



A systems approach to the relation

between landscape and animal husbandry







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## Colophon

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This north arrow applies to all maps in this report, unless stated differently.

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# A systems approach to the relation between landscape and animal husbandry

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# Preface

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The farmers' daughter in me won a little bit after all. I guess my background was the first push towards writing something about landscape and agriculture. During my internship at Agroplan, I got fascinated by integration of new agricultural developments in the landscape. This integration seems totally insufficient the way it is executed right now, forcing farmers to hide their farms.

As a landscape architecture student and a farmers' daughter, I feel personally responsible for this landscape. I think this thesis is a great way to let the world know what I think should happen. It is underpinned by literature and landscape architectural methods but also considering the persons who have to work in this environment every day: the farmers. I hope it worked out right.

I struggled a lot. Being involved in the sector makes me aware of what the farmers think and want but sometimes, I was involved too much. By making a landscape design, not every problem in the agricultural sector can be changed and it was hard for me to accept that I could not change everything. Eventually, I think I found a nice balance.

Of course, I was not alone. In the first two months, Ingrid Duchhart helped me with my proposal, joined my green light presentations and helped me when I needed it. She made Rudi van Etteger my official supervisor. Rudi guided me through the rest of the process with a lot of patience and helped me making my decisions without imposing his own opinion. Thanks for helping me during this process.

Mom and dad, although you thought you could not help me because I was "too smart to help", they advised about farming, telling the histories of the case and being psychologists now and then helped me a lot. Sharon and Franka, you two always distracted me during the weekends so I did not have to think about my thesis. Whether it was walking Hayley, mountain biking, bringing you forgotten lunches at work or wanting to dye my hair, I could not get bored. I also forced you two to be models for my

visualisations; I hope you think you look great in them. Francis, your critical eye on my design and research were very useful and your overall support and presence is indispensable. Hope you stick around for a while. Thanks to you all.

Yet I have a long list of friends who listened to me whine about my thesis: I'm sorry about this, it will be over soon and thank you so much. I also want to thank the rest of my crazy farmer-family, all having their own opinion about what I did in this thesis, Edo Gies from Alterra, the farmers I got to visit during the past year, the landscape architects I got to speak about design and agriculture, the people from Animal Production Systems that helped me and I guess there are a lot more people, but they just do not come to mind right now. Thanks anyway!

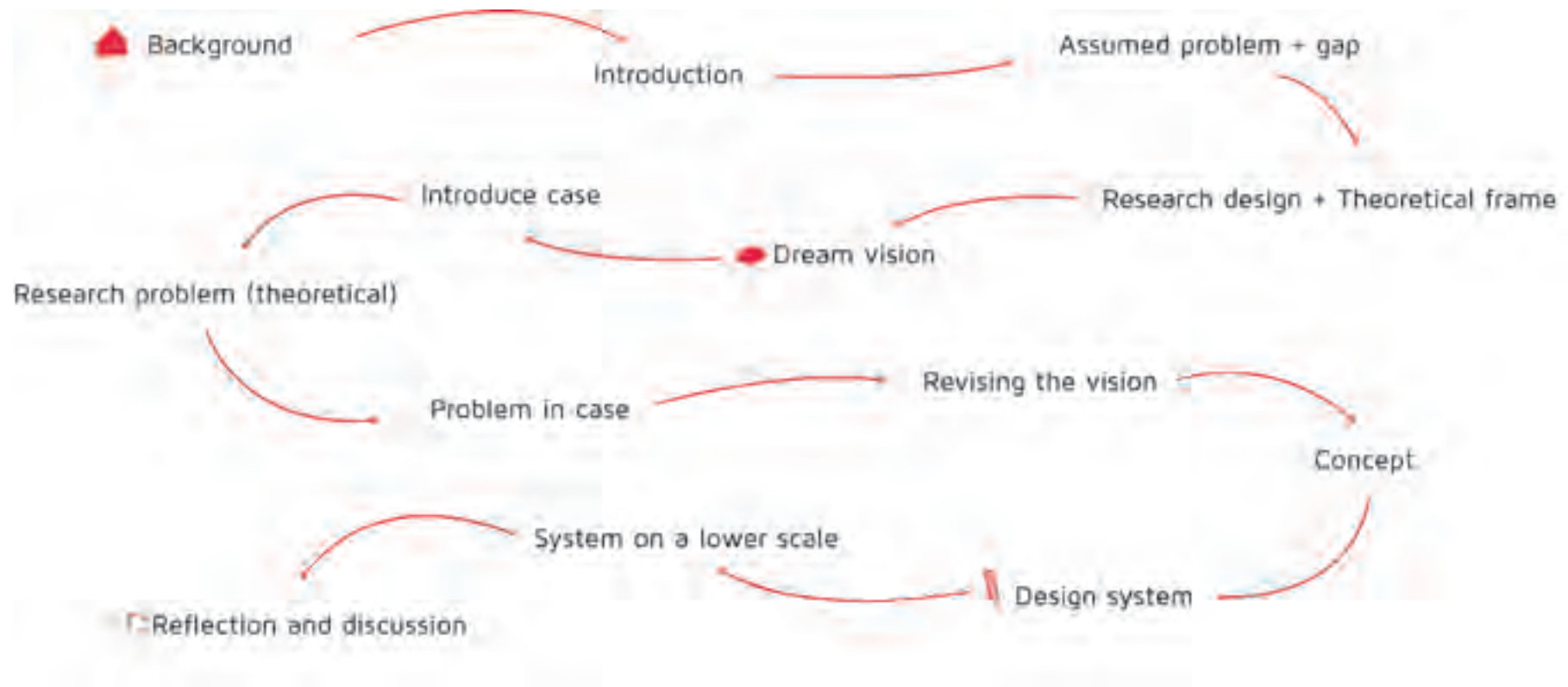
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# Reading guide



