

An aerial architectural sketch of a rural landscape, likely the Binnenveld region. The drawing shows a network of roads and paths crisscrossing a field of green and yellow agricultural plots. There are several small buildings, possibly farmhouses or agricultural structures, scattered throughout the landscape. A river or canal flows through the lower-left portion of the sketch. The overall style is a hand-drawn architectural rendering with a focus on land use and infrastructure.

# AGRICULTURAL PARK IN THE BINNENVELD

Identifying the possible implementation of a multi-functional agricultural park in the Binnenveld.

# ABSTRACT

In the Netherlands the agricultural sector is for a big part export-oriented. Not only does this export-oriented mass production result in high greenhouse gas emissions, it also contributes to negative externalities affecting the functioning of local landscape. Furthermore, urban expansion is major threat to the permanence of farmland.

The Binnenveld is an agricultural area surrounded by the cities of Wageningen, Ede and Veenendaal. A design for a new agricultural park of the Binnenveld, to facilitate a necessary transition of the agricultural sector, is needed. Due to a newly developed agricultural park, new local networks and markets can emerge, resulting in more local-oriented food production. The connection between the urban and rural domain can strengthen, which increases the value of farmland and the amount of revenue streams a farm has. This makes farmland more dynamic and viable. This coexistence of the rural and urban domain will be enforced by amplifying ecosystem services.

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Submitted on 02-06-2021

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# PREFACE

Dear reader,

Before you lies the result of eight weeks of work on my BSc thesis in landscape architecture. The last three years, I have gone through a personal development. My creative skills have improved enormously, both analogue and digital. I also gained a lot of knowledge about different landscape types in the Netherlands and the successful completion of a design process.

As I am born and raised in the countryside (the Achterhoek), most of the people close to me have a conservative view on agriculture. For instance, I have had very heated discussions with my family on the current nitrogen problem in the Netherlands. The reason I chose this topic emanates from the discord I have with home. I wanted to understand the current issues of the agricultural sector better and come up with a potential solution. A designer's outlook should be positive. It is our job to look for chances where others see problems.

I would like to thank Matti Wirth for his expertise and support. He has helped me to create a coherent and legible report. I hope you enjoy reading this report, as it was a pleasure to create it.

Sincerely,

Arnaud Jansen

# 1. INTRODUCTION

## 1 PROBLEM STATEMENT

### Export-Oriented Mass Production

The Netherlands is the second largest exporter of food in the world. To showcase the impact export-oriented mass production has on the landscape, the area used for food production is mentioned instead of the quantity of food produced. Only the food produced on 800.000 hectare out of the 1.82 million hectare of farmland in the Netherlands is consumed in the Netherlands (CLO, 2020). At a first glimpse this does not seem to be a problem. The Netherlands is feeding the world. However, to suffice the food consumption of the Netherlands, the Dutch import food produced on 2.6 million hectares (Figure 3). A striking example is Dutch beef cows being transported to Italy and Spain, while the Netherlands imports Argentinean meat. As food is transported over long distances the carbon footprint increases. As most consumers do not have the knowledge of where their food comes from and how it is produced, it is important to involve them in a transparent 'food narrative' (Potteiger, 2013). To curtail the carbon footprint, the food network should change towards a local network in which the consumers are also more aware of the narrative of the food they consume. This can lead to a more sustainable food system.

### Negative externalities

Consequently, this export-oriented mass production is the cause of major negative externalities on local

scale. The Binnenveld, located between the cities of Wageningen, Veenendaal and Ede, suffers from issues related to farming with an export-oriented business model (Figure 1 & 2). These negative externalities affect both nature and farmland. In the Binnenveld, a nature area is located east of the Grift. This nature area has two sites designated as Natura 2000, entailing that they are protected by European law. Intensive livestock farming makes up most of the areal of the Binnenveld and is a major cause of the following negative externalities:

- **Drought** due to a too efficient drainage system.
- **Acidification of the soil** due to a decrease in seepage.
- **Excessive inflow of nutrients** due to intensive farming.

Local nature protection or extensification is not enough to tackle these issues. A revision of the landscape is necessary as local civilian organisation 'Mooi Wageningen' states that the current policies of the provinces of Utrecht and Gelderland do not meet the criteria to decrease the impact negative externalities have on the on the Natura 2000 sites in the Binnenveld (Vereniging Mooi Wageningen, 2021).



Figure 1: The location of the Binnenveld within the Netherlands. Adapted from (Google, 2020)

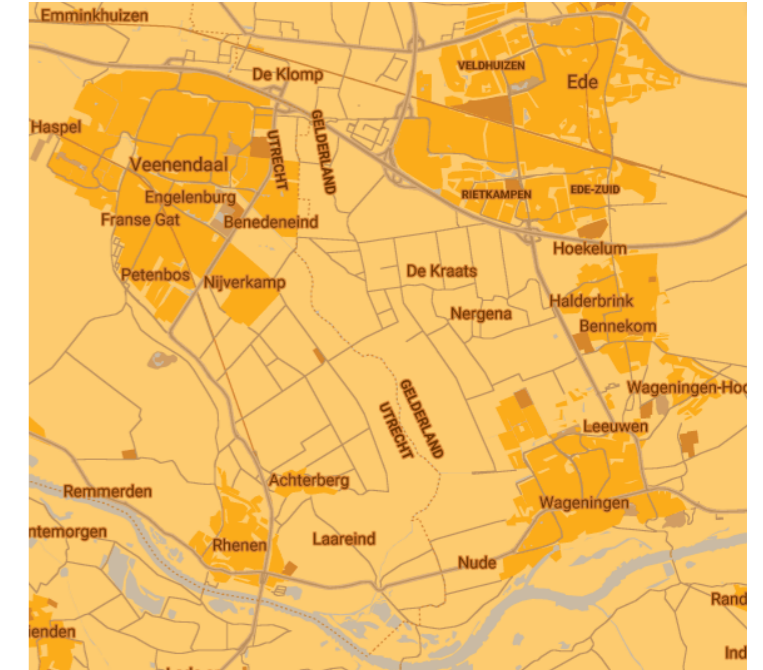


Figure 2: The location of the Binnenveld surrounded by the cities of Veenendaal, Ede, Bennekom and Wageningen. Adapted from (Google, 2020)

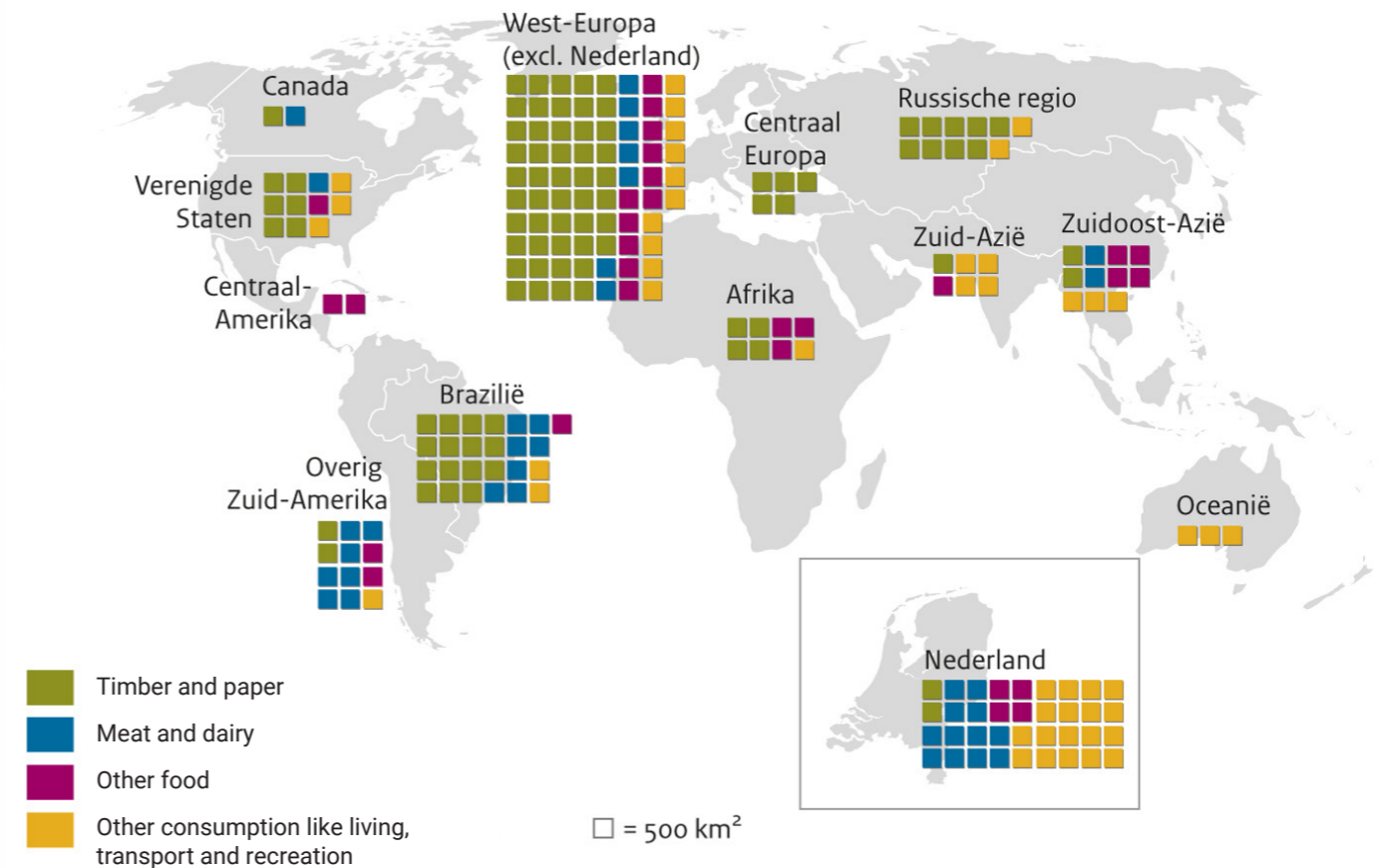


Figure 3: Global land use for the production of products for Dutch consumption, 2017. Retrieved from (CLO, 2020)

## Urban expansion

During recent decades, a still ongoing process of urbanisation is taking place in western Europe. The Binnenveld is under constant pressure of expanding surrounding cities. This growth pattern not only entails land being taken in a quantitative way, but also the emergence of low density and dispersed urban settlements (Figure 4). Due to this development, the classical distinction between the urban and rural domain has faded. This calls for a new approach in spatial planning and politics in which the urban and rural domain are intertwined. This peri-urban agriculture zone is neither rural nor urban (Allen, 2010; OECD, 2009; Fanfani, 2019).

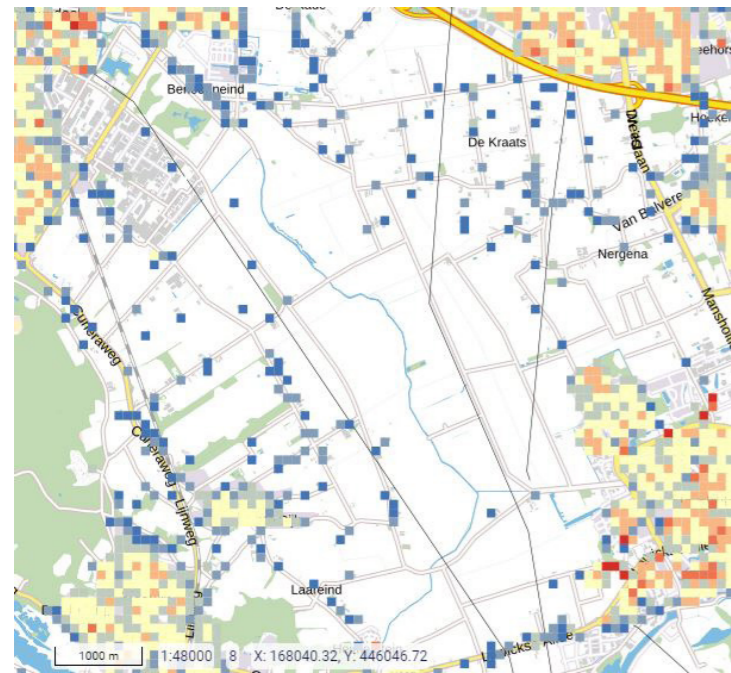


Figure 4: Population density, 2018. Retrieved from (Pdok, 2018)

## Agricultural Park

An agricultural park is a concept that fits the purpose of a peri-urban agriculture zone. This purpose ranges from local food production, recreation and education to heritage and environmental aims (Lohrberg, 2019). Montasell (1996, p. 40) defined the concept of agricultural park as '...a confined open space which purpose is to ease and to ensure the farmland exploitation continuity, protecting it from its embodiment in the urban process, promoting specific programs that allows for the development of its natural environment and socio-cultural economic potential and to protect the natural patrimony of surrounding areas.' A transition towards an agricultural park can give an area the opportunity to establish new local economies and networks at the urban-rural interface (EESC, 2004; Fanfani, 2019). This lays the foundation for an agricultural park to tackle issues related to export-oriented mass production and urban expansion by respectively involving people in the food narrative and protecting farmland. An agricultural park, however, cannot tackle the issues by itself.

## Ecosystem Services

An integral approach, in which policy makers realise that people in their daily lives depend on various services ecosystems provide, is needed. Dialogue on town and country relationships gained momentum as, awareness is growing for the relevance of multiple and mutual relationships between the urban and surrounding rural domain (Hidding et al., 2000; Van Leuven, 2010). The Ecosystem services the rural domain provides (e.g. micro-climate control, carbon capture, storm water retention, pollination, forage, natural combat against pesticides and diseases, renewable energy sources, recreation, etc.) will benefit the urban domain. This can support the protection and permanence of farmland and agricultural activities (EESC, 2004; Fanfani, 2019).

## 2 THESIS STATEMENT

### Objective

The objective of this research and design is to play a significant role in the development of Agricultural Parks by using the Binnenveld as a prototype. The Binnenveld could be a starting point for many similar regions to implement an Agricultural Park. This will be done by conducting a design-led investigation to shift the Binnenveld from a weak and threatened agricultural area, to an enhanced and viable multi-functional and socio-economic activity, suitable to provide healthy food and other key services for local urban areas.

### Design Question

**How can the transition from agricultural area into an agricultural park in the Binnenveld contribute to an enhanced and viable multi-functional and socio-economic activity, suitable to provide healthy food and other key services for local urban areas?**

In order to design an Agricultural Park in the Binnenveld, one needs to know more about to what extent the Binnenveld could contribute to a change from export-oriented production towards self-sufficiency-oriented production. Business models for farms have to become more transparent and oriented towards a local market. One should also consider what ecosystem services to amplify and thus support the protection and permanence of farmland and agricultural activities.

