The experiential quality of circular agrarian landscapes

How implementing circular agriculture based on the archetypes of SPLENDID on a testing ground in the agrarian area of Etten-Leur can contribute to the experiential quality of the landscape.

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Abstract

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The increasing intensification of agriculture in the past decades poses many problems such as environmental pollution and increasing conflict between farmers and the government. Circular agriculture, as divided in three archetypes by research project SPLENDID, could pose a solution to these problems. In this thesis I investigate how to design archetypes of circular agriculture that can contribute to the experiential quality, of agrarian landscapes. The design area for this thesis is the agrarian area north of the Dutch town Etten-Leur. Based on research into the archetypes, circular agriculture and landscape quality, a regional model with the three archetypes will be created. This regional model will be used as a basis for the design of a testing ground of the archetypes of circular agriculture in a detail area. This testing ground could be used to interest and persuade surrounding farmers and interested citizens that a circular agrarian landscape can be a great solution to the current problems in agriculture. The outcomes of this research could be used in the future as an example of how circular agriculture can be effectively implemented in the landscape and improve the experiential quality of the landscape.

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1. Introduction

Because of agricultural intensification in the past years, the quality of soil, air and water in The Netherlands has decreased drastically. Farmers are forced to adapt their farms to decrease pollution and improve animal welfare but get little support from politics or society. Circular agriculture may be a solution for the pollution and political friction caused by agricultural intensification (Van Dinther, 2021; VVM, 2021). Another problem caused by agricultural intensification is the decrease of the landscape quality (VVM, 2021). The transition towards circular agriculture provides an opportunity to address these environmental problems and concerns about landscape quality. By improving the spatial quality, new developments can receive support from the general public (VVM, 2021; Van Dinther, 2021). In this thesis, circular agriculture is defined by the nine archetypes described by research project SPLENDID (Camara de Assis, 2021).

For finding a spatial application of circular agriculture, landscape architecture is needed. Landscape architects can translate theories and ideas into designs that increase the spatial quality of the agrarian landscapes (Marušič, 2002).

1.1 Thesis statement

The objective as well as the main research question of this thesis is: 'How can the different archetypes for circular agriculture contribute to the experiential quality of the agrarian landscape on a testing ground in Etten-Leur?'.

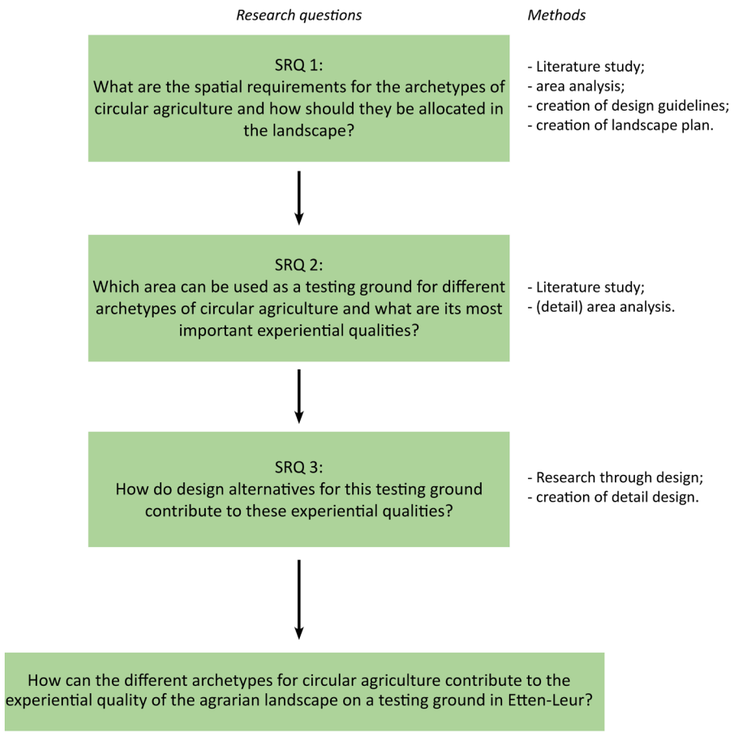


Figure 1: Diagram of research questions and research methods

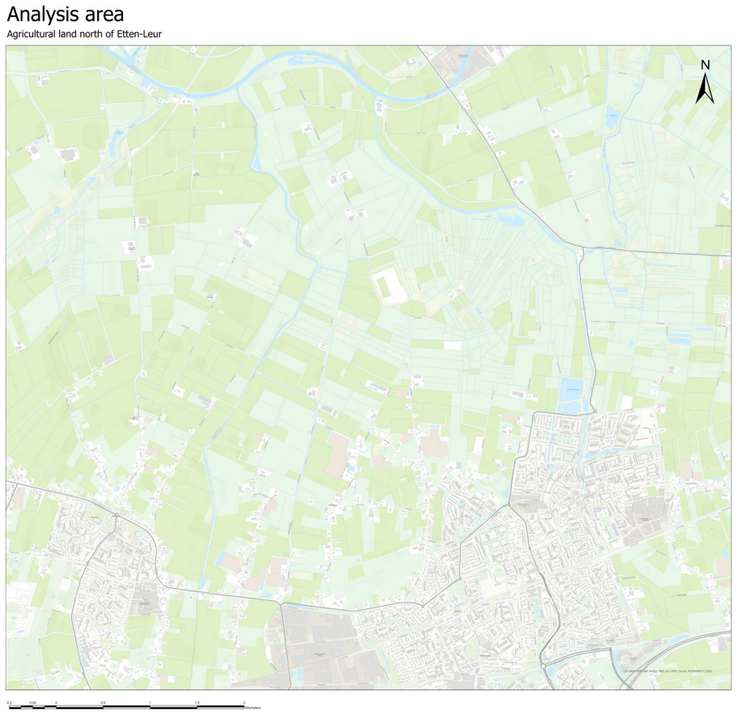


Figure 2: Map of the analysis area (Esri, 2021)

The sub-research questions are:

1. What are the spatial requirements for the archetypes of circular agriculture and how should they be allocated in the landscape?
2. Which area can be used as a testing ground for different archetypes of circular agriculture and what are its most important experiential qualities?
3. How do design alternatives for this testing ground contribute to these experiential qualities?

At the end of this thesis, the three sub-research questions should answer the main research questions, as you can see in figure 1.

1.2 Design area

The design area of this thesis is the agrarian area north of the Dutch town of Etten-Leur (figure 2). Etten-Leur is located on the edge of the Van Gogh National park, includes several types of agricultural practices and has three different soil types (Van Gogh Nationaal Park, n.d.; ArcGIS, 2021). This combination makes this agrarian area an interesting place to implement the archetypes of circular agriculture.

1.3 Methods and theories

In this paragraph I will shortly explain methods and theories I will be using in this thesis.

In sub-research question 1, I describe the archetypes of circular agriculture. These archetypes were developed by research project SPLENDID. Archetype A is technology land based agriculture, archetype B is nature based agriculture and archetype C is technology non-land based agriculture (Camara de Assis, 2021). I will describe these archetypes in more detail and explain what they look like and what their spatial requirements are. To answer sub-research question 1 design guidelines will be used to allocate the archetypes in the landscape. Design guidelines are 'rules' for designing. Design guidelines are based on research and design theories and can be put into practice in real designs. They make the design process easier and more efficient (Prominski, 2017).

In sub-research question 2 I describe the experiential quality of the landscape. This is based on the criteria of spatial quality formulated by Bakx, which includes experiential, economic, ecological and long-term qualities (figure 3) (Bakx, 2021). The experiential quality includes nine criteria for experiential quality, which will be used in sub-research question 2. I chose to use only the experiential criteria because these criteria are visible on a very small scale. Humans can only experience their near surroundings and not an entire region at once. Besides, more knowledge about landscape is needed to judge the economic, ecological and long-term qualities, whereas anyone can judge the experiential qualities of a landscape.

A small-scale area is also very important for sub-research question 3. In sub-research question 3 I will design a testing ground for the archetypes of circular agriculture. This testing ground will be designed as an agricultural, educational but also recreational area. It is meant to serve as an example for future developments in the area. It shows how the archetypes of circular agriculture can be combined and how they can positively influence the landscape. For sub-research question 3 I use the method 'research through design' for designing the detail design. The method 'research through design' means that the activity of designing is used as a research method (Lenzholzer et al., 2013). For this sub-research question I will create three sketches which I will judge based on the experiential spatial criteria from sub-research question 2.

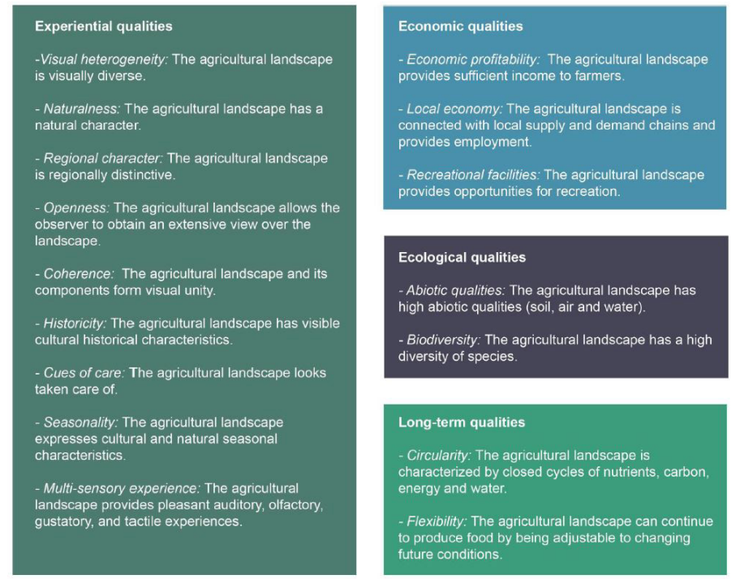


Figure 3: Table of spatial criteria by Bakx (2021)

2. Area analysis

2.1 Location

The Dutch city of Etten-Leur lies in the western part of Noord-Brabant. It is located between Roosendaal and Breda, two relatively big cities. The town Etten-Leur has almost 44 thousand inhabitants (CBS Statline, 2021). Etten-Leur has a good infrastructure, with both train tracks and a highway, which connect Etten-Leur to Breda and Roosendaal but also to smaller towns surrounding Etten-Leur. The area that will be used in this thesis is the agrarian area north of Etten-Leur. It includes the river de Mark as the northern border. Half of the city of Etten-Leur is also included in the area, as well as the village Hoeven in the west. I have chosen these borders and not only used the agrarian area because I think the transition between agrarian lands and industrial or residential areas is very interesting. Besides, one cannot look at an agrarian area without looking at its surrounding towns, because these towns are of major importance for agrarian areas.

2.2 Dutch layers approach

For further analysis of the area, I will use the Dutch layers approach. This approach was created in a model by De Hoog, Sijmons and Verschuuren between 1996 and 1998. It contains three layers, namely the substratum layer, the networks layer and the occupation pattern layer (van Schaick & Klaasen, 2011). I have chosen this approach because the networks layer is an interesting layer to use to see relations between locations.

2.2.1 Substratum

The substratum or abiotic layer exists of bedrock, soil and water. This layer is a slow-changing layer (van Schaick & Klaasen, 2011). For the analysis of the area north of Etten-Leur, I looked at elevation, soil types, origin of the landscapes and waterways. These landscape components are all visible in figure 4. The most remarkable part of the substratum is the three soil types, namely sand, peat and clay. In the south cover sand ridges of 1 to 5 meters above sea level dominate. These cover sand ridges are cut through by brooks and brook valleys. The cover sand ridges further south are covered with peat. These peat soils are partially excavated and relatively low—between 1 meter above and 1 meter below sea level. The last soil type is clay, in the northern part of the area. These clay areas are levees and floodplains of the river de Mark. The levees are relatively high, about 1 meter above sea level, whereas the floodplains are about 0.5 meter below sea level. Several brooks and waterways flow from the south towards the river de Mark, which flows from the east to the west (Provincie Noord-Brabant, n.d.; AHN, 2014-2019).

