

BACHELOR THESIS

THE GREEN RINGBELT OF THE BINNENVELD

A multifunctional transition zone surrounding the Binnenveldse Hooilanden



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ABSTRACT

This thesis project focuses on the design of the surrounding agricultural fields of the Binnenveldse Hooilanden. There is an abrupt boundary between the Binnenveldse Hooilanden and its surrounding fields. This sharp border between nature area and intensive agriculture has negative effects for the nature development. Examples include nuisances in the form of eutrophication, acidification or desiccation. For the development of nature to succeed, this boundary will have to be softened with the integration of a created transition zone.

In order to redesign the area successful, the current approach in agriculture also has to change. This thesis will also investigate which required changes should be made in agriculture. Nature inclusive agriculture will be used to investigate an agricultural concept in which opportunities for combining nature development with recreation are involved. The aim is to create a sustainable, multifunctional, and recreationally attractive agricultural area which will form a ring structure surrounding and as an expansion of the Binnenveldse Hooilanden.

This thesis will investigate which design and form of nature inclusive agriculture has the best chance of success and with which aspects it can be combined the best to make the Binnenveld an attractive landscape with sustainable production and high nature values.

Wageningen University & Research, June 2021

Bachelor Landscape Architecture and Spatial Planning

BsC Thesis Landscape Architecture/LAR-81812

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1. INTRODUCTION

AGRICULTURE IN EUROPE

Agriculture is one of the most important sectors in our daily lives, it provides us with food. In the Netherlands a lot of agriculture is practiced, for own production and consumption but certainly also to a large extent for export. In addition to the many profits and production, agriculture has also disadvantages. The intensively practiced forms of agriculture and the use of artificial fertilizers and pesticides are harmful to nature and biodiversity.

Even more, contemporary agriculture as practiced in Europe has become the biggest threat to biodiversity and the quality of our natural environment (EBB, 2017).

There is an increasing call for ecologically responsible agriculture. This ‘nature inclusive’ agriculture must also contribute to solutions for the current problems of nature, landscape, soil and water quality. In this way, ecosystems and biodiversity can be restored (GLB, 2020).

This will require change in both the landscape and the food system (Potteiger, 2013).

In Europe, and certainly in the Netherlands, there is growing attention for the realization of nature development in projects. Everywhere, projects are being set up to restore old nature or create new nature, which contribute to increasing biodiversity. More and more often people are looking at how agriculture can be made more nature friendly.

THE BINNENVELDSE HOOILANDEN

A project that has recently been realized is the Binnenveldse Hooilanden. In this project not too lucrative, often wet agricultural land has been replaced by 300 hectares of wet nature, located in the Binnenveld between Veenendaal, Ede, Wageningen and Rhenen.

The Binnenveldse Hooilanden are a classic example of what a meadow bird grassland should look like, with a dynamic alternation of long and short grass, transitional phases and lots of diversity.

The Binnenveld functioned as an agricultural area for a long time. Because the Binnenveld lies in a low-lying seepage area, it was always very wet and very marginal agricultural land. For the transition from agriculture to nature reserve, the nitrate-rich top layer was excavated to restore the old situation and regain the botanical richness. The initiative was a collaboration between farmers and nature organizations (Janmaat, Jochemsen, Scheepers, 2016).

Citizens and farmers contributed to the realization of the Binnenveldse Hooilanden; the money did not come from the government, but from the foundations, farmers and enthusiasts. Together they realized the largest and best bluegrass meadow area in the Netherlands.

Yet the area is plagued by eutrophication, acidification, and desiccation. The surrounding intensive agriculture is responsible for this.

Due to the expansion of the surrounding municipalities such as

Veenendaal, there is also more demand for nearby leisure and the recreational pressure is increasing.

NEED FOR DESIGN

Intensified agriculture should change to a more sustainable and innovative agricultural concept. These surrounding areas need a new design if the nature development is wanted to succeed.

Currently, in many places there is a very hard border between high valued nature and intensive agriculture, which is also the case with the Binnenveldse Hooilanden (see figure 1). It would be better for the nature area and agriculture to merge into one another. Nature inclusive agriculture is a middle ground between this nature and intensive agriculture and could just be the future (Pol, 2021).

Nature inclusive agriculture can form a transition zone which can be multifunctional in use. Here a combination of different functions of the transition zone can be investigated. One of them is the operation as buffer zone, to soften the harmful effects of the surrounding intensive agriculture and act as conductors, filters or barriers that can improve water and habitat quality (Mander et. al, 2005).

Furthermore, (future) recreation may offer interesting opportunities for realizing the desired buffer zone, in which the aesthetics and attractiveness of the landscape play an important role. The local farmers’ collective that wants to support nature is in fact partly dependent on visitors. The question is which combinations of aspects can lead to a buffer form that satisfies as many parties as possible and which works best.



Figure 1: the visible boundary between the Binnenveldse Hooilanden under development and the surrounding fields of intensive agricultural fields (source: Stichting Mooi Binnenveld).

THESIS STATEMENT

The aim of this research is to investigate possibilities for a multifunctional transition zone between nature development and surrounding agriculture, that is based on specific types of nature inclusive agriculture. The main research question which is central to this thesis and needs to be answered states:

“What characterizes an appropriate transition zone between nature and intensive agriculture in the Binnenveld?”

To answer the main MRQ, there are some sub research questions which are related to chapters in this thesis report. By answering these questions, the answer for the MRQ can be given.

1. *How can a transition zone be designed in the most multifunctional way? E.g., which functions can be combined, and which ones are desired to separate?*
2. *Which forms of nature inclusive agriculture are most suitable for the Binnenveld?*
3. *What will be the impacts for the recreational attractiveness of the landscape?*

2. METHODS & MATERIALS

This chapter explains the explorative method in which way the research will be done to answer the research questions.

The research will be guided by a research through design, where the designs will be evaluated using criteria drafted from the literature.

Exploratory designs will guide the research. After evaluating these designs, the advantages and disadvantages will be considered and examined. The outcomes of the research will provide an appropriate design. In this way, the design can come to its end result in the right way by making considerations and thinking about combinations.

The result of the design process will be a design that has been critically evaluated and has had adjustment moments during the process.

First, as described in the introduction, the research objective will be stated after the definition of the design need. After that the area will be analysed and a literature review will be conducted covering the principles of landscape functions, nature inclusive agriculture and recreational attractiveness.

From this insights and literature review, design goals with associated design criteria will be formulated. These criteria will be considered in the design principles. Three different design iterations will be made based on the three different chapters and considering the design criteria.

Then these designs will be evaluated against the criteria and a new integrated design will be created. This combined integrated end design will be evaluated too and is the end product of the research.

Based on the literature review and chapters of key drivers associated with the SRQs, design goals and associated design criteria have been created. The design goals are linked to the need for design which was also mentioned in the introduction. More about these design goals and criteria will follow in later chapter.

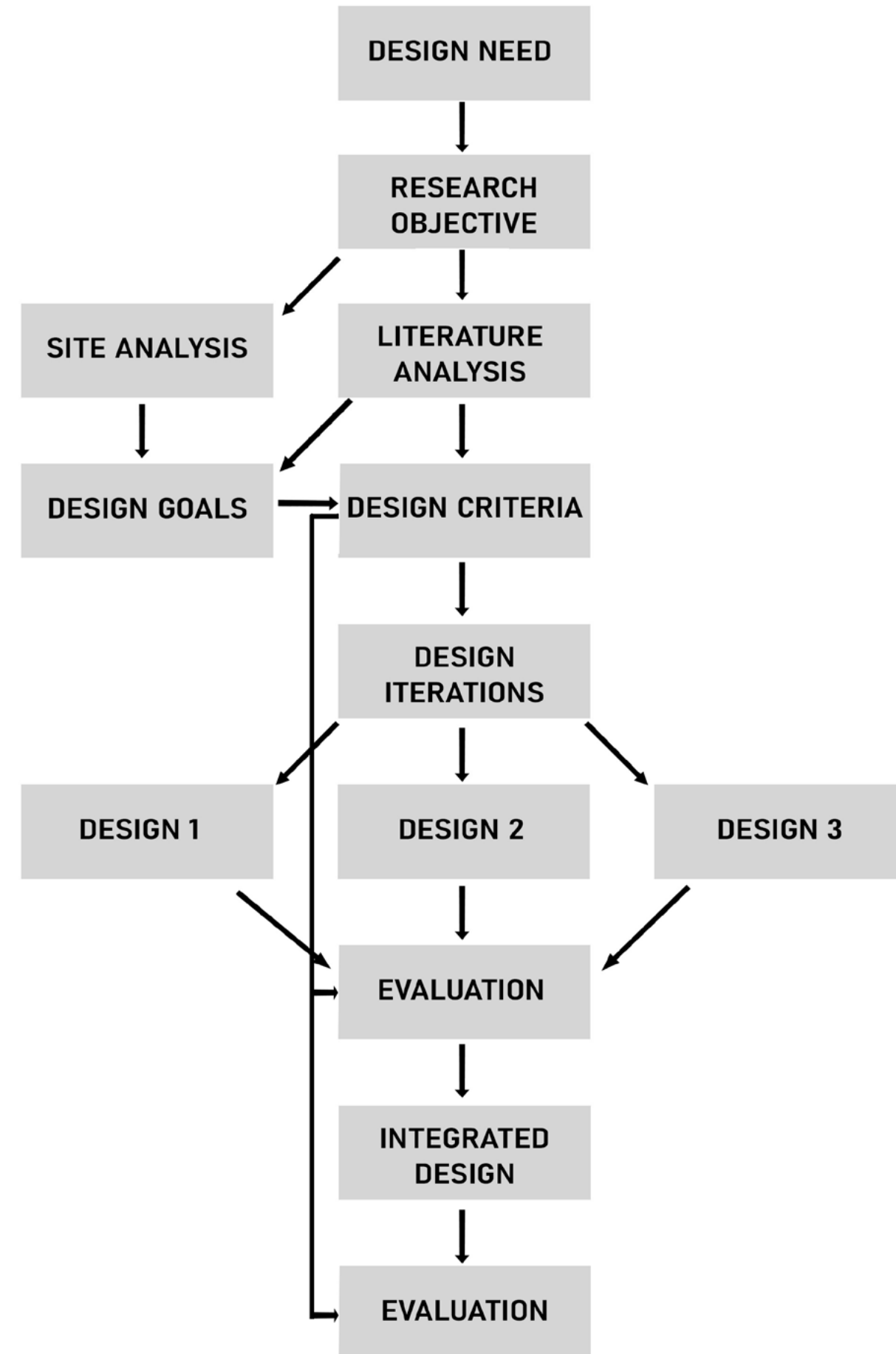


Figure 2: schematic view of methods.

3. SITE ANALYSIS

3.1 TOPOGRAPHIC ANALYSIS

INTRODUCTION

As mentioned in the introduction and the thesis statement, the Binnenveldse Hooilanden is a nature area surrounded by intensive agriculture. This area and its surrounding fields will be the case area for this thesis.

In this chapter the case area is analyzed, and the current situation will be examined.

TOPOGRAPHY

Geographically, the Binnenveld is located in one of the lower areas of the region. The area is surrounded by two lateral moraines, the Utrechtse Heuvelrug and the Veluwe. The valley is characterized by seepage water and because of its low position it is an area with a high groundwater level. Because of the many ditches used for agriculture, the groundwater level has lowered, but the Binnenveld is still a very wet area. Because of the seepage water, the nature reserve the Binnenveldse Hooilanden lies on former peat grounds. The remaining geomorphological structure of the soil can be roughly divided into a higher sand area and in the by the river Rhine as a river area.

Topographically the Binnenveld lies between the towns of Veenendaal, Ede, Wageningen and Rhenen and the nature reserve itself lies in all four municipalities.

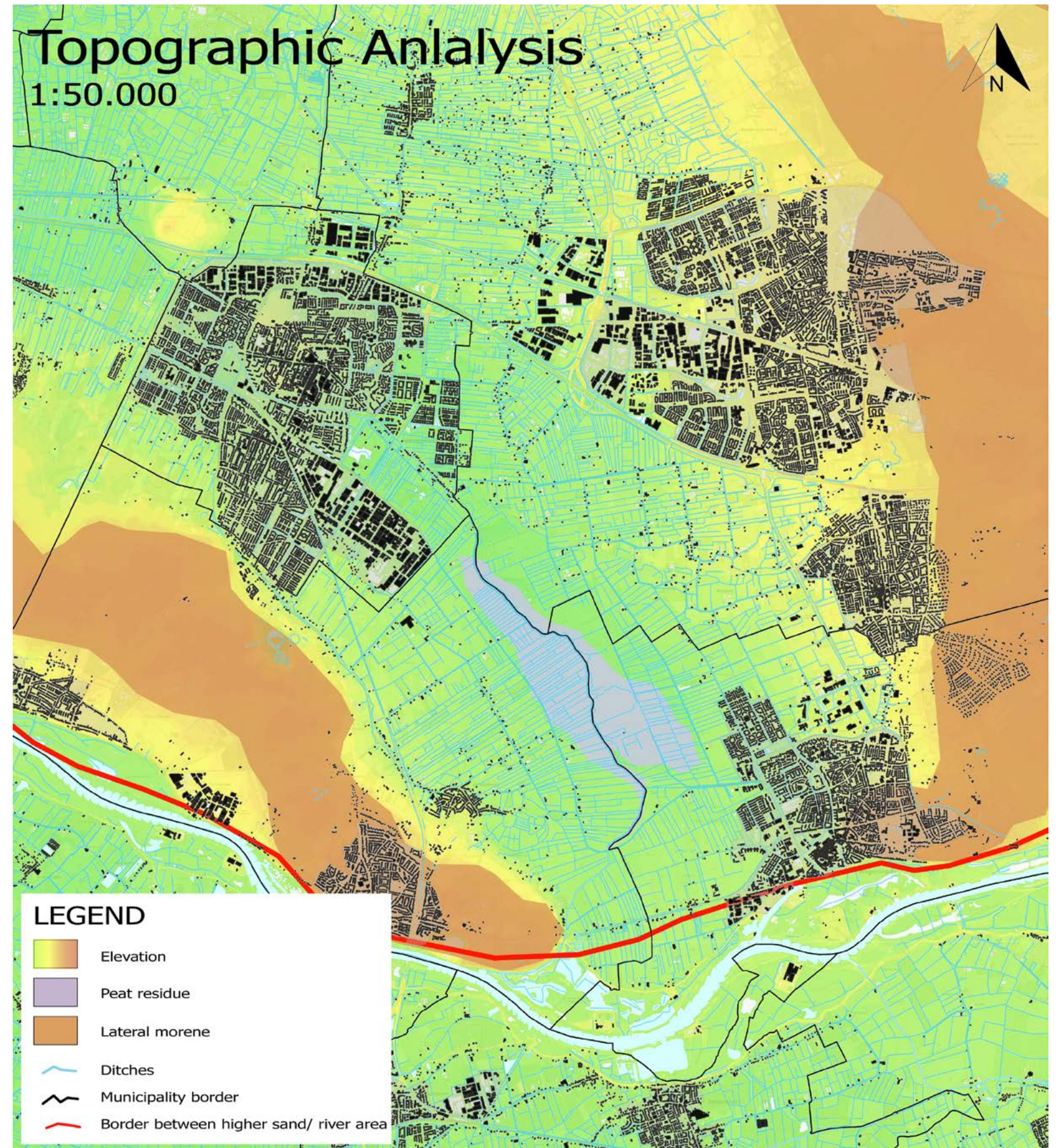


Figure 3: topographic analysis map made originally made on scale 1:50.000

3.2 NATURE ANALYSIS

NATURE

From a natural perspective the Binnenveld is located in between large ecological main structures. The Utrechtse Heuvelrug and the Veluwe are the most prominent, but also in the south near the Rhine with Uiterwaarden (floodplains) and Blauwe Kamer runs a nature network. The Binnenveldse Hooilanden itself is also marked as part of the Nature Network Netherlands (former EHS), but is geographically quite isolated from the rest. Cosidering the EHS, the Binnenveldse Hooilanden could play an contributing role in connecting the nature areas. The surrounding forests are mostly privately managed. The Binnenveldse Hooilanden are part of the nature management of Staatsbosbeheer, with some parts agricultural nature management by farmers. In the north near Veenendaal two pieces of nature are Natura 2000 areas, while almost the entire Binnenveld has a ‘protected’ status, which means that it is an area with restrictions on housing development (Atlas van de Regio, 2021).