This produces three sub-research questions:

**1. To what extent can the surrounding cities of the Binnenveld be self-sufficient in terms of their food supply?**

For which the answers to the following questions are required:

- *How much food does the region consume?*
- *How much food can the Binnenveld produce?*

**2. Which ecosystem services will be in focus for designing an agricultural park in the Binnenveld?**

For which the answers to the following questions are required:

- *What ecosystem services strengthen the Binnenveld?*
- *How can these ecosystem services be amplified?*

**3. What business models for farms will do well in line with the view of an agricultural park?**

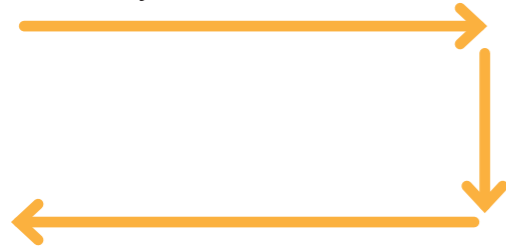
For which the answers to the following questions are required:

- *What business models for farms are possible in line with an agricultural park?*
- *Where and how can these business models be applied?*

# 2. METHODS & MATERIALS

## Chapter 3

First a literature analysis is made on the key concepts of an agricultural park and ecosystem services. As the ecosystem services are to generic to be design guidelines, extra design criteria have been developed to evaluate the design. The landscape analysis of the area will not be covered as a separate chapter. It makes more sense to cover the different landscape entities while going through the research questions and design process, because this fits the story better.



## Chapters 5 & 6

Now the research questions have been answered, by going through an iterative process of research and design, it is time to start designing the agricultural park in the Binnenveld. This will be done by designing the northern part of the Binnenveld. This location has been chosen as it is relatively densely populated making it the perfect site for an agricultural park. The method used is research through design. This method generates new knowledge by understanding the current state and then suggesting an improved future state in by making a design. 'It involves deep reflection in iteratively understanding the people, problem, and context around a situation that researchers feel they can improve' (Zimmerman and Forlizzi, 2014).

Research question

Methods & materials

Challenges

## Chapter 4.1

### 1. To what extent can the surrounding cities of the Binnenveld be self-sufficient in terms of their food supply?

- How much food does the region consume?
- How much food can the Binnenveld produce?

First of all, we need to know how much food the region consumes. This will be based on a **literature study** on the average Dutch diet and on **data** on the amount of residents in the region of the Binnenveld. The amount of food the Binnenveld can produce will be based on a **literature study** and **data** on the average yields or produce per year in the Netherlands. To compare it with the current situation a land use analysis will be made based on **map data**.

Based on this data an estimate can be made to what extent the surrounding cities of the Binnenveld can be self-sufficient in their food supply.

The biggest challenge is that the data on the average yields or produce per year, does not take into account soil types and other regional conditions. Another challenge is taking into account the shifting diet of the Dutch.

## Chapter 4.2

### 2. Which ecosystem services will be in focus for designing an agricultural park in the Binnenveld?

- What ecosystem services strengthen the Binnenveld?
- How can these ecosystem services be amplified?

First of all, a **literature study** will need to be done on what different ecosystem services there are. Furthermore, a landscape analysis of the current situation will be made using **map data** and **fieldwork**. When comparing the ecosystem services to the landscape analysis, various options will be depicted.

The next step will be assessing how these ecosystem services can be amplified using interventions in the landscape. This is a case of **research through design**.

The biggest challenge will be assessing which ecosystem services can serve a major role in strengthening the connection of the urban and rural domain. In addition, it will be a challenge discovering how these ecosystem services can be amplified.

## Chapter 4.3

### 3. What business models for farms will do well in line with the view of an agricultural park?

- What business models for farms are possible in line with an agricultural park?
- Where and how can these business models be applied?

In order to answer this question a **literature study** has been done on different business models that sort with the concept of an agricultural park. Furthermore, a landscape analysis of the current situation has been made using **map data** and **fieldwork**.

The best implementation of the business models will be explored by assigning different spatial concepts to the business models in preliminary designs. These preliminary designs will then be assessed, resulting into a final conclusion. This is a case of **research through design**.

The challenge lies in combining different functions of the landscape (e.g. ecological connectivity, recreation, education, etc.) with the business models. An even bigger challenge is combining the different preliminary designs into one.

In chapter 5, the spatial concept of the design is developed. Different options are combined into one final spatial concept. In chapter 6, the design will be further elaborated by going through different design options. These will then be evaluated by the design criteria (Figure 5).

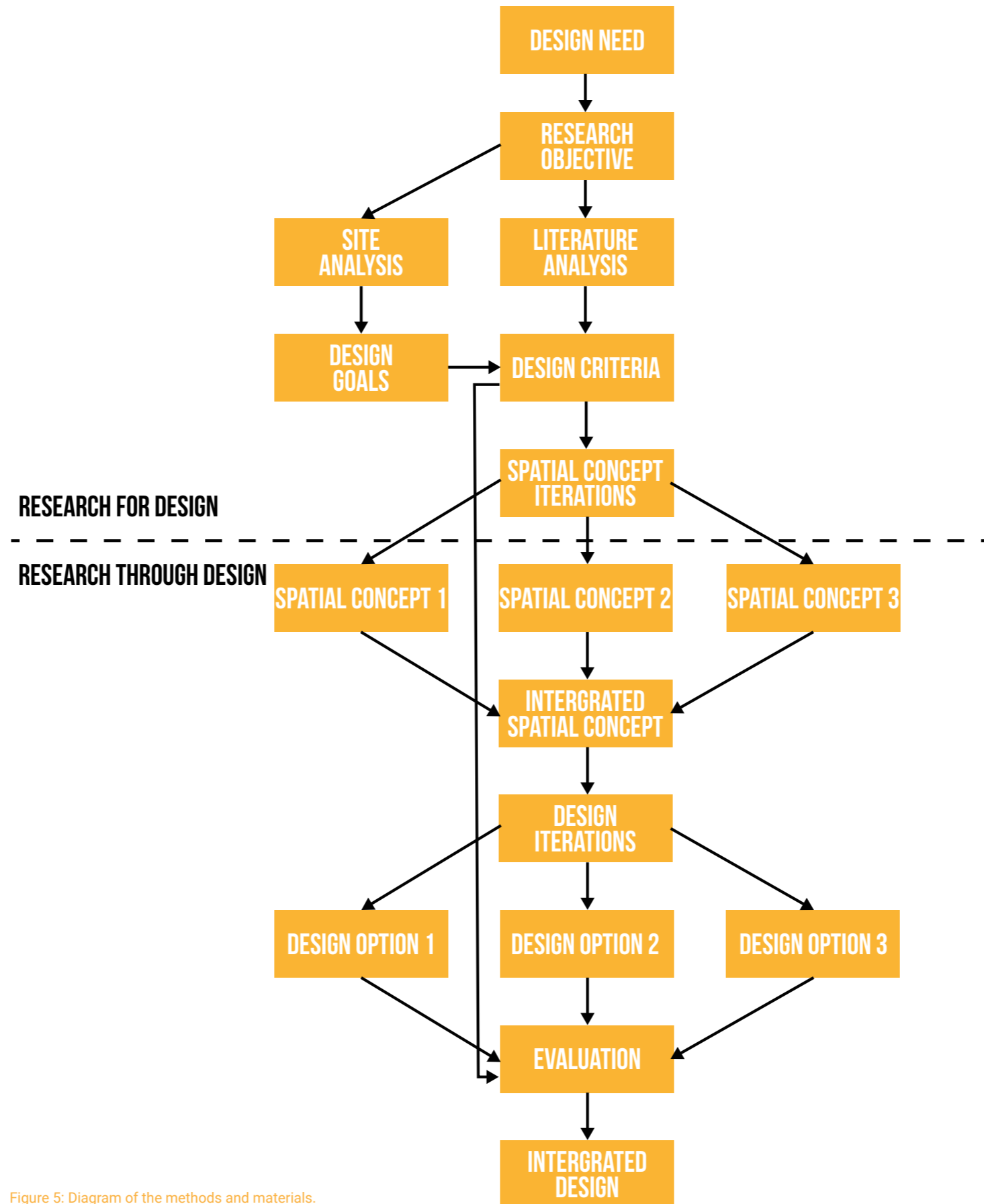


Figure 5: Diagram of the methods and materials.

# 3. LITERATURE ANALYSIS

## 1 KEY CONCEPTS

### Agricultural Park

In the introduction was mentioned that urban expansion is a main threat to the agricultural areas near expanding settlements. The growth pattern not only entails land being taken in a quantitative way, but also the emergence of low density and dispersed urban settlements. This calls for a new approach in planning that intertwines the urban and rural domain: the peri-urban agriculture zone (Fanfani, 2019). This also implies for the agricultural area of the Binnenveld.

An agricultural park can be conceived as a transitional zone of the urban and rural domain, as it is crossed by flows, practices and relationships (Allen, 2003; Gallent et al., 2006; Fanfani, 2019) and has the purpose ranging from local food production, recreation and education to heritage and environmental aims (Lohrberg, 2019). The main goal of an agricultural park is to shift from a weak and threatened agricultural area, to an enhanced and viable multi-functional and socio-economic activity, suitable to provide healthy food and other key services for local urban areas (Zazo Moratalla, 2015; Fanfani, 2019). The EESC (2004) argues there are three main key goals to successfully realise this goal:

- The need for protective land use policies at different levels to counteract rising land prices.
- The need to improve citizen awareness about

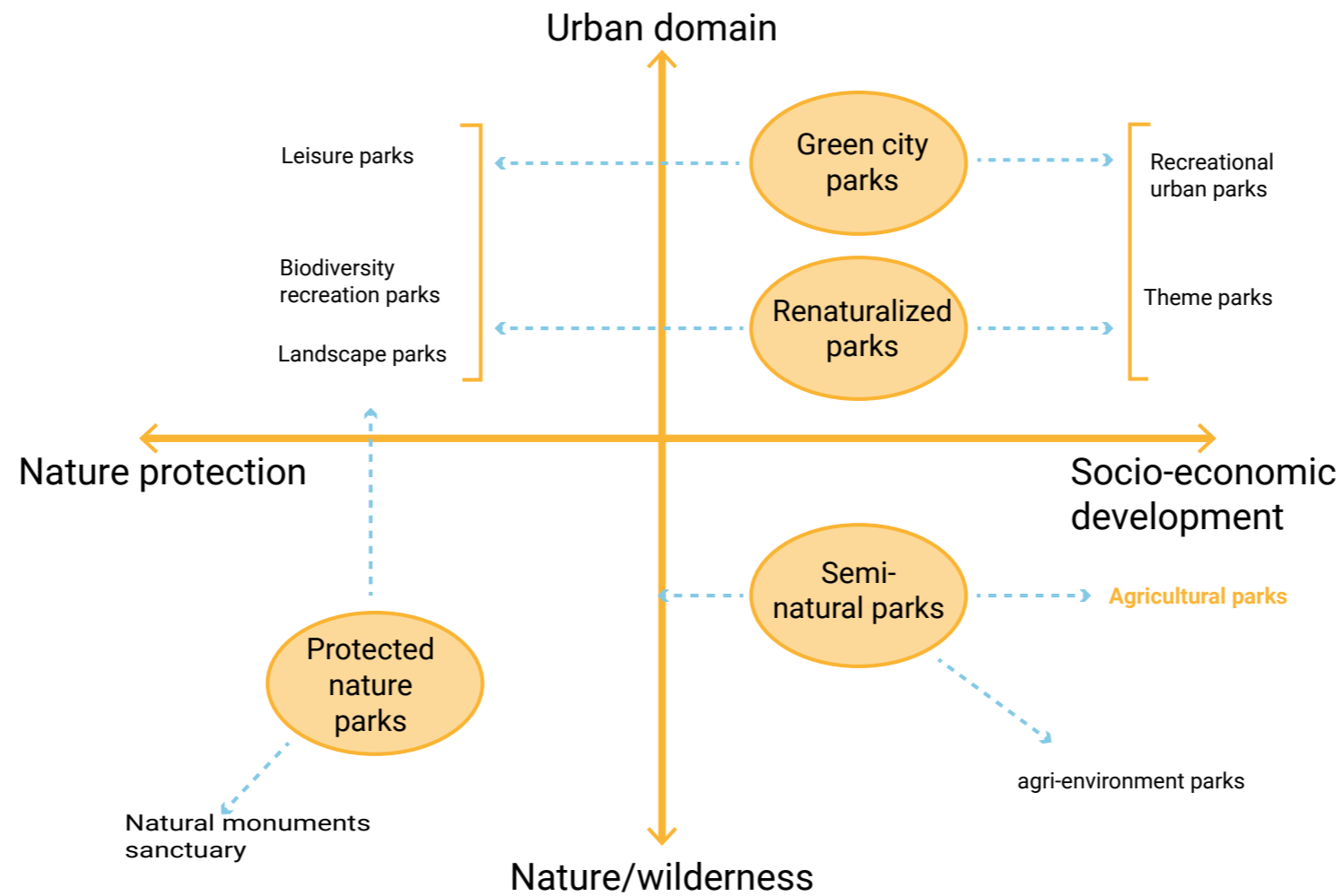


Figure 6: Concept diagram of peri-urban park typologies according to the 4 typologies identified by the Interreg IVc Programm (Fanfani-Peri-urban Parks Project-Interreg IVc, 2012)

the fragility of the area and thus the importance of peri-urban agriculture.

- The need to develop a dynamic and viable peri-urban agricultural system.

The concept of an agricultural park is related to ecosystem services, business models for farms and a self-sufficient local food market, as they can contribute to meeting these three main key goals.

### Peri-urban park typologies

The Interreg IVc Programm “Periurban Parks” created operation methodology for peri-urban green spaces and how to manage and protect their biodiversity. The framework divides peri-urban parks in 4 typologies (figure 6). In the concept diagram you can clearly see the transition from the rural domain (nature/wilderness) to the urban domain on the vertical axis. The agricultural area in

the Binnenveld can be defined as the semi natural park and the Natura 2000 areas as a protected nature park.

### Tackling current issues

A transition towards an agricultural park can give an area the opportunity to recuperate its settlement metabolism and landscape amenities, and trigger the formation of new local economies and networks at the urban-rural interface (EESC, 2004; AA. VV, 2010; Terres and Villes, 2008; FAO, 2015; Fanfani, 2019). The latter is important as local networks and economies lay the foundation for an agricultural park to tackle issues related to export-oriented mass production. Currently, a lot of food is imported and exported. Food produced in the Netherlands on only 800.000 hectare out of the 1.82 million hectare is consumed in the Netherlands (CLO, 2020). By involving people in the food narrative, they become more aware of the impact export-oriented mass production has on the environment and thus more conscious in buying local products.

In addition, agricultural parks could tackle the issue of urban expansion. A good network between farmers and policy makers, stimulate farmers to invest in their business, making the agricultural sector more viable (Lohrberg, 2019). This can be further stimulated by making farmland protection policies.



## Ecosystem Services

In the past, policy makers focused mostly on mitigating the impact of resource harvesting (e.g. farming, mining, etc.) or allocating areas for nature protection to increase biodiversity. Policy makers will have to break this boundary between mitigation and protection. We need an integral approach in which policy makers realise that people in their daily lives depend on various services ecosystems provide. These ecosystem services play a key role in achieving development goals (Figure 7) (Ranganathan, et al., 2008). Also, in peri-urban agricultural areas like the Binnenveld.