Substratum layer

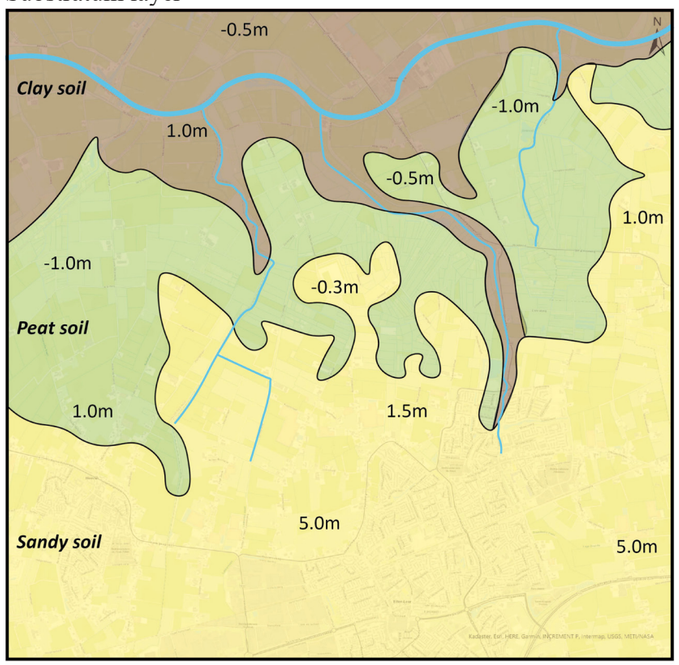


Figure 4: Substratum layer (Basemap: Esri, 2021)

2.2.2 Networks

The networks layer deals with networks of roads and waterways, as you can see in figure 5. This layer changes more quickly than the substratum layer (van Schaick & Klaasen, 2011). Nature networks are not named in van Schaick & Klaasen (2011) as part of the original Dutch layers approach, however, nature networks do belong to this layer, which is why nature networks are also shown in the map in figure 5. In this map the most important networks in the area north of Etten-Leur are shown. There are three main roads in the area: highway A58 in the southeast, which runs from Breda to Roosendaal, and two provincial roads. The first provincial road, the N389, goes from the north of the area, across the river, to the south of Etten-Leur, where it changes into a minor road. The other provincial road, the N640, passes Hoeven and runs through the industrial area of Etten-Leur, to the A58. Two train tracks run through the area, one of which goes through Etten-Leur, from west to east, passing by the train station. The other train track runs along the north-western edge of the area, going from Oudenbosch in the west to Zevenbergen in the north. There are several waterways in the area, of which the most important is the river the Mark, a meandering river that flows from the east to the west. Three major brooks flow from the south towards the Mark, which are (from west to east) the Laaksche Vaart, the Leursche Haven and the Halsche Vliet. None of these brooks are fit for transportation (Provincie Noord-Brabant, n.d.; Planbureau voor de Leefomgeving, 2021).

Networks layer

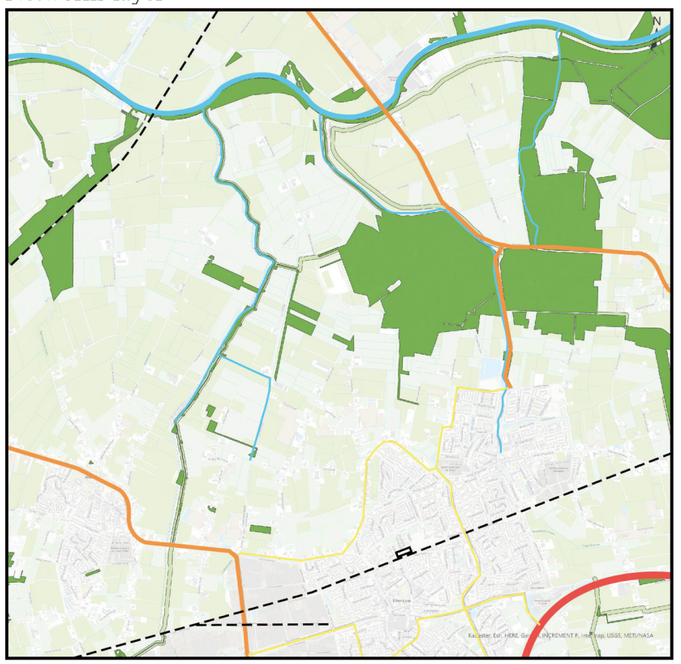


Figure 5: Networks layer (Basemap: Esri, 2021)

The last type of network is the nature network. A large nature area with peat subsoil, called De Kelsdonk, lays just east of the centre of the area, expanding towards the northeast. Small patches of nature along the Laaksche Vaart create a 'line' of nature from north to south. Nature area Hoevense Beemden is situated along the train track in the west of the area (Visit Halderberge, 2021; Staatsbosbeheer Regio Zuid, 2005).

2.2.3 Occupation pattern

The third and last layer is occupation pattern, which includes build up. The components in this layer change quicker than both the substratum and the networks layer (Van Schaick & Klaasen, 2011). The map of the occupation patterns is shown in figure 5. The major town of this area is Etten-Leur. Only the northern part of Etten-Leur is visible on this map. Etten-Leur has a relatively new neighbourhood in the northeast and a large industrial area in the west. De Hoeven, a smaller village, lies west of Etten-Leur. Throughout the agrarian area farms and houses are placed in ribbon settlements and in the polder the farms are placed two by two or alternately along roads, with less houses the further north you go. Historic structures are also part of the occupation pattern. A large area with historical importance covers nature area De Kelsdonk and lands west of it. This area is called de Oostpolder and de Westpolder and are historic peat areas, with estates, peat relics and traces of peat extraction. Dikes, *wielen*[1], and the typical long, narrow peat plots are characteristic of the area. Another cultural-historic landscape lies east of Etten-Leur, which is also an old peat extraction area, including a *turfvaart*[2]. Lastly, several lines in the landscape are marked as historic geography lines. These lines are among others historic roads, waterways and dikes (Provincie Noord-Brabant, n.d.; Planbureau voor de Leefomgeving, 2021).

Occupation pattern

Figure 6: Occupation pattern layer (Basemap: Esri, 2021)

[1] A wiel or kolk is a lake originated from a breach in the dike (Van Dale Uitgevers, 2021)
[2] A turfvaart is a man-made channel used for the reclamation of peat areas and the transportation of excavated peat (Van Dale Uitgevers, 2021)

3. The archetypes of circular agriculture

This chapter will answer sub-research question 1: 'What are the spatial requirements for the archetypes of circular agriculture and how should they be allocated in the landscape?'.

SPLENDID (Spatial planning for environmentally diverse circular development), a research project from Wageningen University, has formulated three archetypes of circular agriculture (figure 7). These archetypes are three types of circular agriculture, namely technology land based, nature based and technology non-land based (Camara de Assis, 2021). Each of these archetypes will be explained shortly and their spatial requirements will be explained.

<table>
<tr><th colspan="3">NATURE BASED</th><th colspan="4">TECHNOLOGY LAND BASED</th><th colspan="2">TECHNOLOGY NON-LAND BASED</th></tr>
<tr><td colspan="2">Small scale mixed farming</td><td rowspan="2">Extensive livestock farming</td><td colspan="2">Cropping</td><td colspan="2">Livestock farming</td><td colspan="2">Food cluster or Agropark</td></tr>
<tr><td>Agroforestry</td><td>Traditional mixture of crops and livestock</td><td>Precision cropping</td><td>Intensive cropping with capturing, processing and exporting waste streams</td><td>Intensive dairy farming , with processing manure beyond what is legally required and use local waste as feed (partly)</td><td>Indoor livestock in association with intensive feed production</td><td>Focus on technological innovation</td><td>Focus on closing regional cycles</td></tr>
</table>

Figure 7: The archetypes and sub-archetypes of circular agriculture (Camara de Assis, 2021)

3.1 Archteype A: Technology land based

Technology land based agriculture relies on technologies and transport to ensure circularity at a relatively large level. It is an intensive type of farming, with dairy farming, agriculture and horticulture. The productivity of this archetype is high and its orientation is on the world market. Pesticides and artificial fertilizers are used, but the loss of polluting chemicals through the soil, water and air is minimized through technology. This archetype is divided into cropping and livestock. Cropping is divided into 'precision cropping' (figure 8) and 'intensive cropping', and livestock is divided into 'intensive dairy farming' and 'indoor livestock' (van Dinther, 2021; Camara de Assis, 2021; VVM, 2021).

Spatial requirements
As this type of agriculture is based on high productivity, it needs fertile soils with good dewatering systems, especially the sub-archetype cropping. Because the orientation of this type of agriculture is on the region and the world market, it also needs good infrastructure close by. Because this archetype is an intensive type of agriculture that uses pesticides and artificial fertilizers, it cannot be in or close to sensitive or protected nature areas. There are differences in the spatial requirements between the sub-archetypes of the archetype technology land based. There is especially a big difference between indoor livestock, which does not need a highly fertile soil, and the other three sub-archetypes, which all need fertile soils to function efficiently (Camara de Assis, 2021).

Figure 8: Example of archetype A: technology land based (DJI-Agras, 2019)

3.2 Archetype B: Nature based

This archetype of circular agriculture is extensive and relies on natural processes. It is based on the use of local inputs and without the use of any pesticides of artificial fertilizers. It mainly consists of dairy farming and agriculture and is similar to current biological farms. These farms will produce high quality produce for the local market. Areas with nature based agriculture are cultural landscapes with a high (bio)diversity. Nature based agriculture is divided into extensive livestock farming and small scale mixed farming, which includes agroforestry (figure 9) and the traditional mixture of crops and livestock (van Dinther, 2021; Camara de Assis, 2021; VVM, 2021).

Spatial requirements
Nature based agriculture is for areas that need to be protected for their ecological, natural or cultural value, as nature based is a small-scale type of agriculture that can best protect these valuable places. Nature based agriculture can serve as a buffer around Type A agriculture. Type B agriculture should also be placed on areas with sensitive soils, like peat soils that can still settle or soils with high risk of outflow of chemicals. However, there is a difference in spatial requirements for the sub-archetypes within the archetype nature based; agroforestry has different needs than cropping or extensive livestock farming (Camara de Assis, 2021).

Figure 9: Example of archetype B: nature based (Kentorchards, 2021)

3.3 Type C: Technology non-land based

This type of agriculture is a new type of intensive agriculture. This type can also be called agroparks; industrial parks with agricultural purpose. These agroparks are 'hotspots of technology', with agriculture fully in barns or greenhouses (figure 10). This ensures that the in- and outflow of substances like water, air, and chemicals, can be fully regulated. The clustering of type C agriculture can reduce transport movements and reduce the nuisance for humans and nature caused by these parks. Technology non-land based agriculture is divided into two categories, namely agroparks with the focus on technological innovation and agroparks with the focus on closing regional cycles. A distinction is made between agroparks with a focus on technological innovation and agroparks with a focus on closing regional cycles (van Dinther, 2021; Camara de Assis, 2021; VVM, 2021).

Spatial requirements
This archetype needs to be placed close to existing industrial areas. Just like 'normal' industrial areas, it needs good infrastructure and places where large barns and buildings can be build. It cannot be on areas with high ecological, cultural or historical importance, as in these areas only Type B agriculture can be placed. The agroparks also have to clustered and be a certain distance from residential areas, to reduce nuisance (Camara de Assis, 2021).

