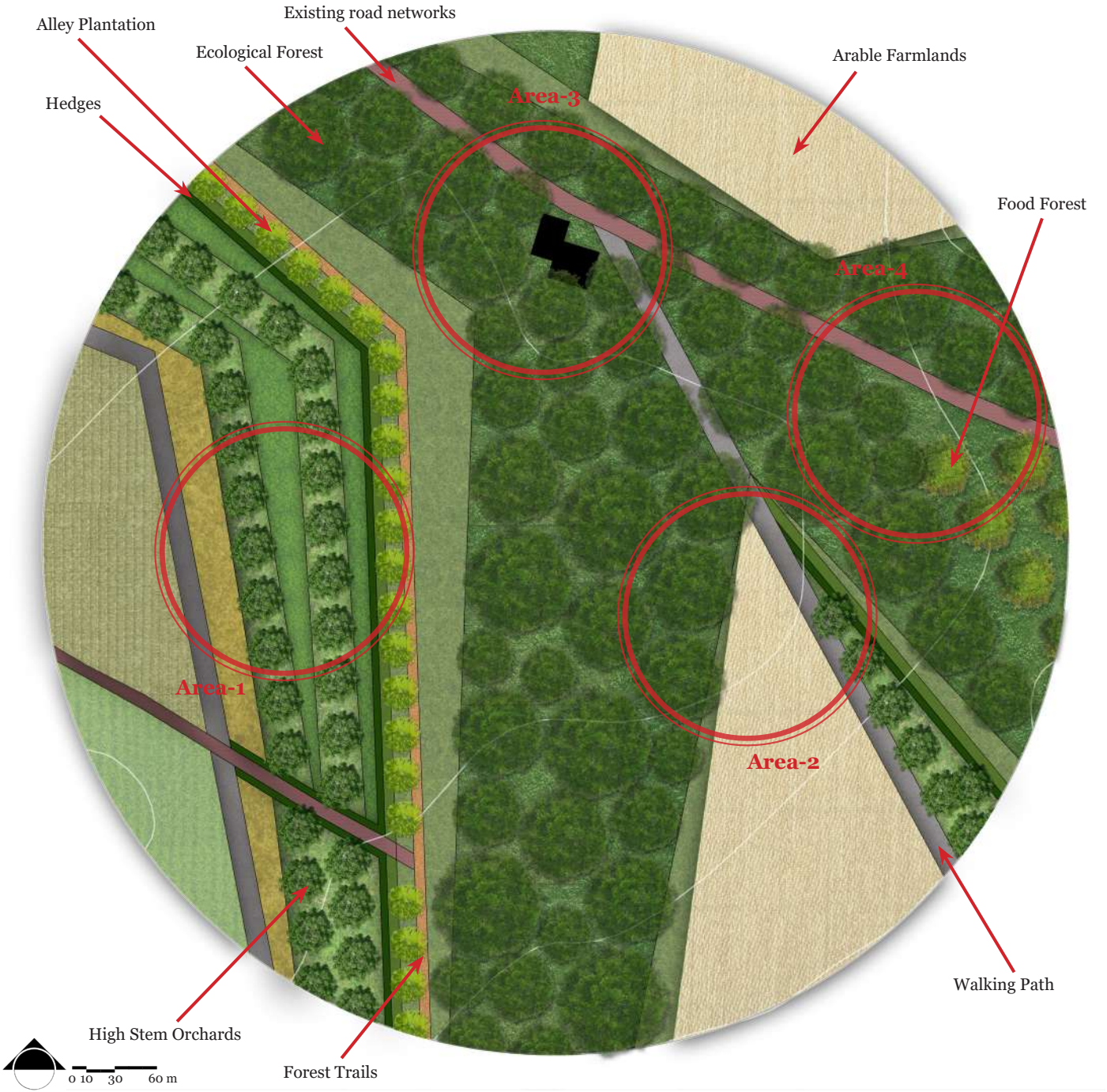
Area-4



(1)
(2)
(3)

- Obtain a yield (1)
- Use small and slow solutions (2)
- Creatively respond to change (3)

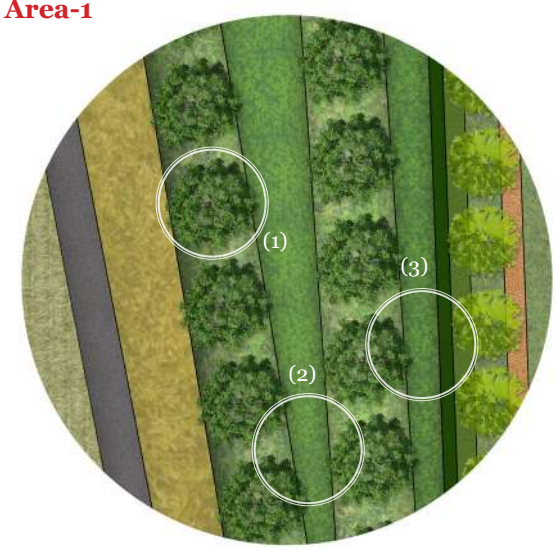
Permacultural intervention Scenario-2



Applying the Permaculture principles

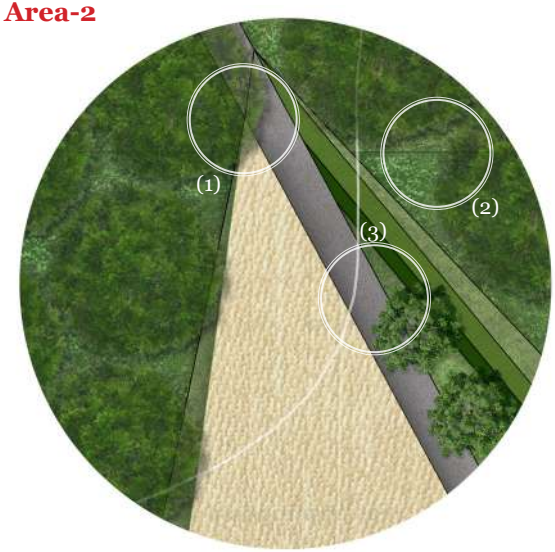
(1)
(2)
(3)

Area-1



- Obtain a Yield (1)
- Design from patterns to detail (2)
- Use edges and value margins (3)

Area-2



(1)
(2)
(3)

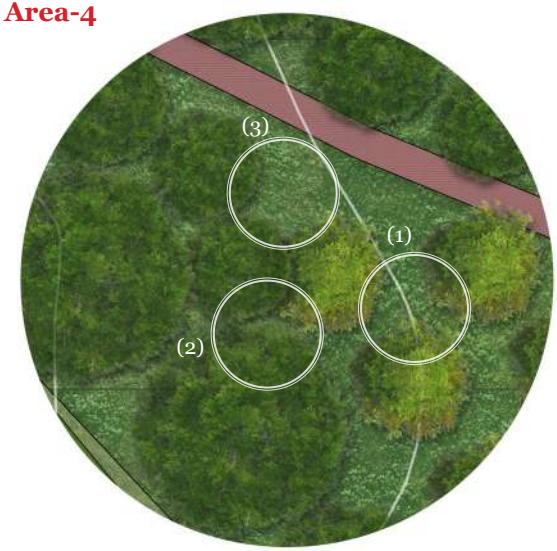
- Integrate rather than segregate (1)
- Use and value diversity (2)
- Creatively respond to change (3)

(1)
(2)
(3)

Area-3

- Apply self-regulation and feedbacks (1)
- Produce no waste (2)
- Observe and interact (3)