The scheme below shows in short what to expect in this master thesis and how it can be read. This offers a short and clear overview for you, the reader, but also guides me and gives a clear structure on which I can draw back on.



# Summary

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Agriculture is very important for the Netherlands in several aspects: economical, social, but also from landscape perspective. Through the ages, the Dutch landscape was formed by farmers, doing their job. The relationship was close and mutual. Agriculture depended on the landscape (the soil, the present water, the relief). Agriculture, on the other hand, shaped the landscape. In the past 50 years, the relationship changed. A focus on higher production and the introduction of large-scale farming and mechanization lead to a less strong relation between agriculture and landscape. Landscape used to determine what kind of agriculture could flourish. Now, landscape is no longer a limiting factor. Everything is possible. Therefore, the development of agriculture went fast, without any binding with the landscape. Agriculture used to be based on the landscape type and showed diversity between areas. Now, everywhere the same fast and cheap methods are applied. The diversity of the landscape disappears. With this diminishing diversity, the legibility and orientation in the landscape decline, according to Hendriks and Stobbelaar (2003). This leads to less appreciation of the agricultural landscape.

In this research the relation between landscape and animal husbandry is central. By using a systems approach, these two elements are analyzed: the landscape system and the animal production systems, together forming the agricultural landscape system. This systems approach guides the vision on and the analysis of this landscape. A dream vision is made to shape an ideal for this agricultural landscape. A case in the south of the Netherlands is chosen to look at the problem and make design for. A step back is taken to look if the problem, the disappeared relation between agriculture and landscape, really is the problem. First an analysis is made of already existing sources, like literature. Later on, the problem is analyzed in the case. This will be done by the four-relations approach of Hendriks and Stobbelaar. These four relations are horizontal, vertical, seasonal and historical relations. By this, the legibility and therefore the appreciation of the landscape can be determined.

With this information the dream vision will be revised and a concept is made. The concept makes a distinction between intensive and extensive farming areas. For three of these regions, based on the landscape types within the case, a design is made. The design is based on the systems approach and tries to find a balance between the landscape system and the animal production systems, so mutual influences are present. Models are made and tested according to the four relations of Hendriks and Stobbelaar. The goal is restoring the mutual influences between farm and landscape, without one overruling the other. On several scale levels, the design is executed. The agricultural landscape will be diverse and legible, people can orient themselves and the landscape gets appreciated. The farms tell the story of the landscape and the landscape supports the farms.