### Human well-being

Dialogue on town and country relationships gained momentum as, awareness is growing for the relevance of multiple and mutual relationships between the urban and surrounding rural domain (Hidding et al., 2000; Van Leuven, 2010). The Millennium Ecosystem Assessment framework (2005) emphasizes on the dependence of people and how ecosystem services support development goals by stressing the importance of human well-being. The framework lists five components of well-being:

- **Basic material for an adequate life:** good livelihood, sufficient food, shelter, etc.
- **Health:** Feeling well, access to clean water and air.



Figure 7: The Relationship between Development and Ecosystem Services. Derived from (Ranganathan, et al., 2008)

- **Social relations:** adequate network for social cohesion, mutual respect.
- **Security:** (personal feeling of safety, safety from natural disasters.
- **Freedom of choice and action:** ability to control what an individual values doing or being.

As the Netherlands is quite secure from natural disasters and goverend with the value of equality, we will only focus on the first three.

### Types of ecosystem services

To increase the well-being of people by amplifying ecosystem services, we first need to analyse the different types of ecosystem services. The Millennium Ecosystem Assessment framework (2005) identified four types based on 24 ecosystem services:

- **Provisioning:** harvesting of resources (e.g. food, fresh water, timber, fuel, etc.)
- **Regulating:** regulates negative externalities via natural processes (e.g. climate regulation, disease regulation, water purification, etc.)
- **Cultural:** (e.g. recreation, spirituality, aesthetics, educational, etc.)
- **Supporting:** underlying processes (nutrient cycling, soil formation, primary production, etc.)

These four types of ecosystem services extend the focus of decisions beyond only provisioning services. Ecosystems are frequently altered to increase the supply of provisioning services (e.g. when forests are cleared for cropland). This often results in a decrease in capacity of these ecosystems to provide regulating and cultural services (Ranganathan, et al., 2008).

### Tackling current issues

The Ecosystem services the rural domain provides will beneficiate the urban domain and thus support the protection and permanence of farmland and agricultural activities. If the right balance can be found between the urban and rural domain, the agricultural park will not only provide a pleasant environment, but could also develop new local economies (EESC, 2004; Fanfani, 2019). This way ecosystem services can play a major role in tackling issues related to export-oriented mass production and urban expansion.

## 2 DESIGN CRITERIA

The ecosystem services are a tool to reinforce the concept of an agricultural park. They are, however, too generic to evaluate the design. Therefore, more applied design criteria were developed.

The most important function of an agricultural park is the primary production of food. However, society increasingly expects the agricultural sector to become more multi-functional and contribute to social services and nature development (van Huylenbroeck et al., 2007). This trend calls for new design criteria.

Bernd Pölling et al., (2017) developed various indicators of urban farming. Although these indicators are developed for urban farming, they can be transferred to fit the purpose of an agricultural park. In line with the four different purposes of an agricultural park defined by Lohrberg (2019), Pölling assigns these indicators to four benefits of urban farming:

- Economic benefits
- Social benefits
- Environmental benefits
- Cultural heritage

For the purpose of this report, I altered and simplified these benefits slightly so they are more adjusted to the location of the Binnenveld. The benefits are the following:

- Agricultural benefits
- Social benefits
- Nature benefits

Four different criteria (partially based on Pölling's indicators) are assigned to these benefits (Figure 8). The indicators will be assessed during the design process in a qualitative way. Also, the design criteria 'amenity value' has been added as I deem it to be very important.

### Agricultural benefits

#### High production value & amount of paid jobs

By generating turnover, profit and jobs in the agricultural sector, the sector becomes more viable and thus stands a better chance to hold back urban expansion (Pölling et al., 2017).

#### Self-sufficiency

Self-sufficiency of the region of the Binnenveld helps to tackle export-oriented mass production. Both in terms of income and labour.

#### Agrobiodiversity

Provides attractive sceneries for recreation (Pölling et al., 2017), but most importantly it provides stability, adaptability and resilience to the agricultural sector (FAO, 2011).

### Social benefits

#### Social services & amount of non-paid jobs

Social services are often stressed when talking about multi-functionality. Social services entails: recreation and leisure, sports and care farming for disadvantaged people (Pölling et al., 2017).

#### Educational services

As children are more distant to agriculture than before, children become more unaware of how their food is grown (BNF, 2013). It is important to educate this on site. Educational services could also be oriented towards adults.

#### Involvement of civilians in the food narrative

When civilians are more involved in the food narrative, they can make better informed choices in their food consumption (Potteiger, 2013).

### Nature benefits

#### Biodiversity & connection of nature

A higher biodiversity contributes to a greater resilience of the ecosystem. This is important, not only for leisure, but also to forestall the loss of key species necessary for maintaining the ecosystem services. The connection of nature patches makes sure populations are more resilient to disturbances due to gene flow between populations.

#### Limit eutrophication

Limiting eutrophication gives vulnerable nature types a chance to sustain or even flourish. This increases the biodiversity.

#### Public edible green amenities

Public edible green amenities make people connect with nature. Also, these amenities can be a hiding place for animals.

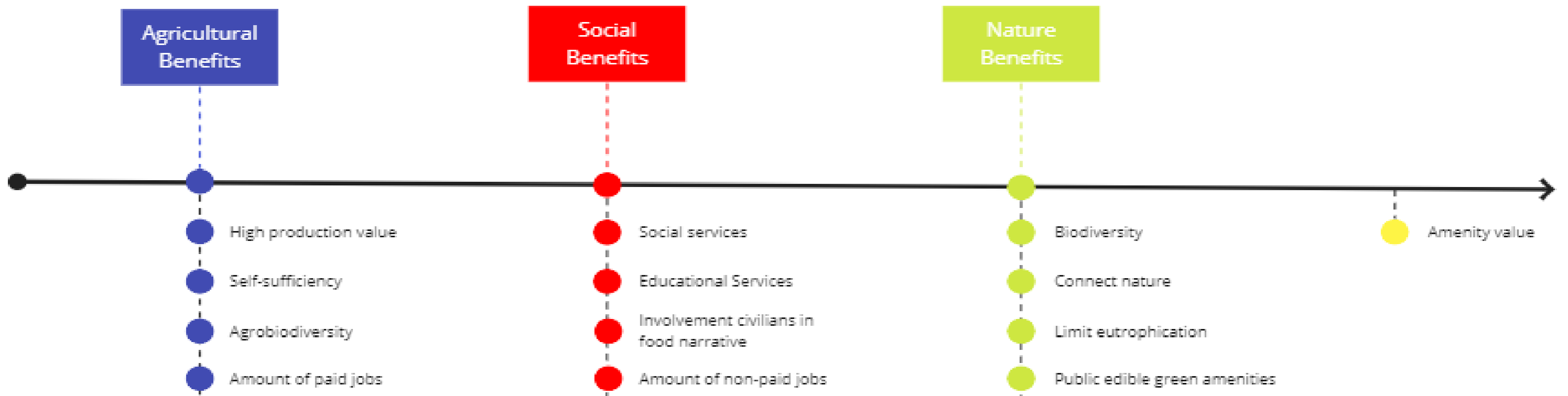


Figure 8: Design criteria assigned to the three benefits of an agricultural park.

# 4. RESEARCH FOR DESIGN

## 1 SELF-SUFFICIENCY

The Netherlands is the second largest exporter of food in the world. Almost 60% of the Dutch agricultural area is used for export-oriented production (CLO, 2020). As a result, negative externalities affect the local functioning of landscapes and higher quantities of greenhouse gases are emitted during transport. Besides reducing greenhouse gas emissions, a transition towards a local food market will decrease the effect of negative externalities caused by this export-oriented mass production.

This produces the following research question:

**To what extent can the surrounding cities of the Binnenveld be self-sufficient in terms of their food supply?**

- How much food does the region consume?
- How much food can the Binnenveld produce?

### Consumption of the region

The region of the Binnenveld is defined to the municipalities of Veenendaal, Rhenen, Wageningen and the cities of Ede and Bennekom. As the municipality of Ede stretches far to the east, the demographics of only the cities Ede and Bennekom were ought to be more viable to represent a local scale. Together the region counts 217,514 inhabitants.

The amount of food that the inhabitants of the region of the Binnenveld consume is based on

the average diet in the Netherlands in 2010 (PBL, 2014) and the average yields or produce per year of organically grown products (De Vries & Fleuren, 2015). For one person to be fully sufficient on food supply, you need 415 m<sup>2</sup> per year for production. This includes the areal of land needed to produce forage for all cattle except pigs, as it is assumed that these are mainly fed on leftovers from other crops. Also, the average yields of crops are based on farming on cropland and not in greenhouses. The region of the Binnenveld thus consumes food produced on 9.020 hectare of land.

### Production in the Binnenveld

The total agricultural area of the Binnenveld is about 2700 hectare. This means it could produce food for around 65.000 people. This means that about 30% of the local inhabitants can be self-sufficient on food supply from the Binnenveld. As the Binnenveld is not the only agricultural area neighbouring these cities, the region might achieve a 100% self-sufficiency, however further research on this is necessary. Keep in mind that this scenario does not take into account soil types and the suitability of the region to reflect the production of an average Dutch diet. In Figure 9 you can see the crops produced on every plot of land in 2018. This does not reflect the average Dutch diet (Figure 10 a,b). The scenario also did not take into account a change in diet.

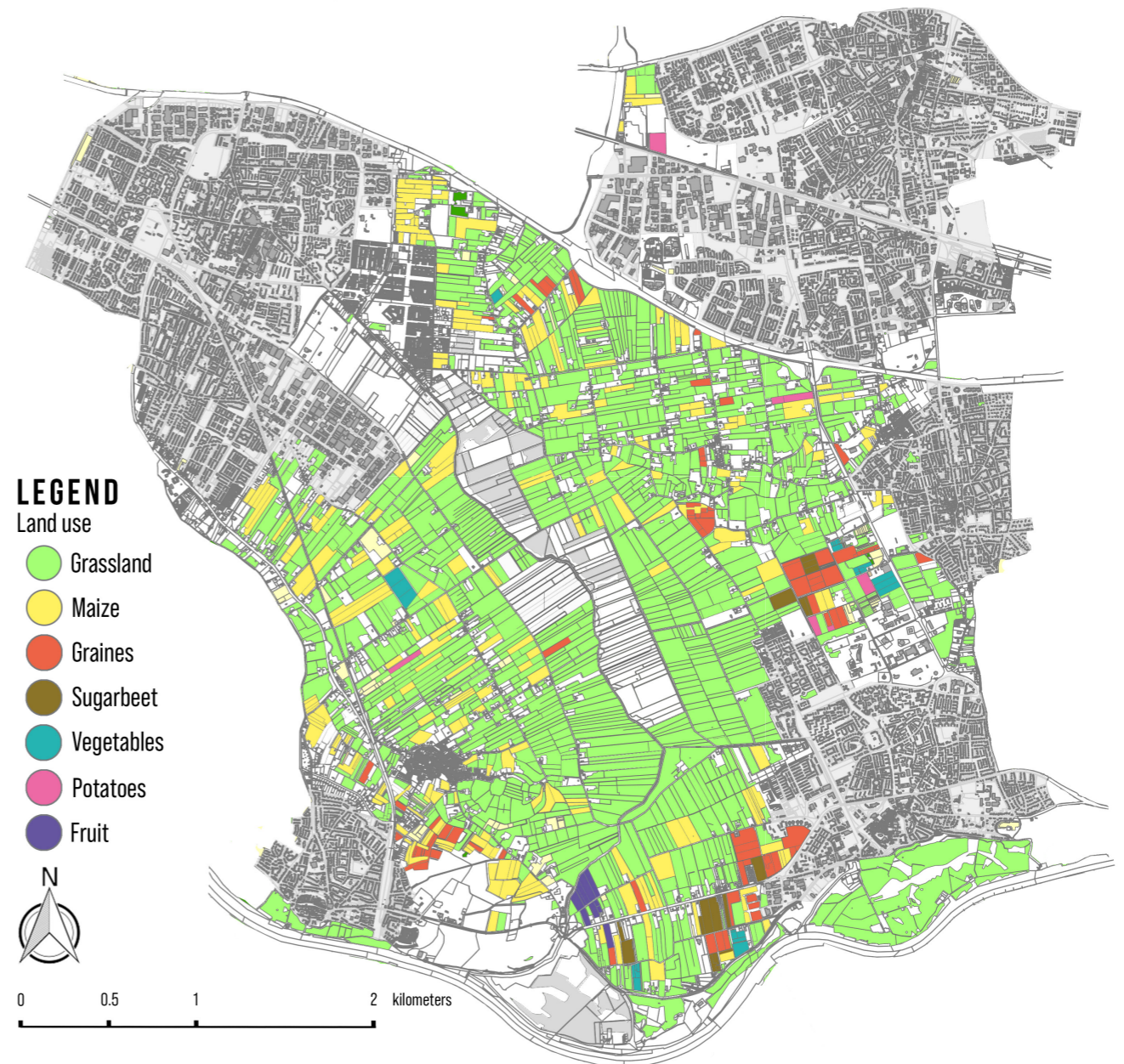


Figure 9: Division of crop areal (2018)

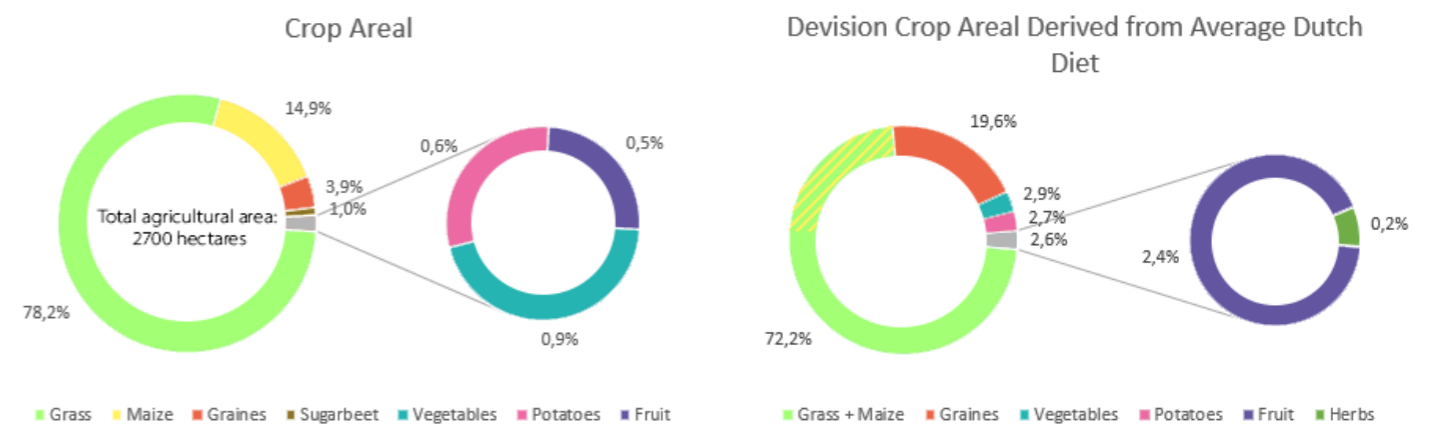


Figure 10: a) division of crop areal (2018).

b) Ideal crop areal division derived from average Dutch diet.