Figure 10: Example of archetype C: technology non-land based (Harding, 2020)

3.4 Allocation in the landscape

For this sub-research question a regional model was created which suggests how the three archetypes can be placed in the landscape. This model is shown below, with green as nature based agriculture, yellow as technology based agriculture and purple as technology non-land based agriculture (figure 11)

This map was based on several criteria, part of which I mentioned in the paragraphs about the archetypes themselves. Eight design guidelines were used to decide where what archetype fits the best. These guidelines can be seen in figure 12. The design guidelines are based on theories, in this case theories about the spatial requirements of the archetypes. I converted these spatial requirements in eight design guidelines. These design guidelines make the allocation of the archetypes easier and more efficient (Prominski, 2017). They can not only be applied in the agrarian area north of Etten-Leur, but also in other areas in The Netherlands where the three archetypes need to be placed in the landscape.

The theories for spatial requirements for the three archetypes are based on information from SPLENDID, the explanation in De Volkskrant (2021) and in the journal Milieu of how the map of The Netherlands was made by Martha Bakker and her research team (van Dinther, 2021; Camara de Assis, 2021; VVM, 2021). The guidelines show that archetype A, technology land based, needs to be allocated first. The left over agricultural land becomes archetype B, nature based. Archetype B can serve as a buffer around nature areas, because it is a less intensive type of agriculture and does not use any pesticides or artificial fertilizers (Camara de Assis, 2021). After allocating archetype A and B, areas can be indicated that might be suitable for archetype C, technology non-land based. The last step is to check if there are any small areas of specific archetypes. These areas need to be removed or be connected to other areas of the same archetype, because small areas of one archetype function inefficiently and will only increase tension between farmers of two archetypes (van Dinther, 2021; VVM, 2021).

For the allocation of the archetypes four maps were created to decide on the allocation of archetype A: a cultural-historical map, an ecological map, a map of land use and a map of soil fitness. After allocating archetype A, archetype B was allocated to the left over agricultural land. Lastly, existing industrial areas were investigated and sport were marked that could be suitable for archetype C. These steps came down to the single map in figure 11. This map of the allocation of the archetypes is very generalized and not all landscape characteristics were taken into account. For an example, no research has been done into how citizens value certain landscapes. These landscapes should be appointed archetype B because for the implementation it is easier to take historical and cultural values into account (Camara de Assis, 2021).

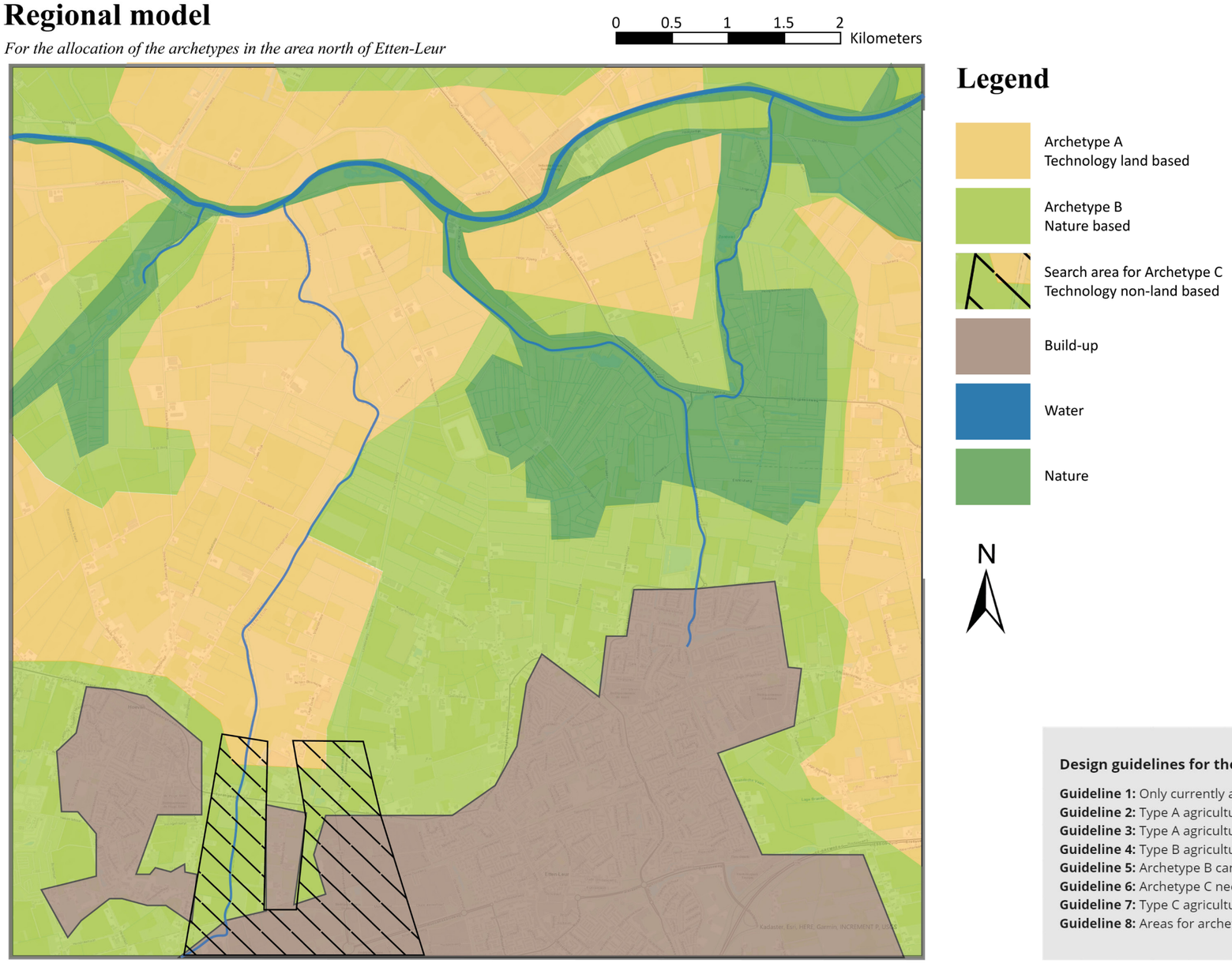


Figure 11: Regional model of the allocation of sub-archetypes (Basemap: Esri, 2021)

3.5 Chapter conclusion

Research project SPLENDID has formulated three archetypes of circular agriculture: technology land based, nature based and technology non-land based. Technology land based is an intensive type of agriculture and thus needs fertile soils. It uses artificial fertilizers and pesticides which means it cannot be too close to nature areas. The second archetype, nature based, is based on biological farming and does not use any artificial fertilizers or pesticides. It can be allocated to areas with sensitive soils or as a buffer around nature areas. The last archetype, technology non-land based, is based on all-indoor farming. It needs a good infrastructure and clustering to increase its efficiency. Based on the spatial requirements of the archetypes, a landscape model was created. Using a set of rules each archetype was allocated to several areas, starting with archetype A, then B and ending with the creation of a 'search area' for archetype C. The landscape model of the archetypes can be used as an indication of what the most suitable places for the archetypes are. In the next chapter I will select a detail area which I will use to look at the experiential quality of the landscape. This can be used to decide on how to implement the archetypes in the landscape on a smaller scale.

Design guidelines for the allocation of the three archetypes

Guideline 1: Only currently agricultural land can be used for the archetypes
Guideline 2: Type A agriculture cannot be placed on areas with cultural, historical or ecological importance
Guideline 3: Type A agriculture has to be placed on fertile soils
Guideline 4: Type B agriculture will be placed on the areas that cannot be Type A
Guideline 5: Archetype B can function as a buffer around nature areas
Guideline 6: Archetype C needs to be placed in an area with good infrastructure
Guideline 7: Type C agriculture needs to be placed close to existing industrial areas and needs to be clustered, to prevent nuisance
Guideline 8: Areas for archetypes cannot be too small, because of economies of scale and efficiency

Figure 12: Design guidelines for the allocation of the three archetypes

4. Experiential quality

In this chapter sub-research question 2 will be answered: 'Which area can be used as a testing ground for different archetypes of circular agriculture and what are its most important experiential qualities?'.

My interpretation of experiential quality is derived from Bakx (2021), who has formulated sixteen criteria for spatial quality. These sixteen criteria are divided into four categories: experiential, economic, ecological and long-term qualities. In this thesis the focus will be on the experiential qualities, which includes nine criteria. Before looking at how the experiential spatial qualities relate to the area of Etten-Leur, I first had to think about how the criteria are visible in the landscpae. Figure 13 shows a table of the nine criteria, how they are visible in the landscape and how they are related to each other.

For the evaluation of the landscape of Etten-Leur, and thus for answering the second sub-research question, a detail area was selected. I chose to select a detail area because experiential quality is something that you can only measure on a smaller scale. Humans can only experience their near surroundings and not an entire region at once. Thus, the landscape is experienced by humans on a small scale; a landscape is open if a person standing in it experiences it as open and a landscape is varying if that person experiences it as varying. Besides, small-scale landscape components and interventions can make big changes in the landscape for humans. This is why it is important to choose a detail area before looking at the experiential spatial qualities. The detail area selected in this chapter will also be the location of the testing ground that will be designed in chapter 5.

Experiential spatial quality	How is this visible in the landscape?	Is related to
Visual heterogeneity	- Alternating plot patterns - Different water bodies - Variety of greenery - Difference in elevation - Variety of buildings in different patterns	Naturalness Coherence Openness Multi-sensory experience
Naturalness	- Variety of greenery - Water bodies with a 'natural' look (meandering rivers) - Low/little maintenance - Little agricultural or industrial practices	Visual heterogeneity Cues of care Seasonality Multi-sensory experience
Regional character	- Types and patterns of plants and trees - Size and patterns of plots - Style of buildings - Road patterns - Types of agriculture	All other criteria, especially historicity
Openness	- Amount and height of greenery - Elevation - Build-up - Fences, walls or other types of visible boundaries	Visual heterogeneity Coherence Regional character
Coherence	- Patterns of trees and build-up - Tree or plant rows - 'Transition zones'	Openness Visual heterogeneity
Historicity	- Old buildings - Historic landmarks like burial mounds, walls or fortresses - Historic landscape components like tree rows, hedges or mounds	Regional character
Cues of care	- Cut grass, clipped trees and hedges, etc. - Intact human made structures (buildings, fences, roads...) - Clear road signs and signs about protected nature or historical areas	Naturalness
Seasonality	- Deciduous trees - Flowers and fruits (especially for fruit trees and flowers in grassland) - Changes in the use of the landscape are visible (agricultural but also recreational)	Naturalness Multi-sensory experience Regional character
Multi-sensory experience	- Auditory: birds and insects, water, wind - Olfactory: flowers and fruits, plants - Gustatory: fruits, places to eat like a cafe or restaurant - Tactile: different textures of plants and trees, flowing water, type of path (sand, pebbles, soil...)	Naturalness Visual heterogeneity Seasonality

Figure 13: The nine experiential qualities and how they are visible in the landscape

4.1 Detail area

The specific detail area was chosen based on several criteria. Firstly, I wanted multiple archetypes to be allocated to the detail area. The archetypes have a huge impact on the experiential quality and I find it interesting to combine the criteria of experiential quality with different archetypes. besides, I think the transition zone between two archetypes is very interesting and the most challenging to design, especially when there are big differences between the archetypes. This is why I chose an area with both archetype A and B. Secondly, I didn't want the entire detail area to be the same type of area so I tried to choose a diverse location. Thirdly, I wanted to show what function the archetypes had in the landscape. I based my decision of the detail area on these three criteria. Figure 14 shows the location of the detail area in a red frame, with figure 15 showing the topographic map of the detail area. This area contains archetype A and B and a nature area. In this area archetype B functions as a buffer between archetype A and the nature area. Archetype B is also partially placed on less fertile and relatively wet soils, which is why this area in the north of the detail area, surrounding the nature area, consists of mostly grasslands.