Keywords:

*Landscape, agriculture, animal production systems, landscape system, legibility, experience, appreciation, systems approach, landscape architecture*

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## Samenvatting

Landbouw is erg belangrijk voor Nederland in meerdere opzichten: economisch, sociaal maar ook landschappelijk. Door de eeuwen heen heeft het Nederlandse landschap zich gevormd door de agrariërs die er hun werk deden. Deze relatie was hecht en wederzijds. De landbouw was afhankelijk van het landschap (de ondergrond, het aanwezige water, het reliëf). Anderzijds vormde de landbouw het landschap. In de afgelopen 50 jaar is deze relatie sterk veranderd. Een focus op hogere productie en de introductie van schaalvergroting en mechanisatie zorgt voor een minder sterke relatie tussen landbouw en landschap. Waar landschap eerst bepalend was voor de soort landbouw, wordt het landschap nu niet meer gezien als een beperkende factor. Alles is mogelijk. Hierdoor ontwikkelt de landbouw zich snel, zonder enige binding met het landschap. Waar landbouw vroeger was gebaseerd op het landschapstype en dus diversiteit tussen en binnen regio's vertoonde, wordt nu overal dezelfde snelle, goedkope methode toegepast. De diversiteit in het landschap verdwijnt. Met deze verdwijnende diversiteit, daalt te leesbaarheid en het oriëntatievermogen in het landschap, volgens Hendriks en Stobbelaar (2003). Dit leidt tot een lagere waardering van het agrarische landschap.

In dit onderzoek wordt met name gericht op de relatie tussen het landschap en veehouderij. Door middel van een systeem benadering wordt naar deze twee elementen gekeken: het landschapssysteem en dierlijke productie systemen die samen het agrarisch landschapssysteem vormen. Deze systeembenadering helpt met het kijken naar en het analyseren van het agrarische landschap. Een droom visie wordt gemaakt om een ideaal beeld van dit landschap te bepalen. Een case in het zuiden van Nederland wordt gekozen om specifieker naar het probleem te kunnen kijken en uiteindelijk ook een ontwerp voor te maken. Er wordt een stap terug gedaan om te kijken of het probleem, de verdwenen relatie tussen landbouw en landschap ook echt het probleem is. Eerst wordt dit gehaald uit bestaande bronnen, zoals literatuur, later wordt het probleem ook geanalyseerd in de case. Dit gebeurt door

middel van de vier samenhangen van Hendriks en Stobbelaar. Deze vier samenhangen zijn de horizontale, verticale, seizoens- en historische samenhang. Hiermee kan de leesbaarheid en dus de waardering van het agrarische landschap bepaald worden.

Met deze informatie wordt de droom visie geconcretiseerd en wordt een concept gemaakt. Het concept onderscheidt intensive veehouderij regio's en extensieve regio's. Voor drie van deze regio's, gebaseerd op de landschapstypen, binnen de case wordt een ontwerp gemaakt. Het ontwerp vindt zijn basis in de systeem benadering en het vinden van een balans tussen het landschapssysteem en de dierlijke productie systemen, zodat er wederzijdse invloed is. Modellen worden gemaakt en getest aan de hand van de vier samenhangen van Hendriks en Stobbelaar. Het uiteindelijke doel is het opnieuw vinden van een wederzijdse relatie tussen landbouw en landschap, zonder dat de een de ander overheerst. Op meerder schaalniveaus is dit uitgewerkt. Het agrarische landschap zal divers en leesbaar zijn, mensen kunnen zich er in oriënteren en het landschap wordt gewaardeerd. De boerderijen vertellen het verhaal van het landschap en het landschap ondersteunt de boerderijen.





# Table of contents

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Preface	6
Reading guide	8
Summary	10
Table of contents	14
<i>Fascination and intention</i>	
1. Background	18
2. Introduction	22
3. Research Design	28
4. Theoretical Frame	32
5. Dream Vision	40
<i>Exploration and comprehension</i>	
6. Case	44
7. Problem in Theory	48
8. Problem in Case	64
9. New Vision	80
<i>Design and envisioning</i>	
10. Concept	84
11. Design	88
12. Conclusions	128
<i>Reflection</i>	
13. Discussion	136
References	140
Picture sources	146

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A landscape photograph showing a wide, grassy field in the foreground. In the middle ground, a row of trees stands against a bright, hazy sky. Behind the trees, a small, dark building is visible. The sun is high in the sky, creating a strong lens flare on the right side. The overall scene is peaceful and open.

Fascination and intention







1.