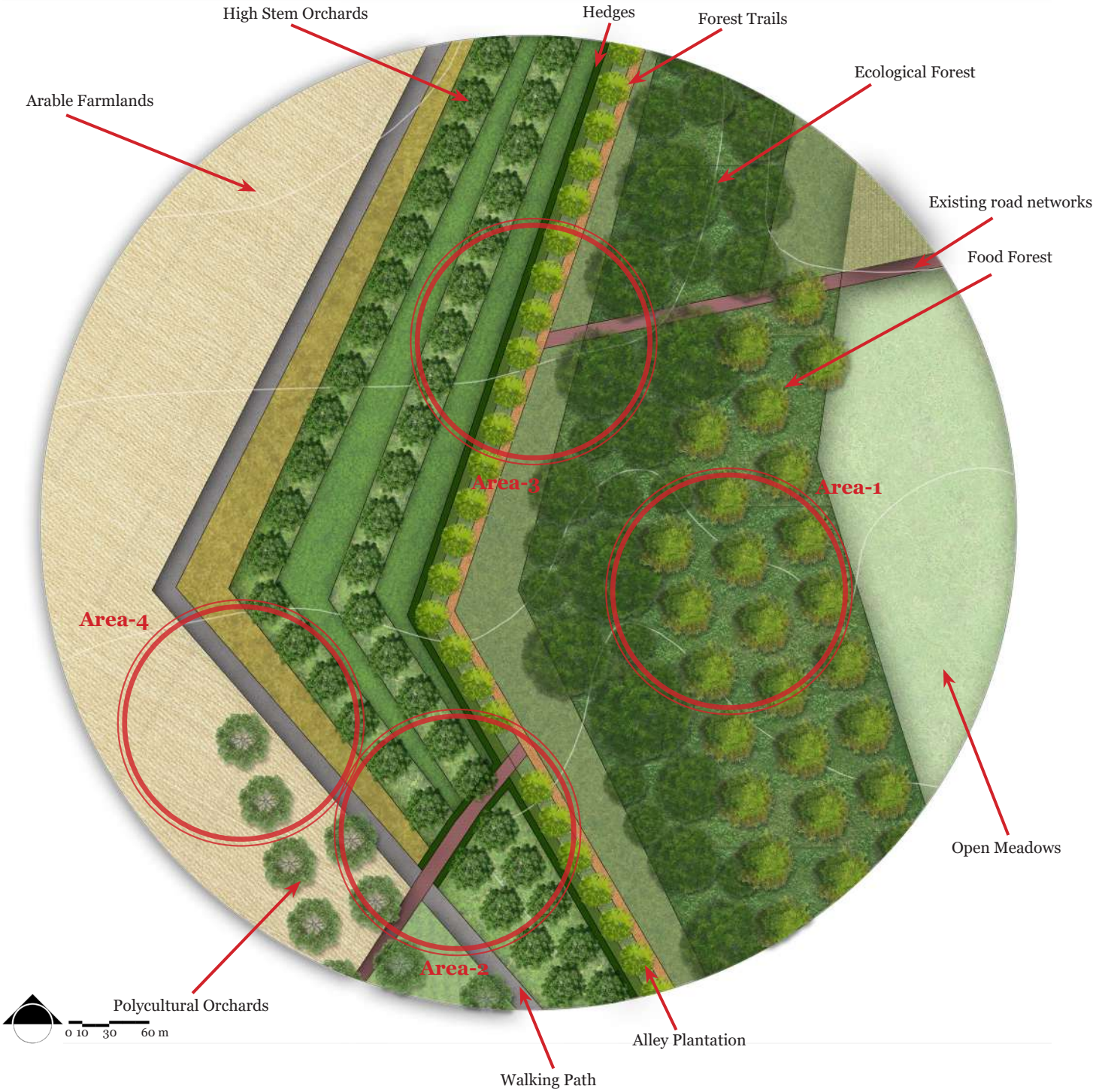
Area-4



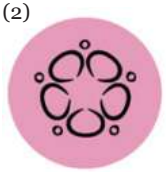
(1)
(2)
(3)

- Obtain a yield (1)
- Use and value renewable resources (2)
- Use small and slow solutions (3)

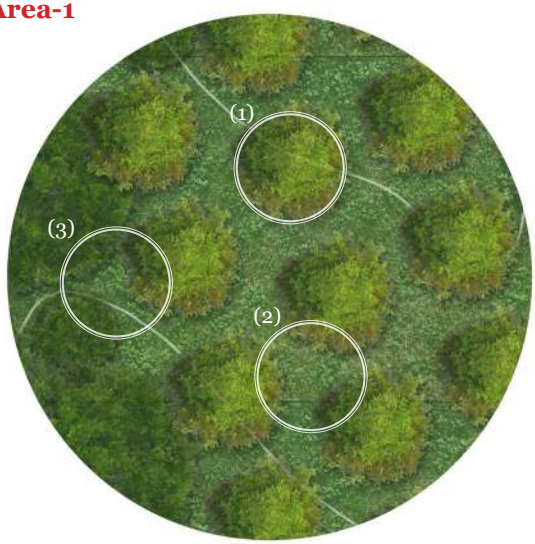
Permacultural intervention Scenario-3



Applying the Permaculture principles

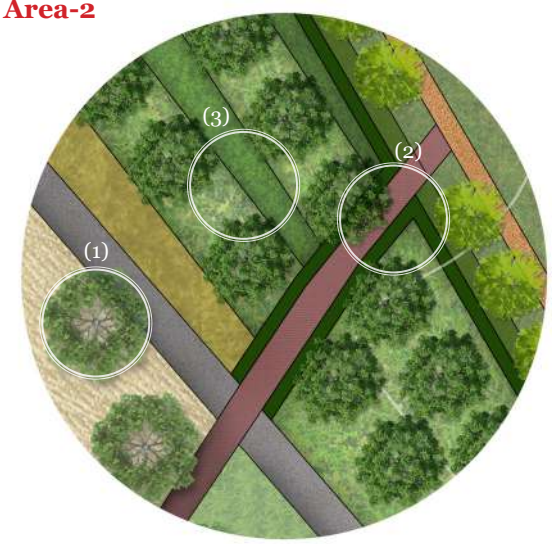


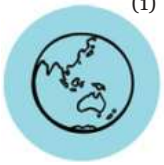
Area-1

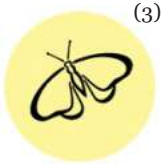


- Obtain a yield (1)
- Integrate rather than segregate (2)
- Use and value diversity (3)

Area-2

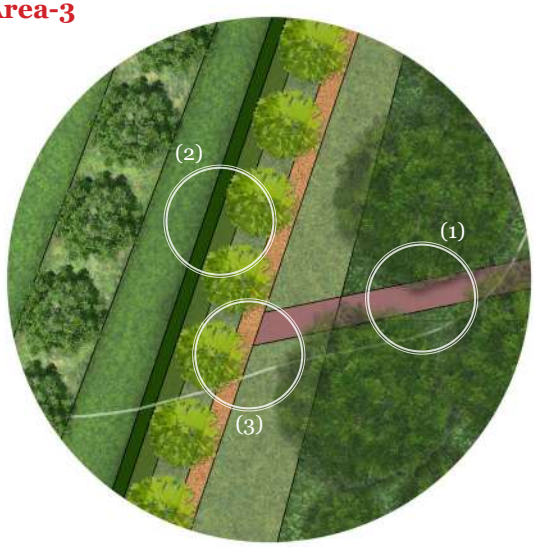






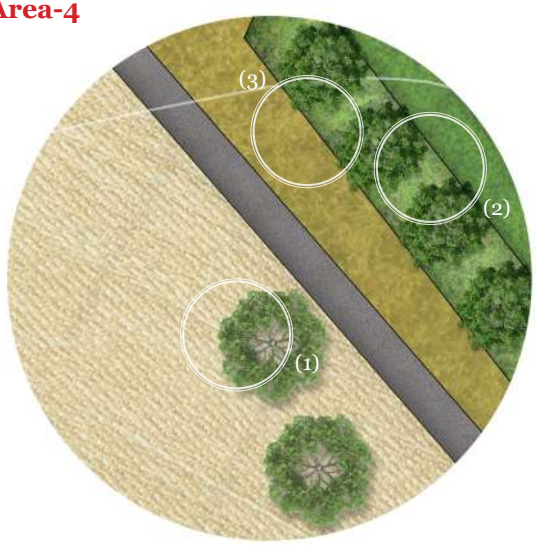
- Apply self-regulation and feedback (1)
- Design from patterns to detail (2)
- Creatively use and respond to change (3)