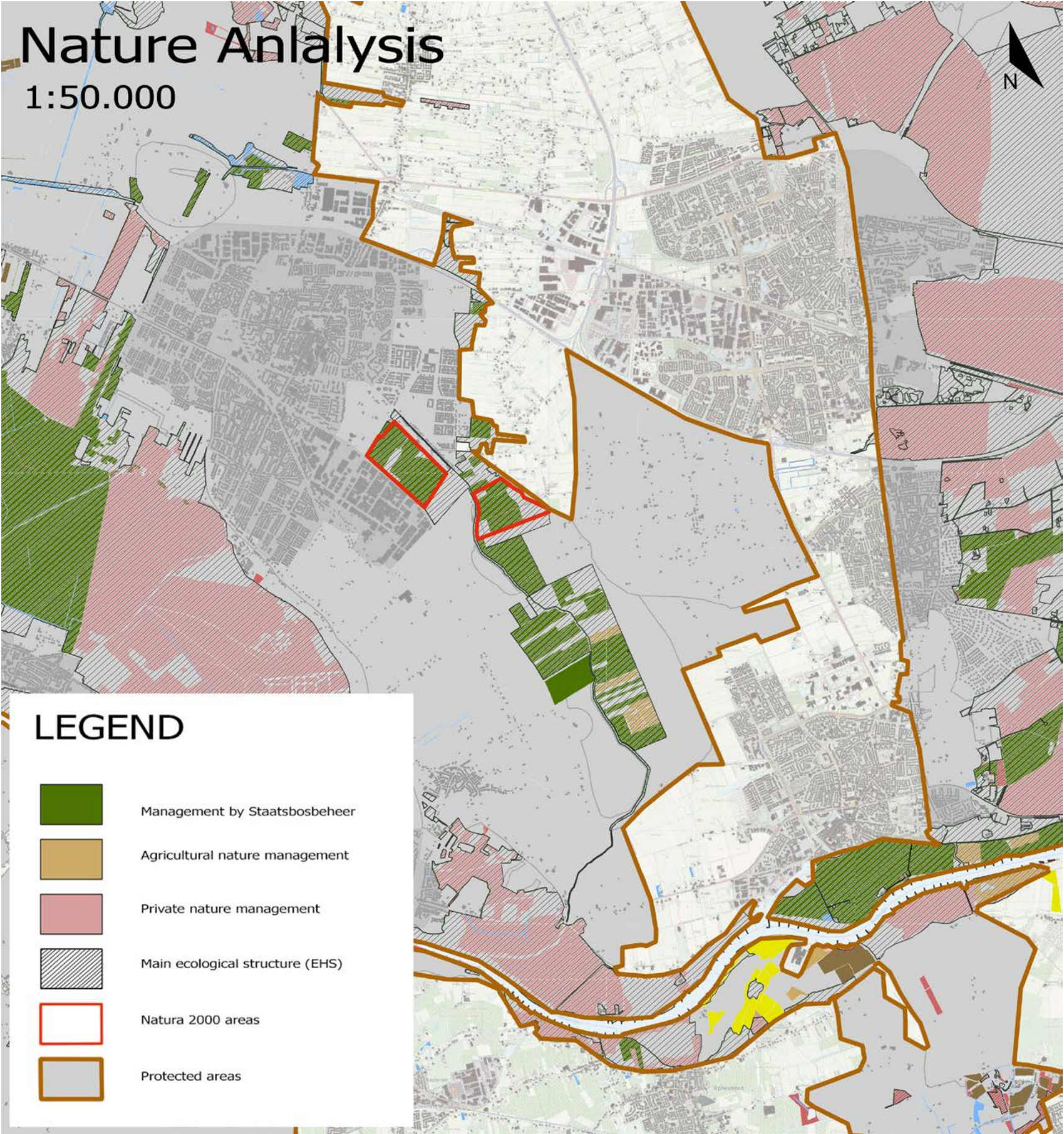


Figure 4: nature analysis map made originally made on scale 1:50.000

3.3 RECREATIONAL ANALYSIS

RECREATION

In terms of recreation, there are already a lot of recreative aspects in the area, but there is also definitely room for improvement. A large part of the Binnenveld belongs to a zone of silence, where the sounds of flora and fauna dominate without the presence of other noises which are unusual for the environment (Atlas Leefomgeving, 2021). Along the entire Grift from the Blauwe Kamer to the north runs the former Grebbelinie, with remains of defensive works near the Blauwe Kamer and north of Veenendaal. There is a modest amount of walking and cycling routes. The bicycle routes mainly surround the Binnenveldse Hooilanden, the same counts for the walking paths. In a few places they cross the nature reserve or some 'klompepaden' run through it. The Binnenveldse Hooilanden are relatively inaccessible to recreation. It can mostly be viewed from the side but there is hardly any access to the area itself. There are also few crossing points over the Grift, so walking or cycling a bridge further will soon add several kilometers to a visit. There are also some recreational facilities such as bird-watching spots and a watchtower. Some local stores and catering facilities are present but are mainly located on the edge of the Binnenveld with a residential area, so not near the Binnenveldse Hooilanden. An information center or opportunity at the entrance of the area or centrally located in the area is also missing. The low number of facilities of this type has to do with the fact that it is a silence area and largely closed to recreation. This in order for nature to be able to rest. More on this later chapters of the creation of the design iterations.

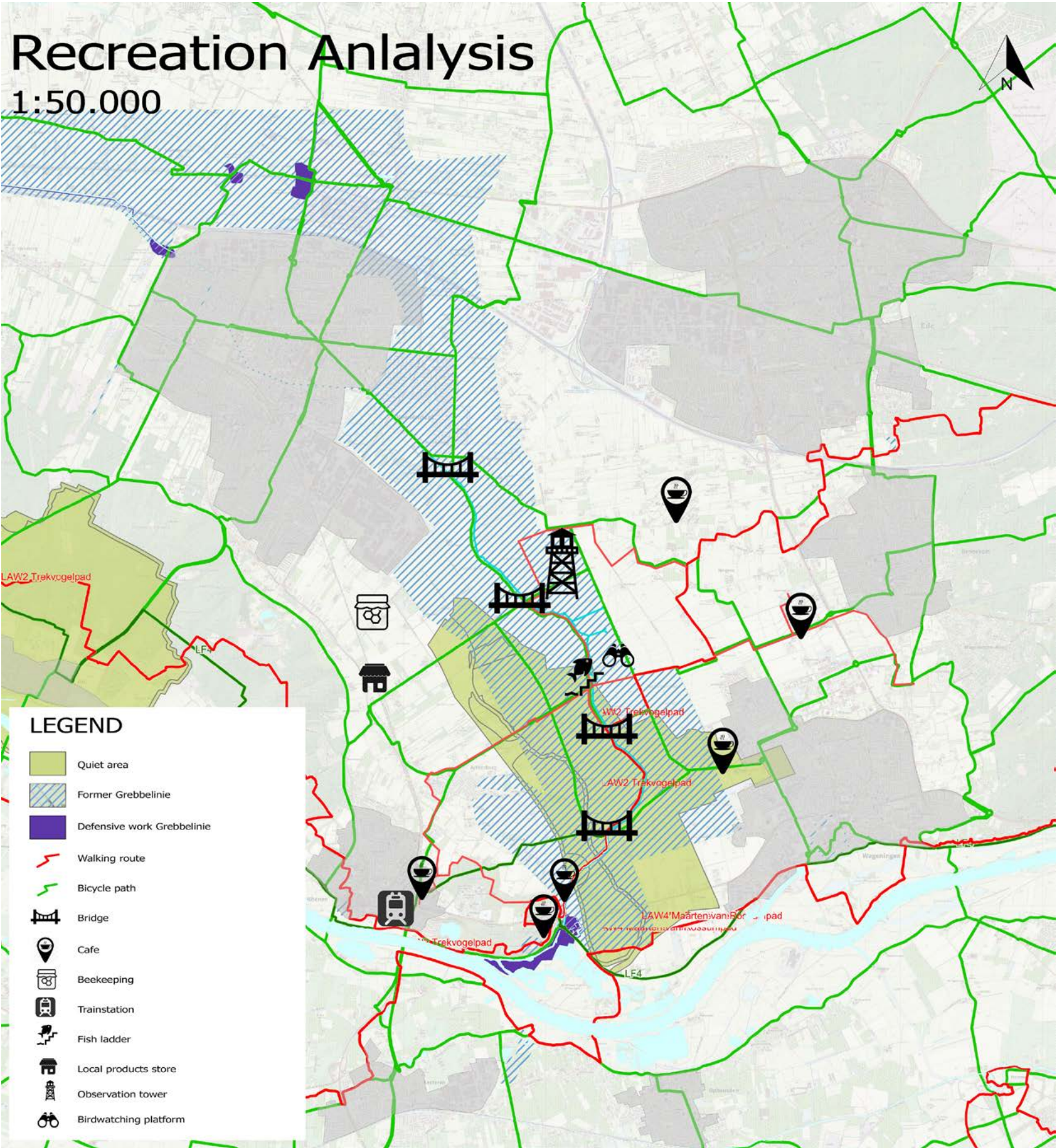


Figure 5: recreational analysis map made originally made on scale 1:50.000

4. LITERATURE ANALYSIS TO DESIGN PATHWAYS

4.1 LANDSCAPE FUNCTIONS

This chapter focuses on the question “how can a transition zone be designed in the most multifunctional way?”. Literature analysis will be used to explain how a landscape can best be used in a multifunctional way, which functions can be combined, and which ones are desired to separate. Literature analysis will be used to explain how a landscape can best be used in a multifunctional way and which functions can be combined, and which ones are desired to separate. Furthermore, attention will be paid to the valuation of landscape functions in the field of ecosystem services.

HETEROGENIC AND MULTIFUNCTIONAL LANDSCAPE

Landscapes are often arranged in a basic land-use type with one function, while linking different landscape and socio-economic functions would be more desirable (de Groot & Hein, 2006). Cultural landscapes are multifunctional landscapes where different aspects form a heterogeneous landscape. Here functions like habitat, productivity, regulating, social, and economic functions come together. When there is heterogeneity, multiple functions are supported together at the same time and give the landscape a multifunctional character (Mander, Helming, & Wiggering, 2007). Some functions are easy to combine, such as different types of nature which provide habitat for different species. For other functions this is more difficult, such as intensive land use that suppresses the performance of the landscape on other functions. In the Binnenveld there is a suppression of the nature function, the good thriving of the wet nature in the Binnenveldse Hooilanden is made difficult by the surrounding intensive agriculture. Integration between socio-economic functions and environmental functions is desirable for a varied and heterogeneous landscape. This can be done, for example, by preserving biodiversity in multifunctional, human-dominated landscapes, but also by integrating socio-economic functions such as recreation into nature, which is a more likely relationship in a nature area such as the Binnenveld (see figure 6). There are a lot of possibilities to give recreation a significance in nature and landscape (Goossen et. al, 2013).

ECOLOGICAL STRUCTURES

To maintain the habitat function of a landscape, the presence of ecological networks to accommodate species migration is desirable. Ecological structures also serve as excellent combinable landscapes, where space can be made for almost all landscape functions (Von Haaren

& Reich, 2006). According to Mander et. al, ecological networks form the basic structure of a landscape, and are thus hierarchically one of the most important functions for a multifunctional landscape (Mander, Helming & Wiggering, 2007). The former land use of the Binnenveldse Hooilanden and the current land use of the surrounding fields consists of agriculture. Landscapes with intensive agriculture often have only one function. To maintain some of the productivity of the landscape and the current land use, there is a need for a multifunctional concept of agriculture, such as agroforestry or nature inclusive agriculture. More on this in the next chapter. Economic, social and environmental aspects are desired to be combined in a multifunctional landscape. Landscape heterogeneity and landscape functionality are then both high, leading to the most attractive landscapes.



Figure 6: intergration of recreation in a nature area and utilizing the recreational potential of a multifunctional landscape (source: WUR project Goosen).

NATURE DEVELOPMENT

Nature development was highly valued in the original plan of nature realization of the Binnenveldse Hooilanden. That is an important reason why nature development and habitat functions will be highly valued in the new design planning of this thesis project. Nature development could become one of the pillars in the basis of a design. Ecosystems in a landscape can provide many services and goods to human society. Not only for functional, ecological value, but also socio-cultural and economic value (de Groot & Hein, 2006). The interactions between humans and the environment are complex, therefore there is no clear agreement on the final definitions and typology. De Groot and Hein have attempted to create a general framework for the analysis and valuation of landscape and ecosystem functions (see figures 7 & 8).

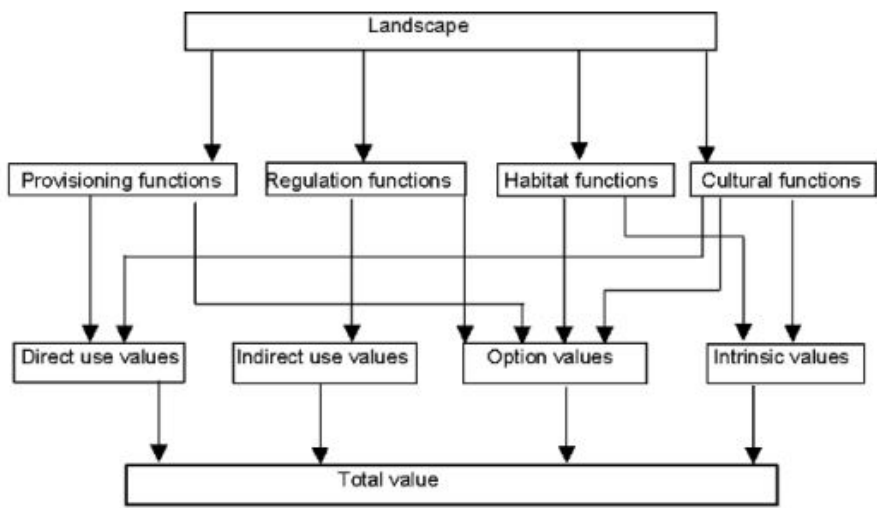


Figure 7: a general framework for the analysis and valuation of landscape function (source: de Groot & Hein, 2006)

Ecosystem Functions (1)		Short Description	Biophysical Indicators (examples) (i.e. ecosystem properties providing the good or service)	Goods and Services (examples)
1	Prov i-sio-ning	Production Funtions	Resources from un-manipulated ecosystems	-Biomass (production and stock) -Biochemical properties -etc
		Carrier functions	Use of space to (enhance) supply resources or other goods and services	-Freshwater (* -Food (eg fish, bushmeat) -Raw materials (wood, fodder, etc) -Etc.
2	Regulation Functions	Direct benefits from ecosystem processes	Depending on the specific land use type, different requirements are placed on environmental conditions (e.g. soil stability and fertility, air and water quality, hydrology, topography, climate, geology, etc)	-Cultivation (eg, agriculture, plantations, aquaculture) -Energy conversion (eg wind, solar) -Mining (ore, fossil fuels, etc.) -Transportation (esp. on waterways) -etc
			Role of ecosystems in biogeochemical cycles (e.g. CO2/ O2 balance, hydrological cycle)	-Climate regulation -Maintenance of soil fertility -etc
			Role of vegetation & biota in removal or breakdown of nutrients and toxic compounds	-Waste treatment (e.g. water purification) -Maintenance of air quality
			Physical properties of land cover	-Water regulation (eg buffering runoff) -erosion prevention -storm protection & flood prevention
			Population control through tropic-dynamic relations	- Biological control (of pests and diseases); -Pollination
3	Habitat Functions	Maintenance of biodiversity and evolutionary processes	Etc.	Etc.
			Presence of rare/endemic species; species diversity, etc	Refugium for wildlife
4	Cultural & Amenity Functions	Non-material benefits	Reproduction habitat for migratory species	Nursery function (for commercial species)
			Landscape (or ecosystem) properties with aesthetic, recreational, historic, spiritual, inspirational, scientific or educational value	-Enjoyment of scenery (eg scenic roads -Eco-tourism and recreation -Heritage value/cultural landscapes -Spiritual or religious sites -Cultural expressions (use of landscapes as motive in books, film, painting, folklore, advertising, etc) -Research & education

Figure 8: Typology of Ecosystem Functions, Goods and Services (adapted from de Groot et al, 2002 and Millennium Assessment, 2005).

PROVISIONING FUNCTIONS

Provisioning functions are about physical services; resources produced by natural ecosystems. In the Binnenveld one can think of the harvest of the arable farming or the orchards, but also of the edible flora and fauna that benefit from each other.

REGULATING FUNCTIONS

Regulation functions is about regulating processes. The ability of ecosystems and landscapes to influence climate, hydrological and biochemical cycles, processes at the surface and a variety of biological processes.

HABITAT FUNCTIONS

Habitat functions deal with the ability of a landscape to contribute to population maintenance. The refugium function reflects the value that landscape elements can have in providing habitat for (endangered) flora and fauna. The nursery function is about the presence of places that are suitable for breeding and raising offspring. This in turn affects the maintenance of natural processes and biodiversity.

CULTURAL AND RECREATIONAL FUNCTIONS

The cultural and recreational functions are about the benefits that people experience from landscapes through recreation, cognitive development, relaxation, and spiritual reflection. These aspects are regularly part of ecosystem services and will be discussed in more detail in a later chapter. In any case aspects like these can be combined well with other ecosystem functions, like recreation incorporated into ecological networks, as mentioned earlier in this chapter.

The design process in this thesis will especially focus on improving habitat functions and cultural and recreational functions in the area.

SUMMARIZED

Referring to the question “how can a transition zone be designed in the most multifunctional way?”. One can conclude that the integration of different landscape and socio-economic functions is most desirable in a landscape. This creates a heterogeneous landscape with a varied range of functions. The nature function in between the Binnenveld is affected by the surrounding monotonous intensive agriculture. A less monotonous land use could be the solution. Nature functions such as ecological structures can be combined well with other functions such as recreation. Recreation is at the same time a good way to attract more enthusiasm for the initiatives of nature conservation and development. In order to provide good conditions for nature development it is important to look at where the ecosystem services can be improved. In the Binnenveld, the current land use must of course be taken into account, which makes an alternative agricultural concept that can be used in a more multifunctional way desirable. With agricultural concepts such as nature inclusive agriculture and agroforestry it is possible to combine agriculture with nature and also with recreation. So, a varied landscape is desired with a big variety of attractions combined with ecological structures and a different agricultural concept to include nature development and recreation. Nature inclusive agriculture seems to be an alternative for the current intensive agriculture in the area and a win-win situation that benefits all stakeholders. More on this and its possibilities will be covered in the next chapter.