Background

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*This research, from beginning to end is influenced by the way I look towards reality. The problems I see, the gap within the research and the way I want to solve this, depends on this lens. On the one hand, this is determined by my own background, like my education as a landscape architect and my 'roots', on the other hand, it depends on my scientific worldview.*

## 1. Personal lens

23 years ago, I was born in a small rural village in the south of the Netherlands, called Vinkel. I am a farmer's daughter. My parents owned a dairy farm and I played here when since I was a small child. Racing through the barn on a way to small bike, joining my dad on the tractor, having a picnic in the field while he was haying, talking to cows and trying to help in the milking parlor: it was all part of my youth (figure 1.1).

My dad, grandpa's and uncles are or were all farmers. When they sat together for a cup of coffee, farming was the topic of discussion. They talk about how the fields are way too wet to harvest, about that one cow that still had to give birth to a calve



Figure 1.1: 'Helping' my parents at the farm

and what kind of new regulations the government have come up with to make it more 'difficult' to farm. I had to cycle to primary school two kilometres every day, which then seemed really far away. On the way there, I crossed only agricultural land. My neighbours almost all own livestock, do arable farming or live in an old farm converted to a normal house. This was my landscape, where I grew up, defined by agriculture and husbandry. Over the years, I formed my own opinion about the animal husbandry sector, by reading sector related magazines, listening to discussions between my dad, grandfather and uncles and experiencing the whole system myself. This embedded knowledge, which had 23 years to shape itself, influences the way I look towards this research. Making a little leap already, my scientific worldview could be seen as participatory, because I'm part of this landscape and it touches me personally. I see how this can be a pitfall, but I'm determined I can use this knowledge in a good way, combining it with landscape architectural knowledge.

5 years ago, I started studying landscape architecture. These years have left their mark on me and my opinion. Landscape architecture itself, in my eyes, is a field where all possible sorts of knowledge come together. This research lies within the context of other researches from other work fields, like environmental sciences, social sciences and animal sciences. The landscape architect stands in the middle, grabs the knowledge he needs from each field and forms it into an integral plan (van der Brink en Bruns, 2012, Miedema, 2006). Besides that, the landscape architect himself adds something, an approach that is not found within other research fields: experience and aesthetics. This forms hard knowledge for producing a liveable environment.

During my master-years, I focussed myself on animal husbandry and followed courses within the chairgroup Adaption Physiology and Animal Production systems. My intention was to connect the landscape to the farm, not knowing what exactly was happening yet. I knew enough about landscape, but the real details of animal housing, feeding, systems approaches et cetera were still vague for me. Learning about this has made my position stronger when

writing this thesis.

I wanted to see what current approaches towards agriculture are in landscape architecture, so I did an internship at Agroplan. Agroplan is a small landscape architecture office that focuses itself on developments in rural areas. I helped with integrating new stables in the landscape and making plans for quitting or expanding farmers, wanting to change the function of their farm. I liked the people over there, but the designing itself was simple. I questioned myself: was I missing some key method? Or was it really this simple? I was used to thinking through concepts and working scientifically, but at Agroplan everything seemed to be straightforward. Just draw a row of trees and the problem was solved. Everything had to be simple, cheap and should be quickly implemented. Most things I drew did not add anything to the

whole landscape, in my eyes. This triggered my fascination (or maybe frustration) for these kinds of 'integrations in the landscape'.

## 2. Scientific lens

This personal lens shapes the way I approach the problem, questions and solutions that will come, but next to that, I'm educated as a landscape architect. I'm a researcher and therefore, I also have a scientific lens (figure 1.2). This lens helps me looking towards the research and taking my position. It helps me filtering what is important and what is less important. Of course, the idea is to take as much as possible in account, for example when describing the context. Though, this will never be complete, since there is so much information. By having and forming a scientific lens, this research can be more focused, though it also causes bias. Acknowledging this bias and being aware of it, makes the transparency bigger and thus more open and honest (Deming and Swaffield, 2011).

My position as a landscape architect plays a big role, like I mentioned in the first paragraph. The way I work as a researcher will be influenced by my background as a student of landscape architecture, but other factors also play a role. As I mentioned before, the landscape architect can work in between work fields, gathering the generated knowledge and combining it. The research approach differs in every work field, thus my approach will consist of several different methods and strategies.