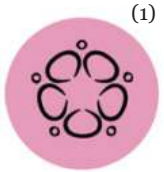
Area-3



- Observe and interact (1)
- Use edges and value margins (2)
- Use and value renewable resources (3)

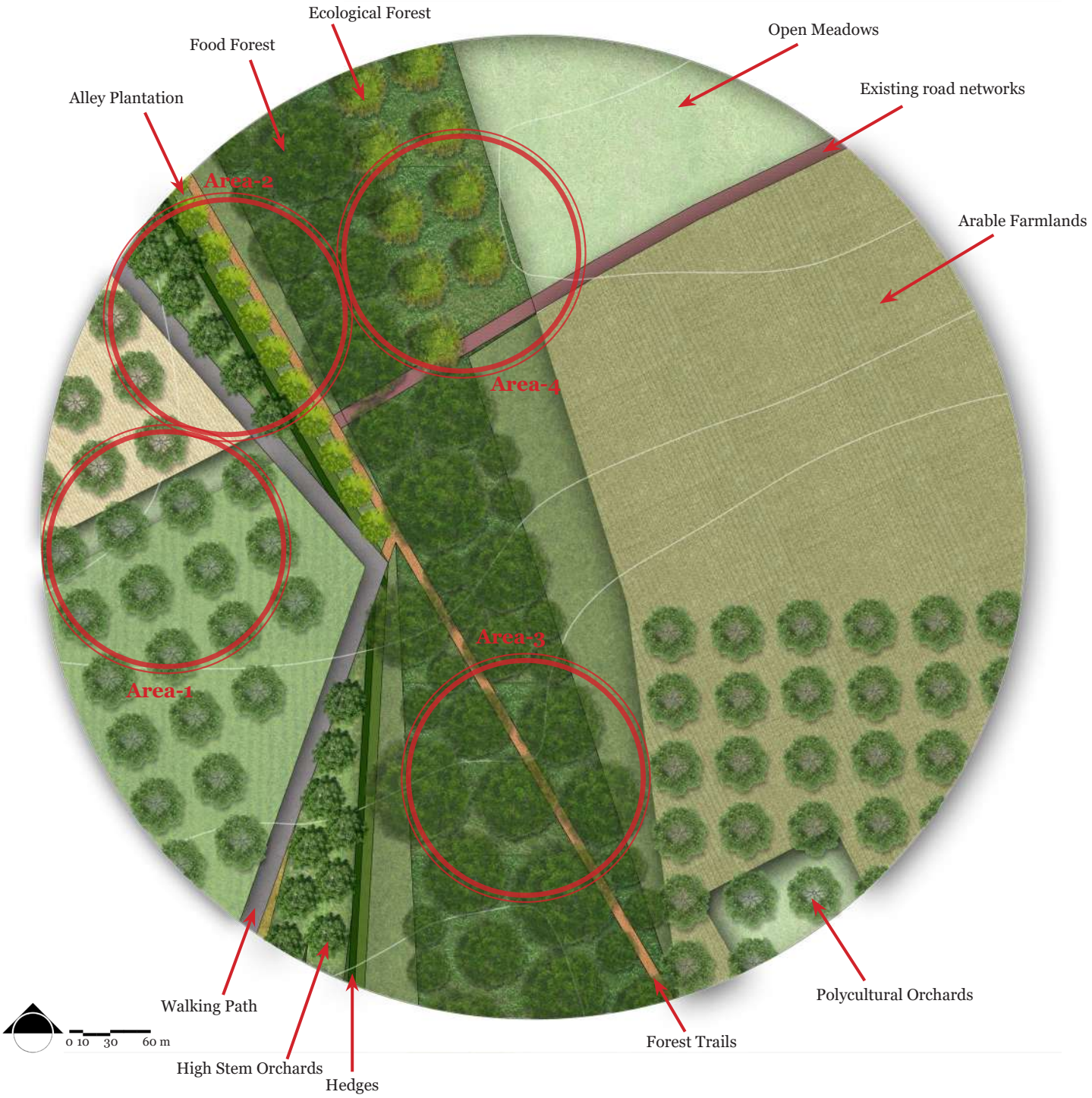
Area-4





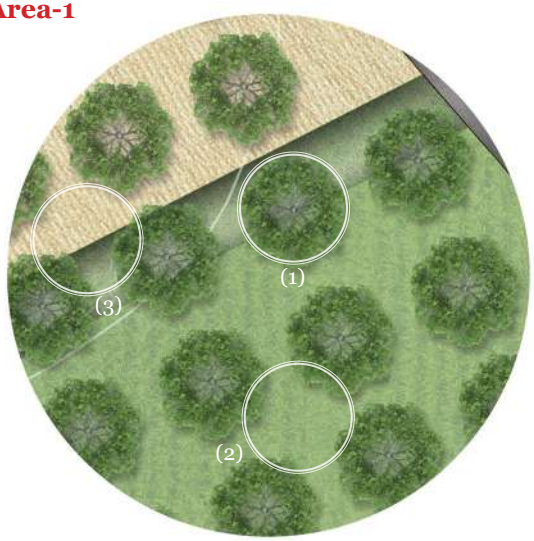
- Integrate rather than segregate (1)
- Use small and slow solutions (2)
- Produce no waste (3)

Permacultural intervention Scenario-4



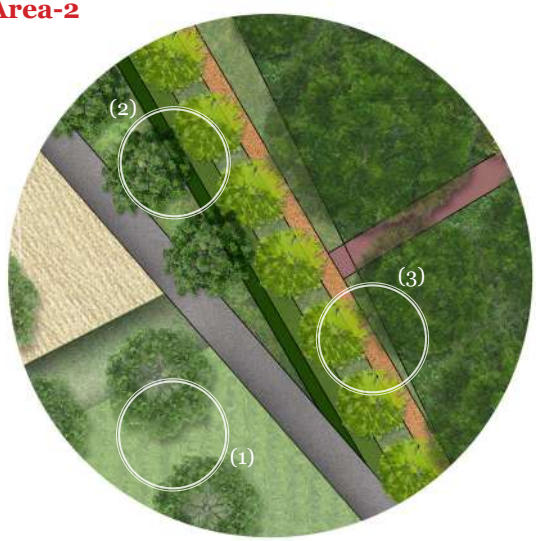
Applying the Permaculture principles

Area-1



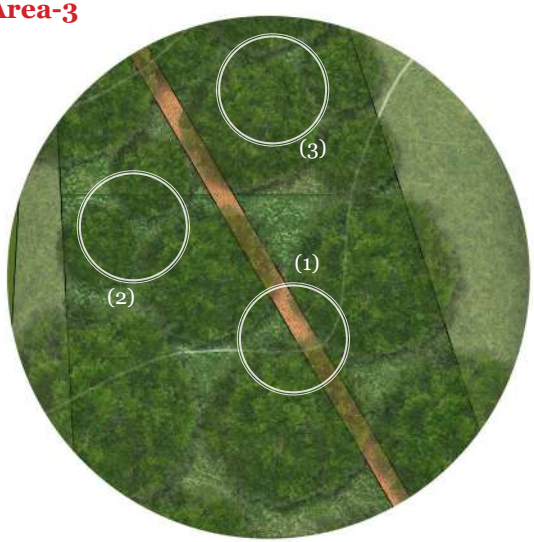
- Obtain a yield (1)
- Apply self-regulation and feedbacks (2)
- Integrate rather than segregate (3)

Area-2



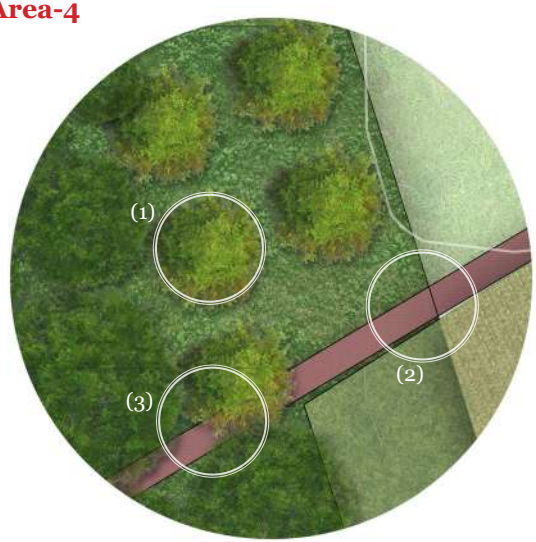
- Use small and slow solutions (1)
- Use edges and value margins (2)
- Creatively use and respond to change (3)