4.2 NATURE INCLUSIVE AGRICULTURE

This chapter focuses on different types of nature inclusive agriculture and will try to find an answer to the question “which forms of nature inclusive agriculture are most suitable for the Binnenveld?”

AGRICULTURAL SHIFT

It seems to be more and more difficult to combine a sustainable and productive way of farming with nature conservation and development, while at the same time an attractive landscape in which people enjoy spending their leisure time must be ensured (Runhaar, 2016). Intensification and expansion of agriculture was associated with the removal of hedgerows, other natural landscape elements and the lowering of groundwater levels. This resulted in habitat loss and a decline in biodiversity. In contemporary agriculture there is more and more attention for the conservation of natural values, so also in the Binnenveld. Yet the way back to a well-functioning nature system with the current forms of agriculture seems more difficult than thought. There is a need for a concept in which economic, ecological and social values are more in line with each other, something that is reflected in ‘nature-inclusive’ agriculture.

NATURE INCLUSIVE AGRICULTURE

According to Runhaar, nature inclusive agriculture is interesting because of three reasons:

- 1. It is a sustainable form of agriculture that minimizes negative ecological impacts and maximizes positive effects (Sanders & Westerink, 2015).
- 2. The concept is attractive because of its flexibility. There is still room for discussion and negotiation among policy makers, farmers and stakeholders to a balance in agriculture concept.
- 3. The undefined meaning makes it a promising concept for co-production and to experiment with.

However, the question is how agriculture can best be combined with biodiversity in a sustainable and resilient way. An integrated water policy combined with adapted grassland management are essential pillars. Meadow bird protection and limiting peat oxidation are also important aspects, even as biodiversity in ditches and field borders.

Because nature inclusive agriculture is still a relatively new concept and there are not many reference projects yet, the design of the new agricultural concept is mainly presented in future scenarios (Van Doorn et. al, 2019). How nature and agriculture can go together and what the practical elements of nature inclusive agriculture will look like differs per type

of landscape and depends on the current type of agriculture that is practiced. Nevertheless, there are some aspects that apply to nature inclusive agriculture in general:

- **Farmland birds** are conserved through favorable habitat conditions and for nesting. Herb-rich grasslands, ponding, higher groundwater levels, and grass plots with nest protection and are suitable for raising and breeding young.
- **Bee friendly management** of berms. Adapted mowing management must be implemented and flowery herb mixtures must be sown along field edges and ditch sides, as well as less use of plant protection products.
- **Landscape elements** determine the regional and historical identity and will be integrated where they already existed. They create an attractive landscape and environment and form a basis for pollination, pest control and as a hiding place for birds and small fauna. Examples are wooded banks, trees (rows), pools and ditches.
- **Landscape perception** is about an attractive landscape for recreation. Nature inclusive agriculture is also closely linked to socio-cultural functions. New agricultural nature is made accessible by bicycle and walking paths, nature trails and ‘klompen’ paths. Picking forests and gardens attract people, even as the sale of local products and the opportunity for a cup of coffee or an overnight stay (van Doorn et. al).



Figure 9 & 10: the black-tailed godwit and lapwing are characteristic meadow birds found in the Binnenveld. Nest protection prevents destruction by mowing or fertilization activities (source: Vroege Vogels & Zeevang).

Furthermore, there is natural pest control instead of using pesticides, and field and ditch edges are decorated with flower strips. In fact, herb- and flower-rich edges also bring more organic matter into the soil and play an important role in successfully restoring biodiversity on agricultural lands (Sanders & Westerink, 2015). There is also a varied landscape with many landscape elements. This variety is good for biodiversity and attractive for recreation. Nature inclusive agriculture has a more robust system and could also reduce drought and water damage in agriculture. It also improves the image of local products, which are more nature-

friendly and where people can see for themselves how products are produced.

TOWARDS NATURE INCLUSIVE AGRICULTURE

Nature inclusive agriculture requires not only changes in business operations but also different consumer behaviour and a change of strategy on the part of the government. There is, in fact, a growing awareness among the business community, citizens, and civil society organizations that the food supply must be more sustainable. Many actors want to contribute to the achievement of a nature inclusive agriculture (Runhaar, 2016).

NATURE INCLUSIVE AGRICULTURE IN DIFFERENT LANDSCAPES

Earlier landscape analysis pointed out that the Binnenveld is located on the border of a higher sand area and a river area. A big part of the Binnenveldse Hooilanden is located on the spot of a peat residue. According to van Doorn et. al, there are several different considerations for nature inclusive agriculture depending on the type of landscape and current landuse.

PEAT LANDSCAPE

A peat soil consists of fertile and wet soil. These landscapes are mainly used as grazing land for livestock, because the soil is too wet for growing crops. Often it is already considered a very suitable breeding area for meadow birds. The problem is that more and more peatlands are suffering from subsidence caused by drought and drainage, which release a lot of greenhouse gases. Just like the washing out of nutrients from agriculture, which causes a decline in the number of meadow birds. As mentioned in the site analysis, a big part of the Binnenveldse Hooilanden lies on former peat soils, which has a lot of potential for an attractive wet nature area for meadow birds. The peat soils in the Binnenveld are also suffering because of the negative aspects of the intensive agriculture. Solutions for this type of landscape are raising the groundwater level with the introduction of wet cultivation. Furthermore, a varied grassland with a phased mowing management to help the meadow birds.

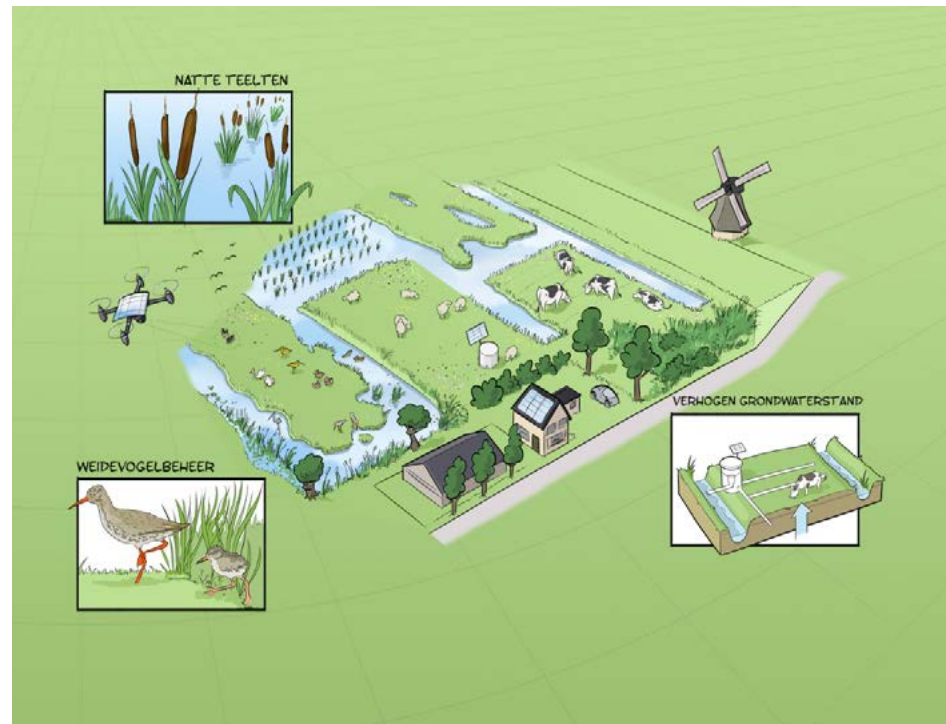


Figure 11: proposed impression of nature inclusive agriculture in a peat landscape (source: WUR van Doorn et. al).

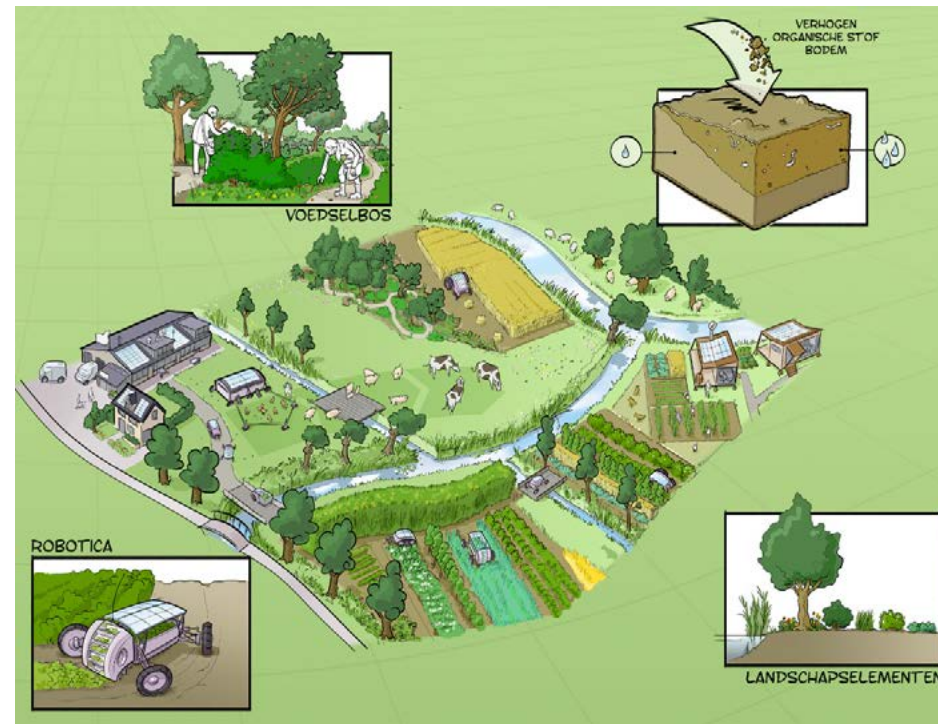


Figure 12: proposed impression of nature inclusive agriculture in a higher sand landscape (source: WUR van Doorn et. al).

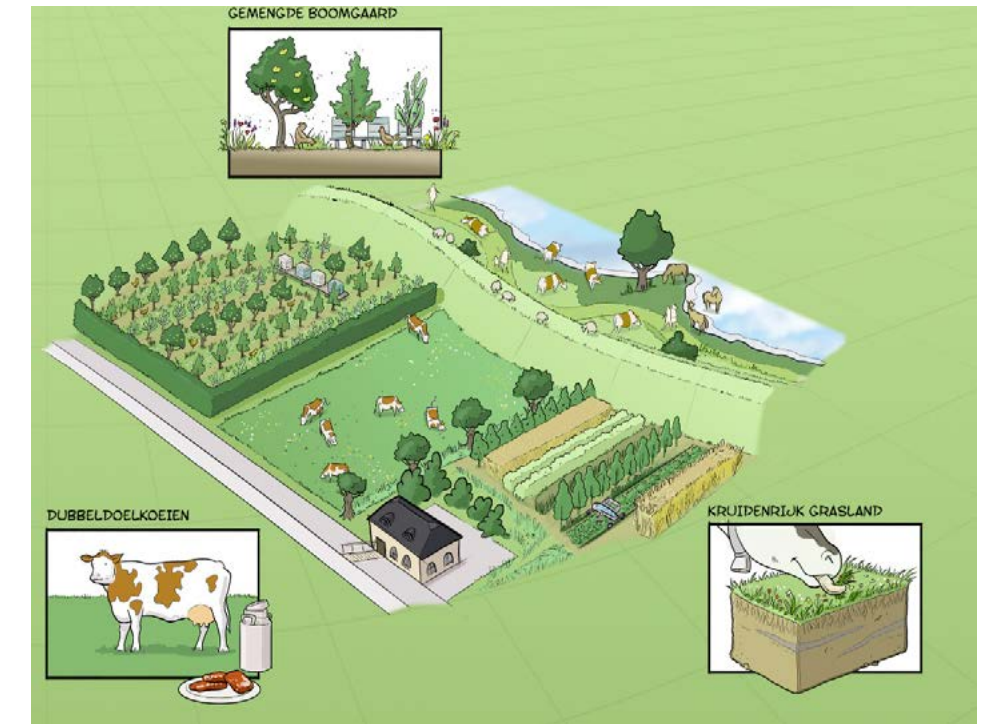


Figure 13: proposed impression of nature inclusive agriculture in a river area (source: WUR van Doorn et. al).

HIGHER SAND AREA

The biggest part of the entire Binnenveld can be categorized as a higher sand area. Higher sand areas are known for their relatively high livestock density and arable farming with dairy farming. In the Binnenveld most of the land use consists of livestock farming. The problem here is also that the nutrient-poor nature is sensitive to fertilization and desiccation by agriculture. Solution here is to scale down dairy farming and combine it with meadow bird grassland. In order to offer farmers a more stable income, they can switch to dual-purpose cows, which provide both milk and meat. On the wetter soils, healthier, extensive livestock is kept, and on the higher soils there is room for adapted arable farming. These can be food or production forests, permaculture or picking forests for higher biodiversity and relate to leisure people (see figure 12).

RIVER AREA

The Binnenveld is bordered in the south to the river Rhine, resulting in a transition zone to a river area. The river area as a landscape is characterized by livestock farming on the lower grounds and trees with fruit growing on the higher grounds. The problem is that here too agriculture is too intensive and water quality is insufficient, which puts pressure on biodiversity. Solutions for the river area are more diverse and less intensive agriculture. Livestock farming can be more nature inclusive with nature grazing and hayland management, where orchards with fruit cultivation should be more mixed to reduce pests. Between the orchards chickens can walk around against weeds, harmful insects and to keep the grass short (van Doorn et. al, 2019). Agroforestry can also be an alternative. This is a cultivation system that usually combines fruit trees with annual agricultural crops or livestock on the same parcel. This mixed cultivation can also have a positive impact on soil fertility, biodiversity and landscape attractiveness (Sukkel et. al, 2019).

SUMMARIZED

Referring to the question “*which forms of nature inclusive agriculture are most suitable for the Binnenveld?*” one can distinguish different applications of nature inclusive agriculture for the Binnenveld. Due to the negative effects of agricultural intensification, there is a need for a different agricultural concept. Nature inclusive agriculture can be a solution because it minimizes the negative ecological effects and maximizes the positive effects. Nature inclusive agriculture considers good management and living conditions for meadow birds and bees, appreciation of landscape elements and landscape perception is important. The Binnenveld can be divided originally into parts from different types of landscapes which all have their own approach for nature inclusive agriculture. Depending on the type of landscape and land use, wet meadows with or without extensive livestock farming, food forests, picking forests, mixed orchards, herb and flower fields and agroforests are suitable as a productive, more sustainable and nature inclusive form of agriculture. There is no ‘most suitable’ form of nature inclusive agriculture for the Binnenveld, but a big variety of sustainable agriculture forms depending on the type of landscape and current land use will be the way to arrive the design choices. The concept of nature inclusive agriculture is opened to combining it with landscape elements and perception, which is strongly related with landscape attractiveness. More on attractiveness

4.3 RECREATIONAL ATTRACTIVENESS

In the previous two chapters there is already mentioned short the importance of recreation as a function in a multifunctional landscape and the chances of combining recreation with nature development or nature inclusive agriculture.

In this chapter we will study the impact of a multifunctional transition zone on the recreational attractiveness of a landscape. The focus will be on answering the question: *“what will be the impacts for the recreational attractiveness of the landscape?”*

RECREATION IN THE COUNTRYSIDE

In the countryside the quality of many areas is considered quite low, due to its large-scale character, poor accessibility, lack of functionality and of scenic beauty (Brul et al. 2002).

Yet the countryside in the Netherlands is already popular for recreation, while there is still a lot of potential for improvement.

Traditionally, people have enjoyed outdoor recreation, especially in free nature (Brinkhuijsen, 2008). Recreation is closely linked to leisure and tourism and includes a wide variety of non-utilitarian pursuits, such as lots of activities, enjoying scenic beauty and visiting cultural heritage attractions (Shaw & Williams, 2002).



Figure 14: outdoor recreation in the Dutch countryside (source MariaBode).

INTEGRATION OF ‘LEISURE LANDSCAPES’

Brinkhuijsen already wondered what makes a rural area suitable and attractive for leisure purposes. The term “leisure landscape” is not only limited to landscapes which are intended exclusively for leisure purposes. The term actually includes any type of landscape that can be experienced as ‘picturesque’ or ‘sublime’ in someone’s perception. So, it is not about a type of landscape, but about a perspective on a landscape. Rural landscapes, such as the Binnenveld, can also be experienced as leisure landscapes. (Brinkhuijsen, 2008).

Recreation in designs is often considered something less important than other functions, while it actually has an important function and

easily can be inserted into many landscape uses. Leisure can be one of many land uses and activities and is easily combined, fitting recreation into a landscape is just a design issue. Therefore, it is not common for recreation to be the only design goal resulting in a mono-functional leisure area. By integrating recreation into a design, the focus will be no longer only on the physical-spatial aspects of landscapes, but also more on the social-psychological aspects (Brinkhuijsen, 2008). The integration of recreation into the landscape might go against the traditional ideal of function-separated leisure. The familiar concept of a forest full of recreational facilities will no longer be the most logical one. It must be integrated into agricultural areas; a multifunctional agricultural natural landscape with recreational facilities is more the future.