The way I look to the research itself can be classified in 4 worldviews, proposed by Creswell (2009):

- Post-positivism
- Social Constructivism
- Advocacy/Participatory
- Pragmatism

Each of these approaches will be deployed in a different kind of question. Questions that concern hard knowledge, like research

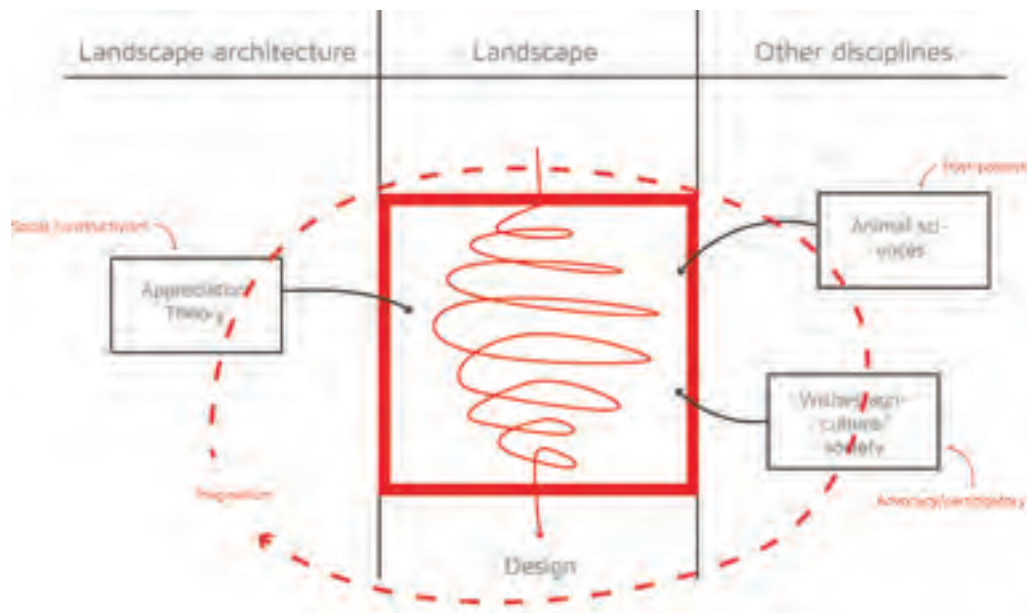


Figure 1.2: Scientific lens



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considering properties of stables and animal welfare, will be more post-positivistic and use accompanying methods. This can be borrowed from animal sciences. The advocacy/participatory worldview will be of large influence. Because of my own interests and involvement in agriculture, I can represent the wishes of both landscape and farmers. Involving farmers, locals et cetera in the process can strengthen the research. The knowledge of the parties that get involved and my expertise together can form an overview of the problem and possible solution. The social constructivism is based on the principle that "individuals try to understand the world they live and work in" (p.8, Creswell, 2009). A researcher can conduct interviews in order to gain insight in the wishes of residents considering landscape. Also design theory and studying form belongs to social constructivism: What is considered as nice, liveable and useful? The pragmatic worldview, the search for the solution of a problem, is present in all elements of the research. Each step that is taken and each question asked contributes to the finding of an answer and the making of a new design. In the design process, all these elements come together and form the design.

The starting proposition is meant to give a clear view of me, who I am and what the driving forces are behind the meanings I give to landscape architecture, animal husbandry, landscape itself, creativity, animal welfare et cetera. This background can explain and supported the choices that I make, the methods I choose and the way I solve problems in this master thesis. It makes the research more transparent and understandable. The same applies to the scientific lens; it guides choices. As already mentioned forms a scientific lens a focus on the research, but also creates bias. By acknowledging this, the research gets more transparent (Creswell, 2009).

2.

Introduction

*In this introduction, the subject of the research will be introduced. It will also lead up the the research design, already stating the assumed problem, research goal and the context and relevance of this research.*

## Dutch animal husbandry

In the Netherlands, livestock husbandry always has always played an important role. It is an economic incentive, it provides work, feeds people, defines a part of the Dutch history, is interwoven in social-cultural aspects and most important in this case: it created a large part of the Dutch landscape (LNV, 2001). About 10% of the Gross National Product in the Netherlands is generated by the agro sector and more than 10% of the employment origins in this sector. More than 50% of the Dutch landscape is defined by agricultural activities (figure 2.1). This all together makes livestock husbandry essential for the Netherlands.