## 2 ECOSYSTEM SERVICES

To improve the self-sufficiency of the Binnenveld, ecosystem services can be used as a tool to increase the quantity of food harvested from the area. In the past, policy makers focused mostly on provisioning ecosystem services (e.g. food production, fuel, timber, fiber, etc.) and mitigating the impact of resource harvesting. When policy makers focus more on regulating and cultural ecosystem services, the agricultural park can function better in terms of food production, but also leisure and the involvement of consumers in the food narrative. Instead of combining these services for efficient production of food, policy makers created a hard boundary between them, allocating separate areas for nature protection and biodiversity. By using an integral approach, ecosystem services can be used to create a more viable and dynamic agricultural sector in the Binnenveld (Ranganathan, et al., 2008).

This produces the following research question:

**Which ecosystem services will be in focus for designing an agricultural park in the Binnenveld?**

*What ecosystem services strengthen the Binnenveld?  
How can these ecosystem services be amplified?*

To answer this research question, eight different typologies of ecosystem services were developed. These services all have a focus on at least one component of human well-being: Basic material for an adequate life, health or social

relations. Globally will be discussed to which type of ecosystem service they belong (supporting, provisioning, regulating or cultural) and how these services can be amplified to benefit the urban domain.

### Supporting services

#### Recycling waste flows

Ecosystems are generally consumed and not produced in urban settings. Recycling waste flows can however create opportunities for the agricultural sector by reducing costs. For example, excessive heat from industrial sites can be used to warm greenhouses (Figure 11) and organic waste can be used as fertilizer or forage for pigs. A way to amplify this is by locating greenhouses near industrial sites and improve recycling of organic waste.

### Provisioning services

#### Food supply

Cultivated plants, agricultural produce and livestock are harvested by people for human or animal consumption (Figure 12). This service could be amplified by changing the local land use. For example, orchards could be turned into food forests. Due to the different vertical layers, the average yield can be higher a few years after the forest has been planted. On the other hand, a food forest is more labour intensive, so might be less attractive for farmers (Boulestreau, 2016). Another

option is to commit to (technological) innovation, like greenhouses or vertical farming.

### Nature as forage supply

In the nature area east of the Grift livestock is not allowed. The grass in the area however, does need to be cut every year. Farmers can maintain the nature area and use the hay to feed their livestock (Figure 13). Especially in dry years, this extra forage supply comes in handy. This service can be amplified by subsidising farmers to maintain the nature area. For the Binnenveld this already been realised. Primarily, the ecosystem service gives an extra layer of protection for the nature area.

### Regulating services

#### Climate regulation

Ecosystems regulate the climate in different temporal and spatial scales. On a large temporal scale vegetation segregates CO<sub>2</sub> (when the soil is not disturbed). This process slows down climate change. On a smaller temporal scale, ecosystems regulate air quality either by emitting greenhouse gases or aerosols to the atmosphere or by absorbing greenhouse gases or aerosols from the atmosphere. On a smaller spatial scale ecosystems have a cooling effect on the environment (Ranganathan, et al., 2008). This service can be amplified by changing the land use to forest (Figure 14).

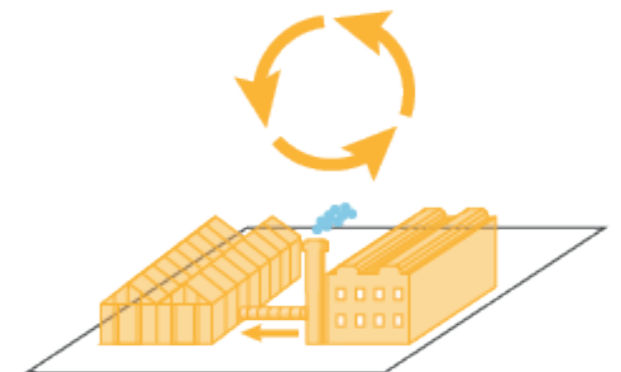


Figure 11: Recycling waste flows

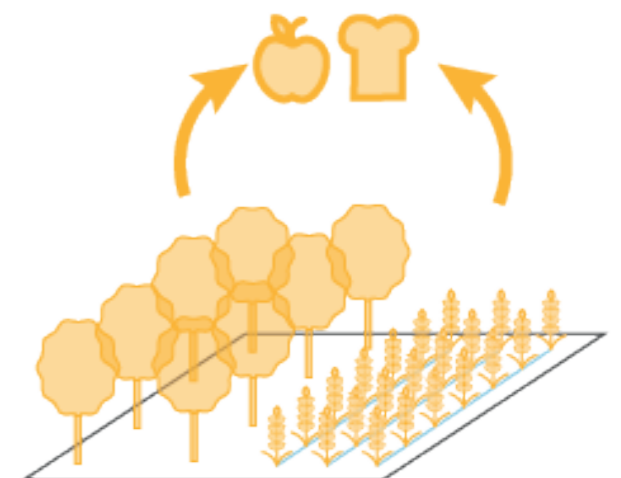


Figure 12: Food supply

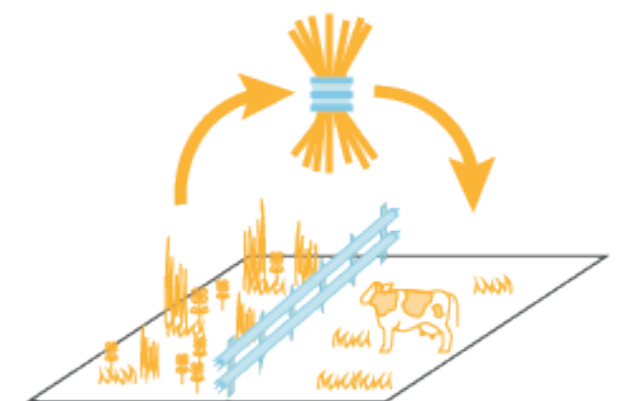


Figure 13: Nature as forage supply

### Pollination for agricultural crops

An increase of pollination by insects can increase the quantity of food that can be harvested from an area. Especially fruits benefit from this ecosystem service. This ecosystem service can be amplified by using less pesticides, constructing beehives near orchards, planting more forest or not mowing green amenities so plants can flower (Figure 15).

### Purification of water by wetlands

Wetlands can purify water as it seeps through the soil (Figure 16). Helophyte species mainly filter out pollutants, but ammonia and phosphorus are also filtered out partially. The latter one would decrease the magnitude of eutrophication in the Natura 2000 areas, making them more viable. This ecosystem service can be amplified by the construction of more wetlands by increasing the groundwater level or the construction of vertical helophyte filters.

### Prevalence on pests and diseases

Ecosystems have an effect on the prevalence of crop and livestock pests and diseases. Predators from nearby forest, such as bats and toads consume crop pests (Figure 17) (Ranganathan, et al., 2008). This ecosystem service can be amplified by planting more forest and constructing toad pools. Also agrobiodiversity helps against fighting pest and diseases as they cannot spread as rapidly. Amplifying this ecosystem could result in a decline of pesticide use.

### Cultural services

#### Aesthetic value and recreation

Ecosystems also provide humans with space to recreate or unwind from the hectic modern society. People derive pleasure from natural or cultivated ecosystems (Figure 18). This ecosystem service can be amplified by creating a network for recreational activities and the promotion of diversified business models for farms. The aesthetic quality can be improved by changing land use or a transition to nature inclusive agriculture.

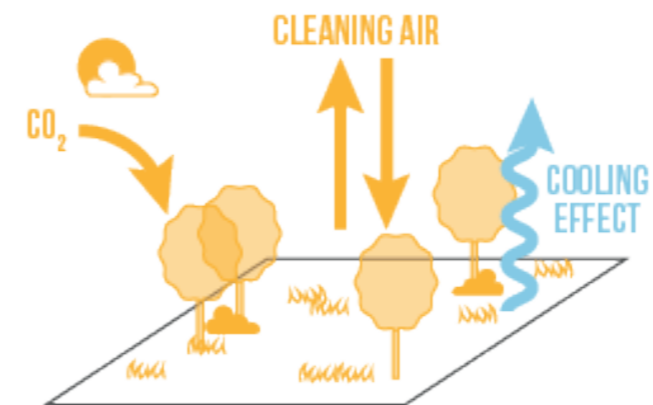


Figure 14: Climate regulation

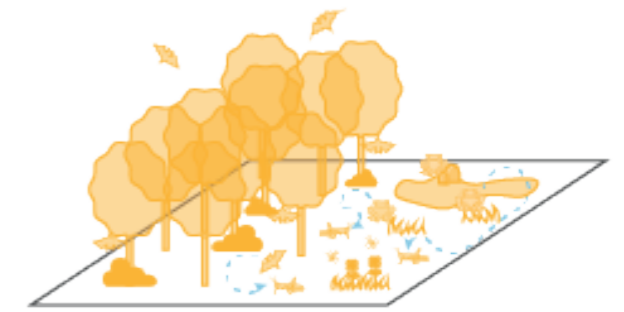


Figure 17: Prevalence on pests and diseases



Figure 15: Pollination for agricultural crops



Figure 18: Aesthetic value and recreation

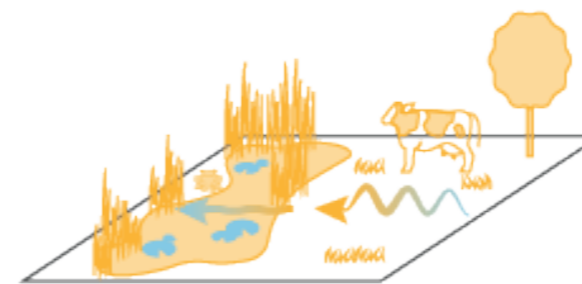


Figure 16: Purification of water by wetlands

### 3 BUSINESS MODELS

Ecosystem services alone, however, are not enough to make an agricultural park. To create a dynamic and viable agricultural area, business models need to be developed in line with the concept of an agricultural park. This produces the following research question:

**What business models for farms will do well in line with the view of an agricultural park?**

- *What business models for farms are possible in line with an agricultural park?*
- *Where and how can these business models be applied?*

Over the last decade Van der Schans, Heding, Liu and Pölling tried to define multiple business models in line with urban farming. Although these business models are developed for urban farming, they can be transferred to fit the purpose of an agricultural park. Overall, their conclusion turned out to be quite similar. The three business (Figure 19) models most of these scientist agree on are:

- Low-cost specialisation
- Differentiation
- Diversification

More business models have been defined in literature, but these three mainly cover the big picture. Moreover, these business models are not mutually exclusive, meaning that farms are not tied

to one individual business model. This one more highlights the multi-functionality of an agricultural park.

**Low-cost specialisation**

Herein, products characteristic for their high production value, high transportation costs, freshness and high perishability (e.g. vegetables, ornamental plants, dairy products, etc.), are produced in close proximity to urban areas. Urban encroachment necessitates higher added values of farmland to keep the agricultural area viable. Examples of low-cost specialist farming are greenhouses or high value recreational activities like horse riding or kindergarten farms. To realise this low-cost strategy, farms can use currently underutilized urban resources like: urban organic waste as compost or urban heat waste.

**Differentiation**

The business model of differentiation is based around the concept of differentiating your product, production process or marketing strategy from other (surrounding) farms. Farms create a unique selling point by farming with exotic species or traditional breeds. A very short supply chain is of key importance to market this unique selling point. Creating a transparent and authentic production process can create a personal producer-consumer relationship, which helps in terms of ‘standing out of the crowd’. The ‘rent-a-field’ concept is good tactic

to create this producer-consumer relationship. In this concept, the farmer rents small parcels (mainly of pre-sown vegetables) to interested local residents for one season. The farmer provides the renters with knowledge, tools and water, but the renters are responsible for the cultivation and the harvest work of the crops.

**Diversification**

The business model of diversification embraces a

variety of commercial services that can be combined with agricultural production. Examples of such agro-tourism are: recreation, sports, gastronomy, education, therapy and caretaking. However, also public services, like nature maintenance, log work or winter road clearance, can be part of the business model. This business model gives farms more revenue streams, making them more dynamic and viable. The ‘rent-a-field’ concept also fits in with diversification.

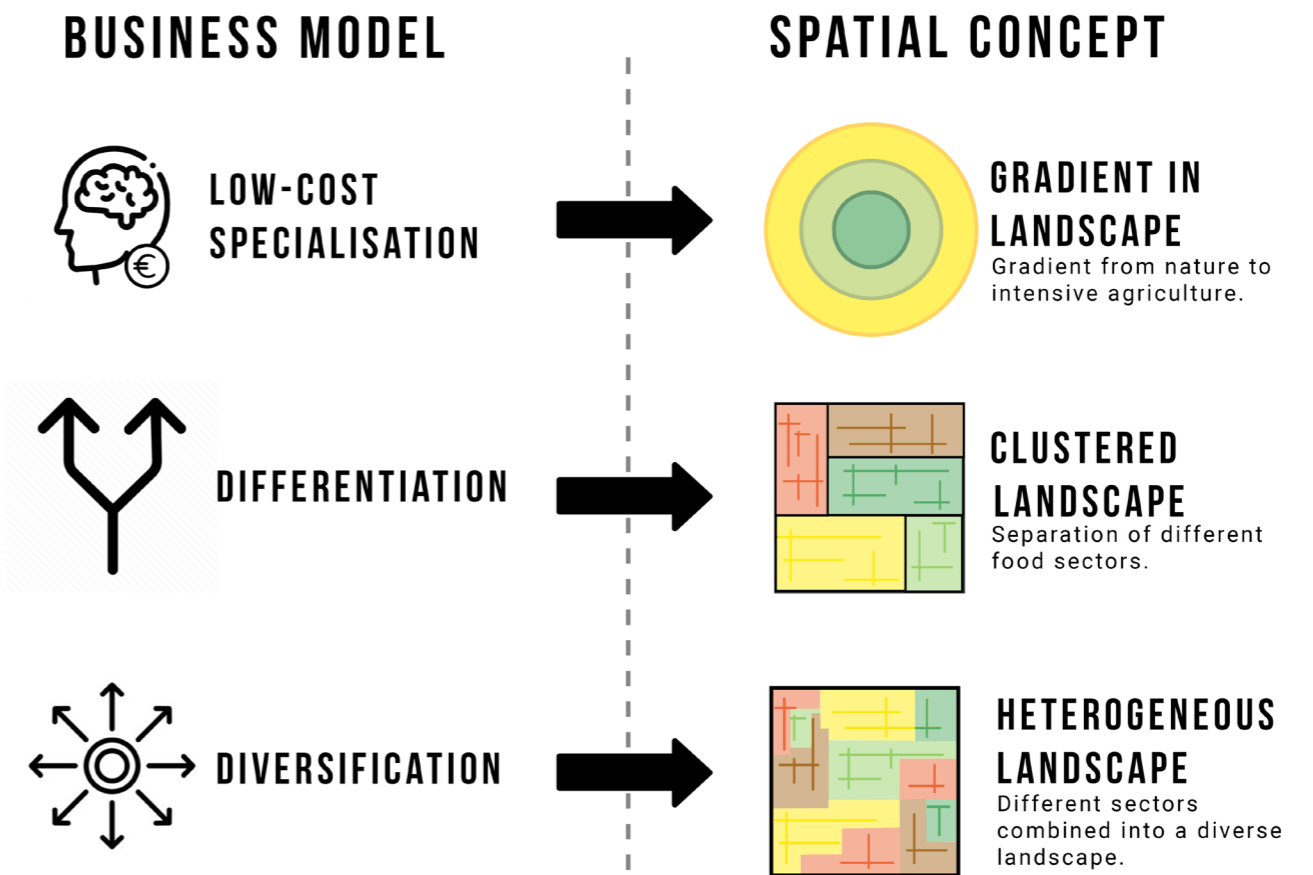


Figure 19: Business models for an agricultural park and their derived spatial concept.