LANDSCAPE ATTRACTIVENESS

For a recreationally attractive landscape it is important to create unique and memorable experiences which can express themselves in aspects such as nature, landscape image, cultural heritage and leisure experience (DLG, 2004). The use of landscape elements and the variation between open and closed landscape also plays an important role, the experience is defined by the precise arrangement and composition of elements (Brinkhuijsen, 2008).

For recreation, the creation of diversity is always a successful principle. This gives visitors the choice to go to busy or quiet places, and a diverse range of different activities.

According to Brinkhuijsen, there is a well-founded design tradition in the domain of recreation and leisure which also applies to rural areas such as the Binnenveld. This can be seen as design guidelines to create attractive landscapes for recreation.

TRADITIONAL RECREATION AND DYNAMIC DEVELOPMENTS

Recreation can be seen as a broad and dynamic range of tourism and leisure segments such as nature, sports and adventure, health, culture, heritage and gastronomy. There is also increasing interest in intellectual and spiritual activities. Despite the developments towards a more dynamic form of recreation, there is a kind of stable, timeless recreation base. Traditional activities such as walking and cycling are still the most popular open-air activities, especially in rural areas. Despite this, recreation is becoming more varied with many different attractions. There is often something for everyone in recreational landscapes.

EXPERIENCE AND PERCEPTION

Another notable change in recreation is the increasing emphasis on experience. There is an increasing impact of experiential relationships

and emotions, and people place more and more value on a symbolic experiential value. This goes further than aesthetics alone; a landscape does not have to be visually attractive to provide a unique or memorable experience.

Perception can be affected by playing with material and physical stimuli such as scale, texture, sound, shape, size and composition of landscape elements. For example, the experience of a narrow meandering, swampy, path will be very different from the experience of a straight, wide paved road. A fine-tuned, detailed landscape design can stimulate the senses and increase the impact and richness of the experience.



Figure 15: the texture of a ‘blotenvoetenpad’ plays with physical stimuli and stimulates the senses in a unique way (source: Gouwe Voeten).

OPPORTUNITY TO CONSUME

Spending on leisure items or services has become a recreational activity on its own. Fun shopping is now one of the most popular recreational activities. This can be considered as a little bit 20th century. Of course people do not have to consume when they recreate, but leisure people like to spend money on (local) products, services, catering or overnight stays. This to give their visit to an area extra memory value.

People have more to spend and thereby expect high quality products and services. High quality is not to be confused with luxury. For example, people like to go on wilderness tours with the feeling that they have to roam through nature and that there are only back-to-basic facilities. Hereby they like to be confronted with real wilderness experiences. Extreme experiences used to be less common, where nowadays they are more often created on purpose, which leads to familiarization and a decrease of impact (Steg & Buijs, 2004).

FREEDOM OF CHOICE

As mentioned earlier, diversity in recreation can also be offered by offering people freedom of choice with as little forced meaning as

possible. This freedom of choice is often limited to extensive forms of outdoor recreation. Freedom of choice in recreation areas can be created by offering the possibility to choose multiple paths (see figure 16) and making the area accessible in different ways (Brinkhuijsen, 2008). Furthermore, the attractiveness of routes from home and onwards is also very important.



Figure 16: the possibility to choose between paths gives leisure people a feeling of freedom (source: Persona).

SUMMARIZED

Referring back to the question: *“what will be the impacts for the recreational attractiveness of the landscape?”* one can conclude that the more varied and multifunctional a landscape is, the more positive influence it will have on the recreational attractiveness.

The rural landscapes are popular for recreation, despite there being a lot of room for improvement. How something can be named a ‘leisure landscape’ is about how someone perceives the landscape, not so much about the design intentions. Recreation is something that can very easily be combined with other landscape functions.

For a recreationally attractive landscape, it is important to create unique and memorable experiences. Adding diversity and variety to attractions is good for recreation dynamics. Not only traditional recreational activities but also intellectual and spiritual activities are attracting more and more interest. Experience, perception, emotions and symbolism are also increasingly valued, which can be triggered by certain stimuli.

The opportunity to spend, consume and freedom of choice are also important aspects that must be present for a landscape to be recreationally attractive. A transition zone which is designed multifunctional with a big variety of attractions will have positive impacts on the recreational attractiveness of the landscape.

5. DESIGN CRITERIA & EVALUATION

In the previous chapters different theoretical concepts have been discussed which will be considered in the research through design method.

Before starting to create different designs, guidelines are needed that can be taken into account in the design process. In this chapter we will discuss the formulated design criteria.

Based on the literature review and chapters of key drivers associated with the SRQ’s, design goals and associated design criteria have been created. The design goals are linked to the need for design which was also mentioned in the introduction. The design goals are listed below with the corresponding design criteria that must be met as much as possible to reach the design goal.

1. TO PRESERVE OR IMPROVE THE HABITAT SERVICES AND BIODIVERSITY

- Protection of (rare) species through favorable living conditions.
- The possibility of migration between parts of nature reserves.
- Nature-friendly management.

2. PREVENTION OF NUISANCES IN THE FORM OF EUTROPHICATION, ACIDIFICATION OR DESICCATION

- Reduce/filter the exceedance of the nitrogen deposition.
- A naturally functioning soil-water system.

3. INTERGRATE AND COMBINE RECREATION WITH THE AREA

- Create a recreationally attractive landscape with varied attractions
- Not too closed to the public.
- A diverse landscape experience; mentally, emotional and spiritually.

4. PRESERVE THE AESTHETIC VALUES OF THE LANDSCAPE

- Strengthen landscape elements which determine the regional identity.
- Reflect history in the design with characteristic elements.
- These design criteria can be used to evaluate the various design iterations.

The chapters from the literature analysis are linked to the need for design and can provide the solution to the design goals.

For example, the first design goal on habitat services and biodiversity can be linked to the chapter on landscape functions. The design goal about prevention of eutrophication, desiccation and acidification caused by intensive agriculture can be linked to a transition to nature-inclusive agriculture. The last two design goals on combining with recreation and maintaining landscape aesthetics can be linked to the chapter about recreational attractiveness.

The design criteria can be used to evaluate the various design iterations. The design criteria were drawn from assertions made in the literature. From these assertions, a selection was made of those that were most applicable to the landscape situation in the Binnenveld.

Some criteria are more measurable than others, ultimately some are a matter of personal preference. They are rather intuitive criteria, but they certainly give food for thought and form a good basis for evaluation. Some are really criteria to be applied in the design, where others are more of an indication of the associated use/management type to reach the relevant design goal.

In the table below there are some design suggestions/principles shown that belong to a design criterion and can contribute to the achievement of the related criterion, and thus to the achievement of the design goal.

DESIGN GOAL	DESIGN CRITERIA	DESIGN SUGGESTIONS/PRINCIPLES
1. To preserve or improve the habitat services and biodiversity	Protection of (rare) species through favorable living conditions.	herb-rich grasslands, ponding, higher groundwater levels, grass plots suitable for nesting and raising of nestlings, nest protection
	The possibility of migration between parts of nature reserves.	Connecting green spaces, fish ladders, amphibian tunnels, reed strips
	Nature-friendly management.	Phased mowing management, reduced use of plant protection products
2. Prevention of nuisances in the form of eutrophication, acidification, or desiccation	Reduce/filter the exceedance of the nitrogen deposition.	Nature inclusive agriculture as transition zone, expansion of the cultivation plan with rust crops, less (artificial) fertilizer
	A naturally functioning soil-water system.	Water storage, dynamic (ground)water level management, and custom irrigation. Less crop protection products
3. Integrate and combine recreation in the area with various aspects	Create a recreationally attractive dynamic landscape with varied attractions	picking forests and gardens, sale of various local products, restaurants for a cup of coffee on overnight stay
	Not too closed to the public	accessible by bicycle and walking paths, ‘struin’ nature and ‘klompenpaden’
4. Preserve the aesthetic values of the landscape	A diverse landscape experience: mentally emotional and spiritually attractive landscape that stimulates the senses and offers unique or memorable experiences.	Freedom of choice for recreationists important, playing with material and physical stimuli: the shape, size, scale, material, texture, smell, sound and composition of landscape elements, educational aspects.
	Landscape elements which determine the regional identity.	hedges, hedgerows, (rows of) trees, pools and ditches, view-throughs.
	Reflect history in the design with characteristic elements.	Cultural heritage such as the Grebbelinie or historical remains give identity to the design.

Figure 17: table with design goals, criteria and suggestions.

These design suggestions will be applied in the different thematic designs as much as possible to achieve the design goal as good as possible.

EVALUATION

Using the design goals, criteria and design suggestions from the above drawn table, the thematic designs will all be evaluated to what degree they meet the design criteria (see figure 18). A subjective score will be given per criteria between 1 and 5, where 1 means ‘not met at all’ and 5 means ‘fully met.’

The different thematic design iterations will score differently on the different goals in this evaluation. In the end, the combined integrated design must have the highest total score and thus prove that it has taken all design goals in consideration as much as possible.











DESIGN GOAL	DESIGN CRITERIA	1 - not met at all	2	3	4	5 - is fully met	TOTAL SCORE
1. To preserve or improve habitat services and biodiversity							
							
							
2. Prevention of nuisances in the form of eutrophication, acidification, or desiccation							
							
3. Integrate and combine recreation in the area with various aspects							
							
							
4. Preserve the aesthetic values of the landscape							
							
TOTAL SCORE							

Figure 18: table with evaluation of the design criteria.

LEGEND











- Protection of (rare) species through favorable living conditions
- The possibility of migration between parts of nature reserves
- Nature-friendly mowing management
- Reduce/filter the exceedance of the nitrogen deposition with less artificial fertilizer
- A naturally functioning soil-water system with less crop protection products
- Create a recreationally attractive dynamic landscape with varied attractions
- Not too closed to the public
- Mentally emotional and spiritually attractive landscape that stimulates the senses
- Landscape elements which determine the regional identity
- Reflect history in the design with characteristic elements

Figure 19: legend of the table with evaluation of the design criteria.

6. RESEARCH BY DESIGN

6.1 DESIGN FOCUSSES

In the previous chapter it was discussed how the design goals and design criteria were developed and how they could be applied to the landscape with their design suggestions and principles.

This chapter continues on the design suggestions but focuses more on the visual aspect.

In four conceptual drawings, showing a conceptual part of the study area in the Binnenveld, the four design goals are sketched as what the area could look like after following the corresponding design criteria.

In these conceptual illustrations the current situation is presented first. With on the right side of the Grift the nature of the Binnenveldse Hooilanden and to the left intensive agriculture. The other drawings are conceptual applications focusing respectively on nature development, nature inclusive agriculture, recreation, and landscape elements.

The next chapter discusses the three themes from the literature analysis. These themes are nature development, nature-inclusive agriculture, and recreational attractiveness. Therefore, the conceptual sketch of landscape elements will be included in the other three concepts.

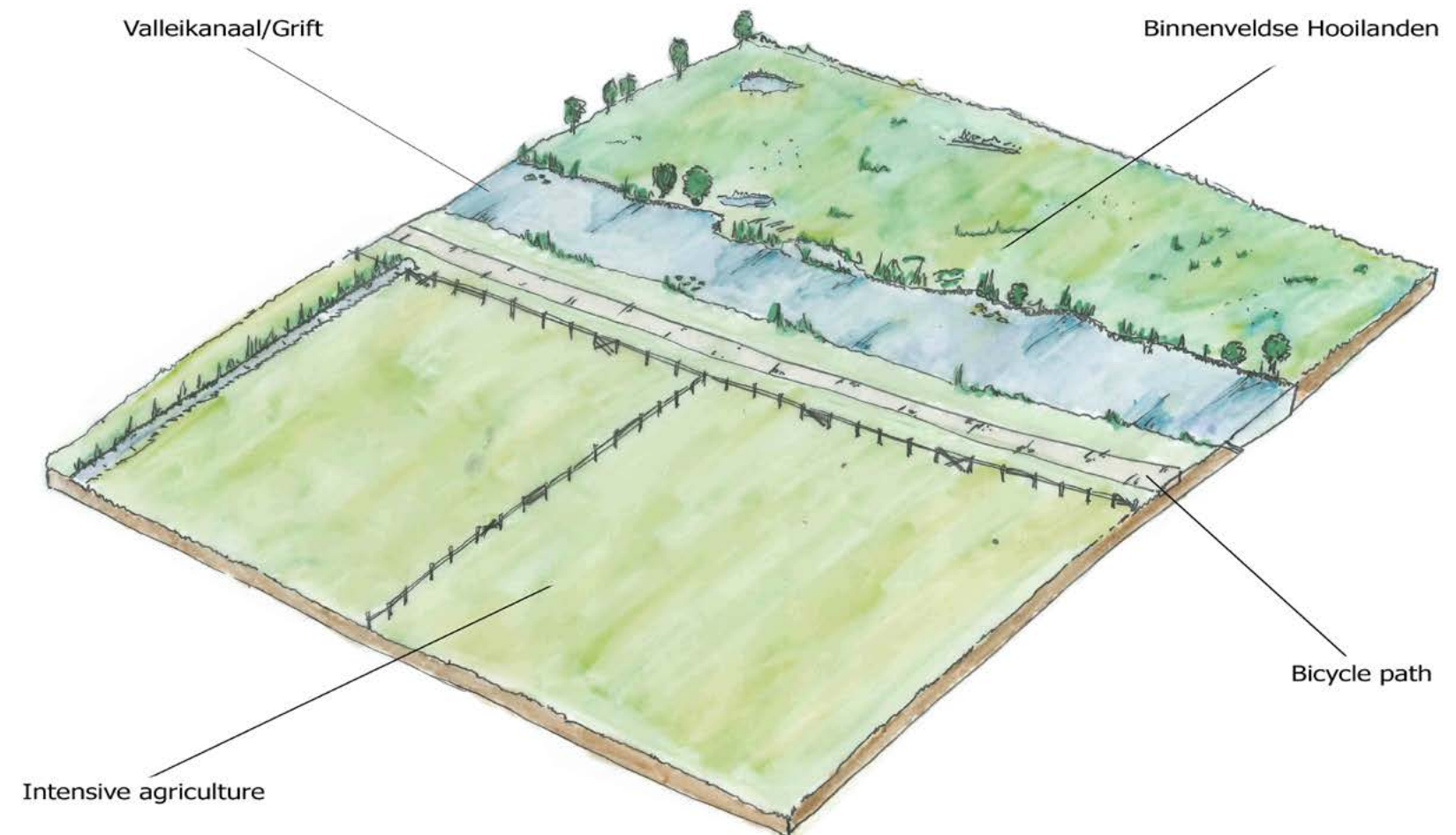


Figure 20: concept of the current situation.

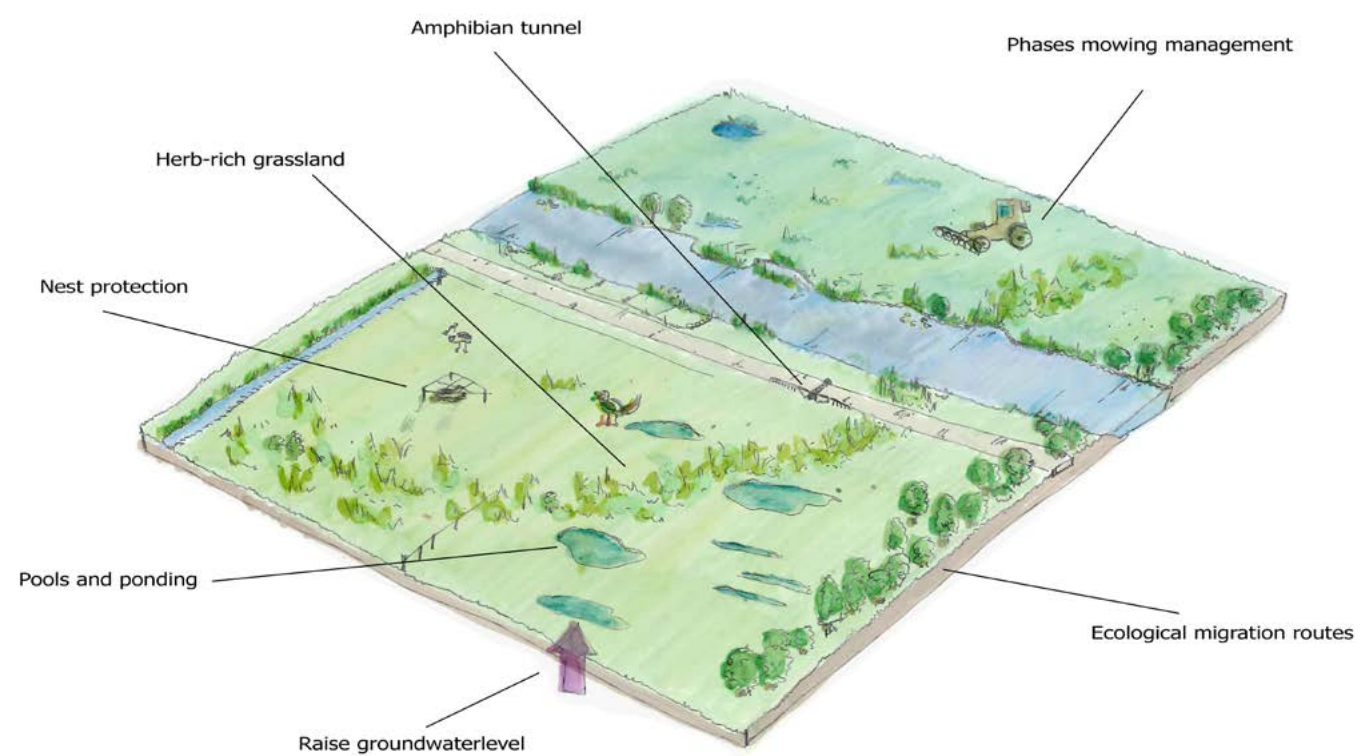


Figure 21: design concept for nature development.