Area-3



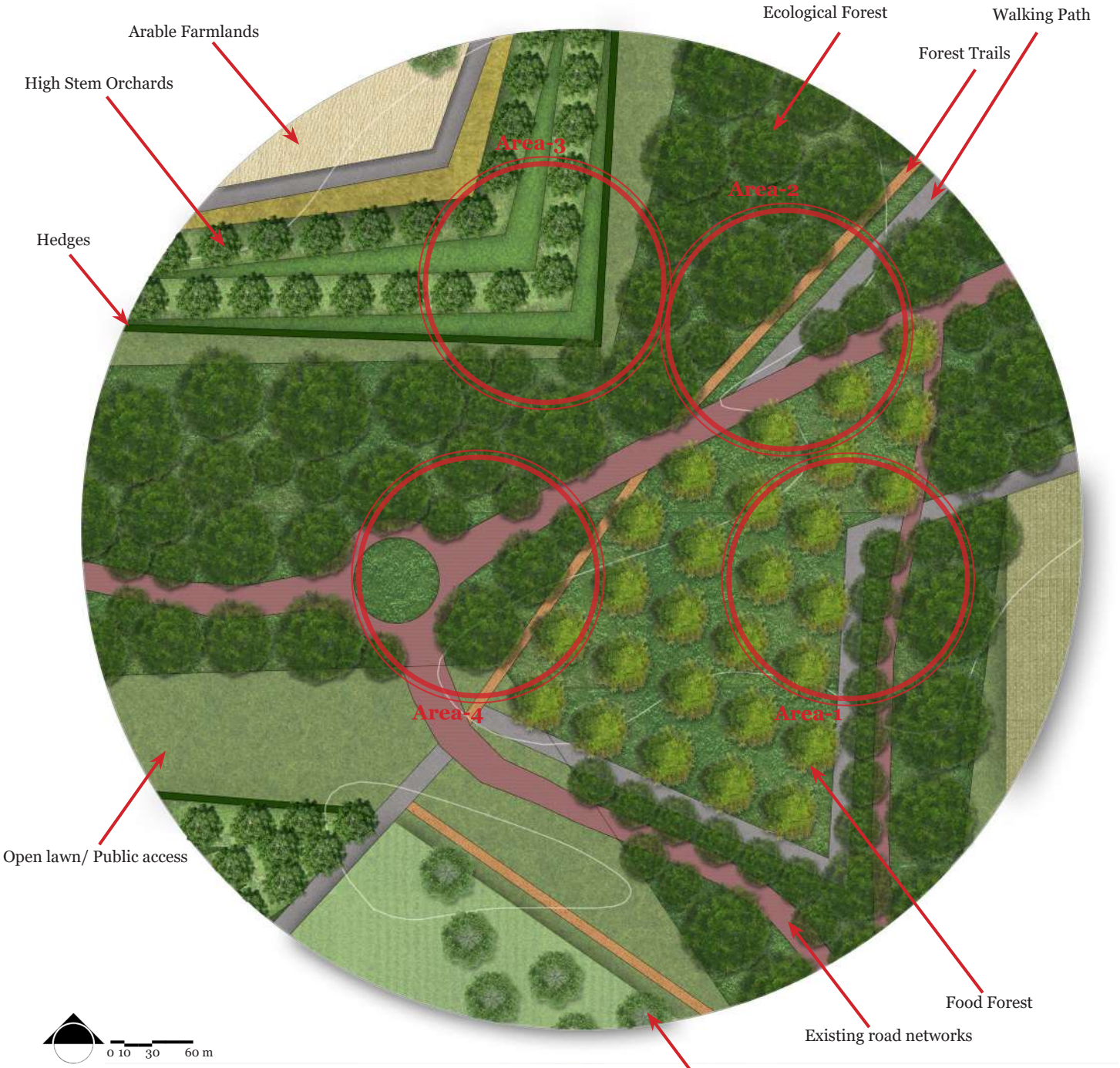
- Observe and interact (1)
- Use and value diversity (2)
- Produce no waste (3)

Area-4



- Obtain a yield (1)
- Use and value renewable resources (2)
- Use small and slow solutions (3)

Permacultural intervention Scenario-5



Applying the Permaculture principles

(1)

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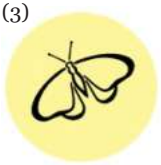
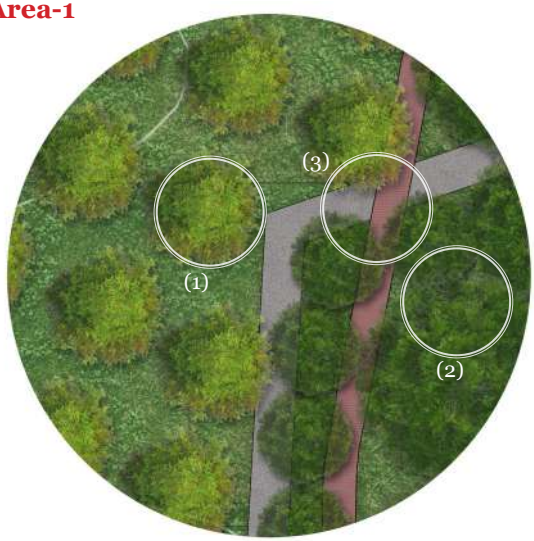
(3)

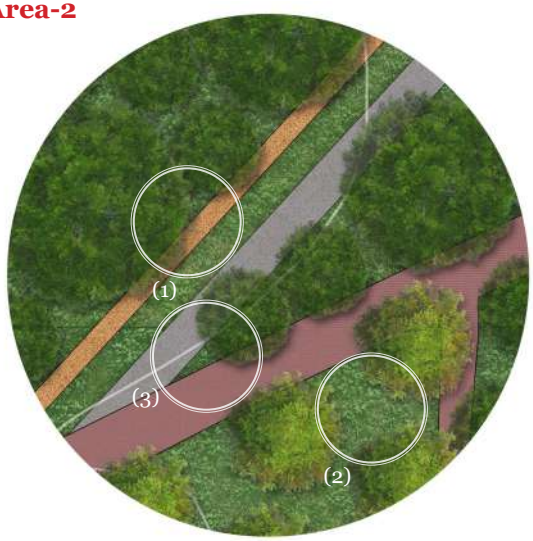


Area-1



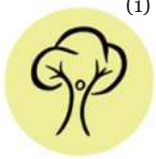
- Obtain a yield (1)
- Use and value diversity (2)
- Creatively use and respond to change (3)

Area-2



- Observe and interact (1)
- Apply self-regulation and feedback (2)
- Use and value renewable resources (3)

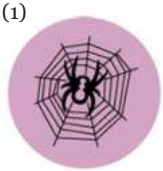
(1)



(2)

(3)

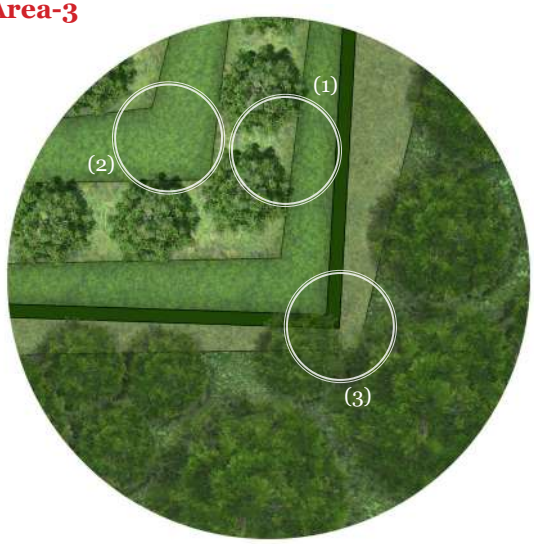
(1)