# 5. CREATION OF SPATIAL DIVISION

## Spatial division on a big scale

The river of the Grift functions as the border between the provinces of Utrecht and Gelderland. Due to this, the Binnenveldse Hooilanden were not constructed in the province of Utrecht, west of the Grift. When biking along the Grift, this border between the two provinces can clearly be seen. As the province of Utrecht realises the benefits of the Binnenveldse Hooilanden after they had been realised, they want to extent the nature area west of the Grift. The remaining landscape will make up the agricultural park (Figure 20).

For further design we will focus on the northern part of the Binnenveld. This location has been chosen as it is relatively densely populated making it the perfect site for an agricultural park.

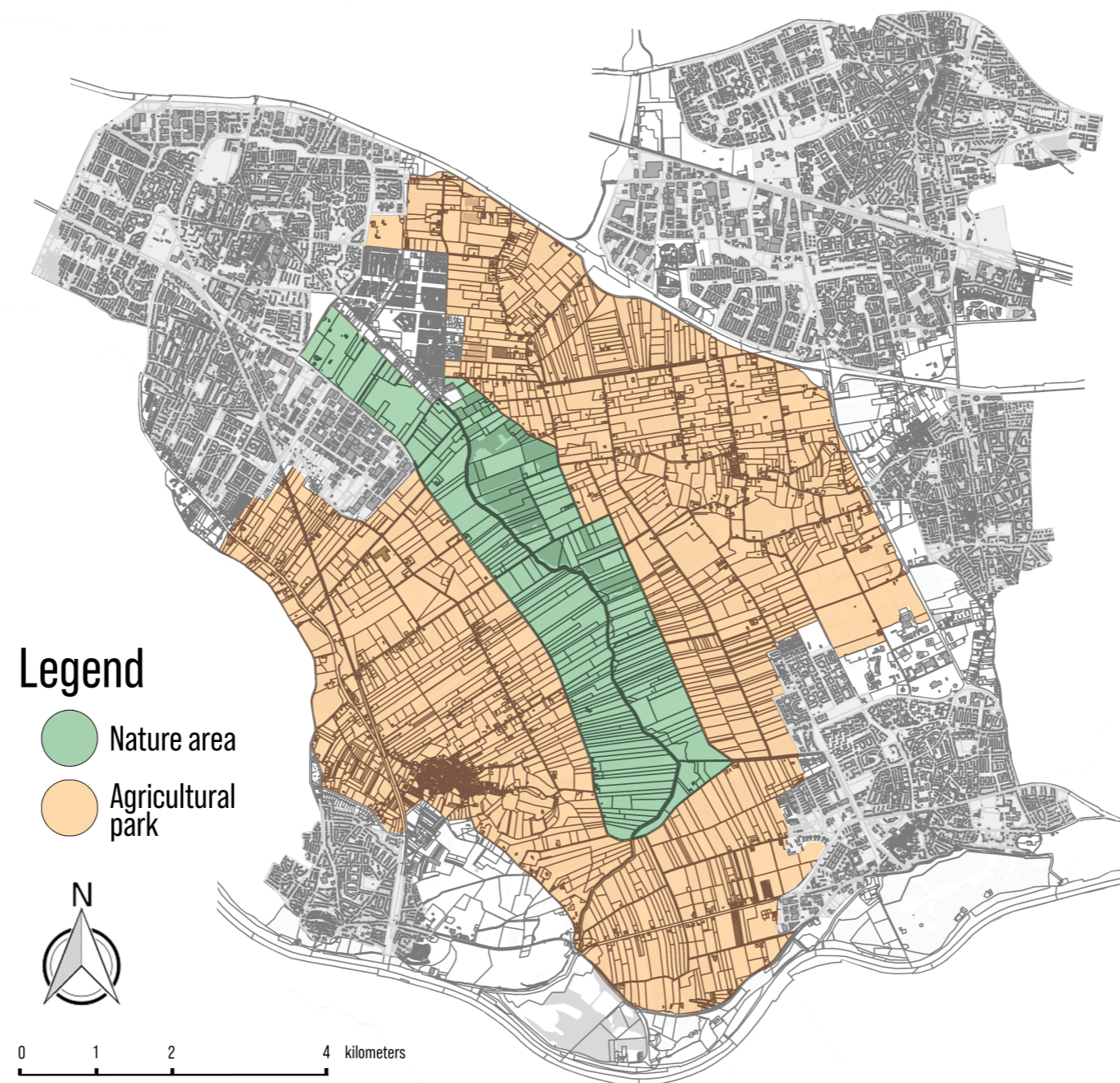


Figure 20: Spatial division of nature area and the agricultural park in the Binnenveld.



## Spatial division of business models

To translate these business models into a design, a spatial concept was derived from each of them (Figure 19 & 20.a,b,c). These spatial concepts show similarities with the global concept of the business models.

The first spatial division, for low-cost specialisation, is a gradient in landscape. The gradient starts with the area in close proximity of the urban domain producing high value products. This then gradually transforms into more extensive farming when approaching the nature area.

The spatial division for differentiation is a clustered landscape. Groups of similar oriented unique selling points (e.g. different crop clusters cultivating different cultivars or different livestock clusters keeping different breeds) are clustered together. This spatial division can highlight the uniqueness of the farms to urban dwellers if communicated well.

The last spatial division, for diversification, is a heterogeneous landscape. The diversity of farms is represented by a diverse landscape. This also increases the amenity value of the landscape, which is in line with the multi-functionality of farms.

## The rationale behind the approach

These spatial concepts might face confrontation by farmers. The issue with these spatial concepts is that you cannot tell a farmer how to farm or by what business model. It is a better idea to combine the three different spatial concepts into one and create a framework for farmers in which they can decide for themselves which pathway to choose for their business. The transition towards an agricultural park needs to be in everybody's best interest. By giving farmers the option between different pathways, a bigger support base can be created.

The three different business models are now spatially allocated (Figure 21.d). Low-cost specialised farms are located at the edge of urban settlements, as that is the location this business model flourishes the most. The remaining area in the Binnenveld is designated for differentiation as the main business model. Diversification of farms can happen in the entire Binnenveld in not restricted to a specific area. This spatial division is rather a guideline for farmers than a strict division. The spatial boundary between low-cost specialisation and differentiation is not a hard boundary.

Co-creation of the agricultural park with farmers is important. This is, because the multi-functionality of the agricultural park is dependent on the different social services and other key services the farms provide.

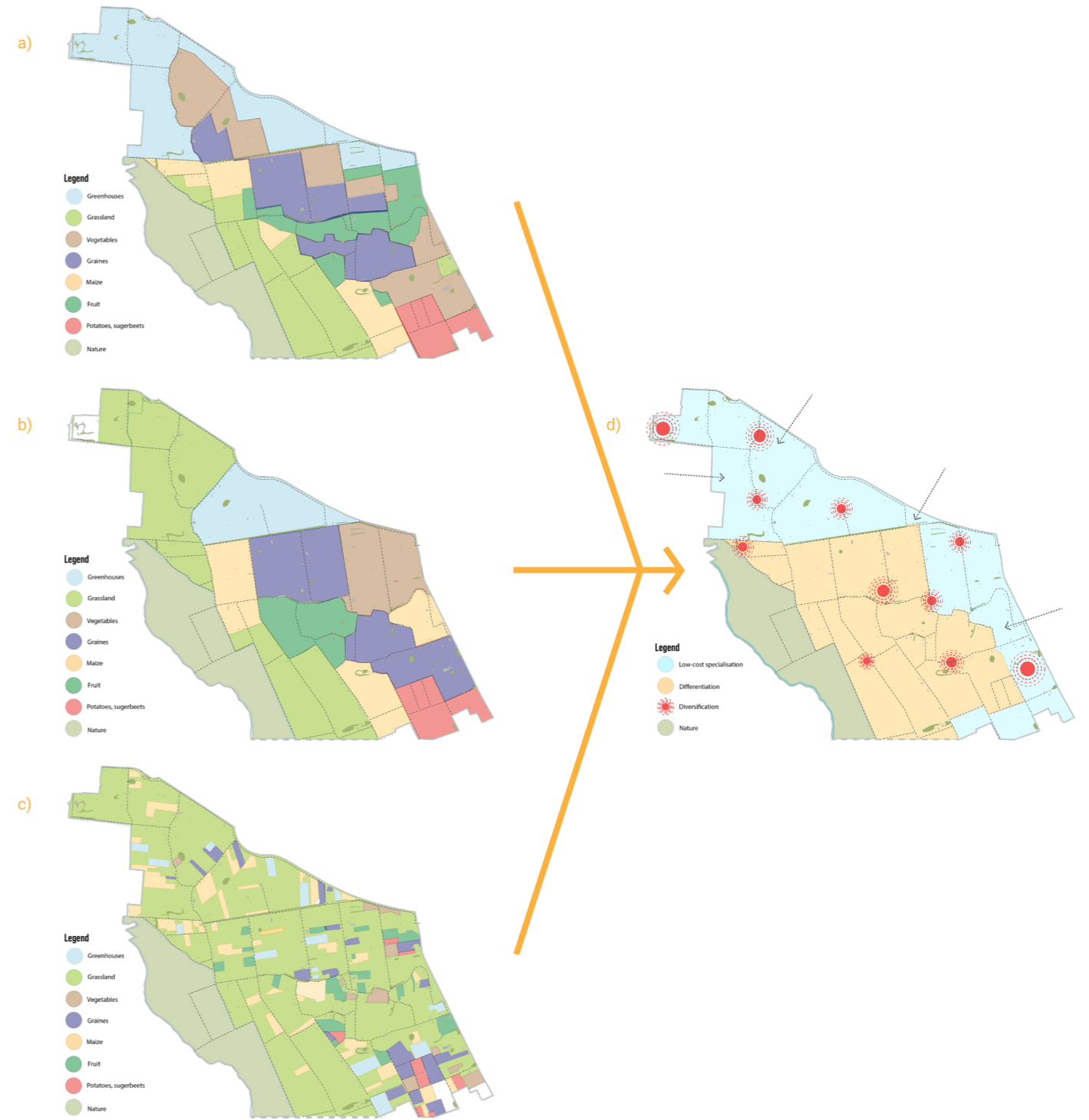


Figure 21: Spatial concepts derived from one specific business model ( a) Low-cost specialisation - gradient in landscape, b) differentiation - clustered landscape, c) Diversification - heterogeneous landscape) combined into d) one spatial division of the different business models. The arrows indicate the utilisation of waste flows.

# 6. DESIGN

With the business models and ecosystem services set, it is time to get into the design of the Binnenveld. During the design process, several considerations had to be made. These considerations will be discussed by comparing them to the design criteria. As the agricultural sector is the most important in the Binnenveld, it will bite the bullet. Then we will look into the nature development as it shapes the landscape drastically. Finally, recreation and leisure will be discussed. This last one does not have multiple design options as the goal is to design a framework of access roads.

## 1 AGRICULTURE

As agriculture is the primary function of the agricultural park in the Binnenveld, it should be the starting point for the design. The design goal for agriculture is to create a more viable and dynamic agricultural sector that connects to the local diet. Two main design options were developed: a soil based clustered landscape and a shattered heterogeneous landscape and these will be qualitatively evaluated by the design criteria: high production value, self-sufficiency, agrobiodiversity, amount of paid jobs and amenity value.

### Clustered landscape

This design option is mainly based on soil type and groundwater levels. During the last ice age, sand dunes (dekzandruggen) were formed, due to a lack of vegetation to keep the soil in place. Also in the northern part of the Binnenveld these dunes were

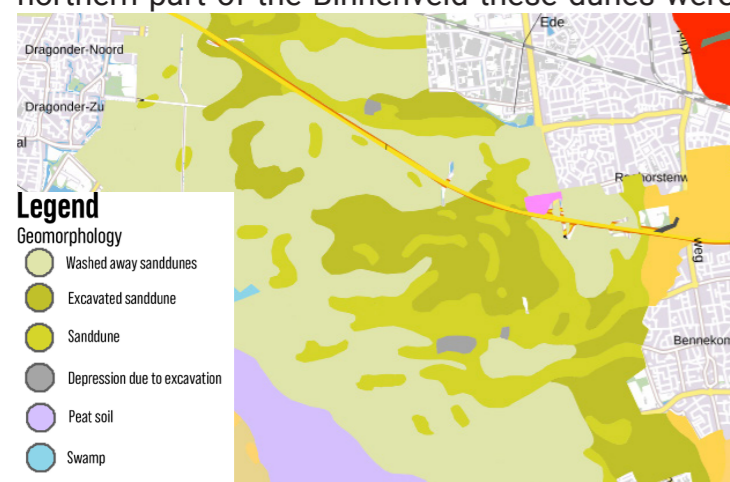


Figure 22: Geomorphology of the Binnenveld. Retrieved from: (Pdok)

formed (Figure 22). Due to the higher elevation of these dunes, the groundwater level is relatively low (Figure 23). This offers land use potential for cropland and orchards/food forests. Food forest might seem to be contradicting to the current open landscape. However, food forests are a great addition to an agricultural park in the Binnenveld because of their multi-functionality, which will be discussed later in this chapter. The remaining lower sandy soils are more suitable for grassland. This division is already partly realised, but the landscape is still quite shattered. Greenhouses will be placed on the edges of the Binnenveld, near the urban domain and the highway A12 south of Eden (Figure 24).

### Shattered landscape

The current landscape of the Binnenveld is relatively shattered in land use (Figure 9). This design option prioritises the current character over soil and

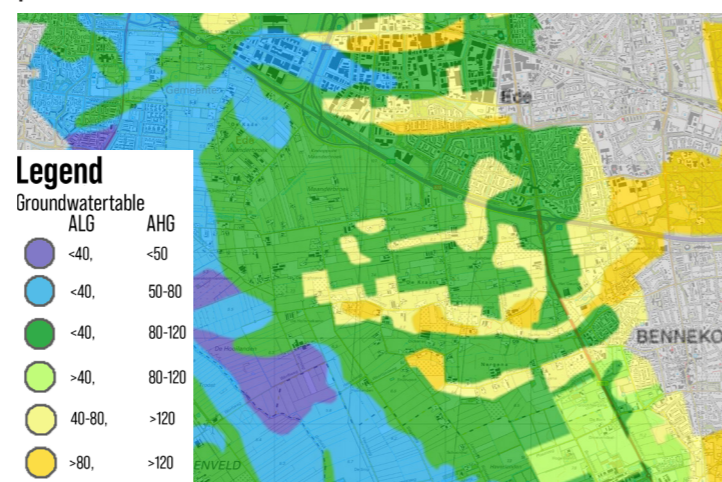


Figure 23: Groundwatertables of the Binnenveld (1964)

hydrological conditions, but these conditions are still of major importance as the operation needs to be feasible. To accentuate this current pattern, greenhouses will be distributed in a shattered pattern in the low-cost specialisation zone near the urban domain (Figure 25).