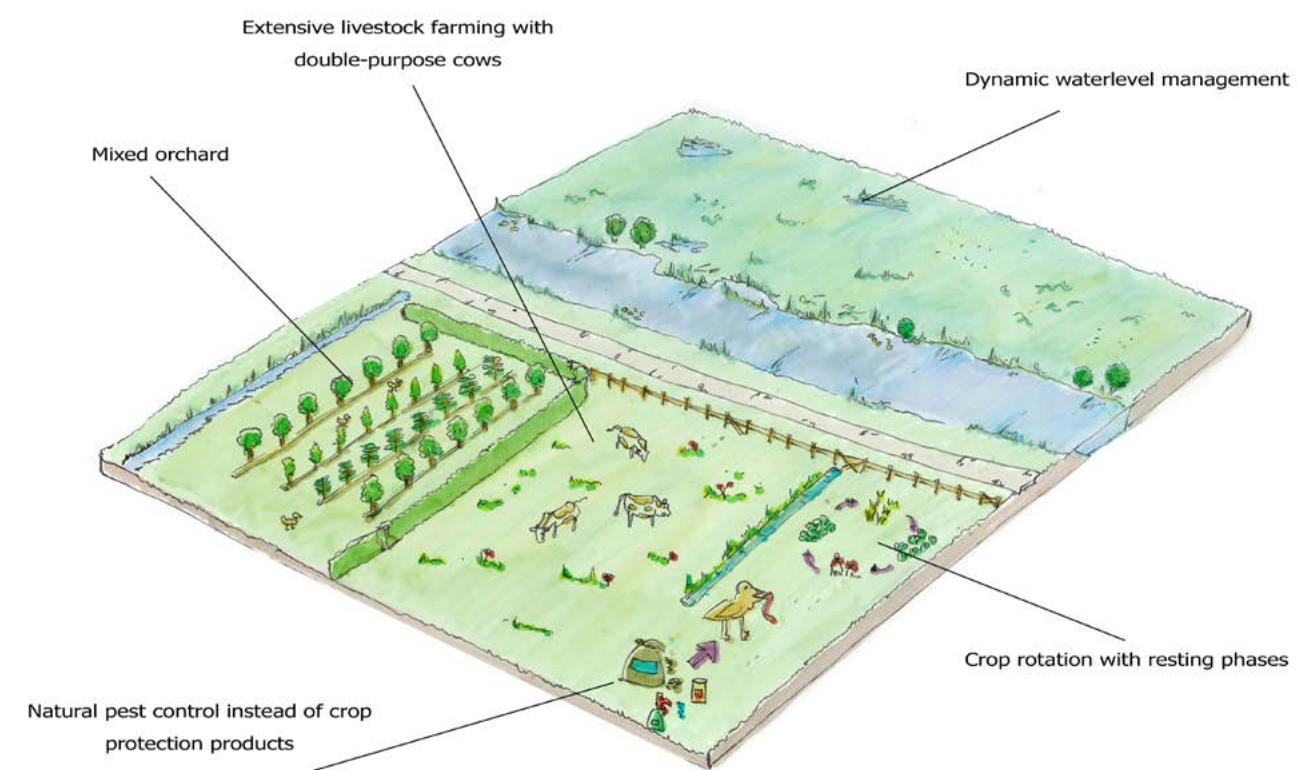


Figure 22: design concept for nature inclusive agriculture.

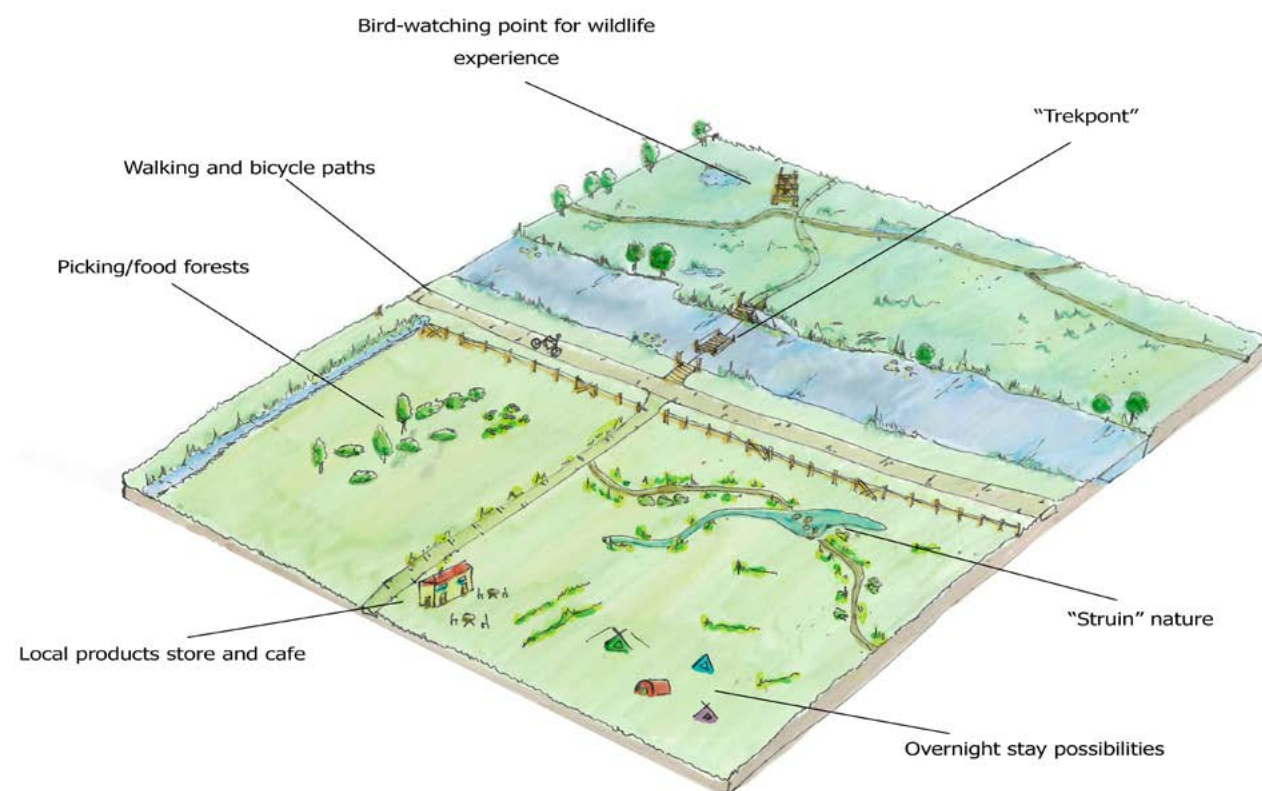


Figure 23: design concept for recreation.

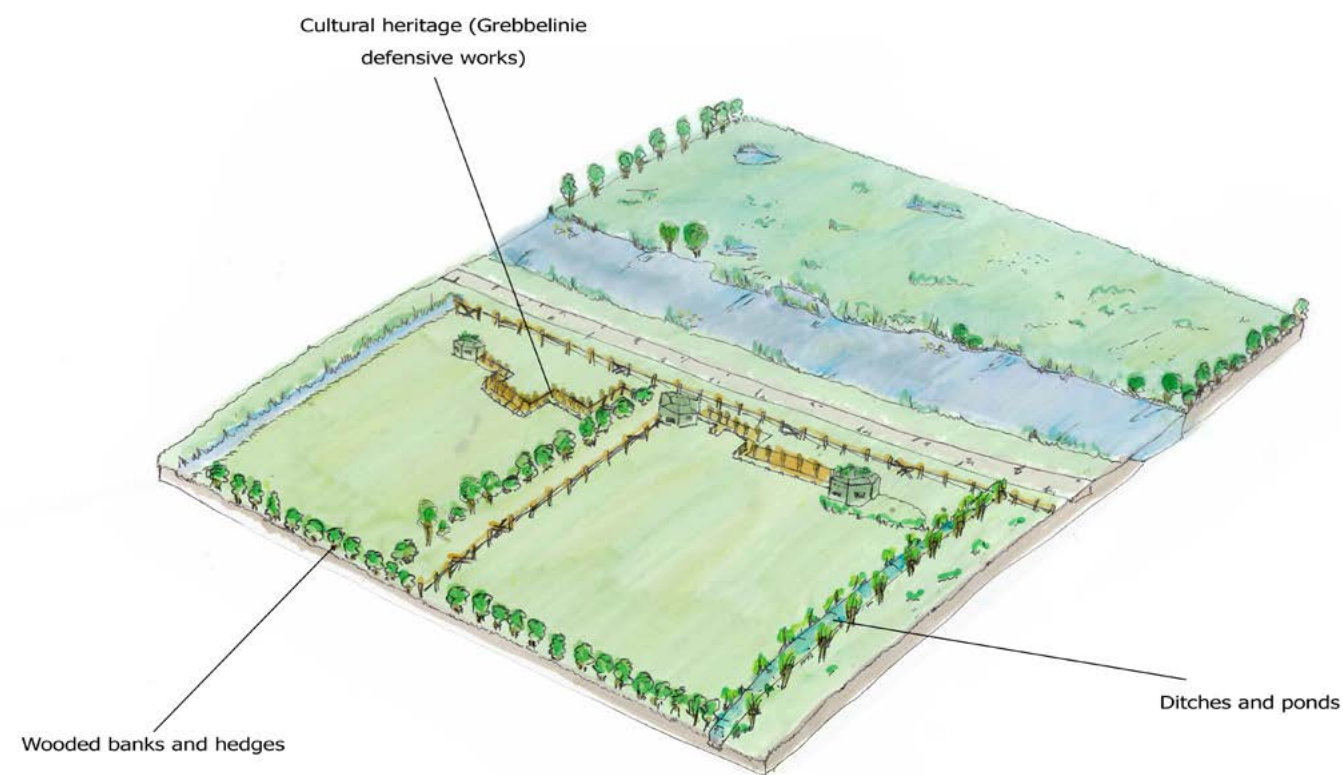


Figure 24: design concept for landscape elements.

6.2 NATURE DEVELOPMENT

As mentioned in the previous chapter there will be used three themes considering the chapters in the literature analysis. The themes are nature development, nature inclusive agriculture and recreational attractiveness. All these design focuses resulted in their own original design.

NATURE DEVELOPMENT

The first design focusses on nature development. This design is basically an extension of the Binnenveldse Hooilanden itself, with some attention to the intergration of specific elements. Because the current nature area is being plagued by the surrounding intensive agriculture, this new 'buffer zone' of nature has to ensure that the Binnenveldse Hooilanden will flourish again. There will be less disturbance from agriculture in the area and the nature reserve will be expanded, providing a larger habitat for flora and fauna.

The focus is mainly on the habitat functions of the landscape, the ability of a landscape to contribute to population maintainance. The area should provide as much habitat as possible for (endangered) species.

This is expressed in the design by the implementation of many herb-rich grasslands and landscape elements such as hedges and rows of trees. To support the nursery function even more, nest protection and a phased mowing management will be used to create more places which are suitable for breeding and raising offspring. The groundwater level of the area will be raised, to give the wet nature a chance again and to create pools which are attractive for water birds and amphibians. Furthermore, there will be a number of ecological connection routes through the area, to accommodate migration. These are hedges, landscape avenues of trees, bushes and natural ditches banks. These ecological routes will also continue outside the Binnenveld and connect the Binnenveldse Hooilanden with the Utrechtse Heuvelrug, the Blauwe Kamer and the Veluwe. In the area itself, there will be interventions on a smaller scale to accommodate ecological migration. Examples are amphibian tunnels under the roads or fish ladders.

With different types of nature, an attempt will be made to create a varied and heterogeneous landscape, but despite the fact that ecological networks can be combined well with other functions, the focus in this design lies exclusively on nature development. The area will therefore not be made more accessible for recreation. The existing roads and paths will remain, but there will be no new paths through the new nature. This is to preserve nature as much as possible and to not disturb the quietness for the flora and fauna.

There will be a visitor center, in the north-east central part. There was originally a very large farm group here, for which there is no longer room in the design with this focus.

The visitor center will provide information about the nature area, the walking and cycling routes and the flora and fauna.

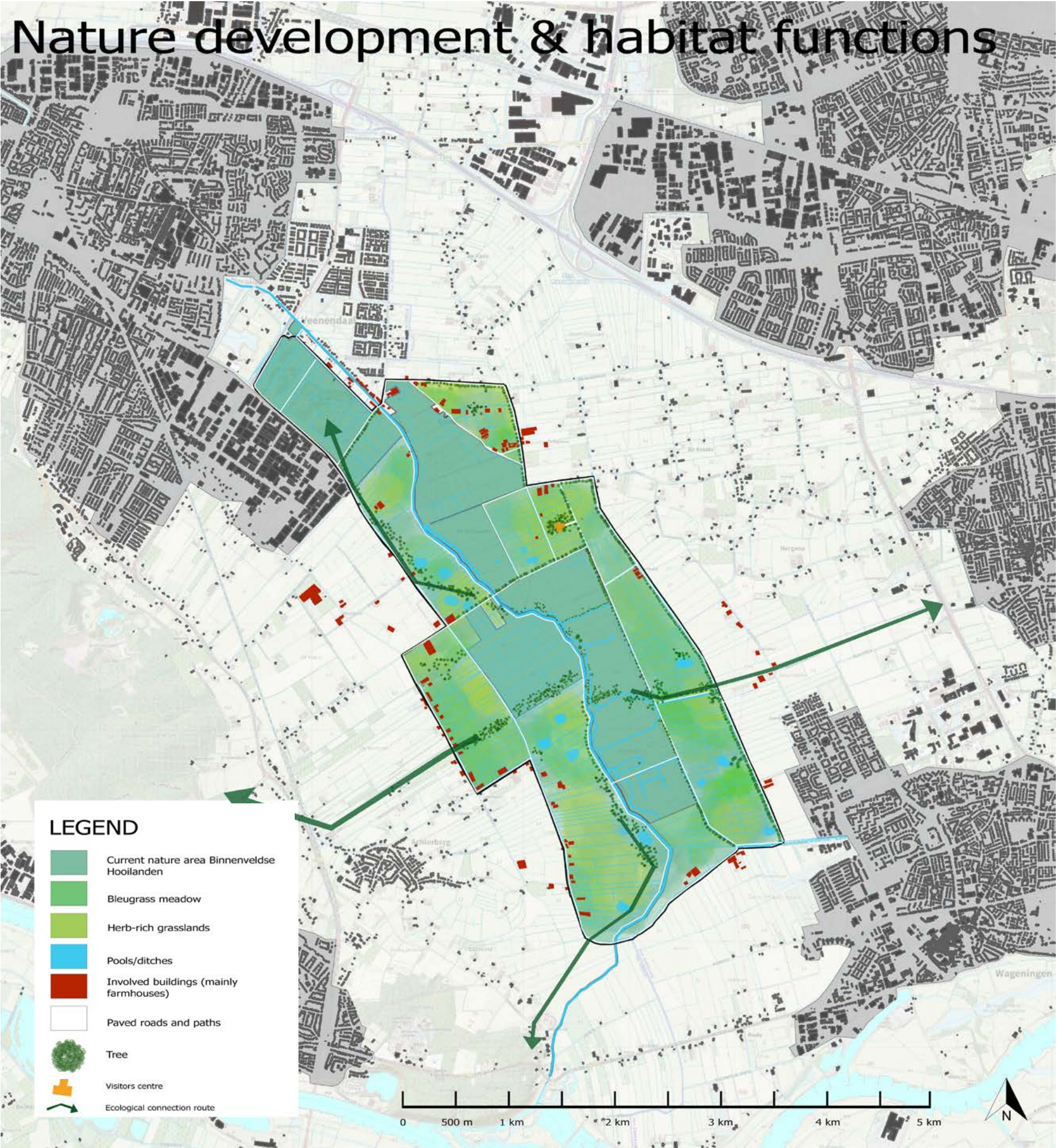


Figure 25: design focussing on nature development.

6.3 NATURE INCLUSIVE AGRICULTURE

The second design focusses on farmers’ agricultural production. However, in order to address the current problem that intensive agriculture is causing, agricultural production needs to change. This design focuses on the implementation of nature inclusive agriculture.

Considering the mix of landscape types that can be associated with the Binnenveld there are several aspects of nature inclusive agriculture that can be applied. First of all, a varied grassland with a phased mowing management is important to support the meadow birds, which also was the case in the design focusing on nature development. In addition, livestock farming can become more nature inclusive with natural grazing and hayland management.