(2)

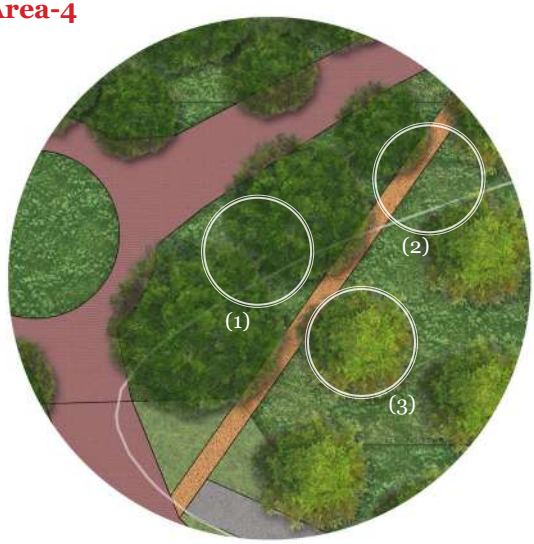
(3)

Area-3



- Design from patterns to details (1)
- Use small and slow solutions (2)
- Use edges and value the margins (3)

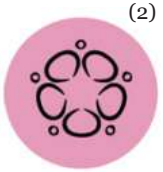
Area-4



- Produce no waste (1)
- Integrate rather than segregate (2)
- Obtain a yield (3)

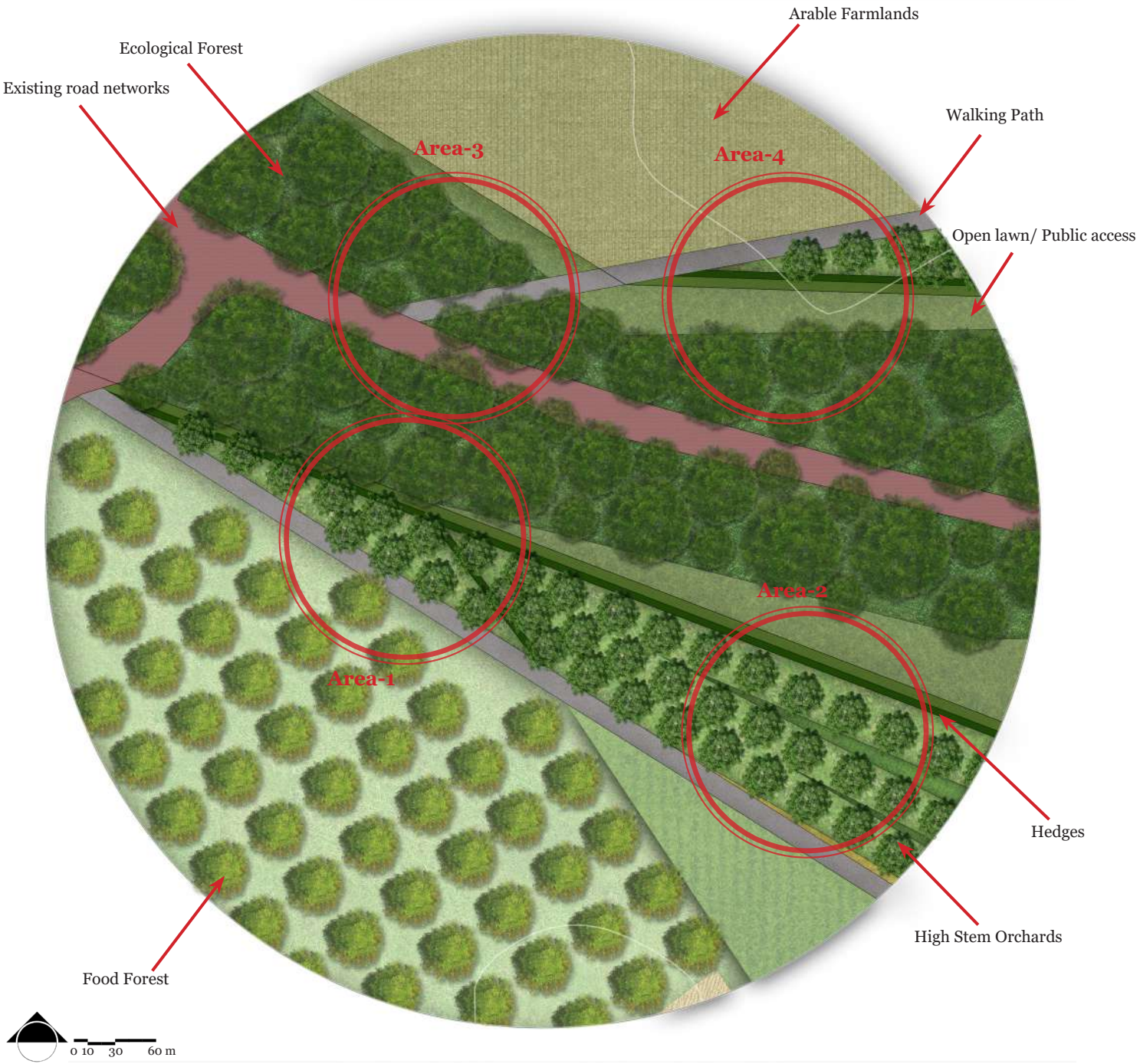
(1)

(2)



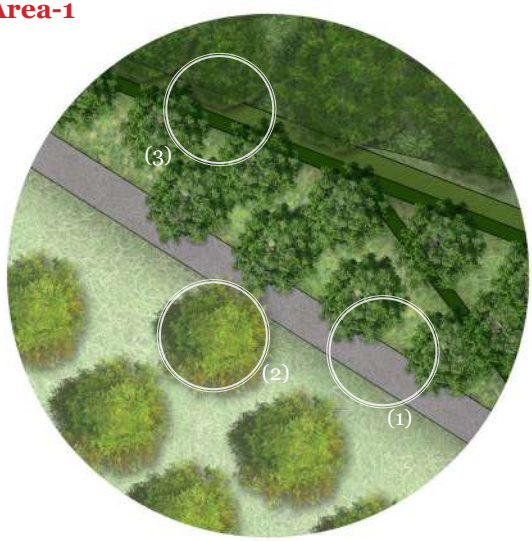
(3)

Permacultural intervention Scenario-6



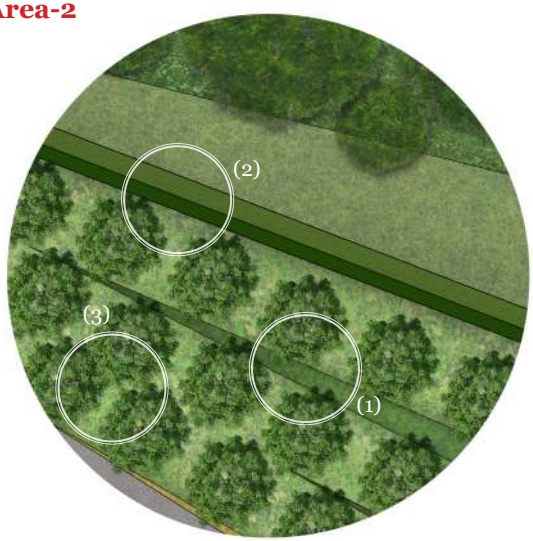
Applying the Permaculture principles

Area-1



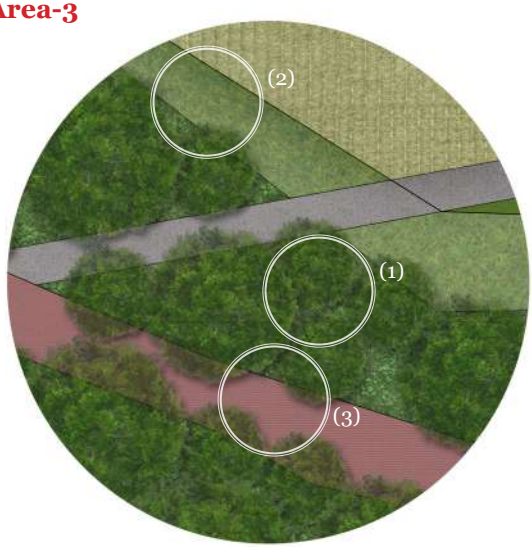
- Observe and interact (1)
- Obtain a yield (2)
- Integrate rather than segregate (3)