### Evaluation of the design options

#### High production value

The division of cropland primarily based on soil and hydrological conditions have the potential for higher yields, resulting in a higher production value of the land. Also, food forests have the potential to have higher yields than orchards after a few years of construction. This is due to the different layers of vegetation creating a bigger area to utilise the power of the sun (Boulestreau, 2016). This would give the design option of a clustered landscape an advantage over the shattered landscape.

#### Self-sufficiency

Self-sufficiency is related to the amount of products harvested from the area and to what extent it represent the diet of an average Dutch person. As mentioned before the design option of a clustered landscape might have a small advantage in the average crop yield the area could provide.

Whether the products harvested from the Binnenveld represent the Dutch diet is mostly dependent on the crops and livestock farmers decide to cultivate.

The area has to potential to turn more grassland into cropland to create a better representation of the Dutch diet.

#### Agrobiodiversity

For both design options, agrobiodiversity is mainly dependent on the business model of the farmer. The shattered landscape design option might however create a better framework for agrobiodiversity.

#### Amount of paid jobs

Both design options create more or less the same amount of paid jobs. Especially, the low-cost specialised and diversified farms create many jobs. These jobs however tend have low salaries. Food forest are also labour intensive and can create multiple jobs. However, to be profitable they might have to rely on volunteers (Boulestreau, 2016).

#### Amenity value

The amenity value is a subjective notion. However, literature suggest that 'a diverse landscape with fragmented forest patches, and more complex and natural forest edges are more highly valued in Rural-Urban interfaces' (Cho et al., 2008). This would mean that a combination of food forest and shattered landscape would result in a higher amenity value. Locating greenhouses at the boundary of the Binnenveld stimulates in maintaining the open character of the Binnenveld.

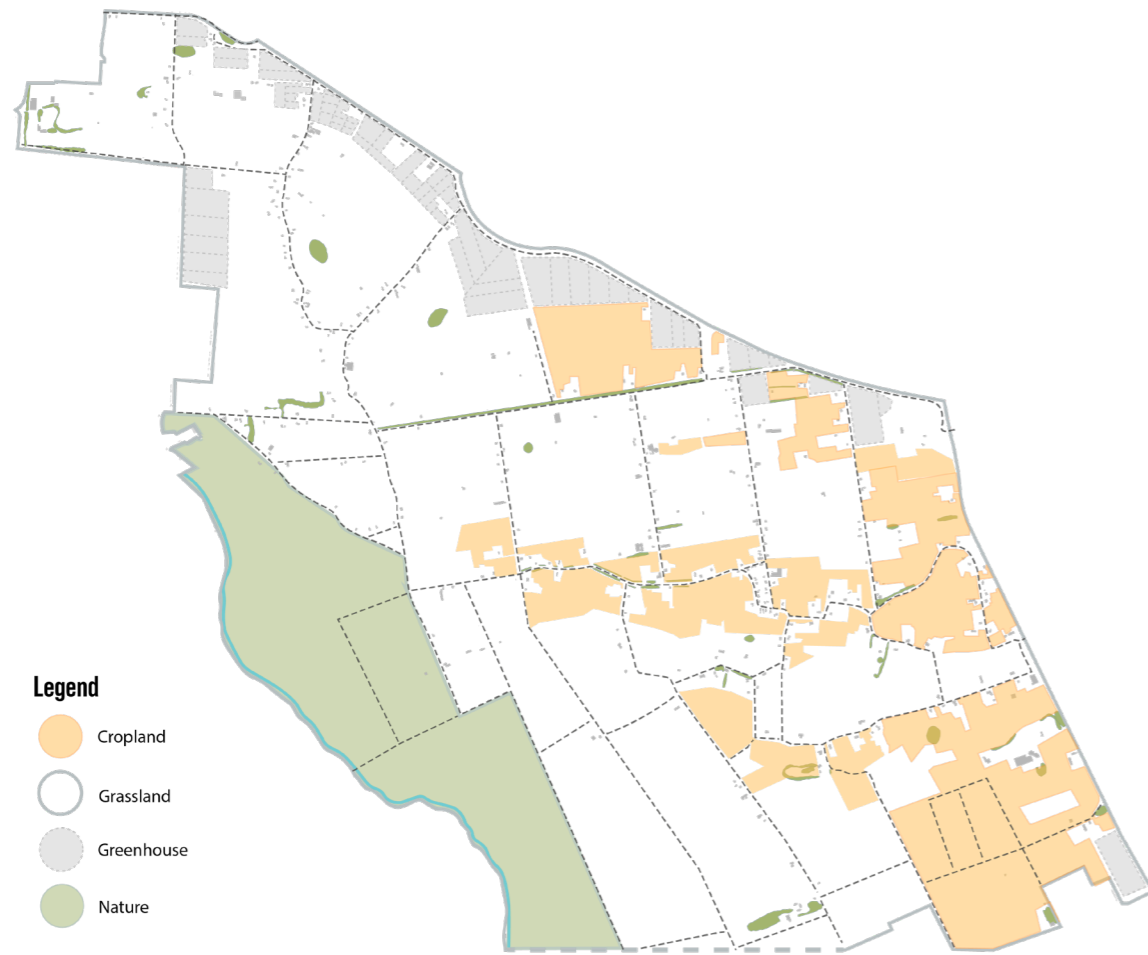


Figure 24: Clustered agricultural landscape prioritising soil type and hydrological conditions.



Figure 25: Shattered agricultural landscape prioritising the characteristics of the current landscape.

## Conclusion

To conclude, combining the two design options will have a better chance at creating a more viable and dynamic agricultural sector that connects to the local diet. In this combined design option soil and hydrological conditions are the driving force for the division of the different land uses. Within these different land use clusters a diverse landscape

should be promoted to increase the amenity value. This can be done by increasing the agrobiodiversity or construction of shattered parcels of food forests. The greenhouses, however, should be located along the edges of the Binnenveld near the urban domain to keep the landscape of the Binnenveld open and to block the view towards the highway.

## 2 NATURE DEVELOPMENT

Nature development can have a big impact on the functioning of a landscape. It can conflict with agriculture, but could also provide opportunities for the agricultural sector or recreation and leisure. The design goals for nature development are 1) to connect the Veluwe National Park, Grebbeberg, and the Blauwe Kamer and 2) to increase the biodiversity in the Binnenveld. As the design location is in the northern part of the Binnenveld, we will mainly look into the connection of the Veluwe with the Binnenveldse Hooilanden (Figure 26). Two main design options have been developed: corridors and stepping stones. These will be qualitatively evaluated by the design criteria: biodiversity, the connection of nature, limiting eutrophication, the development of public green amenities and the amenity value.

Before we get into the two different design options, two interventions have to be highlighted that will have to be implemented regardless of which design option is chosen.

The first intervention is the construction of an ecoduct over the N781. This road, connecting Wageningen, Bennekom and Ede, is a major obstruction for amphibians and mammals. This situation can deteriorate even further, as the municipality of Wageningen is planning to create two more lanes.

The second intervention is the enlargement of the Binnenveldse Hooilanden. An extra block of wetlands will be added to the nature area at one of the narrowest parts. This intervention is necessary to filter the water that flows towards the Grift. As mentioned before in paragraph 4.2, wetlands have the ability to filter water and this way limit eutrophication and increase the water quality.

### Corridors

Ditches or edges of parcels could be used to create a long narrow strip of nature to connect different bigger patches of nature (Figure 27). Important is that they should be able to conduct gene flow. This entails that they should be suitable enough for species to migrate through them, but not too suitable that the species stay put and start new populations in the corridors.

In line with the concept of corridors, public green edible amenities can be added next to bicycle paths and hiking trails (Figure 29). Just like a corridor, it will be a narrow strip of nature adjoined to the paths and trails. The only difference is that people can harvest fruit from the plants themselves, which adds another sense to experiencing nature: taste.

### Stepping stones

Another design option is the construction of stepping stones (Figure 28). Stepping stones are small patches of nature (e.g. forest, grassland,

pools) that species can use to migrate from place to another. These patches of nature have to be located close enough to each other, so animals can migrate from one to the other.

To fit the concept of stepping stones, public green edible amenities can be added in the form of patches. These patches can even be combined with the concept of food forests. These food forests will be mostly private area of farmers. An interesting marketing strategy for food forests is that consumers can harvest the fruits themselves and pay the farmer afterwards (Pölling, 2017). This would lower the workload for the farmer and offer a recreational activity for the consumer. This concept combines agriculture, nature development and recreation into one highlighting the multifunctionality of the agricultural park ones more. These food forest could be made fully public, but that would entail that the maintenance has to be done by volunteers.

### Evaluation of the design options

#### Biodiversity

As a general rule, increasing biodiversity can be achieved by diversifying the range of habitats or vegetation structures available at a site. This has been realised first of all by the enlargement of the Binnenveldse Hooilanden. With an increase of size of a nature area, the amount of potential habitats also increases (MacArthur & Wilson, 1967)

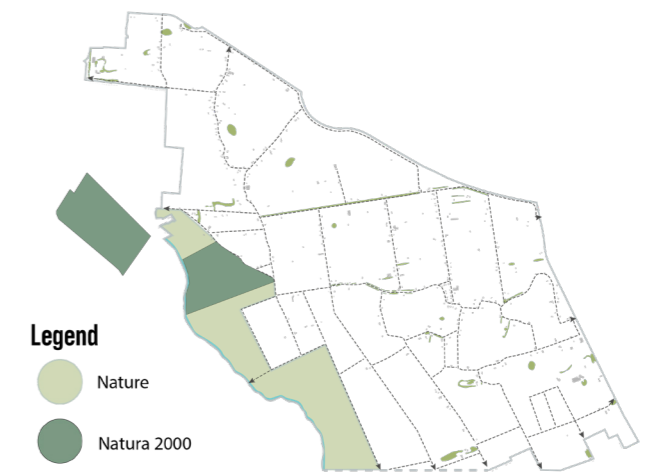


Figure 26: Current situation of green amenities. In green are the Binnenveldse Hooilanden. Also highlighted are the natura 2000 areas.

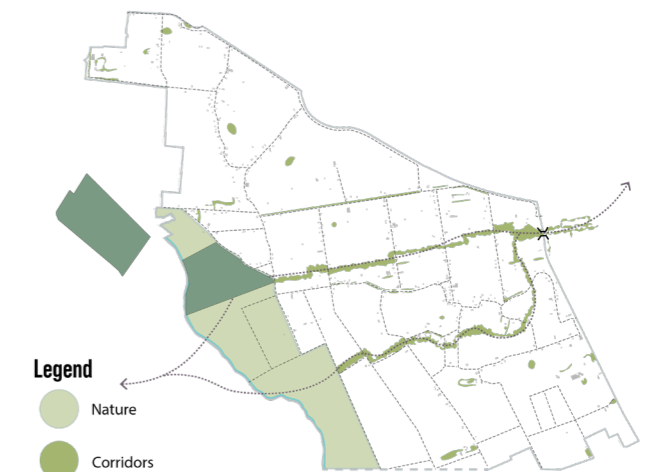


Figure 27: Design option of corridors. The ecoduct passing the N781 and the extension of the Binnenveldse Hooilanden is also shown.



Figure 28: Design option of stepping stones. The ecoduct passing the N781 and the extension of the Binnenveldse Hooilanden is also shown.

The design option of stepping stones also has the potential to increase the biodiversity as the forest patches add a new nature type to the Binnenveld. The design option of corridors has less effect on the biodiversity as these corridors are not suitable for the settlement of new populations. They can however result in the migration of species from other areas towards the Binnenveldse Hooilanden.

Also maintenance of the different nature types is very important for biodiversity. For example, grasslands should not be mowed all at ones, but at different moment, so enough habitat space remains for the population to survive.

#### Connection of nature

Both design options are based around the idea of connecting nature. The question now remains: which design option succeeds the best in connecting nature? Overall corridors conduct the most gene flow. There is no gap to cross from one patch to another, like there is with stepping stones. Nevertheless, this only implies if the corridor is suitable enough for species to migrate through them, but not too suitable that the species stay put and start new populations in these corridors. However, for some species stepping stones may be a better conductor for gene flow. For example, Richardson (2012) discovered that diverging landscape entities affect two co-occurring amphibian species differently on population connectivity.

#### Limiting eutrophication

Eutrophication is limited by wetlands filtering the groundwater. Nevertheless, this effect is quite limited on reducing ammonia and phosphorous concentrations. In addition, only at one particular site in the design was additional wetland area added. Limiting the effect of eutrophication should be further elaborated. For instance, with the construction of a vertical helophyte filter at the edge of the Binnenveldse Hooilanden.

#### Public edible green amenities

The design option of corridors can provide a network of public edible green amenities along the bicycle paths and hiking trails (Figure 29). The other design option of stepping stones, on the contrary, provides mostly private edible green amenities in the form of food forests. This makes it less accessible for recreation.

#### Amenity value

As mentioned before in the last paragraph, literature suggest that 'a diverse landscape with fragmented forest patches, and more complex and natural forest edges are more highly valued in Rural-Urban interfaces' (Cho et al., 2008). Based on this citation, stepping stones are a good addition for a better amenity value. Corridors have less of an impact on the amenity value. Corridors also affect the openness of the landscape more, detracting the character of the landscape.

#### Conclusion

Both design options have arguments going for them. If executed well, corridors are more convenient in connecting nature and providing the Binnenveld with public edible green amenities. on the other hand, stepping stones are better at combining different functions and enhances the amenity value more. Therefore, a combination of both design options should be used.