4.2 Experiential criteria in the detail area

The table in figure 13 helped me with the evaluation of the detail area because it gave me fixed things to look for in the landscape. This allowed me to see how the experiential spatial qualities are related to the detail area. For each of the nine criteria a map was created that gives an idea of how the criteria are visible in the landscape. For each criteria the elements in the map will be described shortly and conclusions will be drawn of how the experiential criteria are related to the detail area.

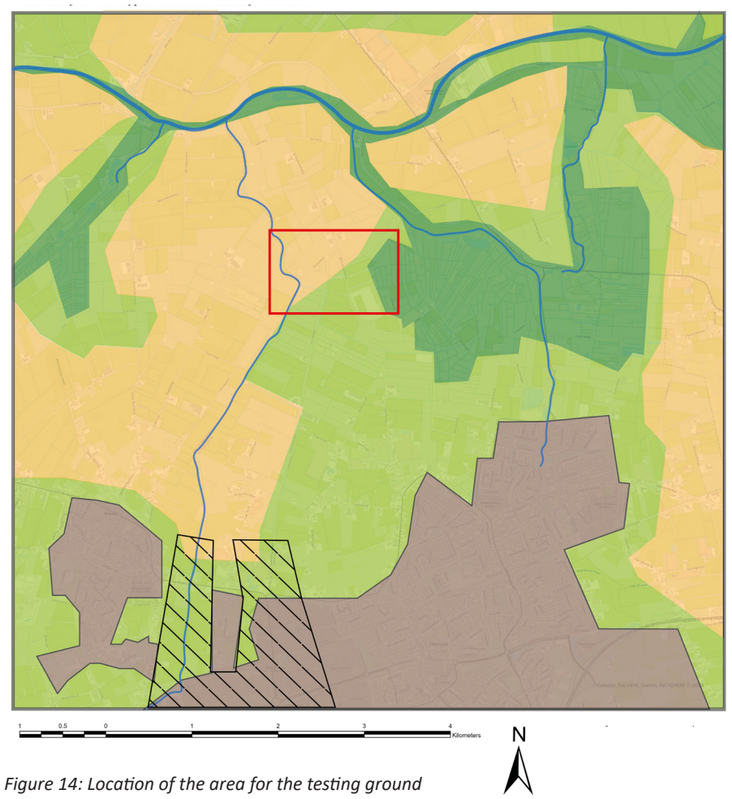


Figure 14: Location of the area for the testing ground (Basemap: Esri, 2021)

Topographic map detail area

Figure 15: Topographic map of the area for the testing ground (Basemap: Esri, 2021)

Visual heterogeneity

Figure 16: Visual heterogeneity (Basemap: Esri, 2021)

Naturalness

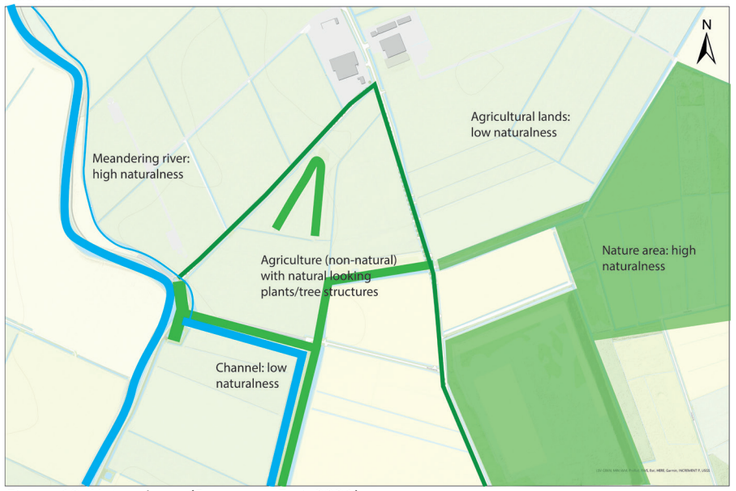


Figure 18: Naturalness (Basemap: Esri, 2021)

Regional character

Figure 21: Regional character (Basemap: Esri, 2021)

Visual heterogeneity
For visual heterogeneity I mainly looked at the 'lines' in the landscape, like ditches, roads and tree rows, but also at the height of plants, trees and crops and the elevation. As there are only a few buildings in the landscape, I did not take the buildings into account for the visual heterogeneity. As you can see on the map in figure 16, the ditches and plot pattern is varied throughout the detail area. There are several types of water bodies: de Laaksche Vaart, which is both a natural and canalized river, and many ditches with varying sizes and lengths. The area is relatively open in the north and west, but in the south and east more trees and nature make the landscape more closed. Thus, the alternation between plot patterns, waterbodies and open and closed landscape in this detail area shows that this area has a high visual heterogeneity. In figure 17 you can see an example of an area with high visual heterogeneity. The tree lane, agrarian land, in the back various trees and buildings and little to no straight lines, make this landscape one with high visual heterogeneity.

Naturalness
For naturalness I mainly looked at what areas are part of nature networks, but I also looked at what the landscape really looks like to people (figure 18). Not everything that is natural also looks natural and the other way around. The east of the area looks very natural, with various tree and plant species, plots with natural grasslands and variation in height and density of the plants. The north of the area has only little naturalness, because of the straight plots and ditches, the buildings and two windmills in the agricultural land. However, the meandering Laaksche Vaart does add some naturalness to this part and to the area further south. In the middle of the detail area, lines of trees and plants in the landscape make the landscape look more natural, however, these lines are mostly straight. Reeds and other plants along ditches and roads also give the area a more natural look. Overall, the east and south of the detail area looks very natural. On the other hand, the north of the area looks very straight, man-made and non-natural. Figures 19 and 20 show examples of what a landscape with high naturalness looks like. The top figure is a photo of natural grassland on peat, whereas the bottom photo shows natural grassland on clay soil.

Regional character
Regional character is based on all of the criteria, because regional character is mainly about what the landscape looks like (figure 21). Especially plot patterns, building types and the use of plants or trees shows the character of a region. In this region, the plots and ditches are varied. In the middle of the area several roads are aligned with trees; one with pollarded willows and one with young poplars. I could not decide on what the 'real' regional character is, this might be because this is a detail area, and to see what the character of a region is you need to look at the entire region. But you could say that all of the other criteria together form the regional character. Figure 22 shows an example of the regional character being visible in the landscape. the lane of poplar trees on the left runs all the way along the waterway to the right side of the image, close to the wind turbines. This poplar lane is very characteristic for this area.

Figure 17: Example of how visual heterogeneity is visible in the landscape

Figure 19: Example of how naturalness is visible in the landscape

Figure 20: Example of how naturalness is visible in the landscape

Figure 22: Example of how regional character is visible in the landscape

Openness

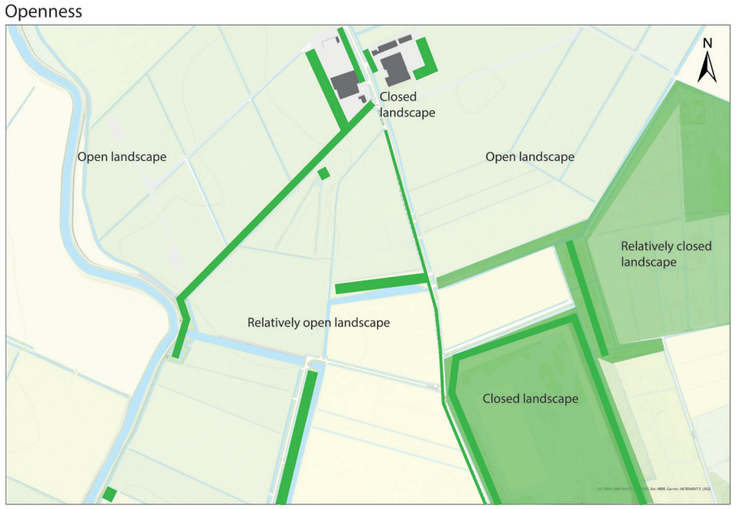


Figure 23: Openness (Basemap: Esri, 2021)

Openness
Openness of a landscape is a relatively easy criteria to judge, because it is easy to see how open or closed a landscape is (figure 23). In the west and north of the detail area, the landscape is relatively open. However, the farms in the far north are very closed off, and the tree lanes along the Emmerweg and the Bollendonkseweg created a more closed off landscape. In the east and southeast of the detail area the landscape is very closed, with tree rows and plants blocking the view from various locations. Overall, the openness of the landscape in the detail area is varying and depends on the where you are standing in the area. The photo in figure 24 shows a very open landscape in the clay area north of Etten-Leur, where you can see all the way to the wind turbines in the back.

Figure 24: Example of how openness is visible in the landscape

Coherence

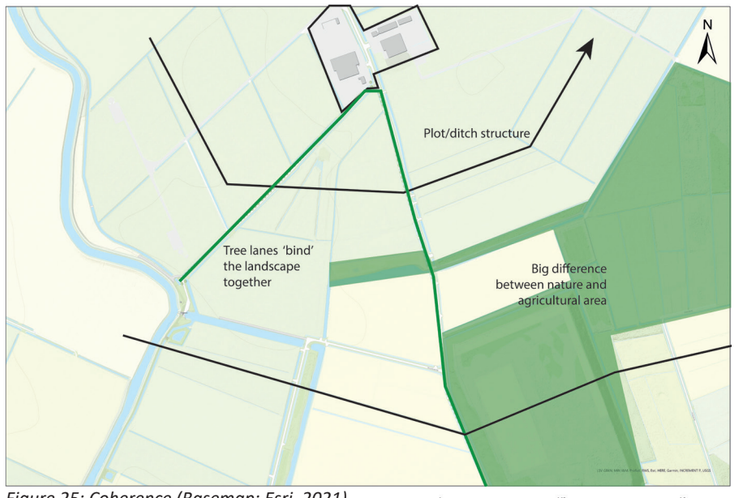
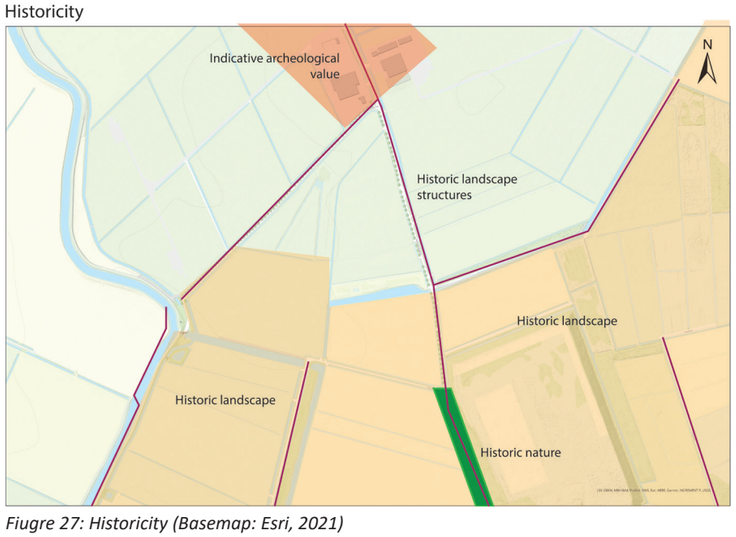


Figure 25: Coherence (Basemap: Esri, 2021)

Coherence
Coherence was for me a hard criteria to judge, because the coherence of a landscape is very dependent on the person judging it and depends on the moment in time. The landscape is not very coherent, however, the plots and ditches do seem to have a structure, as you can see in the map in figure 25. The farms in the north are not very coherent with the rest of the area, as the farms are very 'closed off' and have no real visual connection with the landscape around them. The nature areas in the middle of the detail area do create a transition area between the dense nature area in the east and the agricultural lands in the north and west. The tree lanes along the Emmerweg and the Bollendonkseweg create a more coherent landscape. Overall, this landscape is not very coherent due to many different aspects and patterns. However, some landscape components do make it more coherent, like the pattern of the ditches and the nature transition zones. Figure 26 shows a landscape with a large coherence. The dike on the right and rows of tree and grass make the landscape very coherent; the landscape lines bind the landscape together.