The orchards in nature inclusive farming will be more mixed with different tree species to reduce pests. Between the trees chickens can walk around against weeds, harmful insects and to keep the grass short. Also, agroforestry will be applied, where orchards are combined with annual crops or extensive livestock farming.

In the design, the layout of the parcels is largely based on current land use. Where intensive livestock farming was practiced, this has mainly been exchanged for extensive livestock farming. At parcels where agriculture was practiced (mainly orchards and maize), mixed orchards will be created.

There have been chosen for a diverse variety of different types of nature-inclusive land uses. For example, there are the mixed orchards, where fruit cultivation of different types is practiced. In the mixed crop orchards, fruit trees are mixed with annual crops. Given the nature-inclusiveness that is needed, intensive annual fields with monotonous crops are disappearing from the landscape image. This is because they have no ecological value for the biggest part of the year and are also sensitive to pests. Agroforestry is also applied in extensive livestock farming in orchards. Here double-purpose cows can graze peacefully with plenty of space between the fruit trees.

Furthermore, extensive grazing is also practiced by cattle in the meadow bird grasslands with extensive livestock farming. Here the cattle can enjoy a varied diet rich in flowers and herbs. There will be not too many cattle per field, which means that the grass always stays high in certain places and provides enough habitat for meadow birds. There are also flower and herb-rich fields, which are not grazed anyway and are located between parcels to accommodate biodiversity.

In this design, the path and road structure remain unchanged, and the existing farms are allowed to stay, assuming they make their farming concept more sustainable.

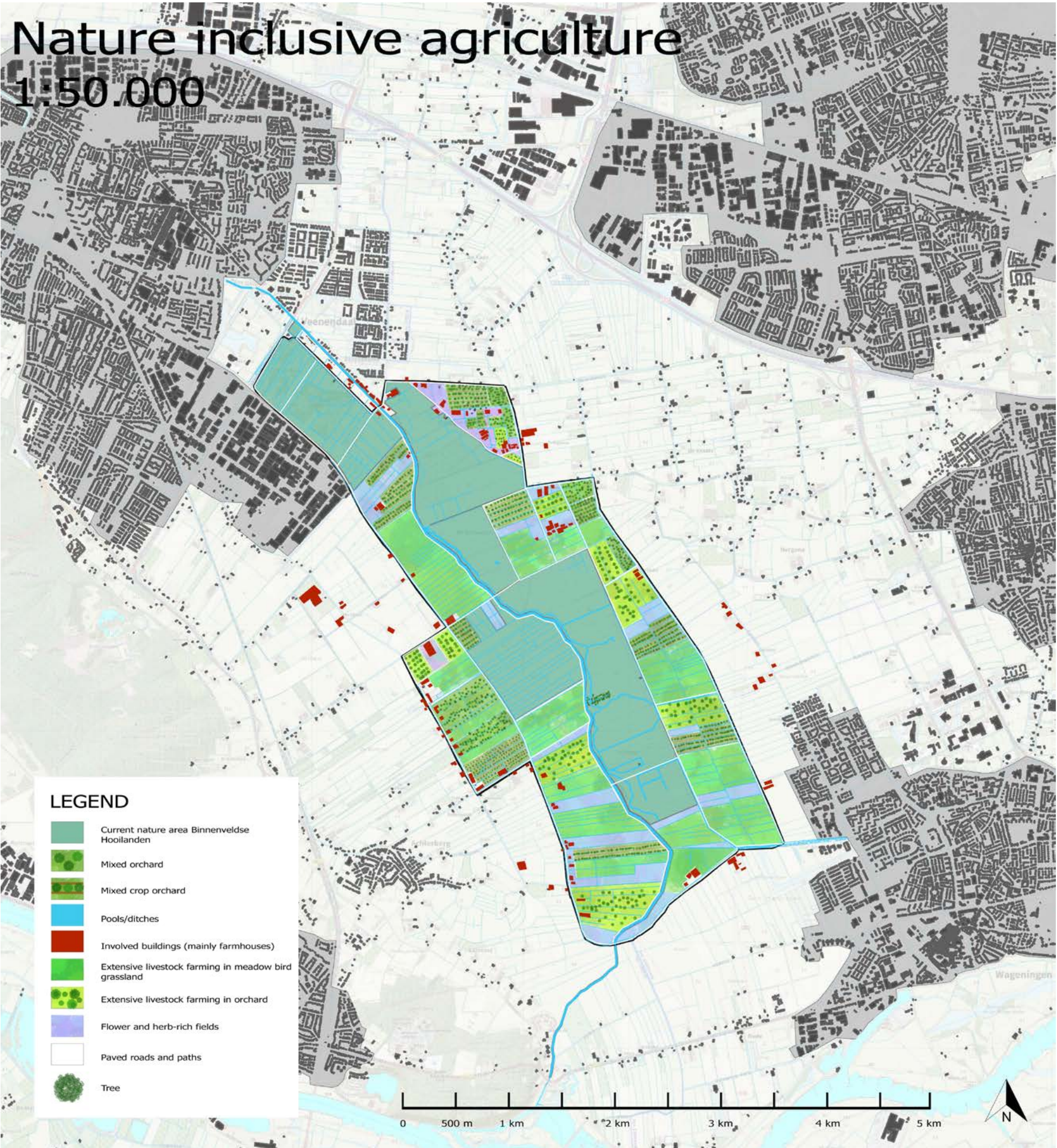


Figure 26: design focussing on nature inclusive agriculture.

6.4 RECREATION & LANDSCAPE AESTHETICS

The third design focuses on the recreational attractiveness of the landscape. As discussed earlier in the recreational analysis, the area already contains quite a few recreational activities, although the offer is not very large and varied. The Binnenveldse Hooilanden is also not very accessible for recreation. The attractiveness of a 'leisure landscape' can be experienced differently by each person, therefore it is important to create a varied landscape with unique and memorable experiences.

The accessibility of the nature area is greatly improved in this design. Previously only a bicycle path mainly surrounded the nature area and one had to make a long travel to get to the next bridge. Now there are more bicycle paths, where one of them will cross the area horizontally in the middle. There, in the form of a 'trekpont', a possibility to cross the Grift is created. There are also a lot of extra footpaths making almost the entire area accessible.

In order to offer a wildlife and back-to-basic experience to recreationists, there are a lot of 'klompen' paths to be conquered as typical 'struin' nature. The wide variety of trails also gives recreationists the desired 'freedom of choice'. Birdwatch and watchtowers also increase the chance of meeting wildlife. The trekpont also certainly contributes to the adventurous aspect of crossing the Grift.

There are also plenty of attractions and oppertunities to spend money, or for drinking a cup of coffee. Due to the implementation of a number of local stores and local cafes. There is also the opportunity for an overnight stay. This is possible in a picturesque bed and breakfast, or for the real nature lovers in the middle of the nature area on a nature campsite. In the visitor center, extensive information can be gathered about nature and activities in the area, which could also be linked to the rental of tandems, steps or canoes.

The involvement of recreationists with the agriculture and food production of the area can be promoted completely in an educational and 'get your own food' way by the food and picking forests in the area.

Overall, it is a design with a very diverse range of recreational opportunities. Of course, the possibilities in combination with the other themes must be considered. Nature should not be disturbed too much. There will be more discussed about this in the integrated design description.

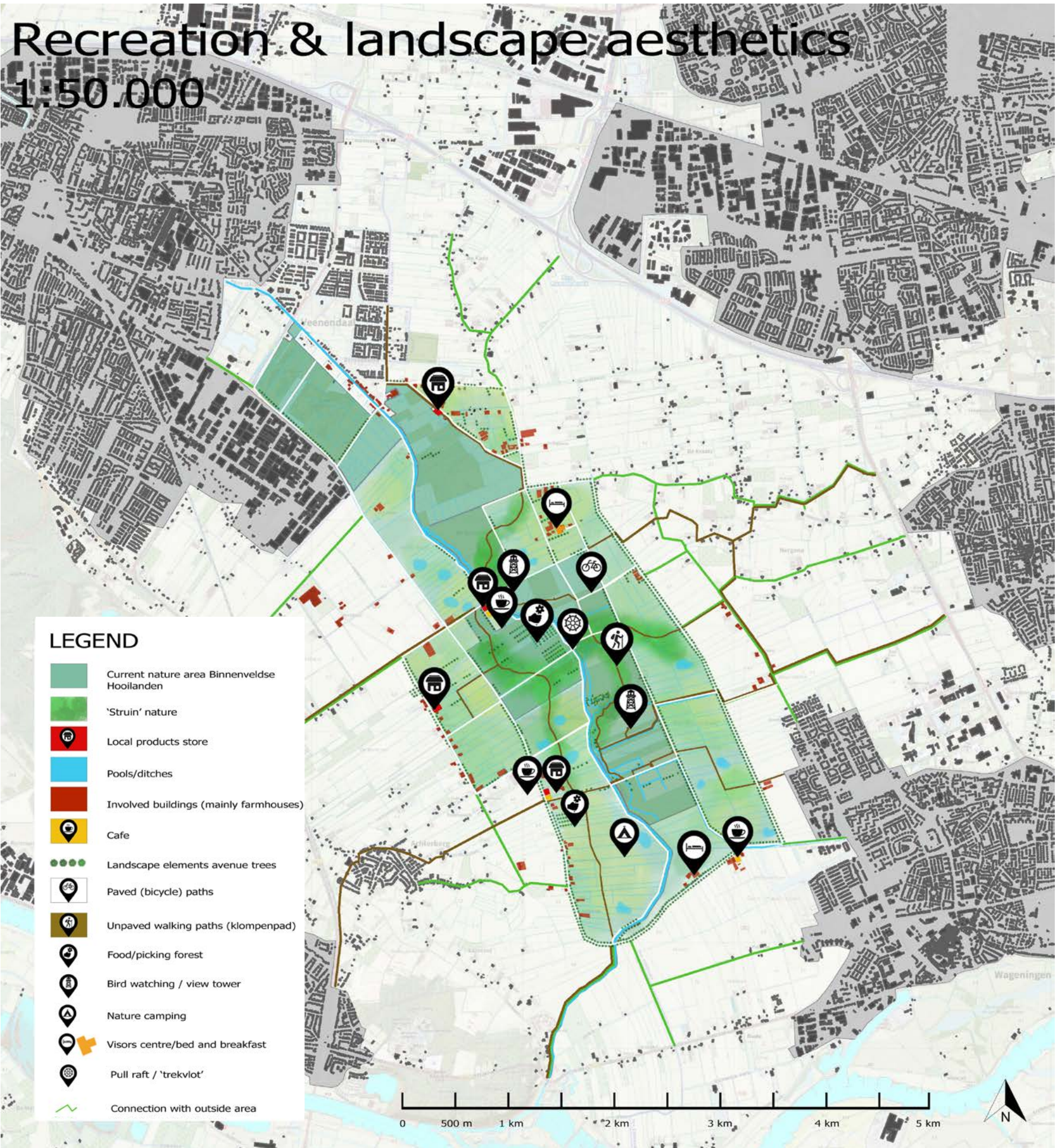


Figure 27: design focussing on nature inclusive agriculture.

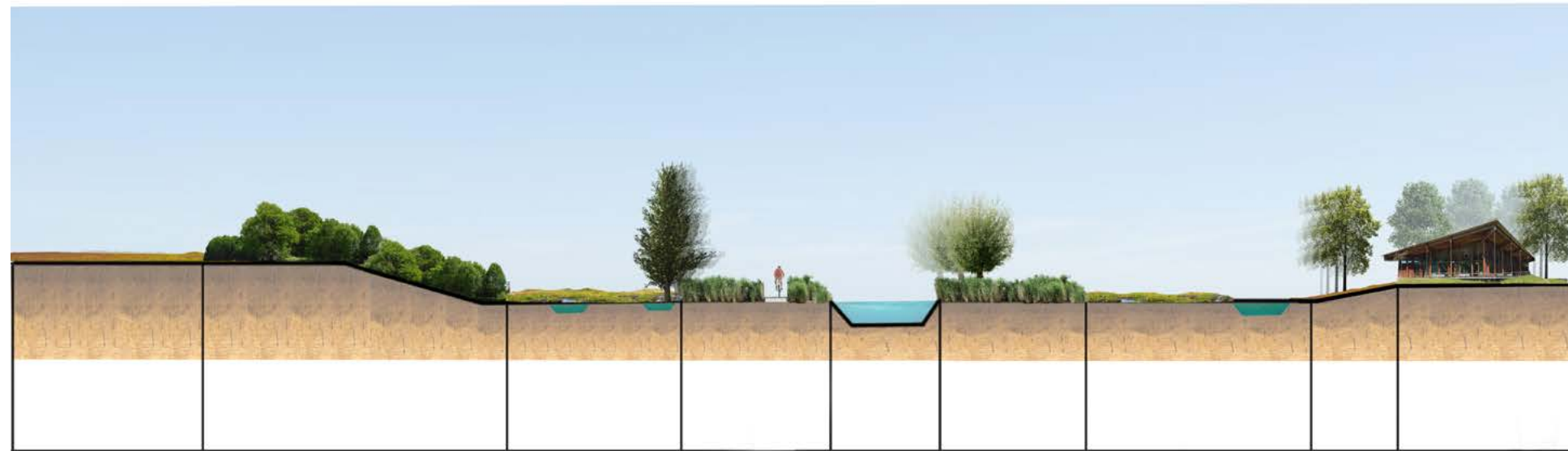


Figure 28: impressive cross section of nature development

Meadow bird grassland Ecological migration routes Wet grasslands with pools Bank and bike path Grift Bank with tree row Wet grasslands with pools Tree avenue Visitors centre

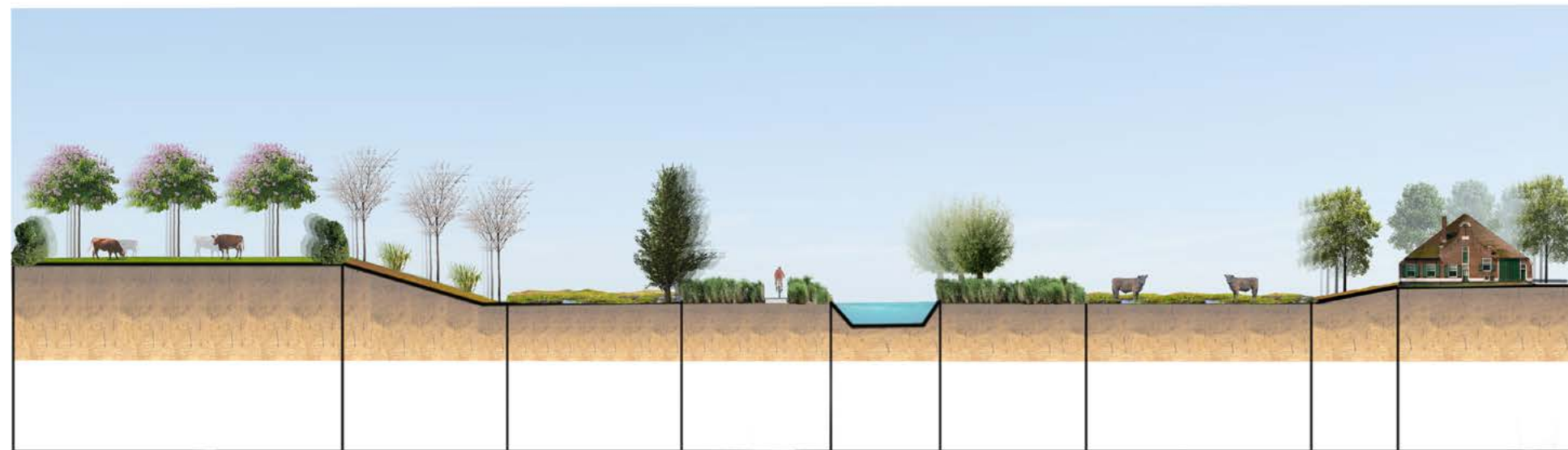


Figure 29: impressive cross section of nature inclusive agriculture

Extensive livestock farming in orchard Mixed crop orchard Flower and herb-rich field Bank and bike path Grift Bank with tree row Extensive livestock farming in meadow bird grassland Tree avenue Farm

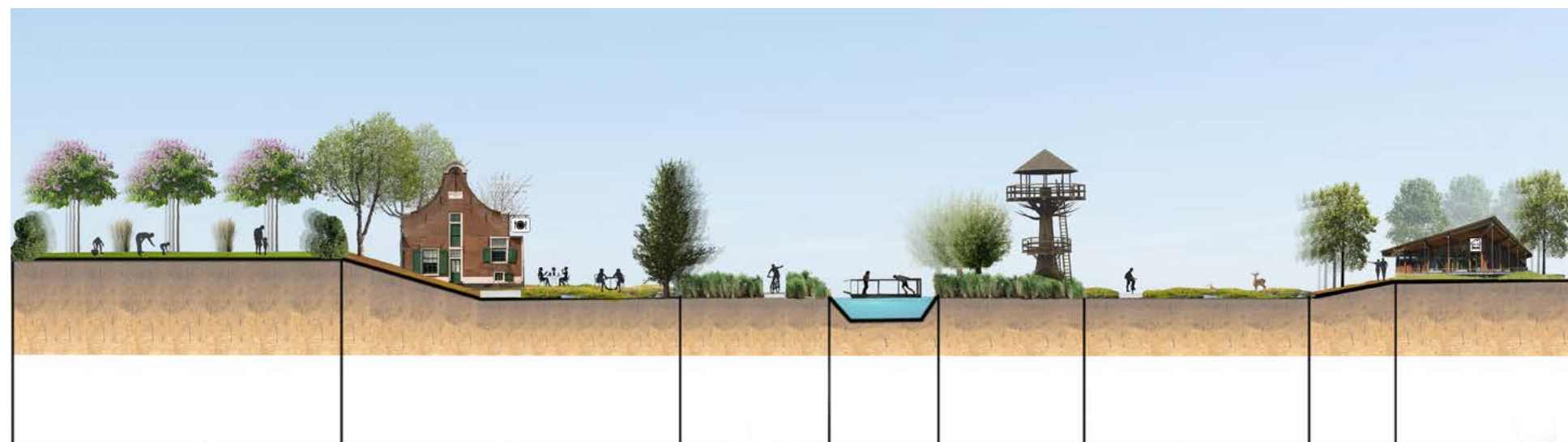


Figure 30: impressive cross section of recreation

Picking forest Cafe/restaurant Bank and bike path Trekpoint Watching tower More bike/hiking paths Tree avenue Visitors centre/bed and breakfast

6.5 DESIGN EVALUATION

DESIGN 1: NATURE DEVELOPMENT

The first design’s nature ratings are of course high because the design is focused on this. The rating for nature-friendly management is also high in the other designs because in all three there will be a management of phased mowing. Due to the absence of agriculture in the plan, no fertilizer or crop protection products are used so these values in the evaluation are also high.