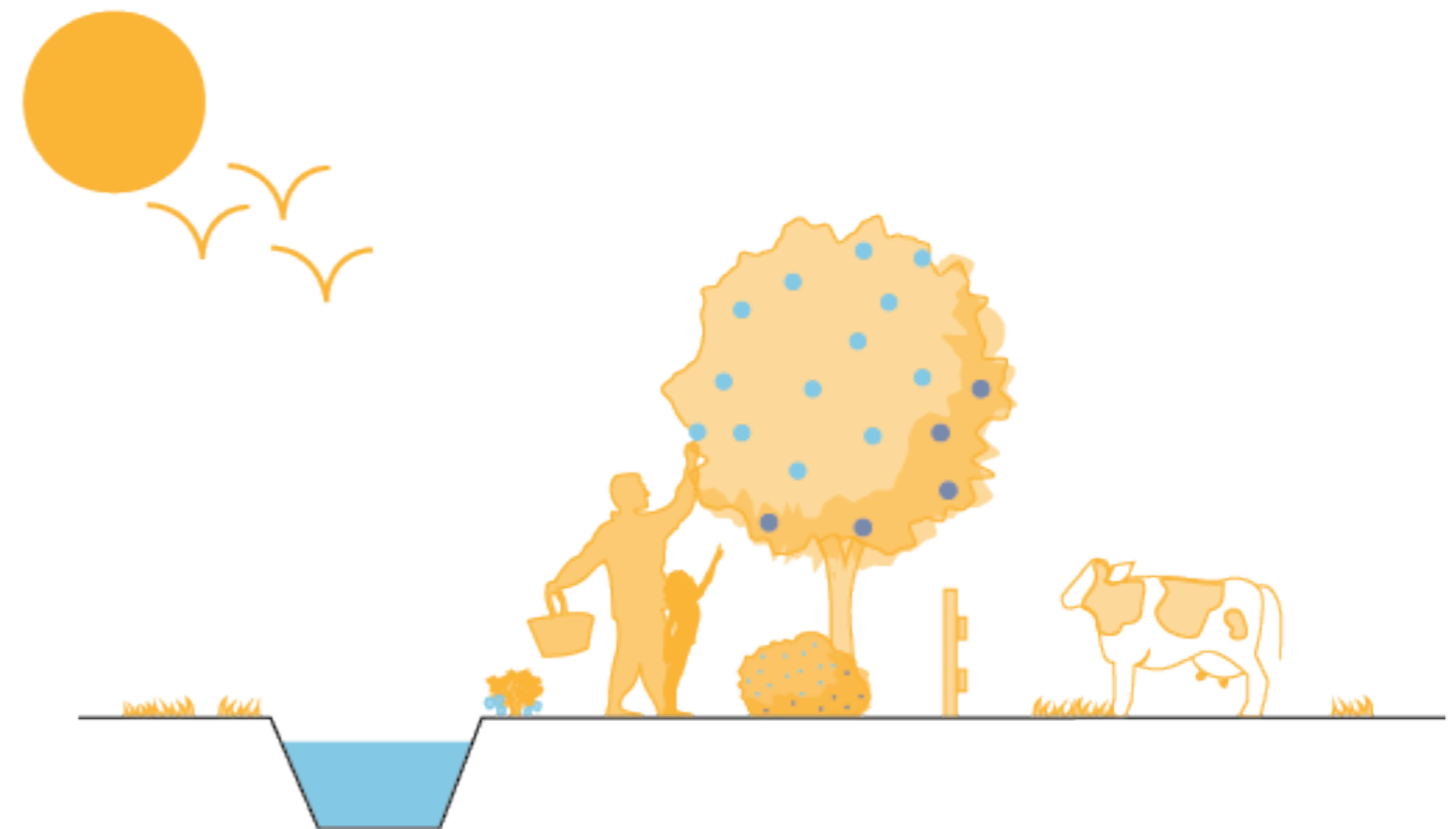


Figure 29: Public edible green amenities along the clog paths. This is in line with the design option of corridors

### 3 SOCIAL SERVICES

Social services in agricultural parks are mostly dependent on the business models of farms. Nevertheless, the designer can create a framework to stimulate the diversification of farms. This framework will be a network of access routes, with the result that farms become more accessible.

Before we go into the design, an analysis of the current framework and social services is needed. After this, the design will be discussed and qualitatively evaluated by going through the design criteria: social services, educational services, involvement of locals in the food narrative and the amount of non-paid jobs. This design is a potential scenario and not a strict end result as farmers have to decide for themselves how to run their business and with what site activities.

#### Analysis

##### Bicycle network

Currently, the bicycle network is comprehensive (Figure 30). All cities are connected with each other and the Binnenveld. The network covers most of the area of the Binnenveld and offers multiple locations to cross the A12 and the N781. The only downside of the current bicycle network is that most paths go over normal access roads. This might affect the amenity value. Nonetheless, this circumstance is not deemed important enough for change.



Figure 30: Bicycle network of the Binnenveld.

##### Hiking trails

The Binnenveld knows two kinds of hiking trails: national hiking trails and clog trails (klompenpaden) (Figure 31). Two national hiking trails cross the Binnenveld: the migratory bird trail (trekvoogelpad) and the Maarten van Rossum trail. These trails both are around 400 km in length. The clog trails have a totally different character. These unpaved trails are about a meter in width and follow the edges of agricultural fields. Agreements with the landowners have made to realise these trails. Because the trails pass through the agricultural fields and come by farms, they create a big opportunity for the development of the accessibility of farms to city dwellers.

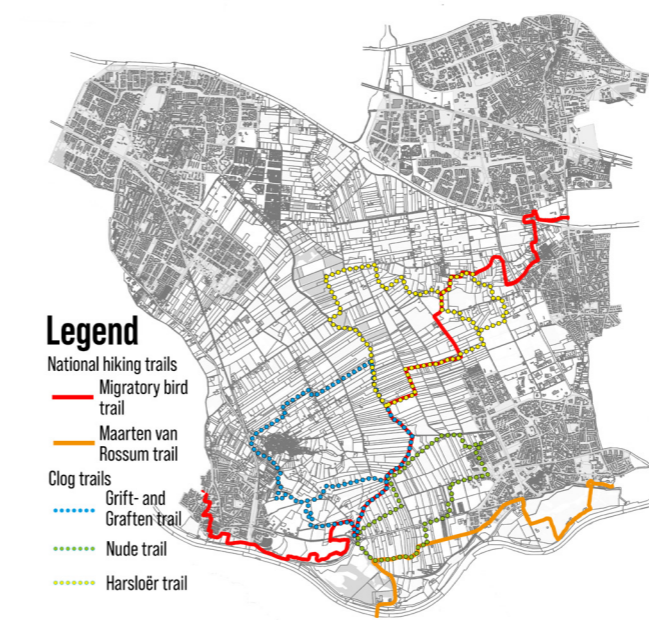


Figure 31: Hiking trail network of the Binnenveld.

##### Social services

Currently, the Binnenveld does not only provide nature recreation, but also other social services (Figure 32). For instances, gastronomy, care farms for disadvantaged people, country shops selling local products and terraces. Some farms show transparency by installing skyboxes, so people can look inside their stables, or by giving tour guides. This can however be further elaborated. Furthermore, there is a primary school. The road network provides sports activities, like cycling, skating and jogging. The grift can also be used for fishing and docks have been constructed for canoeing.



Figure 32: Social services in the Binnenveld.

## Creating a framework

### Social services

Examples of new social services in the area are: farmer golf (boerengolf) and a maize labyrinth (Figure 33). Especially the latter one is a nice addition as the maize can be harvested. This ones more highlight the multi-functionality of an agricultural park.

As mentioned before, the offer of different social services is dependent on the business models of the farms. This entails that the social services mentioned are only speculation of what could be. This makes it impossible to evaluate at this point in time.

### Educational services

In addition to the already existing primary school, an outdoor space will be created at which not only school classes can be educated, but also interested locals. Furthermore, with the 'rent-a-field' concept, farmers provide the renters with the necessary knowledge to harvest their crops (Figure 33). Tour guides can be given by farmers, but this again depends on the business model of the farms.

Based on these interventions, the Binnenveld can have a significant impact in the education of local residents/children. There is most definitely an improvement in the educational services of the Binnenveld.

### Involvement of locals in the food narrative

The involvement of local residents in the food narrative is realised in two different ways: 1) the transparency of farms and 2) the improved access routes.

Changing the transparency of a farm is up to the owner. However, by stimulating the use of skyboxes or giving guided tours, the transparency of farms will increase drastically. Also, country shops selling local products can increase the transparency of the production process of food.

Creating a framework of access routes is less dependent on the cooperation of farmers. As mentioned in the analysis, the bicycle network is already comprehensive. The hiking trails, should however be further extended. In cooperation with the farmers a new clog trail 'het Parkpad' will be constructed in the north-eastern part of the Binnenveld. It will mostly cover the low-cost specialist zone and it connects the clog trail network with the city of Veenendaal and Ede. You can clearly see in Figure 33 that the clog trails and bicycle routes pass along most services.

### Amount of non-paid jobs

The amount of non-paid jobs is ones more dependent on the business models of farms. The food forest however gives an opportunity for voluntary work. An increase in the amount of care

farms will not only increase the amount of non-paid jobs, but also tighten the connection with the urban domain.

## Conclusion

To conclude, the social benefits of the agricultural can only be improved with the cooperation of farmers. The social services have to come about in a process of co-creation.

the outdoor college site and the 'rent-a-field' concept will increase the educational value of the agricultural park. The extension of the clog trail network will involve the residents of Veenendaal and Ede better with the agricultural park. It can also stimulate farms in the north of the Binnenveld to diversify their business model involving more local residents in the food narrative.

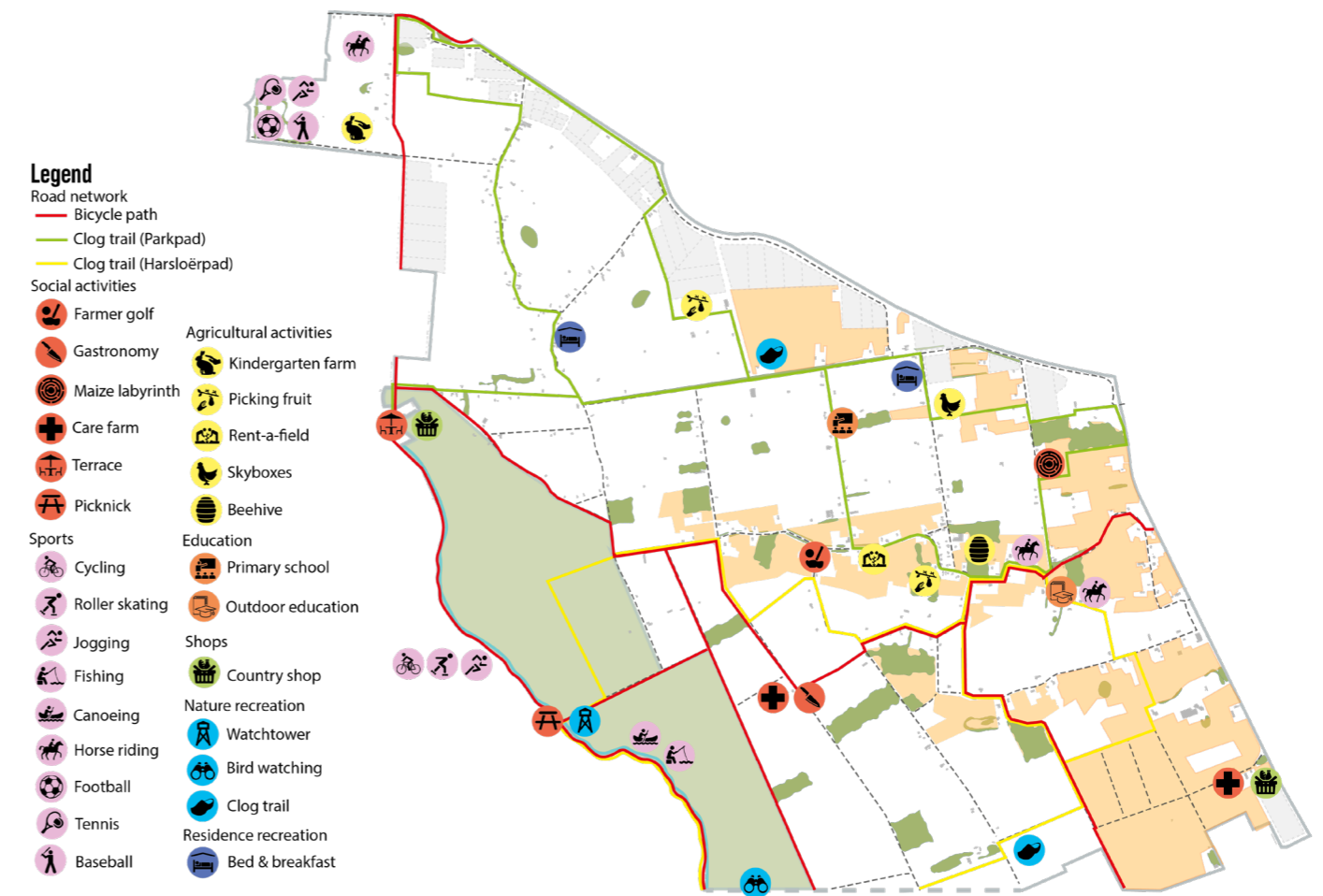


Figure 33: Potential social services and network of access roads to farms.

# SCENARIO SKETCH

This is a possible scenario of the agricultural park in the Binnenveld. The different land uses shown in this scenario sketch is an example of how farmers can evolve their business models to fit the view of the agricultural park. This can create new revenue streams for farmers and potentially make the agricultural area more dynamic and viable.

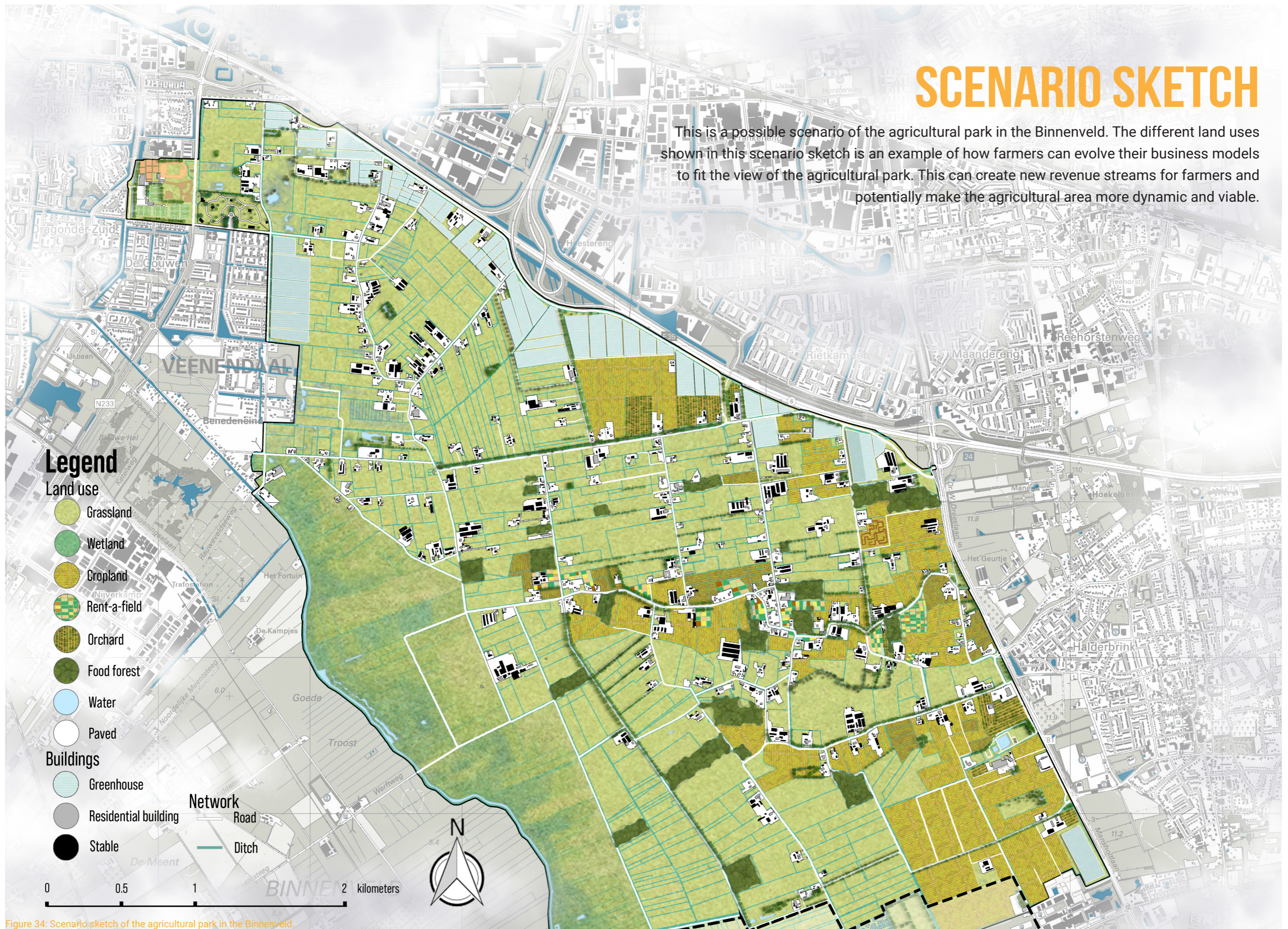


Figure 34: Scenario sketch of the agricultural park in the Binnenveld.