Figure 26: Example of how coherence is visible in the landscape

Historicity



Fiugre 27: Historicity (Basemap: Esri, 2021)

Historicity
For the historicity of the area I mainly looked at maps about historic landscapes and structures (figure 27). The entire southeast of the area is called 'historic landscape', which means it has historic value. Several historic structures are visible in the landscape, which might indicate old roads. A narrow strip of historic nature is visible in the south of the area, surrounding one of the historic structures. Lastly, in the north of the area, a location with indicative archeological value has been found. This value is relatively low according to the map, but this might mean that archeological finds can be made at this location. Overall, the detail area has a relatively high historic value. An example of an historic component in the landscape is an old tree lane, as you can see in figure 28, these old whitebeam trees (*Sorbus Aria*) were planted between 1893 and 1950 and thus form a historic structure in the landscape (Provincie Noord-Brabant, n.d.).

Figure 28: Example of how historicity is visible in the landscape

Cues of care

Figure 28: Coherence (Basemap: Esri, 2021)

Seasonality

Figure 30: Seasonality (Basemap: Esri, 2021)

Multi-sensory experience

Figure 33: Multi-sensory experience (Basemap: Esri, 2021)

Cues of care
This criteria is about how much the landscape has been cared for, which I translated into the map in figure 28. Several components of the landscape are relatively natural, which includes the nature area in the east and the naturally meandering river in the west. The rest of the landscape is mostly man-made; the agricultural lands, ditches and the channel are all man-made and maintained by people. The photo in figure 29 shows a land with high cues of care. This is visible through the straight plow lines, but also the dike on the right and the straight lines of both trees and grass in the landscape. This all suggests that the landscape has been made and is being maintained by humans.

Seasonality
The change of seasons are visible in several landscape components (figure 30). The most important component that shows this is the growth of plants and trees. Especially crop growth is very characteristic for seasonality. Also trees and nature are show change of season very well, especially because there are mostly deciduous trees in the area. Dairy farming, with animals grazing outside in warmer seasons and staying inside in cold seasons, shows the change of seasons. Lastly, change in ground water levels, which is visible in the height of the river water and in ditches, also shows the change of season and mainly change in temperature and drought. Both photos on the right show seasonality. The top photo (figure 31) shows a natural grassland, in which seasons are well visible because of what type of plants are growing or flowering. In this photo it is spring and thus cow parsley (*Anthriscus sylvestris*) is growing. The bottom photo (figure 32) shows land with crops on it. Crops are a good indication of seasons.

Multi-sensory experience
This area has a high multi-sensory experience. There are many landscape components that contribute to this experience (figure 33). Firstly, the two wind turbines in the northwest of the area are both very visible in the landscape and make noise once you are standing close enough. The agricultural lands also contribute to the multi-sensory experience. You can see the crops but also possibly smell, touch or taste them. Animals like cows are also visible in the landscape, they can smell and make sounds, you might even be able to touch them. Rivers and streams make sounds while they flow and you can feel or taste the water. Lastly, nature areas are a rich source for multi-sensory experience. You can see nature, but also smell it, hear leaves rustling and animals making sounds. And if you are able to come close, you can also touch the plants and trees. The photo on the right (figure 34) shows what multi-sensory experience could be like. A field of grazing cows provides all senses. You can see the cows approach, you can smell them and hear them. You might also be able to touch them and to taste their milk on a nearby farm.

Figure 29: Example of how cues of care are visible in the landscape

Figure 31: Example of how naturalness is visible in the landscape

Figure 32: Example of how naturalness is visible in the landscape

Figure 34: Example of how naturalness is visible in the landscape

4.3 Chapter conclusion

In this chapter a detail area was selected and evaluated based on the nine experiential criteria. Overall, the majority of this area has a high experiential quality. This is mainly caused by the heterogeneity of the landscape and the historic structures in the landscape, which both have a positive influence on many of the other criteria for experiential quality. Some of the criteria were hard to judge because experiential quality is also how an individual judges the quality of the landscape, which can be different for each person. By using the table of figure 13 I did try to make objective conclusions about the nine criteria for experiential quality. On the other hand, because experiential quality is based on how an individual experiences the landscape, and I am also an individual judging the landscape, I do not need to be completely objective.

This selection of the detail area and the evaluation of its experiential criteria lays the basis for the design of a testing ground for the archetypes of circular agriculture with high experiential quality. In the next chapter I will design this testing ground based on the conclusions from this and the previous chapter.

5. Testing ground

In this chapter the third sub-research question will be answered: 'How do design alternatives for this testing ground contribute to these experiential qualities?'. The design of this testing ground is based on conclusions from chapter 3 and 4, in which the first two sub-research questions were answered. Sub-research question 3 will be answered with the method 'research through design'.

5.1 Research through design

The method 'research through design' means that the activity of designing is used as a research method (Lenzholzer et al., 2013). The allocation of the archetypes, as described in chapter 3, is based on landscape components like soil type, historic and ecological structures and current land use. In this chapter a specific area of the landscape map will be investigated in more detail and determine the allocation of the sub-archetypes of circular agriculture. This part of the designing phase is based on the same landscape components as the allocation of the archetype, but for the detail design the experiential quality of the landscape is also taken into account. The experiential quality is less objective and thus harder to judge. For this designing phase I will use the table in chapter 3 (figure 13). Through 'research through design' I will make three designs and rate them based on the nine experiential spatial criteria. The best design according to this rating will be the basis for the final design. This method is described in figure 35.

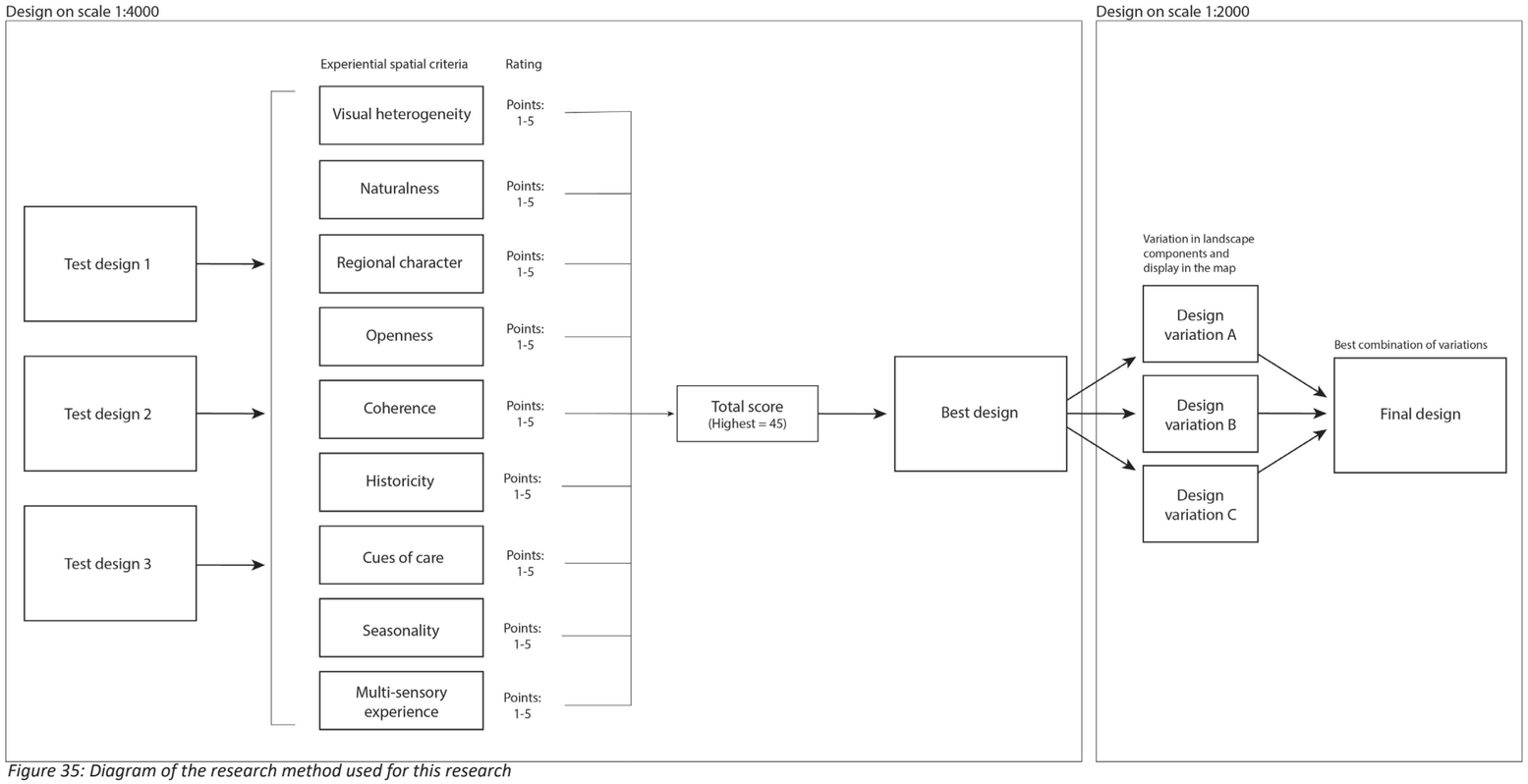


Figure 35: Diagram of the research method used for this research

5.2 Archetypes in the detail design

The first step for the design of the detail area is to allocate the archetypes and sub-archetypes to specific areas. To do this I first looked at how the archetypes were allocated in the detail area in the landscape map. This showed an overall idea of where what archetype would be in the detail design. Because the landscape map did not take into account lines in the landscape and specific landscape components, this was the first thing I started looking for. Based on the current landscape of the detail area, I made a map of the allocation of the two archetypes, namely archetype A and B (figure 36).

5.3 Sub-archetypes in the detail design

Based on the map in figure 36, I started thinking about the different sub-archetypes that would fit in the landscape. The decision of the allocation of the sub-archetype was based on several landscape components, which I mention below:

- Current land use;
- current nature areas;
- soil fitness;
- tree rows;
- waterways like ditches and rivers;
- the current openness of the landscape.

Looking at these landscape components, I created a map for the sub-archetypes in the detail area, as you can see in figure 37. This figure is, of course, not a real design, but merely a model. It gave me something to hold onto during the designing phase. In the next paragraphs I will shortly explain for each sub-archetype what they are, look like and how and why I placed them in the landscape.

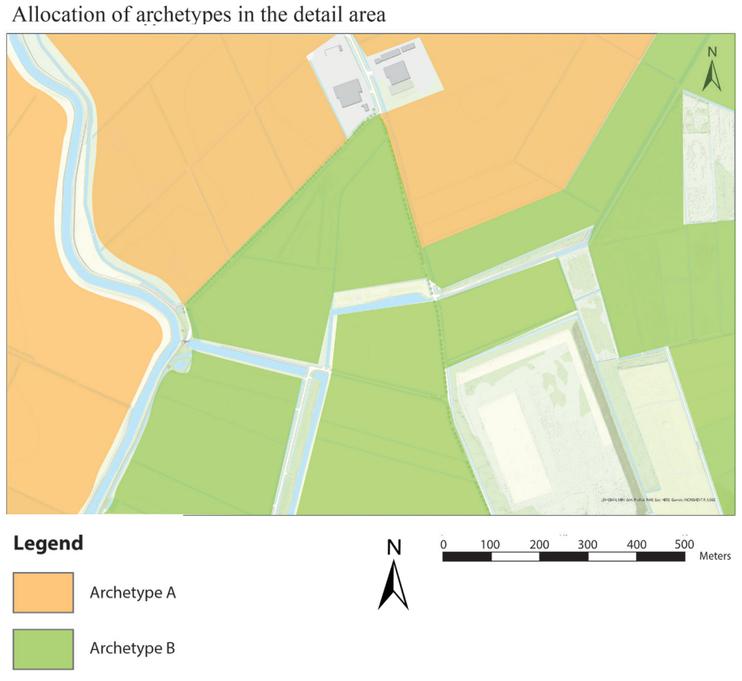


Figure 36: Map of allocation of archetypes in the area for the testing ground (Basemap: Esri, 2021)

Figure 37: Map of the allocation of sub-archetypes in the area for the testing ground (Basemap: Esri, 2021)

5.3.1 Intensive dairy farming
Intensive dairy farming is a sub-archetype of archetype A, technology land based. This sub-archetype is the intensive type of dairy farming we already know in The Netherlands, with grasslands and large barns for the animals. A visualization of this sub-archetype is shown in figure 38. The processes in and outside the barns are made more efficient and waste is reduced through new technologies. Intensive dairy farming can also be combined with wind energy (SPLENDID, personal communication, 2021). I placed this sub-archetype in the north of the detail area because this area is already largely used for dairy farming. There are large, flat grasslands and farms with barns for the animals. There are also wind turbines present in the landscape, from which two are visible in the detail area. To reach the goals of sub-archetype intensive dairy farming, some changes need to be made to the farms to make them more efficient and circular.