The recreational values are very low, as mentioned in the literature it could be considered recreational attractie by some people. The area is also not made accessible so these values are also low.

The total score of the design evaluation is 32.











DESIGN GOAL	DESIGN CITERIA	1 – not met at all	2	3	4	5 – is fully met	TOTAL SCORE
1. To preserve or improve habitat services and biodiversity						5	
						5	
						5	15
2. Prevention of nuisances in the form of eutrophication, acidification, or desiccation						5	
						5	10
3. Integrate and combine recreation in the area with various aspects			2				
		1					
		1					4
4. Preserve the aesthetic values of the landscape			2				
		1					3
TOTAL SCORE							32

Figure 31: evaluation table design criteria for design 1

DESIGN 2: NATURE INCLUSIVE AGRICULTURE

The second design scores lower on nature values, although there are herbs and fauna-rich grasslands that are connected in some places as an ecological connection route. The design also scores slightly lower on the deposition of fertilizer. This is because nature-inclusive agriculture does require some fertilization. In the area of recreation and aesthetics the value is also not too high, because that is not the focus.

The score of this design evaluation is 31.











DESIGN GOAL	DESIGN CITERIA	1 – not met at all	2	3	4	5 – is fully met	TOTAL SCORE
1. To preserve or improve habitat services and biodiversity				3			
				3			
						5	11
2. Prevention of nuisances in the form of eutrophication, acidification, or desiccation					4		
						5	9
3. Integrate and combine recreation in the area with various aspects			2				
			2				
			2				6
4. Preserve the aesthetic values of the landscape			2				
				3			5
TOTAL SCORE							31

Figure 32: evaluation table design criteria for design 2

DESIGN 3: RECREATION

Third design has low nature values due to lack of ecological connection routes. There are also low favorable living conditions due to limited resting places for flora and fauna. Due to the lack of agriculture in the plan, no fertilizer or crop protection products are used so these values are also high.

Of course, the recreational values and aesthetics are high because of the high amount of recreational possibilities and the landscape planting of trees along roads.

The total score of this evaluation is 40.































DESIGN GOAL	DESIGN CITERIA	1 – not met at all	2	3	4	5 – is fully met	TOTAL SCORE
1. To preserve or improve habitat services and biodiversity		1					
		1					
						5	7
2. Prevention of nuisances in the form of eutrophication, acidification, or desiccation						5	
						5	10
3. Integrate and combine recreation in the area with various aspects						5	
						5	
						5	15
4. Preserve the aesthetic values of the landscape						5	
				3			8
TOTAL SCORE							40

Figure 33: evaluation table design criteria for design 3











LEGEND

-  Protection of (rare) species through favorable living conditions
-  The possibility of migration between parts of nature reserves
-  Nature-friendly mowing management
-  Reduce/filter the exceedance of the nitrogen deposition with less artificial fertilizer
-  A naturally functioning soil-water system with less crop protection products
-  Create a recreationally attractive dynamic landscape with varied attractions
-  Not too closed to the public
-  Mentally emotional and spiritually attractive landscape that stimulates the senses
-  Landscape elements which determine the regional identity
-  Reflect history in the design with characteristic elements

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-  Landscape elements which determine the regional identity
-  Reflect history in the design with characteristic elements

6.6 INTEGRATED DESIGN CREATION

In this chapter we will look at how the three thematic design options could be integrated to one multifunctional end design.

To come to a final design that includes aspects from all three thematic designs, it is necessary to look at what the needs are at certain site-specific locations. Thematic interventions may in fact be more logical or more appropriate in certain places than in others.

To get an overview of the land use and facilities on the surrounding parcels in the current situation, the analysis map below was created. The framed areas are classified according to separation by roads to make a distinction. This map will be used to inform the choice of thematic site specific interventions. The analysis was done using map data and additional field observations.

NATURE NEEDS

To accommodate nature development, looking at the a previously mentioned design criteria, more areas with favorable living conditions and ecological migration routes are required. Looking at the current area, given the structure of the Binnenveldse Hooilanden, areas 5, 7, 8 and 2 would be logical places for nature development, as there would be no more odd 'bites' out of the nature structure.

AGRICULTURAL NEEDS

For the new (agricultural) use of the areas around the Binnenveldse Hooilanden, there will be looked at the current land use, and how this can proceed as much as possible, in a sustainable nature inclusive way.

1. Many farms, fields with maize.
2. Mostly agricultural grassland with livestock, large farm group and cultivation of maize.
3. Mainly agricultural grassland, here and there a maize field.
4. Agricultural grassland with livestock farming.
5. Farmhouses next to the road, further agricultural grassland with livestock farming.
6. Many orchards, combined with maize fields and agricultural grassland for livestock farming.
7. Agricultural grassland for livestock farming.
8. Agricultural grassland and maize fields.

Areas 6, 8 and 1 seem suitable for orchard cultivation. 2,3 and 5 partly.
Furthermore, 3, 4, 5 and 7 are mainly suitable as agricultural grassland with extensive livestock farming.

RECREATIONAL NEEDS

For recreation there are more general requirements such as more accessibility to the area and more recreational facilities. These are not strictly site specific and can be distributed more or less evenly throughout the area.

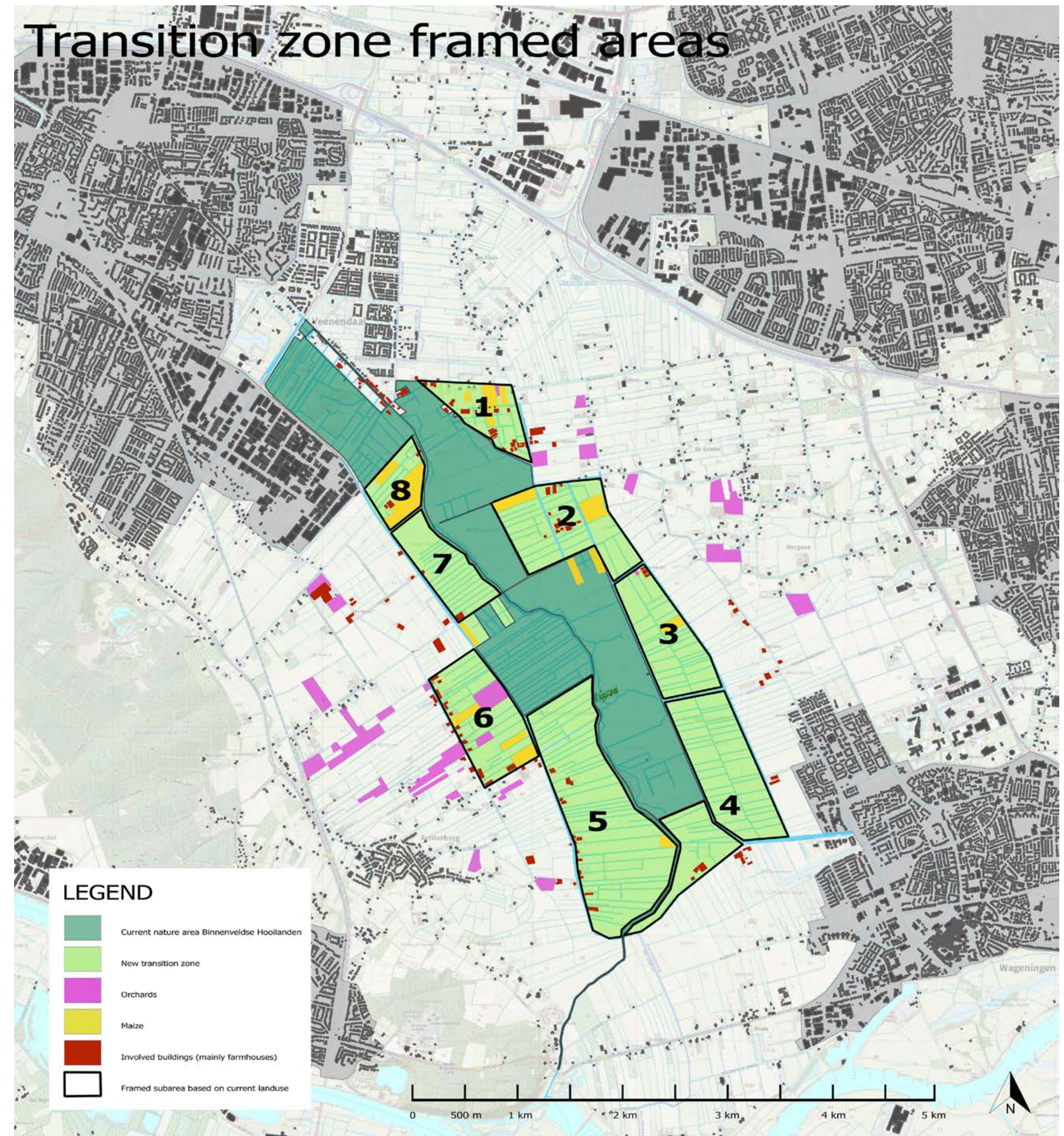


Figure 34: framed sub area's with different design needs.

6.7 INTEGRATED DESIGN

The final integrated design is a combination of the thematic designs discussed earlier. A good multifunctional design takes as many aspects as possible into account.

The parcels where agriculture is practiced have remained more or less location-bound to the places where there was agriculture before. This has been expanded in certain places and reduced in others. As mentioned earlier, the concept of intensive agriculture has been changed and has become more nature inclusive. Now there is mainly fruit farming, with three types of orchards. The mixed orchard, the agroforestry orchard with crops and the agroforestry orchard with livestock farming. Furthermore, where there was agricultural grassland, meadow bird grasslands with extensive livestock farming have been created, which also has a high-quality nature value.

Between the nature-inclusive agricultural fields, the integrated design also made room for herb- and fauna-rich fields, which serve as an attractive shelter and nesting place for bird species and contribute to nature development.

There are also aspects of the nature development design which return in the integrated design. For example, the ecological connecting routes and groups of trees , and much space has been reserved for the above-mentioned meadow bird grasslands and herb- and fauna-rich fields.

The groundwater level will be raised in a few areas to create wetlands and pools for , birds and amphibians. Furthermore, nature-friendly management, such as phased mowing management, amphibian tunnels, nest protection and natural pest control instead of crop protection products will be incorporated.

With regard to recreation in the area, a nature-friendly middle way has been chosen between nature development and a recreationally attractive area with many facilities. To not disturb nature too much there are less paths and roads than in the recreational design, especially the current Binnenveldse Hooilanden will remain untouched. There will be one new bicycle path as a horizontal crossing of the area, including the new crossing point to cross the Grift in the form of the trekpont.

The struin nature will also return in the integrated design, although to a smaller extent. But in the outside areas it is certainly possible to make a nice hike over the klompen paths that pass through orchards, extensive livestock grasslands, herb- and fauna-rich fields, along pools, bushes, the campsite, cafes and also the picking forests. Hiking trails can also be started or ended at the visitor center, which is also incorporated into the design. Here overnight stays are possible or recreational facilities can be rented.

The farms in the area will remain but will be given a more nature-inclusive function. Only the farm group at the location of the visitor center must be removed.

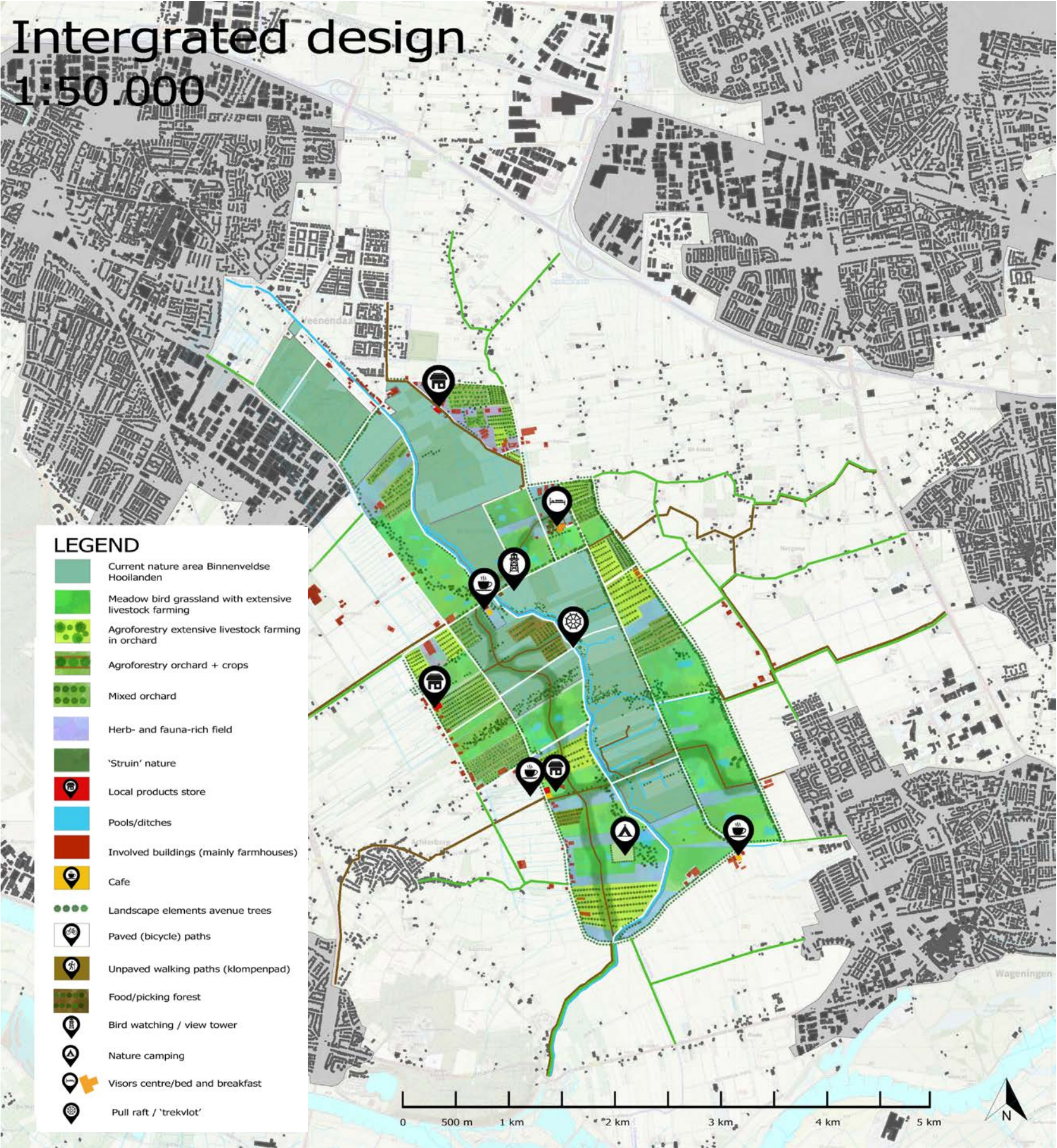


Figure 35: integrated design.

6.8 EVALUATION INTEGRATED DESIGN

INTEGRATED DESIGN

The integrated design combines all design pathways, and this is reflected in the score in the evaluation. Almost on all criteria it gets the maximum score. Only in the deposition of nitrogen and the integration of cultural heritage it does not have the highest score. This is due to the small amount of natural fertilization for nature-inclusive agriculture. Furthermore, there are no former defensive works of the Grebbelinie in the designed area, that is why the Grebbelinie is not incorporated in the final design. The total score of the integrated design is 47.











DESIGN GOAL	DESIGN CRITERIA	1 – not met at all	2	3	4	5 – is fully met	TOTAL SCORE
1. To preserve or improve habitat services and biodiversity						5	
						5	
						5	15
2. Prevention of nuisances in the form of eutrophication, acidification, or desiccation					4		
						5	9
3. Integrate and combine recreation in the area with various aspects						5	
						5	
						5	15
4. Preserve the aesthetic values of the landscape						5	
				3			8
TOTAL SCORE							47

Figure 36: evaluation table design criteria for the integrated design.