Area-2



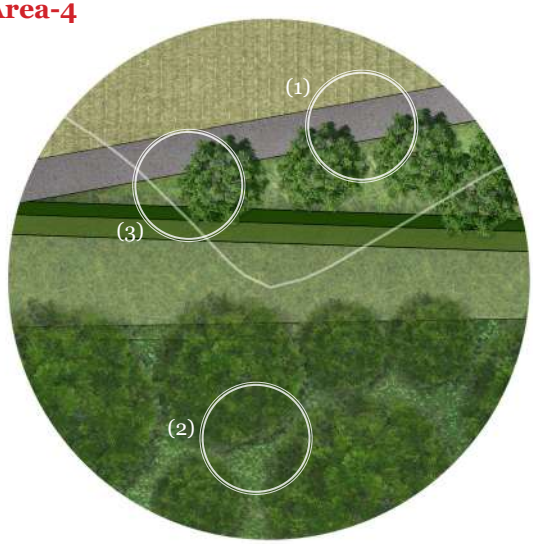
- Design from patterns to details (1)
- Use edges and value the margins (2)
- Use small and slow solutions (3)

Area-3



- Use and value diversity (1)
- Use and value renewable resources (2)
- Observe and interact (3)

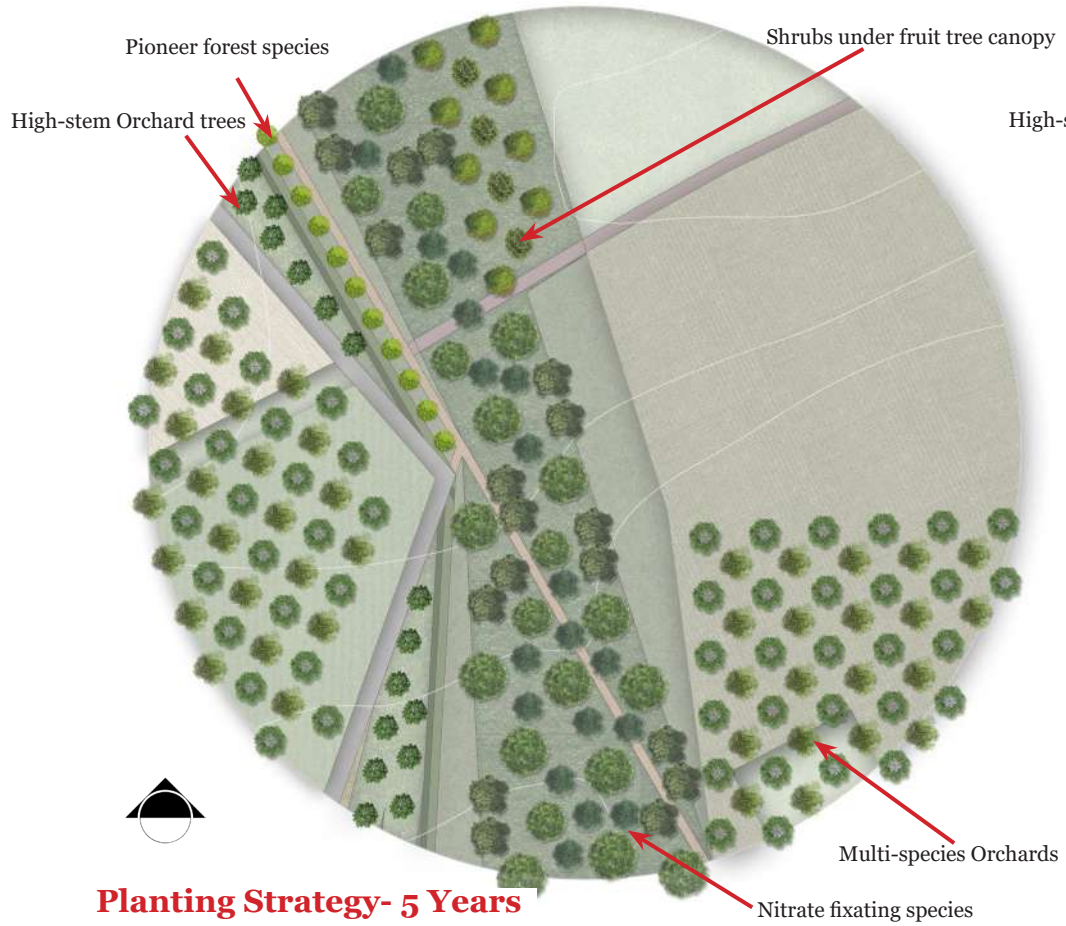
Area-4



- Creatively use and respond to change (1)
- Apply self-regulation and feedbacks (2)
- Design from patterns to details (3)

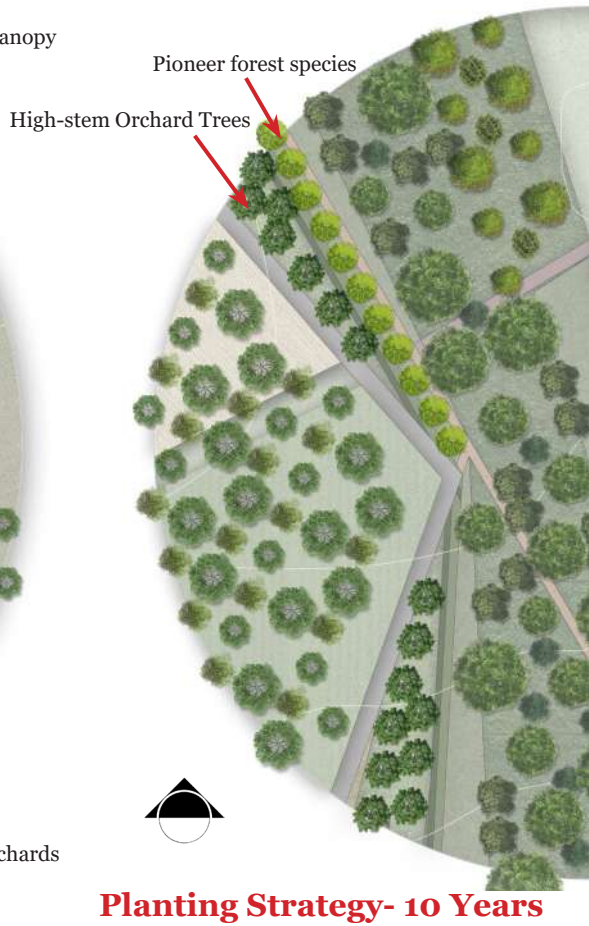
Planting Gradients- 5 years, 10 years and 20 years