5.3.2 Precision cropping
Precision cropping is just like intensive dairy farming a sub-archetype of archetype A. Precision cropping is an intensive, high productivity type of farming. Precision cropping uses machines, robots and drones to make processes more efficient, reduce waste and decrease pollution. This sub-archetype is relatively large scale with a low diversity of crops due to economies of scale but also because the technologies used are highly specialized (Camara de Assis, 2021). A visualization of this sub-archetype is shown in figure 39. I placed precision cropping on the western edge of the detail area because it has a highly productive soil, which reduces the need for artificial fertilizers without lowering the productivity. Besides, it is not as wet as most of the detail area, which also creates a better environment for cropping. Most of this area is already cropland because of these reasons, this also means little changes have to be made to transfer the land into precision cropping agriculture.

5.3.3 Extensive dairy farming
Extensive dairy farming is a sub-archetype of archetype B, nature based. This sub-archetype resembles current biological dairy farming. It includes both dairy farming but also livestock for meat production. This sub-archetype exists of large grazing areas that are maintained by the animals, as visible in figure 40. It has a high cultural value and maintains high biodiversity because of low intensity of the grazing. No artificial fertilizers are used in this sub-archetype (Camara de Assis, 2021). I placed extensive dairy farming in the east of the area, because in this location, there were already herb and fauna rich grasslands present. These grasslands are already maintained like they will through extensive dairy farming. Besides, in this way, extensive dairy farming forms a buffer around the nature areas which protects them from pollution.

5.3.4 Traditional mixture of crops and livestock
This sub-archetype belongs just like extensive dairy farming to archetype B. It is also based on biological farming and uses no pesticides or artificial fertilizers. This landscape is small scale and heterogeneous and combines crops with livestock like chickens or sheep. This sub-archetype is shown in figure 41. Resource sharing with close by neighbours is also an important aspect of this sub-archetype (Camara de Assis, 2021). I placed this sub-archetype in the middle and south of the detail area. The most important reason for this was to create a buffer around the nature area. Another reason is that because this part of the detail area is relatively small-scale, this sub-archetype is able to keep the character of the landscape.

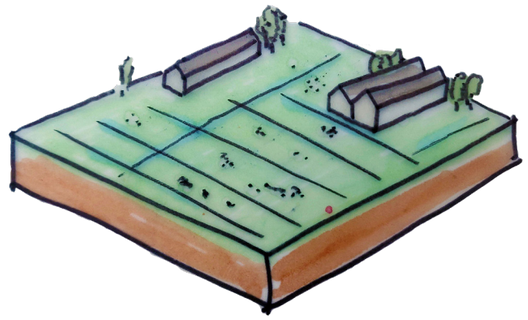


Figure 38: Isometry of intensive dairy farming

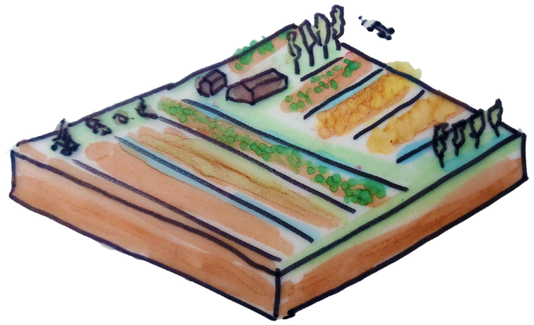


Figure 39: Isometry of precision cropping

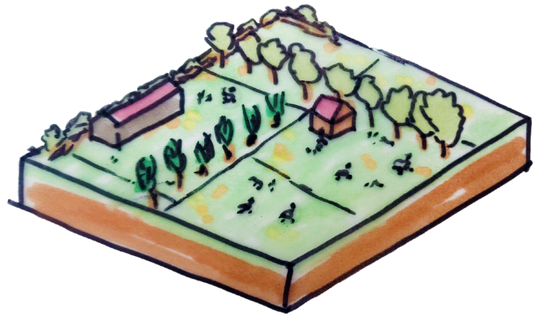
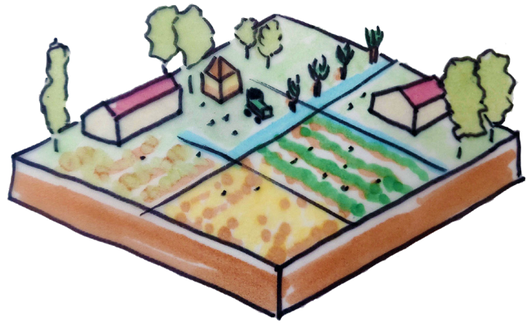


Figure 40: Isometry of extensive dairy farming



Fiugre 41: Isometry of traditional mixture of crops and livestock

5.4 Sketches
After the allocation of the sub-archetypes, the designing phase started. I had a hard time 'translating' the even colours of the sub-archetypes in figure 23 to real interventions in the landscape. This is why I made a list of several landscape components that could be changed and that had influence on the experiential quality of the landscape. This list contained roads, tree lanes, water, nature, buildings, recreation and allocation of the sub-archetypes. Changes to these seven components would lead to different outcomes and to designs that would be rated differently for the experiential spatial criteria. For the first step of the design process I created three sketches. Even though I created a map of the sub-archetypes in 5.3, I decided it would be interesting to change and move these sub-archetypes and even add some, to see what influence the sub-archetypes have on experiential spatial criteria.

5.5 Rating of the sketches
After creating the three sketches, I rated the sketches as well. The sketches are rated based on the nine experiential spatial criteria. For each criteria I looked at the sketch and thought about what it would look like once it was finished. This way, I scored each criteria for all three sketches a number between 1 and 5, where 1 is very bad and 5 is very good. Some of the criteria were hard to judge, because they are not directly visible in a map. Other criteria, like heterogeneity, were easy to judge, because heterogeneity is usually visible in a map.

The rating of the sketches is not only based on how much a criterium is visible in the landscape. It is based on how balanced the criterium is visible in the landscape. For an example, an completely open landscape without any visual borders, will score a 1. This is because a completely open landscape is not visually attractive, but a good balance between open and closed landscape is. This also means that the criteria do not oppose each other, but can complement each other.

Sketch 1: to the center

When I chose this detail area, I was very interested in the plot patterns of the land, which look like a semi-circle. In the sketch in figure 42 I emphasized this interesting plot pattern by extending it to the agricultural lands south and east. This sketch has three different sub-archetypes, namely intensive dairy farming, extensive dairy farming and traditional mixture of crops and livestock. Furthermore, all the farms, barns and buildings are placed in the middle, with all roads leading to the middle as well. In this sketch nature has been expanded slightly and tree lanes are only in the extensive area (archetype B agriculture).

The rating of this sketch has been done according to the rules I mentioned in the previous paragraph. The total score of this sketch is 25 out of 45, of which the calculation is visible in figure 43. The regional character of this sketch is relatively high because the lines in the landscape have been accentuated. However, because the landscape is very open, it scores low on openness (there is no good balance between open and closed). Because of the implementation of only three archetypes, the visual heterogeneity scores low. This causes the multisensory experience to be low as well, because without heterogeneity in the landscape, not many senses are stimulated.

Sketch 1: to the center

Figure 42: Sketch 1: to the centre

Experiential criteria	Visual heterogeneity	Naturalness	Regional character	Openness	Coherence	Historicity	Cues of care	Seasonality	Multi-sensory experience	**Total score**
Rating (1-5)	2	3	4	2	2	3	4	3	2	**25**

Figure 43: Rating of sketch 1

Sketch 2: along the line
This sketch in figure 44 was influenced by the idea of creating a transition zone between archetype A and B. There are five sub-archetypes in this sketch, namely intensive and extensive dairy farming, agroforestry, precision cropping and traditional combination of crops and livestock. Extensive dairy farming forms a transition zone between the two archetypes and agroforestry forms a transition zone between crops and livestock and the nature area. Nature area has not been expanded in this sketch and the existing tree lanes have not been expanded. In this sketch the line, going from west to east, is the most important detail, shown by the buildings and a recreational path along this line.

The rating of this sketch has been done according to the rules I mentioned in the previous paragraph. The total score of this sketch is 31 out of 45, of which the calculation is visible in figure 45. Seasonality and multi-sensory experience both score a 4 because of the addition of agroforestry, in which seasons are very well visible. Visual heterogeneity still scores a 3 out of 5 because there are still only a couple sub-archetypes in the design. Naturalness scores very low because no new nature areas have been added in this sketch. Because of a better combination of open and closed landscape, openness scores higher in this sketch than in sketch 1. Coherence scores a 4 because the transition zone ensures a coherence between archetype A and B.

Legend

- Intensive dairy farming
- Water
- Wet grassland
- Forest
- Extensive dairy farming
- Traditional mixture of crops and livestock
- Precision cropping
- Tree lane
- Agroforestry
- Building
- Recreational path
- Road