# 4 IMPLEMENTATION OF ECOSYSTEM SERVICES



Figure 35: Examples of amplified ecosystem services developed in chapter 4.2.

# BIRD'S EYE VIEW



Figure 36: Bird's eye view of the agricultural park and highlights of some key interventions.

# 7. EPILOGUE

## 1 DISCUSSION

This chapter will give a critical view on the used theory, the design proposed on the Binnenveld and the relation between these two factors.

### Theory

First of all, some of the theory used (e.g. literature on business models or the indicators developed by Pölling) are derived from literature on urban farming and not necessarily on agricultural parks. An agricultural park is a typology within the broader concept of urban farming. Transferring this theory to fit the essence of an agricultural park could result in the theory missing out on specific characteristics of an agricultural park.

### Design criteria

The evaluation of the design has been done in a qualitative way. This method is subjective and the result might differ when the evaluation is done by different stakeholders. A quantitative analysis would have been more reliable, however, also more time consuming. Furthermore, the design is evaluated on only the criteria that are directly related to the different design options. A more integral approach in which the design options are also evaluated on criteria indirectly related to the design options would have been better.

### The farmer's perspective

For the agricultural park to work, farmers need to be convinced to change their business model. It

has to be stressed to the farmers that the transition of their business model can be profitable to both their business and the environment. There is, however, also the uncertainty to what extent local consumers are willing to pay extra for locally and sustainably produced food. It will be difficult to get subsidised for the transition of their business model. Therefore, there will have to be a revision to legislations in order to account for the financial costs.

In addition, farmers could resist to the diversification of their business model, as they start to become more like a manager instead of a farmer. The multi-functional services the farms can provide do not fit within their vision of farming. Policy makers should discuss with these farmers if there are any options in line with their business model that can contribute to the multi-functionality of the agricultural park.

### Solving negative externalities

The report deducts that with the transition from export-oriented mass production towards local food production, the negative externalities caused by the agricultural sector can be (partially) exterminated. However, further research is needed to validate this statement. In addition, the design does not focus on solving the issues related to a too effective drainage system (e.g. drought and acidification of the soil). The other negative externalities that are mentioned, are (partially) solved by amplifying

ecosystem services. However, these are only trying to reduce the effect negative externalities have on the environment. They do not tackle the issue at its source. Concepts, like extensive agriculture, should have been further elaborated in the design.

## 2 CONCLUSION

This chapter will assess whether the objective has been met, and whether the research questions have been answered.

### Objective

The objective of this research and design is to play a significant role in the development of Agricultural Parks by using the Binnenveld as a prototype. The Binnenveld could be a starting point for many similar regions to implement an Agricultural Park. This will be done by conducting a design-led investigation to shift the Binnenveld from a weak and threatened agricultural area, to an enhanced and viable multi-functional and socio-economic activity, suitable to provide healthy food and other key services for local urban areas.

While the influence of the design cannot be measured at this time, the latter statement in the objective can be achieved. An agricultural park can contribute to the transition of export-oriented mass production towards local-oriented food production in the Binnenveld. This can reduce the impact of negative externalities on the Binnenveld, improving the functioning of the landscape, and provide the Binnenveld of healthy food. Furthermore, the agricultural park can make the agricultural sector multi-functional, providing multiple social services to the area. This can make the sector more viable and dynamic. New local economies and networks can emerge, resulting in multiple new revenue

streams for farmers and the protection of farmland against urban encroachment. These new local economies can also give new businesses the opportunity to establish that follow the pathway of (at least) one business model.

### Research questions

*To what extent can the surrounding cities of the Binnenveld be self-sufficient in terms of their food supply?*

In the ideal situation, in which the division of crops and other land uses for food production reflect on the average Dutch diet, the Binnenveld can provide 65.000 people with food. This is about 30% of the inhabitants of the region.

To increase the self-sufficiency of the area ecosystem services should be amplified, so bigger quantities of food can be harvested from the Binnenveld. They can also improve the functioning of the landscape.

*Which ecosystem services will be in focus for designing an agricultural park in the Binnenveld?*

Different ecosystem services of different types have been devised based on the characteristics of the landscape. The devised ecosystem services are the following:

#### Supporting services:

- Recycling waste flows

#### Provisioning services:

- Food supply
- Nature as forage supply

#### Regulating services:

- Climate regulation
- Pollination for agricultural crops
- Purification of water by wetlands
- Prevalence on pest and diseases

#### Cultural services:

- Aesthetic value and recreation

Although, these ecosystem services are based on the local conditions of the Binnenveld, they could be used for designing other agricultural areas.

Ecosystem services are, however, not enough to make an agricultural park. Business models are needed as a guideline for farmers.

*What business models for farms will do well in line with the view of an agricultural park?*

The following business models have been derived from the literature:

- Low-cost Specialisation
- Differentiation
- Diversification

A spatial guideline has been developed to indicate which business models do well at what location. Co-creation of the agricultural park with farmers is important. This is, because the multi-functionality of the agricultural park is dependent on the different social services and other key services the farms provide.

While the design sketches an alluring image to strive for, it will not be easy to implement. It takes a mentality shift from both the producer as the consumer. It would also require subsidising and governmental aid. The result, however, is a healthy, multi-functional, productive and viable landscape.

### 3 REFLECTION

For me this was the first time designing an agricultural area. It was though at first, because designing all parcels is not the way to go. Rather, designing the framework that makes the Binnenveld turn into an agricultural park, resulted in the desired end product. You cannot be too deterministic about the end result as it should be co-created with the farmers in the Binnenveld. I have made myself acquainted with multiple concepts (e.g. agricultural park, ecosystem services, etc.) and tried to implement them to solve the issues of the Binnenveld. I now have a look with a different understanding, when I will be designing agricultural areas in the future. An understanding that takes into account the different relationships with local and global networks and economies.

Furthermore, it was my first time writing a scientific report of this size to support my design. Creating a coherent story out of the issues of the site, the theoretical background and the design, was sometimes challenging.

Overall, it has been a challenging but fun experience. Writing this thesis and taking this bachelor program has opened my eyes in so many ways. It has prepared me for my masters and future job.

# 8. REFERENCES

## Literature

- AA.VV. (2010). Charter of peri-urban agriculture. For the conservation, planning, development and management of periurban agricultural spaces. Castellfelds, Spain. [https://areeweb.polito.it/didattica/UPWARD/dwd/agriculture/charter\\_periurban\\_agriculture.pdf](https://areeweb.polito.it/didattica/UPWARD/dwd/agriculture/charter_periurban_agriculture.pdf)
- Allen, A. (2003). Environmental planning and management of the periurban interface: Perspectives on an emerging field. *Environment and Urbanization*, 15, 135–147. <http://eau.sagepub.com/content/15/1/135>.
- Allen, A. (2010). Neither rural nor urban: Service delivery options that work for peri-urban poor. In P. McCarney & M. Kurian (Eds.), *Peri-urban water and sanitation services. Policies, planning and method* (pp. 27–61). Berlin: Springer.
- Boulestreau, Y. (2016). Design and Performance Evaluation of a 1ha productive food forest model. *Realtime Landscape Architecture*.
- Cho, S.-H., Poudyal, N., & Roberts, R. K. (2008). Spatial Analysis of the Amenity Value of Green Open Space. *Ecological Economics*(66), 403-416.
- Compendium voor de Leefomgeving (CLO). (2020). Landvoetafdruk, 1990-2017. Retrieved from: <https://www.clo.nl/indicatoren/nl-0075-voetafdruk-landgebruik>
- De Vries, J., Fleuren, R. (2015) "A spatial typology for designing a local food system", In: *Localizing urban food strategies. Farming cities and performing rurality. 7 th International Aesop Sustainable Food Planning Conference Proceedings, Torino, 7-9 October 2015*, edited by Giuseppe Cinà and Egidio Dansero, Torino, Politecnico di Torino, 2015, pp 297-306. ISBN 978-88-8202-060-6
- European Economic Social Committee (EESC). (2004). Opinion on agriculture in periurban areas. NAT/204. Brussels. September 16, 2004. <https://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/agriculture-peri-urban-areas>
- Fanfani, D. (2019) 'Agricultural Park in Europe as Tool for Agri-Urban Policies and Design: A Critical Overview', Gottero, E., ed. *Agroubanism*, Springer International Publishing AG, part of Springer Nature 2019, 149-169.
- Food and Agriculture Organization of the United Nations and the Platform for Agrobiodiversity Research (FAO). (2011). *Biodiversity for Food and Agriculture*. Rome, Italy. p. 2. ISBN 978-92-5-106748-2.
- Food and Agriculture Organization (FAO). (2015). Urban and periurban agriculture. <http://www.fao.org/unfao/bodies/coag/coag15/x0076e.htm>.
- Gallent, N., Andersson, J., & Bianconi, M. (2006). *Planning on the edge. The context for planning at the rural-urban fringe*. London: Routledge.
- Hidding, M., Needham, B., & Wisserhof, J. (2000). Discourses of town and country. *Landscape and Urban Planning*, 48, 121–130.
- Lohrberg, F. (2019) 'Urban Agriculture Forms in Europe', Gottero, E., ed. *Agroubanism*, Springer International Publishing AG, part of Springer Nature 2019, 133-148.
- MA (Millennium Ecosystem Assessment). 2005. *Ecosystems and Human Well-Being: Synthesis*. Washington DC: Island Press. Online at: <http://www.maweb.org>
- MacArthur, R. H., & Wilson, E. O. (1967). *The theory of island biogeography*.
- Montasell, J. P. (1996). *Els parcs agrícoles. Concept, règim jurídic, òrgans i agents de gestió*. Diputació de Barcelona
- OECD. (2009). *Regional typology: Updated statistics* (pp. 240–253). Paris: OECD. [www.oecd.org/gov/regional/statisticsindicators](http://www.oecd.org/gov/regional/statisticsindicators).
- PBL. (2014). *The Netherlands in 21 infographics. Facts and figures on the human environment*. Available at <https://www.pbl.nl/en/publications/the-netherlands-in-21-infographics>
- Pölling, B., et al. (2016). Creating Added Value: Societal Benefits of Urban Agriculture. In: Lohberg, F. (eds.) *Urban Agriculture Europe*. Jovis, 92-101
- Pölling, B., et al. (2017). Business models in urban farming: A comparative analysis of case studies from Spain, Italy and Germany. *MORAVIAN GEOGRAPHICAL REPORTS 2017*, 25(3): 166–180
- Potteiger, M. (2013). Eating Places: Food Systems, Narratives, Networks, and Spaces. *Landscape Journal*, 32(2), 261-275. Retrieved June 19, 2021, from <http://www.jstor.org/stable/43323943>
- Ranganathan, J., Raudsepp-Hearne, C., Lucas, N., Irwin, F., Zurek, M., Bennett, K., . . . West, P. (2008). *ECOSYSTEM SERVICES: A Guide for Decision Makers*. World Resources Institute. doi:10.13140/RG.2.1.4060.6164
- Richardson, J.L. (2012) Divergent landscape effects on population connectivity in two co-occurring amphibian species. *Mol Ecol* (21): 4437–4451
- Terres en Villes. (2008). *Guide de la Co-construction des politiques agricoles périurbaines d'agglomération*. [http://terresenvilles.org/wp-content/uploads/2016/11/TEV\\_CH1.2\\_GuideConstruction\\_2008.pdf](http://terresenvilles.org/wp-content/uploads/2016/11/TEV_CH1.2_GuideConstruction_2008.pdf).
- Van Huylenbroeck, G., Vandemeulen, V., Verspecht, A., Vuylsteke, A., Reymen, D., & Van Dingenen, K. (2007). *Toestandsrapport voor verbrede landbouw: Analyse van de beschikbare informatie inzake de verschillende groepen verbrede landbouwactiviteiten*. Brussel: Vlaamse Overheid Departement Landbouw en Visserij Afdeling Monitoring en studie.
- Van Leuven, E. (2010). *Rural-Urban integration; Town as focus point in rural development*. Dordrecht: Springer.
- Vereniging Mooi Wageningen. (2021, 3 26). *Handhavingsverzoek stikstofdepositie Natura 2000-gebied Binnenveld. Handhavingsverzoek stikstofdepositie Binnenveld*. Wageningen.
- Zazo Moratalla, A. (2015). *El Parque Agrario: estructura de preservación de los espacios agrarios en entornos urbanos en un momento de cambio global* (Ph.D. thesis). Escuela Politecnica de Madrid, Depart. de Urbanismo y Ordenacion Territorial, Madrid. [http://oa.upm.es/39083/1/ANA\\_ZAZO\\_MORATALLA.pdf](http://oa.upm.es/39083/1/ANA_ZAZO_MORATALLA.pdf)
- Zimmerman J., Forlizzi J. (2014) *Research Through Design in HCI*. In: Olson J., Kellogg W. (eds) *Ways of Knowing in HCI*. Springer, New York, NY. [https://doi.org/10.1007/978-1-4939-0378-8\\_8](https://doi.org/10.1007/978-1-4939-0378-8_8)

## Figures

### Figures 1, 2

Retrieved from Google maps. (2021). Imagery used to produce these visualisations.

### Figure 3

Compendium voor de Leefomgeving CLO. (2017). *Mondiaal landgebruik door nederlandse consumptie, 2017*. Landvoetafdruk, 1990-2017. Retrieved from: <https://www.clo.nl/indicatoren/nl0075-voetafdruk-landgebruik>

### Figures 4, 22, 23

Retrieved from Pdok. (2021).

### Figures 5, 8-36

Designed by the author with software from Adobe. (2018) Backgrounds of maps are retrieved from Pdok. (2021).

### Figure 6

Artist unknown. (2012). *Concept diagram of peri-urban park typologies according to the 4 typologies identified by the Interreg IVc Programm. Agricultural Park in Europe as Tool for Agri-Urban Policies and Design: A Critical Overview*.

### Figure 7

Artist unknown. (2008). *The Relationship between Development and Ecosystem Service*. *ECOSYSTEM SERVICES: A Guide for Decision Makers*. World Resources Institute. doi:10.13140/RG.2.1.4060.6164