6.9 DETAILED DESIGN

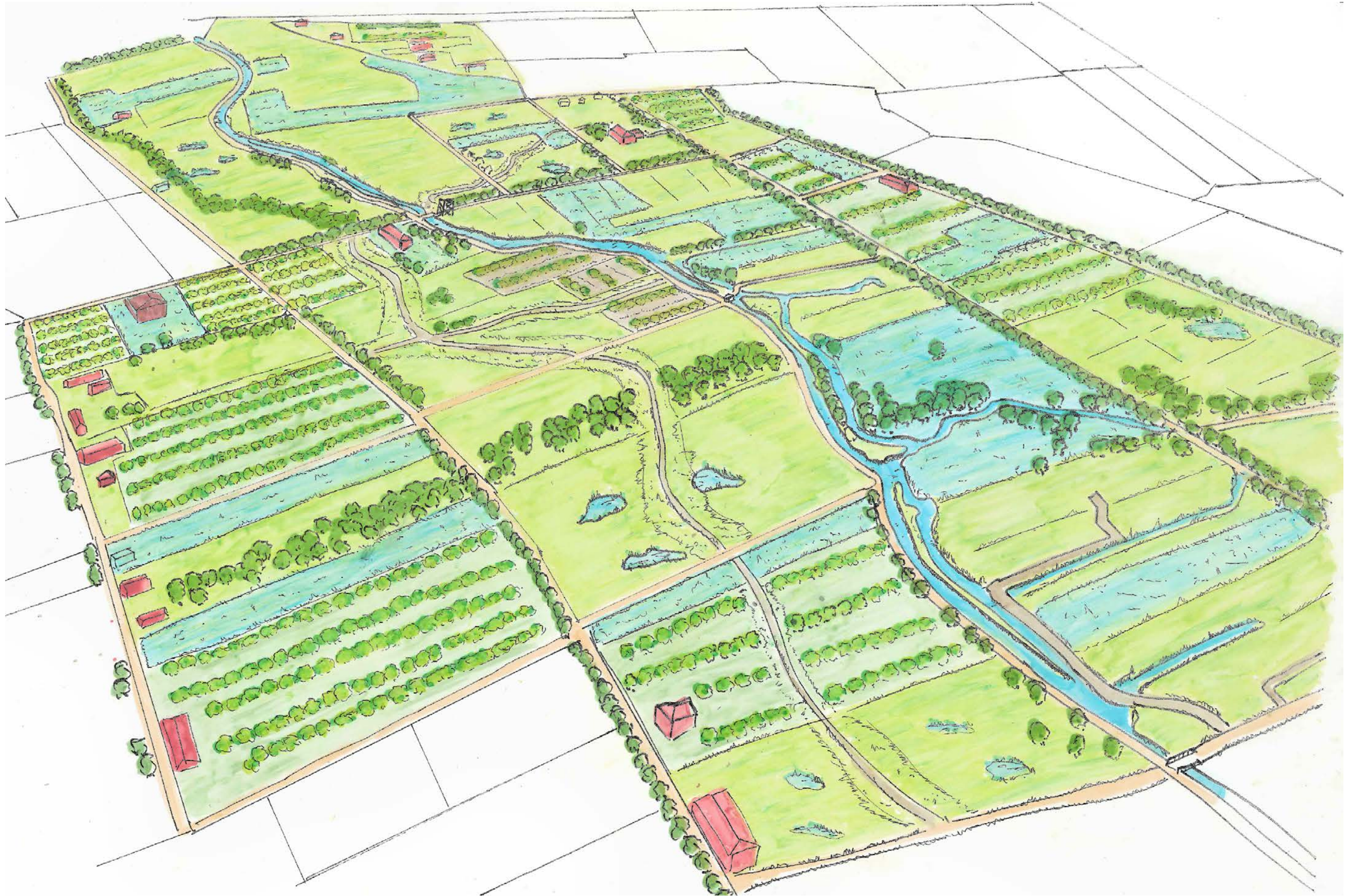


Figure 37: bird-eye view artist impression of the middel part of the design.

7. DISCUSSION

This chapter contains a critical view on the used theory in this thesis, the associated design criteria, and the proposed integrated end design. There will be discussed how the method and certain steps in the process affected the final results and what recommendations are for a follow-up study.

This thesis examined the possibilities for a multifunctional transition zone between nature development and surrounding agriculture, that is based on specific types of nature inclusive agriculture. This research was guided by a research-based design, where the designs were evaluated by using design criteria drafted from the literature.

The SRQ's have given the construction of this thesis structure and have influenced the focus points for the design. The question "how can a transition zone be designed in the most multifunctional way?" has guided a search and process for the surrounding agricultural fields of the Binnenveld. Not to only be used as a transition zone, but to be as diverse and multifunctional as possible. The other sub research questions, about which form of nature inclusive agriculture would be the most suitable, and what the impacts would be for the recreational attractiveness led to a literature research on nature inclusive agriculture forms and different types of recreation.

The method that was developed from the literature analysis in combination with the landscape analysis provided the basis for the proposed design. The design criteria that were set up are based on theories and statements from the literature, which also partly counts for the design suggestions/proposals.

The design criteria could be seen as a limitation in the research since these criteria do not exist as a pointed-out assessment rubric but are in a certain way self-formulated. In addition, many of the design criteria are difficult to measure. 'The possibility of migration between parts of nature reserves' or 'area not too closed to public' are criteria that are relatively easy to implement and can be clearly visible in the design. Criteria such as 'create a recreationally attractive landscape' or 'a diverse landscape experience' are much more subjective and difficult to measure. As mentioned earlier, a landscape can be experienced differently by everyone and will always be based on personal preferences. By applying as much variation as possible, most people can be satisfied.

This thesis examined what kind of division of functions would be best for a multifunctional transition zone. In this research, a distinction was first made between three different design iterations. These themes of nature development, nature inclusive agriculture and recreation were approached independently of each other, and all worked out in separate designs. These designs were evaluated based on the design criteria and later combined into an integrated design, which was then evaluated again. In the evaluation, the different design themes of course scored well on the criteria that were based on their own design focus, and worse on the criteria that placed their focus on other aspects. Because the integrated design took all criteria into consideration, it automatically scored

higher than the designs with a focus on one aspect. From a critical point of view, this is a logical outcome of the study. For the next time or for a follow-up study, it would be better to immediately start designing with integrated designs that take multiple aspects into account, because it is already known that a design with one design focus is not realistic. This integrated design can then be evaluated and based on the assessment and then redesigned, again evaluated, again redesigned etc. until there is a well evaluated and assessed design that has considered multiple aspects from the beginning.

This is more time efficient and provides a better elaborated design, which is recommended for a possible follow-up study.

Also, more design goals and corresponding criteria could be added in a further study, to take into account even more aspects and make the design more refined.

Each subarea could also be designed in detail on a smaller scale. Then all the detailed elaborations and the design as a whole can be further evaluated on the basis of the criteria related to the area of concern. To strengthen the validity of the research, perhaps more scientific sources and theories should be used.

With the previously mentioned adjustments it should be possible to produce a well-founded and well-considered design. After that it is still important to convince farmers, recreational users, nature organizations and other stakeholders of the design. The area will improve for recreationists and nature lovers anyway; only the farmers will have to make their concept more sustainable, which may sound negative from their perspective. The farmers must therefore be convinced that the new way of farming is certainly profitable and has many positive consequences.

8. CONCLUSION

This thesis aimed to answer the following question *“What characterizes an appropriate transition zone between nature and intensive agriculture in the Binnenveld?”*

The research to answer the question examined the possibilities for a multifunctional transition zone between nature development and surrounding agriculture, that is based on specific types of nature inclusive agriculture. The SRQ’s have given the construction of this thesis structure and have influenced the focus points for the design. The question “how can a transition zone be designed in the most multifunctional way?” has guided a search and process for the surrounding agricultural fields of the Binnenveld. Not to only be used as a transition zone, but to be as diverse and multifunctional as possible. One can conclude that integration of all the aspects nature development, agriculture and recreational attractiveness are desired to create a heterogenous landscape. There are a lot of ‘easy’ possibilities to combine the different functions into a varied and multifunctional landscape. Aspects like ecological structures, nature inclusive agriculture and recreation are open to sharing their landscape use with other functions and would combine together well.

The other sub research questions, about which form of nature inclusive agriculture would be the most suitable, and what the impacts would be for the recreational attractiveness led to a literature research on nature inclusive agriculture forms and different types of recreation. This concluded that there is no ‘most suitable’ form of nature inclusive agriculture or recreational attractiveness. It all depends on the landscape type and land use. There are different applications of nature inclusive agriculture for the Binnenveld, and a perfect ‘leisure landscape’ does not exist, because it is about how someone perceives the landscape. The same counts for the multifunctionality. There is no ‘most suitable’ form of a multifunctional landscape.

For a good multifunctional transition zone there must be a good balance between the different functions and all the aspects must be taken into account.

In general, there can be concluded that the more varied a transition zone is, the more chances there will be for nature development, the more the more sustainable and nature inclusive agriculture can be practiced and the more positive influence it will have on the general recreational attractiveness of a landscape.

Multifunctionality and taking as much as possible aspects into consideration characterizes an appropriate transition zone for the Binnenveld.

Given the situation in the Binnenveld and the relatively generally applicable sources, the conclusion of this research can be reasonably generalized for similar situations and could be used as inspiration for future projects.

9. REFLECTION

When creating this multifunctional integrated design, several aspects were taken into account to accommodate as many functions as possible. As mentioned earlier, a landscape can be experienced differently by everyone. For a designer it is therefore difficult to fit everyone's preferences into a design, so it always remains a subjective issue. By applying as much variation as possible, most people can be satisfied. The steps taken and the corresponding choices made in the design have a basic argumentation, but like any design, also remain a choice of the designer. The design could have been designed in many different ways. An integrated design has now been made based on three thematic designs; this could have been many more given the infinite possibilities. There are still numerous aspects that have not been considered which could be linked to new design goals. Given the time there was to make this thesis, it was not possible to do so. If there had been more time, the design could also have been substantiated with more details, technical sections, and visualizations. Each subarea could also be designed in detail on a smaller scale. This is perhaps an idea for a possible further study.

Looking back at the process, it has been eight intense weeks. In May I started with this thesis, knowing that it was the final assignment of the bachelor. It was something I was quite looking up to, because I had never done anything like this before.

Reflecting on my process, I can conclude that I did not do a sufficient job in the first three to four weeks, or at least did not deliver enough results. I got stuck quite a few times, did not know what I was doing, and did not see the use of doing it at all anymore. This was all an important part of the process because it did get me thinking. From week six, I saw the light after a number of guidance meetings. I had a clear structure and knew where I wanted to go, which allowed me to make real steps in an intensive work process from then on.

In the end, I found the thesis not only an intensive but also a very educative period, in which I could refresh my knowledge from the past three years from the bachelor and apply it in a project. I found it a good and worthy way to finish the bachelor with.

What I learned from my own process is that I still find it difficult to make a planning and be disciplined when there is no urgent need yet. When I really have to, I can work hard, but for rest in future projects, I need to start planning better.

Altogether, I am convinced that this thesis contributes to my development as a landscape architect, but also to my life development as a person.

I found the task of the Binnenveld a very interesting one, and I hope that one day I will walk through the Binnenveld and look back on this period with a satisfied feeling realizing that I have become wiser and more mature.

I also realise that in order to develop such ideas, one has to talk extensively to stakeholders such as farmers, government, subsidy providers, recreational users (panels), etc. This to ensure support and

financial feasibility. I am curious whether I could play a role in such a process, and I would certainly like to do so in future projects

10. REFERENCES

Atlas van de Regio (2021). Beschermde gebieden. Retrieved from <https://themasites.pbl.nl/atlas-regio/themas/beschermde-gebieden/>

Atlas leefomgeving (2021). Stillegebieden. Retrieved from <https://www.atlasleefomgeving.nl/thema/geluid/stillegebieden>

Beunen, R. & J.E. Hagens (2009) The use of the concept Ecological Networks in nature conservation policies and planning practices. *Landscape Research* 34 (5): 563-580.

Brinkhuijsen, M. (2008). *Landscape 1:1. A study of designs for leisure in the Dutch countryside*. PhD Thesis, Wageningen University. P. 21-37.

Bruls, E. J., A. J. v. Golen, et al. (2002). Wandelen en toegankelijkheid: bedreigingen en knelpuntgebieden. Den Haag, Stichting Recreatie.

De Groot, R. Hein, L. (2006). The concept and valuation of landscape goods and services. In: Mander Ü, Helming K, Wiggering H (eds) *Multifunctional land use: Meeting future demands for landscape goods and services*. Springer, Heidelberg, Berlin.

De Groot, R. Wilson, M. Boumans, R. (2002.) A typology for the description, classification and valuation of ecosystem functions, goods and services. *Economics* 41: 393-408

DLG (2004). *Ontwerp landinrichtingsplan Haarzuilens*. Utrecht, Landinrichtingscommissie voor de herinrichting Utrecht-West: 55

EEB (September 2017). THE FUTURE OF THE CAP An urgent need for a truly sustainable agriculture, land and food policy. [EEB position paper].

GLB (2020). Position Paper. Position Paper natuur- en milieuorganisaties over het Gemeenschappelijk Landbouwbeleid.

Goossen, C.M. , Langers, F. , Boer, T.A. de (2013) Wageningen : Wettelijke Onderzoekstaken Natuur & Milieu (WOt-werkdocument 329) - p.

Janmaat, R. Jochemsen, R. Scheepers, P. (2016). Schetsontwerp Binnenveldse Hooilanden. Retrieved from <https://binnenveldsehooilanden.nl/>

Lodewijk Pol (May 11, 2021). Interview with extensive farmer.

Lohrberg, F. Lička, L. Scazzosi, L. Timpe, A. (2016). *Urban Agriculture Europe*. Berlin, Jovis.

Mander, Ü. (2005). Purification processes, ecological functions, planning and design of riparian buffer zones in agricultural watersheds. *Ecological Engineering*, 24 (2005) 421–432

Mander, Ü. Wiggering, H. Helming, K. (2007). *Multifunctional Land Use Meeting Future Demands for Landscape Goods and Services*. ISBN 978-3-540-36782-8 Springer Berlin Heidelberg New York pages 15-28

Potteiger, M. (2013) *Eating Places: Food Systems, Narratives, Networks, and Spaces*. *Landscape Journal* 32(2): 261–275

Runhaar, H. (2016). Towards ‘nature-inclusive’ agriculture. Wageningen University.

Sanders, M. Westerink, J. (2015). Op weg naar een natuurinclusieve duurzame landbouw. Alterra Wageningen UR [brochure]. Retrieved from https://www.wur.nl/upload_mm/9/4/5/62e3dcd3-395c-49ff-807b-567286bd6264_8412100830_ALT_binnenwerk_Landbouw2020_wkt_4.pdf

Shaw, G. Williams, A.M. (2002). *Critical issues in tourism: a geographical perspective*. Oxford, Blackwell

Sukkel, W. Schoutsen, M. Cuperus, F. (2019). 5 vragen over Agroforestry: bomen en landbouw op één perceel. Wageningen University. Retrieved from: <https://www.wur.nl/nl/project/5-vragen-over-Agroforestry-bomen-en-landbouw-op-een-perceel.htm>

Steg, L. and A. E. Buijs (2004). *Psychologie en duurzame ontwikkeling. De psychologie van milieugedrag en natuurbeleving*. Nijmegen UCM-DO/KUN.

Unknown author. (2021). Landschapsboeren. Retrieved from: <https://www.delandschapsboeren.nl/>

Van Doorn, A. Hille Ris Lambers, R. Westering, J. (2019). *Natuurinclusieve landbouw*. Wageningen University. Retrieved from <https://v3.jamdots.nl/view/30079/Natuur-Inclusieve-Landbouw>

Von Haaren, C. Reich, M. (2006). The German way to greenways and habitat networks. *Landscape and Urban Planning* 76: 7-22.

Westerink, J. (1999). Boeren voor natuur. Retrieved from: <https://www.wur.nl/nl/project/Boeren-voor-Natuur.htm>

FIGURES

1. <https://mooibinnenveld.nl/buitengewoon-rapportage-over-binnenveldse-hooilanden-op-tv-gelderland/>
- 2-5 own work
- 6 WUR <https://www.wur.nl/nl/project/Recreatieve-potenties-en-baten-van-een-multifunctioneel-landelijk-gebied.htm>
- 7 a general framework for the analysis and valuation of landscape function (source: de Groot & Hein, 2006)
- 8 Typology of Ecosystem Functions, Goods and Services (source: de Groot et al, 2002 and Millennium Assessment, 2005).
- 9 <https://vroegevogels.bnnvara.nl/community/fotos/vogels/grutto/283626>
- 10 <https://www.natuurfoto-zeevang.nl/vogelalbum/Weidevogels/slides/kievit%20met%20zijn%20jong.html>
- 11-13 <https://v3.jamdots.nl/view/30079/Natuur-Inclusieve-Landbouw>
- 14 <https://www.mariabode.nl/binnenland/economisch-belang-van-recreatie-in-de-natuur-neemt-toe/>
- 15 <https://gouwevoeten.nl/blotevoetenpad/>
- 16 <https://personapraktijk.nl/een-ander-pad/>
- 17-37 own work