Sketch 2: along the line

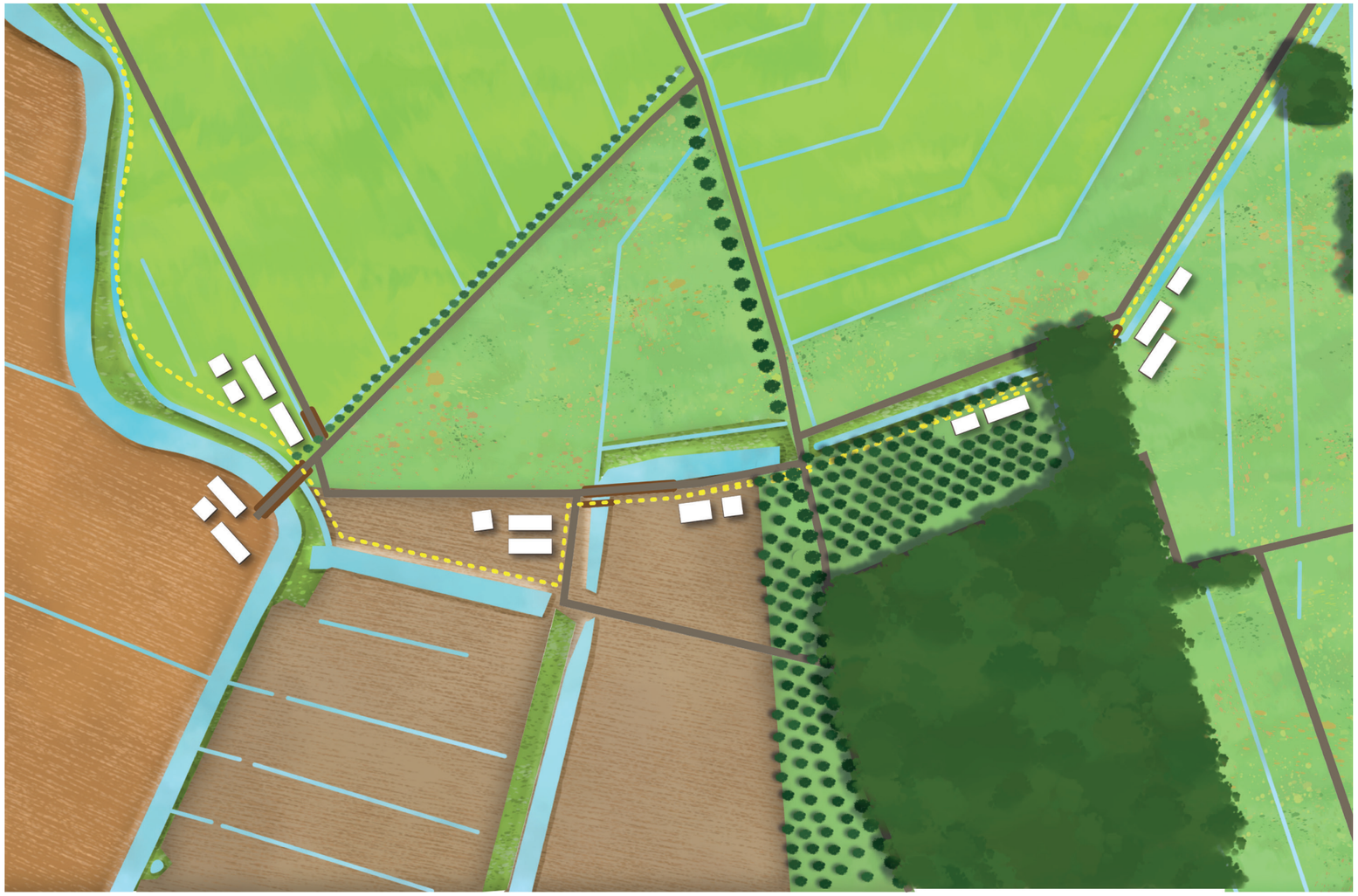


Figure 44: Sketch 2: along the line

Experiential criteria	Visual heterogeneity	Naturalness	Regional character	Openness	Coherence	Historicity	Cues of care	Seasonality	Multi-sensory experience	**Total score**
Rating (1-5)	3	2	4	4	4	3	3	4	4	**31**

Figure 45: Rating of sketch 2

Sketch 3: Diversity

Figure 46: Sketch 3: diversity

Sketch 3: diversity
The third and last sketch, visible in figure 46, is based on the seemingly 'random' placement of buildings and paths. However, the placement of these elements have been done logically; each sub-archetype has its own farm or group of buildings. There are seven sub-archetypes in this sketch, which are intensive and extensive dairy farming, precision cropping, meadow forestry, food forest, combination of crops and livestock, and hedge landscape. Furthermore, nature areas have been expanded to create a nature network along the waterways and ditches.

The rating of this sketch has been done according to the rules I mentioned in the previous paragraph. The total score of this sketch is 34 out of 45, of which the calculation is visible in figure 47. This rating means that sketch 3: diversity is the best sketch and is thus the basis for the final design of the testing ground.

For this sketch, both visual heterogeneity and multi-sensory experience score a 5, the highest score. Because of the large variety of sub-archetypes and landscape components, the visual heterogeneity is high. This causes the multi-sensory experience to be high as well. A high seasonality is caused by the fruit and nut trees and hedges, especially in the middle of the area. Naturalness is scored high because in this sketch a nature network has been created.

Legend

- Intensive dairy farming
- Forest meadow
- Water
- Wet grassland
- Forest
- Extensive dairy farming
- Traditional mixture of crops and livestock
- Precision cropping
- Tree lane
- Agroforestry
- Hedge landscape
- Building
- Recreational path
- Road

Experiential criteria	Visual heterogeneity	Naturalness	Regional character	Openness	Coherence	Historicity	Cues of care	Seasonality	Multi-sensory experience	Total score
Rating (1-5)	5	4	3	3	3	4	3	4	5	**34**

Figure 47: Rating of sketch 3

5.6 Final rating

That sketch 3 (figure 46) was rated the highest score is mostly because the visual heterogeneity is high due to the various sub-archetypes, which in turn influences several other criteria like naturalness and multi-sensory experience. However, for both openness and coherence sketch 2 was better. Sketch 3 is relatively closed while sketch 2 had a good ratio of open-closed landscape. The high score for coherence in sketch 2 was due to the transition zone created by extensive dairy farming. I will use sketch 3 as a basis for my final detail design, in which I will look at the landscape components in more detail.

5.7 Masterplan of the testing ground

Before making the final masterplan, I first made a test design. I looked at several components of the area in more detail. I changed the scale from 1:4000 to 1:2000 to make sure all details could be shown in the design. While creating the test design, I had to think about where the roads went exactly, how the buildings would be placed and how I wanted to show the different types of agriculture on the map. For an example, I realized that even though cars couldn't come everywhere in the area, tractors or other agricultural vehicles, which meant I needed to make country roads. I also realized I placed a parking spot right next to a wind turbine, which meant it had to be replaced because you cannot place roads too close to a wind turbine (RVO, 2014). Because of the smaller scale, I was also able to think about recreational opportunities, like a restaurant, recreational paths or picknick areas. After creating the masterplan, I also created a detail design of a smaller area. This allowed me to show even more details, like connections between roads and the transition between different land usages.

5.7.1 Circular agriculture

The final design in figure 49 has a large variety of circular agricultural practices. The testing ground includes not only crops, livestock and dairy farming, but also mixed farming, orchards and hedge farming. Archetype A, intensive farming, is placed in the north and west of the area. In the north is intensive dairy farming situated whereas the area in the west, across the Laaksche Vaart, precision croplands are situated. All other agricultural lands are archetype B, extensive farming. In the east, in the wet peatlands, extensive dairy farming is practiced. This includes large fauna and herb rich grasslands grazed by various types of cows. In the less wet areas, extensive farming includes orchards with various fruit and nut trees, a forest meadow, mixed crop and livestock farming, and hedge landscapes. The strip of extensive dairy farming in the east and the forest meadow function as transition zones between the intensive and extensive farming. The isometries in figure 48 show what each sub-archetype will look like in the landscape.

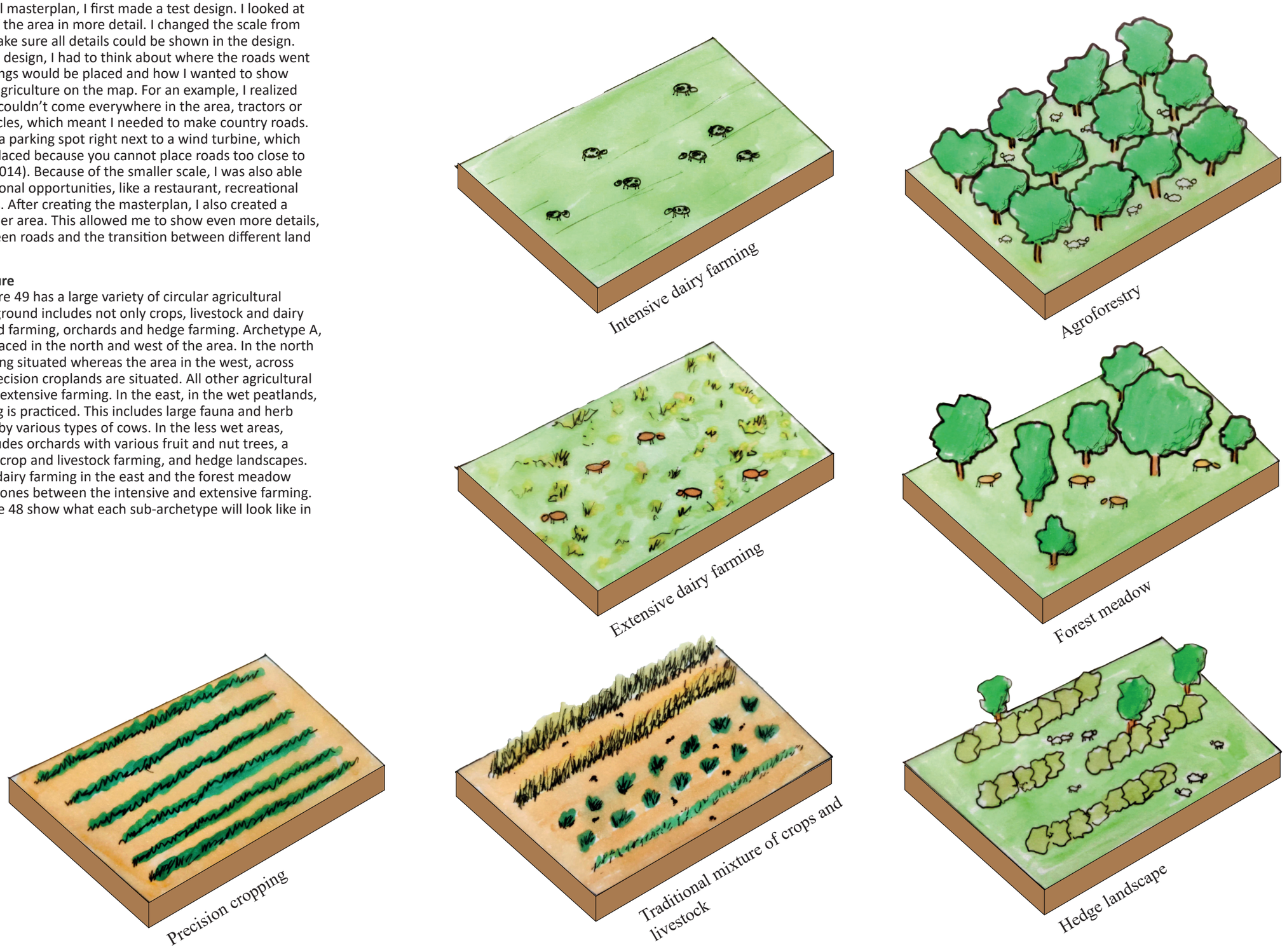


Figure 48: Isometries of all sub-archetypes in the masterplan of the testing ground

Masterplan testing ground

Legend

Archetype A: technology land based

- Intensive dairy farming
- Precision cropping

Archetype B: nature based

- Extensive dairy farming
- Agroforestry
- Forest meadow
- Hedge landscape
- Traditional mixture of crops and livestock

Roads

- Car road
- Parking space
- Country road
- Cycling path
- Walking path

Other landscape components

- Tree lane
- Wet nature
- Water
- Natural slope
- Forest
- Buildings
- Recreational area

Figure 49: Masterplan of the testing ground for the archetypes of circular agriculture

5.7.2 Nature network

A network of nature along the Laaksche Vaart, ditches and other water bodies ensures nature areas are connected to each other. Slopes of most water bodies will be weakened, which makes the shores more natural and it makes it easier for animals to access and leave the water. Waterways and strips of (wet) nature between archetype A and B function as buffers, to protect archetype B from waste streams from archetype A.

5.7.3 Recreation and education

Two roads lead from the north of the area to two parking spaces. From here, visitors can walk or take a bike and cycle through the area. In the forest meadow a cafe-restaurant with a bicycle renting facility is located. Three recreational areas indicate where people can walk freely and have a rest or a picknick. Only in these areas walking freely is permitted, in all other areas visitors must follow the paths. Cycling paths are indicated separately from walking paths. Both hikers and cyclists may also use the country roads, which are prohibited for motorized vehicles except for agricultural vehicles. These country roads connect farms and their agricultural lands. Many of the stables and other farm buildings have both agricultural and recreational functions. In each type of agriculture an explanation about the type of agriculture can be found, how it works and what their spatial requirements are. Guided tours can also be taken in the area, in which a guide explains how the agricultural system works and how all the sub-archetypes work together. This recreational function of agricultural landscape can show how agricultural landscapes can be in the future and can ensure a good cooperation between all parties involved in the transition to circular agriculture.