Enhance planting variation and yields by combining various species



Planting Strategy- 5 Years

Gradually shifting to a Polycultural multi-lay



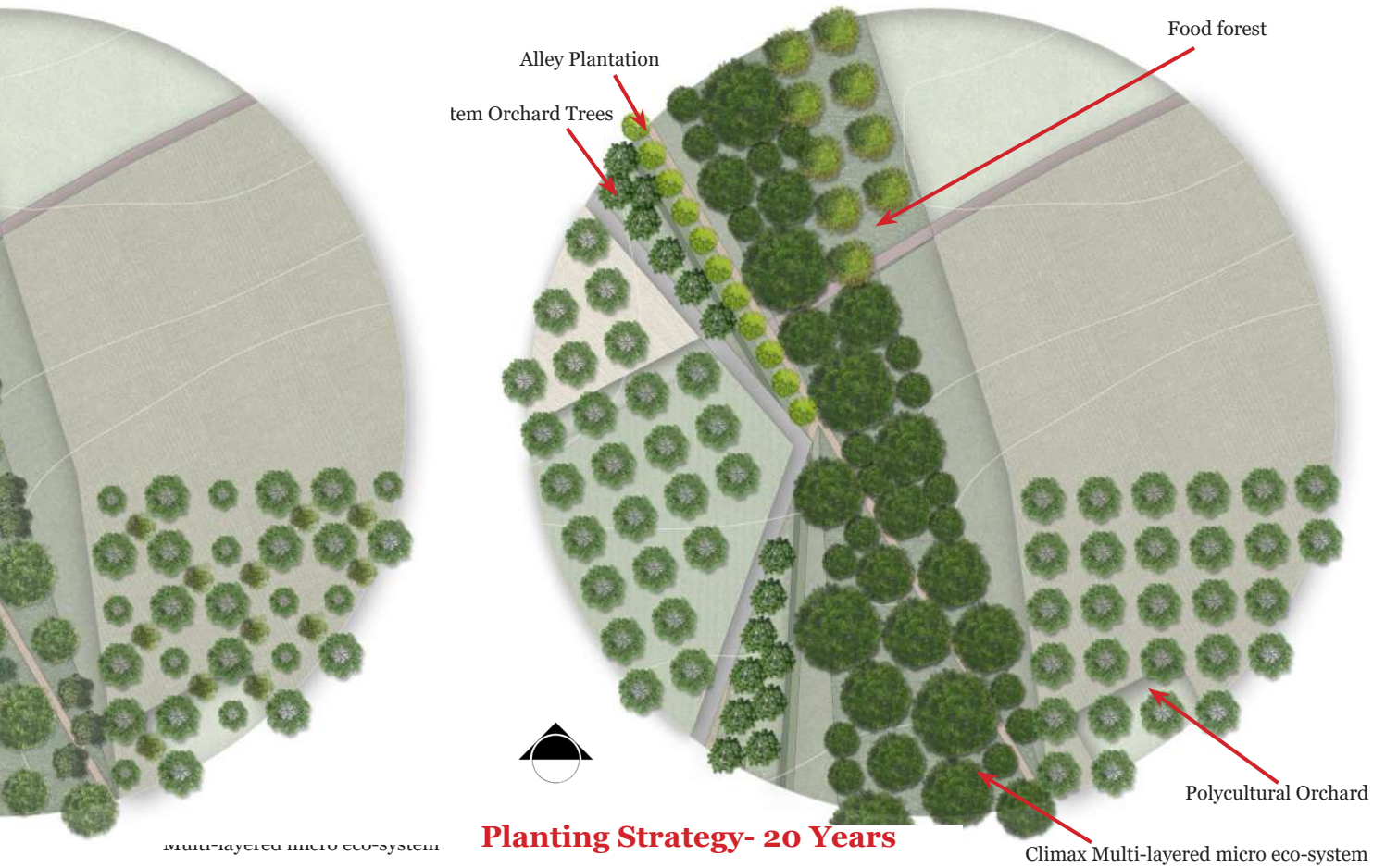
Planting Strategy- 10 Years

The planting strategy to achieve maximum yield is spread along the span of 20 years. As discussed earlier there are various layers of planting gradients prevalent while transiting from a farmland to a climax forest.

In the first 5 years there are different species planted to define a single orchard. This is done to increase the yield as they act as the first point of recovery for the farmer. Areas which are imagined to function as forests are firstly planted with nitrate fixating pioneer species along with pioneer forest species. Areas functioning as food forests are initially planted with dwarf orchard trees and ground covers.

vered yield by using chop and drop

Climax stage achieved by stablizing planting gradients thus achieving maximum crop variation



Planting Strategy- 20 Years

At the mark of 10 years the orchards are thinned and there is a layer of understory shrubs and berry plants which are planted to give the orchard a polycultural character. The nitrate fixating trees are cut down giving room for the forest species to grow and form their micro eco-systems. The food forests form a stable eco-system by gradually merging into the forests completing the plant gradient.

At 20 years all the planting systems are stable and at full blossom. The orchards provide a substantial crop variation for the farmers and thus contribute in enhancing the farmer's economy. These orchards also provide a definite crop safety. The forests are stable housing various ecology and starts functioning as a stepping stone. The food forests enhance community interaction and also provide food for the farmers and the nearby neighborhood's.

Analyze Site conditions

↓

Formulate soil enrichment

↓

Prioritize the living systems (Trees)

↓

Define a permanent nursery- Permaculture Nursery

↓

Define a layer of Perennial Vegetables

↓

Include Nitrogen fixing plants

↓

Select plant species which attract biodiversity

↓

Understory layer of mushrooms

↓

Include livestock occupancy

Permaculture Plantation Toolkit

Ideal Planting scheme (Gradients of Permaculture Plantation)
The planting scheme is consistent of 7 varied layers:

1. Canopy Layer (Over story)
2. Understory Layer
3. Shrub Layer
4. Herbaceous Layer
5. Vine Layer
6. Ground cover Layer
7. Root Layer
8. Mycelium Layer

Canopy Layer
Full size plants= Nut trees, Fruit Trees and Nitrogen fixating trees
Example: Walnut, Chestnut

Understory Layer
Shade tolerant and semi-dwarf fruit trees
Example: Apple, Pear and Mulberry

Shrub Layer
Example: Blueberries, raspberries, rose, bamboo and currant

Herb Layer
Non-woody vegetation
Example: Parsley, Thyme, dill, mint, chive
Plants: Tomato, Pepper, Collards, Okra

Ground Cover Layer
Example: Clover, Nasturtium, Strawberries

Vine Layer
Examples: Grapes, Kiwis, Passion Flower
Climbers: Honeysuckle, roses, clematis

Root Layer
Example: Potatoes, Jerusalem artichokes, turmeric, carrots, garlic, onions, radish, licorice

Shared Cultivation- Community Yields

The illustration depicts the functioning of a shared cultivation structure. As seen in the illustration this entity usually has a lot of human interaction taking place within it. The primary owners of this shared typology are the farmers so as seen in the illustration there are people harvesting fruits and vegetables, sharing the yields amongst themselves creating a healthy production environment.

Arable farming under a canopy

The above illustration shows a frame through the core of the commons. The farmlands shown in the distance show how the farmlands merge into these interconnected meshes of commons structure. There are series of movement patterns introduced within them i.e. walking paths and forest trails. There frame shows the human interaction taking place within the surrounding ecology.

Permaculture Farming- Polycultural crop yield

The illustration shows a scene through a permaculture farm. As seen the lady is harvesting yields from a varied spread of crops. The frame also shows the correct method of planting crops inside a permaculture farm. There are various layers of interdependent crops which support each other and all grow together in complete harmony. The topography looks aesthetic along with being functional.

By the people, for the people and with the people

The illustration shows the seamless harmony between production and leisure. This illustration depicts a frame through the food forests. The food forests over and above providing a stable yield are also imagined to be spaces which offer ample human interaction, where they can be involved in the process of harvesting and also provide a platform for various activities bringing humans and nature closer.

5 STAGE METHOD TO TRANSFORM A SINGLE FARM

Stage 1: **Imagination**

Stage 2: **Partnership**

Stage 3: **Adaptation**

Stage 4: **Outreach**

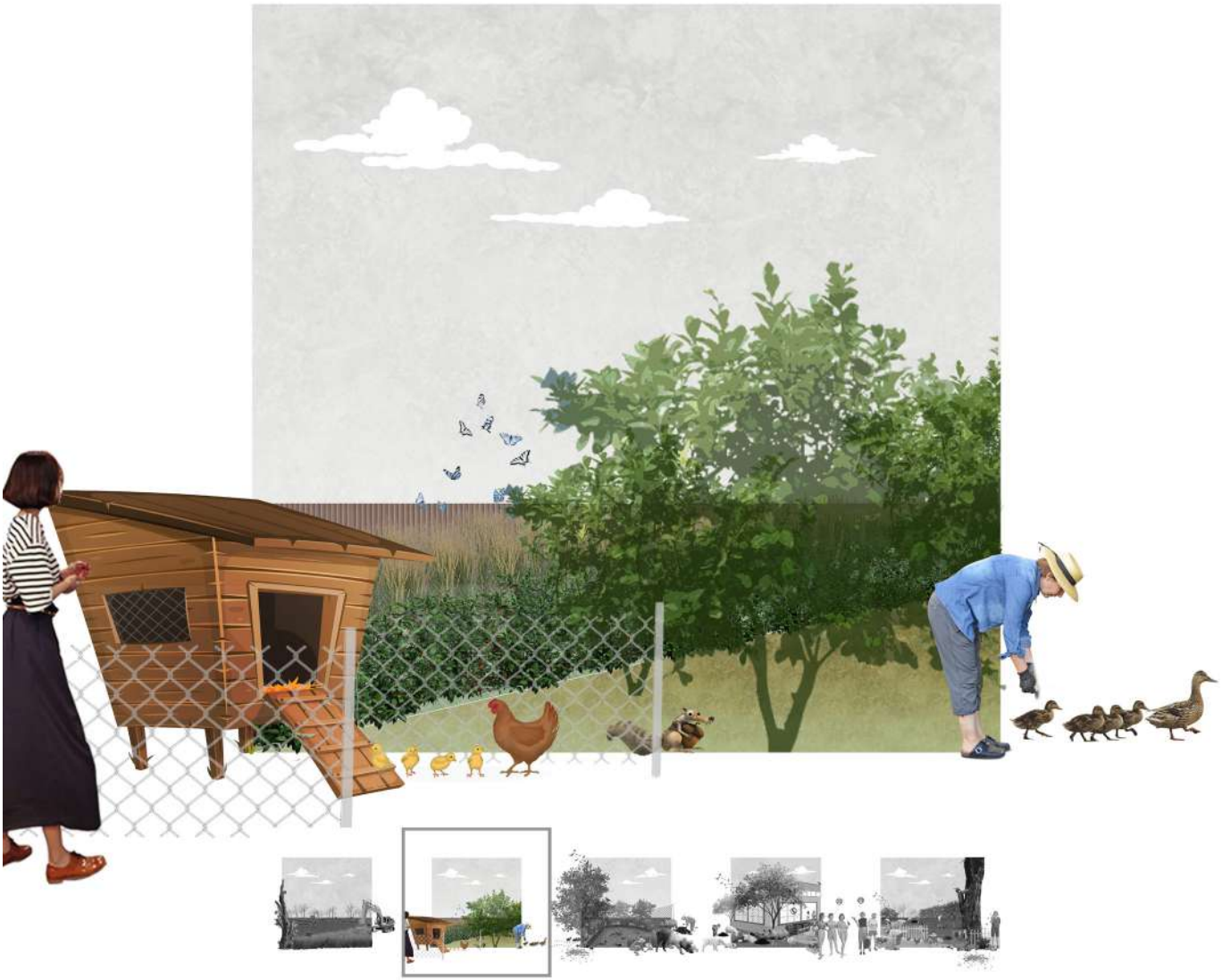
Stage 5: **Problem Solving**

Stage-1: Imagination

The first step is the more critical step. It demands you to take a decision of what is it that you want from the site. This step if fueled by keen observation and evaluation of the existing resources available. It also demands you to identify the elements worth holding onto and those which can be replaced. Once identified it's time to clear out the un-necessary elements making room for change.

Stage- 2: Partnership

At this stage the farm needs to be introduced to partner agents like chickens, ducks etc. They act as the first stage of intervention in the ecological regeneration process. Ducks help is the de-weeding process by clearing out plants while the chickens eat the insects and pests on the damaged crop. This is also the stage where you re-plant orchards and provide a stable cover crop layer to regenerate soil conditions.



Stage 3- Adaptation

At this stage the orchards and plantations have stabilized and are generating a yield. These yields often attract a lot of fauna providing feeding grounds for birds, insects etc. The micro eco-system is becoming richer and more diverse. Introduce pigs in this layer. They trample the soil making it more porous, help in lining the ponds and water bodies and also provide constant source of manure.

Stage 4: Outreach

Let people know what you are doing. Educate them of the benefits it has. Start selling the pesticides free yields in local markets. These products shall be sold for a premium value and shall generate a continuous source of revenue. Invite people to come and learn and indulge in this method of farming. This also creates an increased potential for employment. Lead by example.

Stage 5: Problem Solving

There shall be problems along the way, but the solution also lies within the system. Use all the elements of the eco-system effectively. If a problem arises solve it using natural resources. Always experiment, try things. The entire eco-system is interdependent on each other, if a particular aspect of this system exhausts, re-supply them so that the balance within the system is restored.

7.

REFLECTION

REFLECTION

This chapter talks about the learnings, findings and limitations of Permaculture as a process used to derive a design solution. The first distinct observation made is the fact that Permaculture as a system is a very open ended entity which portrays a blurred start and end point, which implies there is no one definite place to start. This process is embedded within a larger eco-system continuously changing and adapting to the surroundings.

The second observation is that the process of permaculture is usually applied to small controlled scale, in usual cases an individual farm or a small piece of land. Translating this system onto a larger scales meant that I needed to follow a bottom-up system of designing from part to whole. The envisioned result almost functioned as a puzzle where each piece has a specific place and function and in the end what we got was the whole picture which was made up using these array of smaller pictures. The easiest solution is to define all the parameters of the end product up-front and work yourself in reverse solving all the smaller pieces which are woven together to achieve this perfect state of landscape harmony.

The proposed idea of introducing a network of commons which thrive off community involvement has definite agendas chalked out. The first and most important agenda is community based farming. These shared cultivation areas are for the benefits of the locals who work in-sync to define, maintain and cultivate these areas. As the ownership is solely with the farmers each individual farmers develops a sense of ownership and the mindset of sharing creates a healthy environment of production and distribution. The second agenda is to use these commons structure and create smaller food production and distribution chains. This helps keeping the flow of production local making the small scale farmer an important threshold in the production chain, providing money and motivating other small scales farmers to switch to this method of production for their crop yield. The shared cultivation network follows and promotes the slogan “Think Global but act Local”.

As mentioned the existence of this shared cultivating areas is possible when neighboring farmers dedicate a fixed percentage of their land, clear it off the existing planted crops and invest in these shared entities. Reduction of crop yield doesn’t seem like a very convincing idea and for that reasons the proposed solution is to replace the existing crop in the area with multi-species orchard trees which act as cash crops in recovering the yield numbers targeted by the farmers. They provide an added layer of varied crops which increase the diversity of production and provide a sense of crop safety.

The land ownership of these lands still remain with the farmers as they are the primary agents who are targeted to be benefiting from these structures. As these common structures are multi-layered polycultural systems they address to more than just production. The presence of ground covers, shrubs, orchards and pioneer forest species also attracts a lot of ecology. They help stabilizing the ecological thresholds of the area and also function as a definite stepping stone for ecology connecting to the larger Natural reserves. They form their own micro eco-systems which are all connected throughout the common networks thus answering the question of working with nature. These systems help replenishing and regenerating the existing ecology and nature rather than degrading it. They use nature as a tool to enhance and define the functions within.

In conclusion these common structures are the answer to the posted research question and problem statements.

What is the role of a landscape framework in providing a more self-sustainable and resilient farming network to promote/en-vision new production methods to mitigate these negative side-effects of productions and formulate synergies and a coherent design strategy which is in charge for the shift in production network, ecology, society and space in Parkstad, Limburg?

Keywords: Self-sustainable farming, resilient farming networks, production, ecology, space and society.

As mentioned in the keywords the commons networks are Self-sustaining, resilient, nature inclusive and community based cultivation entities. Lastly these permacultural shared cultivating areas work as a policy which can be adapted and translated to any site just by keeping a few variables constant. They are extremely adaptable and robust networks which can be embedded into any region, scale and place.

Permaculture is a process which belongs to a bigger system. Each layer of this system has definite rules and processes taking place. Use those rules as synergies while starting the process and project the targeted end state while benefiting from each of these micro, self-dependent integrated systems.

Coming from the sub-continent of India I am very curious to translate this system in that setting where the farming scales are much more extreme and the amount of people dependent on this system are almost tripled. In such adverse conditions this farming policy seems to be the logical and educated shift needed to address these massive food demands and in the process give back to nature by creating a resilient farming environment.

8.

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