5.8 Detail design

To make the interventions in the landscape clear, I created a detail design of a part of the masterplan for the testing ground. This detail design in figure 50 shows several landscape components that are important for the testing ground ánd have a large influence on the experiential quality of the testing ground. The location of the detail design is at the end of the Bollendonkseweg and includes a parking space, restaurant, farm and several sub-archetypes. This detail design shows how people can use the area, for agricultural and recreational usage. From the parking spaces in the northeast of the area, visitors can choose to rent a bike or start exploring the area by foot. No cars are allowed further into the area. Many hiking paths cross through the agricultural lands to allow visitors to experience the landscape and see what circular agriculture looks like. A visualization of what agroforestry looks like throughout the seasons is shown in figure 51. A cycling path starts at the parking spaces and leads to the south edge of the testing ground. Cyclists can also use the car road or country roads to cycle around. However, the separate cycling paths are both safer than the car roads and more comfortable than the semi-paved country roads.

For the barns in the agroforestry area, just south of the parking space, the agricultural function is most important. These buildings are used to store farming equipment and machines, as a stable for the animals and to process and store the yield from the land. However, they also serve an educational and recreational function. Information signs and a model of the agricultural lands provide information about agroforestry, how it works and how it can be combined with other land uses. This is also the case in other farms on the testing ground.

Fresh produce from the land can be used in the restaurant, in the northwest of the detail area. A terrace and grasslands allow visitors to take a rest and enjoy the fruit and nut trees in the forest meadow.

Figure 50: Detail area

5.9 Chapter conclusion

In this chapter I created the design for a testing ground for circular agriculture. I made this design with the method research through design. First, I allocated the archetypes and sub-archetypes in the landscape. For the allocation of the (sub-)archetypes I used the landscape map and several landscape components like current land use, nature areas and waterways. After creating a map of the sub-archetypes in the detail area, I created three sketches. These sketches were rated using the nine criteria for experiential quality. During the creation of the sketches and the rating of the sketches I found out how interventions in the landscape influenced the experiential quality of the landscape. I used this information to create a masterplan of a testing ground that has a high experiential quality. A detail design shows this experiential quality in more detail, just like the visualizations of agroforestry and cropland in the four seasons in figure 51.

The archetypes of circular agriculture can increase the experiential quality through smart design. The combination of the archetypes and the creation of sub-archetypes and a logical allocation of these in the landscape can improve the visual heterogeneity and the coherence of a landscape. Because of the combination of archetype A (very open) and archetype B (relatively closed) a good ratio open-closed can be created which improves the openness of the landscape. By using archetype B in historically and culturally important areas, these qualities are kept intact. This increases both the historicity and the regional character of the area. Regional character can also be improved by emphasizing and extending landscape patterns, like roads, ditches and tree lanes. The criteria naturalness and cues of care seem to be each other's opposites, which is why a good combination of these two needs to be found. Too many natural areas that are not maintained by humans lowers the criteria cues of care, whereas too many areas maintained by humans lowers the criteria naturalness. By designing an area that allows both nature to develop and people to maintain the agricultural and recreational lands, a harmony between naturalness and cues of care can be found. In the design of the testing ground this is also achieved by combining archetype A and archetype B. Archetype A improves the cues of care whereas archetype B and the nature areas it protects, improves the naturalness of the area. The criteria multisensory experience is largely influenced by visual heterogeneity in the landscape. Heterogeneity in the landscape means that many different senses can be influenced. For an example, a field of grass has only one smell or feeling, whereas grass in combination with a forest and croplands has many different smells and feelings. Thus, the combination of several (sub-)archetypes has a much higher multi-sensory experience than only one or two (sub-)archetypes. The criteria seasonality is influenced by what (sub-)archetypes are placed in the landscape. For an example, an orchard has a high seasonality whereas a field of grass has a very low seasonality. By using various types of (sub-)archetypes with seasonal changes like (fruit) trees and croplands, the seasonality of an area can be improved.

Figure 51: Visualisation of agroforestry with cropland in all 4 seasons

7. Discussion

Although all three sub-research questions were answered, several things could have been researched in more detail for this thesis. For sub-research question 3 not all options were tried, but only three sketches were created. Based on the rating of these three sketches a sketch was chosen on which the masterplan for a testing ground was based. Because of time limitations it was not possible to create any more design sketches or variations.

I did not talk to anyone who lives or knows anything about Etten-Leur. For the creation of the testing ground it would be interesting to know what citizens and farmers think of their surrounding landscape and what could be changed or improved. A questionnaire about how people experience the landscape of the detail area would have been very interesting and would have created a more objective assessment of the experiential quality of the landscape.

Although I have learned a lot about circular agriculture because of this thesis, I am not an expert in circular agriculture. I do not know a lot about types of crops, trees or animals or how the agrarian system functions. I took inspiration from the archetypes from SPLENDID (personal communication, 2021) and existing projects to create logical sub-archetypes. The creation and allocation of the sub-archetypes was thus not entirely based on scientific evidence. The types of crops and animals in both the design and the visualizations are merely examples of what the agrarian landscape could look like.

I do not know whether I missed something throughout this thesis. I did not have enough time to research every detail, I might also have skipped or missed some information. I do not know whether I took into account all important points while designing both the landscape map and the testing ground.

I used the archetypes for circular agriculture by SPLENDID as a guideline for the implementation of circular agriculture. I have not used other ideas or types of agriculture except for the ones SPLENDID proposes (personal communication, 2021). This means this thesis cannot be used to implement all types of circular agriculture. I also used the criteria for experiential quality by Bakx (personal communication, 2021). I have not taken into account other views on experiential quality. The final design of the testing ground has a high experiential quality based on the nine criteria by Bakx. However, if other criteria for experiential quality were to be used, other outcomes are to be expected.

Lastly, the design of this testing ground is very specific for the area and cannot be used for any other areas. It takes into account landscape structures and characteristics of the landscape north of Etten-Leur. However, this area has a high diversity in both soil type and landscape character which means these ideas might be used for other areas. The testing ground is also a very small area compared to the areas that need to be transitioned into circular agriculture. Most of the areas with sub-archetypes are too small to function properly. However, this testing ground serves as a small-scale example of the implementation of the archetypes of circular agriculture.

8. Conclusion

The main research question of this thesis is ‘How can the different archetypes for circular agriculture contribute to the experiential quality of the agrarian landscape on a testing ground in Etten-Leur?’. This research question was answered using three sub-research questions; one about the archetypes and their spatial allocation, one about experiential quality and the third one about design alternatives for a testing ground.

In sub-research question 1 the archetypes created by SPLENDID and their allocation in the landscape were discussed. Each archetype has its own spatial requirements and thus its own place in the landscape. A landscape model was created which served as the basis for the selection of a detail area for sub-research question 2. In sub-research question 2 the experiential criteria for spatial quality were discussed and how they were visible in the selected detail area was shown in maps and through pictures. This research laid the basis for sub-research question 3, in which a masterplan for a testing ground was designed with the method ‘research through design’.

For each sub-research question a short conclusion was formulated in this thesis report, but in this conclusion these conclusions will be combined to answer the main research question.

Several conclusions were drawn during this thesis about experiential quality of the landscape and how it can be influenced by the archetypes of circular agriculture. Experiential quality can be influenced by all landscape components; elevation, trees, barns and wind turbines. They all have an influence on how one experiences the landscape. The combination of various landscape components creates a design with the highest experiential quality, just like that the combination of several (sub-)archetypes creates a design with a high experiential quality. For an example, archetype B allows for high experiential quality and archetype A creates a relatively low experiential quality because of its openness. But the combination of archetype B with archetype A creates an interesting landscape with an even higher experiential quality. This is why the final design of the test ground combines both archetypes and several sub-archetypes to create a landscape with high experiential quality. The creation of three different sketches taught me what exactly influences the experiential quality and how I can improve the experiential quality with spatial interventions like the allocation of sub-archetypes and the placement of tree lanes.

The most important goal of this thesis was to research how the archetypes of circular agriculture formulated by SPLENDID can increase the experiential quality, as formulated by Bakx (2021) in nine criteria. This question was answered with the design of a testing ground; an area where circular agriculture can be implemented as an example for future developments.

Overall, the archetypes of circular agriculture can have a positive influence on the experiential quality of the landscape, if allocated and combined in the right way. Not one (sub-)archetype in itself has a high experiential quality, the combination of all of them is the key to a landscape with high experiential quality. The testing ground like the one that was designed in this thesis shows this. With a variation of sub-archetypes, combined and placed in the landscape in logical ways, it has a high overall experiential quality. The design of this testing ground can thus show that circular agriculture, based on the archetypes of SPLENDID, can create a landscape with high experiential quality. This can inspire farmers, municipalities, politicians and entrepreneurs to make the transition to circular agriculture. It can convince them but also ‘normal’ citizens that the transition to circular agriculture in The Netherlands is positive and that it, if implemented correctly, will have a positive influence on the experiential quality of the agrarian landscape.

9. Reflection

I started working on this thesis after finishing Studio Regional Design and I was not looking forward to another eight weeks of analyzing, designing and visualizing. The subject of this thesis, circular agriculture also didn't appeal to me. I prefer working on a smaller scale and I am also better at this. The first two weeks, in which we had to make our proposal, was quite stressful as I didn't know how making a thesis worked exactly. Along the line I learned that it was a lot like a design studio, but with more theoretical framework and documenting of all the steps you take. Throughout making my thesis, I sometimes struggled with where my priorities had to be; with creating a good design or a good thesis report? Of course, these do not exclude each other, but sometimes it felt like they did because of time pressure.

I was glad I wrote part of my thesis report while sketching and designing. After sketching or designing something, I wrote down what I had done and how and why I did it. This way I made sure I did not forget my process and this meant that in the last few weeks I could focus more on my final design, visualizations and the layout of my report.

There were some moments I got stuck throughout the designing process. this was mostly because I was thinking too much and not designing enough. Especially with designing agrarian lands, there is a lot that needs to be taken into account. The archetypes of circular agriculture had several requirements and I kept having to remind myself to not try and think about every single thing that could influence the placement of the archetypes. This was also the case for the design of the testing ground, where there were unlimited options for placing recreational paths, buildings and tree lanes.

I think making this thesis was a learning process. It helped that I was already used to design studios, in which you go through the same process as while making your thesis. There is a lot I would have done different if I were able to make my thesis again. In some cases, I should have taken more time to research scientific information. In other cases I should have taken less time to think and more time to design.

After getting feedback on my final presentation, I had to adjust a lot of my maps and visualizations. It was hard to get this feedback because the feedback on my draft was very positive. This is why I thought I was on the right track. After the final presentations I realized that I had focused too much on the design process and the story I wanted to tell and not enough on making visually attractive maps or visualizations. I felt like the design process, my research and the story I wanted to tell was more important, as I was working on my thesis and not on a 'regular' studio. During the last few days I thus worked a lot on representation. This is something I would do differently the next time: I would have focused more on my representation. I think it is logical that I would do things different the next time, as I have never made a thesis before.

What I learned from this thesis is that sometimes I just need to start designing instead of wanting to analyze and research everything. I also learned that it is very important to substantiate why I did something or chose for one specific option. I had to make many choices during this thesis, like what my sub-research questions would be, the location of my detail area and what the best design options were. Usually, as long as I am able to explain why I made certain decisions, these decisions are the right ones. I also learned that I need to focus more on making maps and visualizations that are more visually attractive. I was very much focused on doing good research and a good report because I thought this was more important. Next time, I will thus try and find a better balance between representation and creating the thesis report.

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