Though, a lot has changed the past years. Discussions about the future of livestock husbandry are rising. Opinions changed. People are more critical towards animal health and welfare. They plead for organic food production on the one hand, but in practice mostly choose the cheapest option, produced in intensive farming. This puts pressure on husbandry, both economic as technical. The news is full of 'megastallen' (mega-barns), scares, manure and smell, bio-energy, 'plofkippen' (fast growing chicken), diseases like Q-fever and swine flu, organic production and sustainable meat. Researchers are engaged in these developments and public figures try to hook up with this topic. To deal with the current developments, several directions are possible for a farmer:

- Quit
- Expand and intensify
- Facilitate secondary activities
- Switch to organic farming

The timeliness and current impact of this topic makes it interesting to look closer.

Several levels are distinguishable within the Dutch animal husbandry. On national scale level, there are characteristics of Dutch agriculture: it is progressive, looks to sustainable production and focusses on technology. This influences lower scale levels. The lowest level is the farm itself. Within this farm-level, the farmer makes choices for his farm, depending on personal preference, regulations from 'above' and his surroundings. These choices lead to a certain composition of his farm and therefore the appearance and the effect on the environment. Here, this composition is called an animal production system. This production system interacts with the Dutch landscape, so it can be seen as a system. They influence each other and together, they determine the Dutch animal husbandry landscape.

But next to farm and landscape, there is a third party: the



Figure 2.1: Importance of dutch agriculture



Dutch citizens. They are the ones that buy the products that are produced by the farmers. They wander through the Dutch landscape and have, in an increasing extent, the need to recreate here. They give their opinion about production and landscape and influence both. In this way they influence the appearance of the Dutch animal husbandry landscape.

### Assumed problem

Agriculture developed itself since first men began to settle. Cattle was kept instead of followed, crops were grown instead of gathered. This influenced the landscape. Landscape the other way around, influenced agriculture (figure 2.2). Farmers settled on the places where it was dry enough, but not too dry, where the soil was fertile and resources were present (Lambert, 1985). The landscape system (biotic and abiotic) thus defined the placing of farms. The heather sods system with its deep litter barns is a good example of this.

Over time, the agricultural system changed. Especially after 1880, huge transitions began to occur. Industrialization kicked in and the agricultural revolution made it possible to produce higher yields. The population grew and more food was needed. Higher yields were the goal. Artificial fertilizer was introduced, new and bigger machines were built to cultivate the land, land consolidation was

applied for bigger plots, drainage became important and the overall developments within the sector had an economic and technological focus (Bieleman, 2008).

This is just a short first impression of the changes over time. Looking at this impression, it can be assumed that the problem is an off balance system. The new technological approach made 'suitable' land superfluous. Agriculture does not depend on the present environmental factors anymore, like soil type and water presence. The makeability of the landscape becomes too overwhelming; developments will be random and do not relate to the landscape anymore. This technological approach towards agriculture caused a shift in the mutual influences of landscape and farm (figure 2.3). Landscape and farm were in equilibrium in the 'old' agricultural landscape system. In the new system, the farm has much more influence on the landscape than the landscape has on the farm.

But who's problem is this? First: the landscape itself. The specific characteristics of the landscape are underappreciated and become invisible. Next to this, the current way of farming affects the soil and water system and these ecosystems become unbalanced. Secondly, it is a problem for the farms. Farming acts more



Figure 2.2: The old relation between farm and landscape



Figure 2.3: The new relation between farm and landscape



independent from landscape and therefore, for example, forage gets produced in another country instead of on own fields. This especially applies to intensive farming, where the farm consists of just the farmhouses, which do not depend on subsurface characteristics. Surrounding plots are property of someone else, so forage has to be imported. This causes an increase of transport and is from an environmental perspective not the most favorable option.

The two previous parties do suffer under this changing landscape, but this problem is most important from a social perspective. The people that live and recreate in the rural areas want an attractive landscape (Jacobs and Buijs, 2011). If there is no connection between farm and landscape anymore, the diversity will disappear (Hendriks and Stobbelaar, 2003). The ways of cultivation, the use of crops and the barn types will be more or less the same, because of this technical approach. Therefore, the landscape will be less attractive (Hendriks and Stobbelaar, 2003). The recreating people are mostly the ones that think ecosystems are important and find it onerous when big trucks drive by their houses. Thus, the problems for the landscape and the farm become even stronger when involving the social aspect.

This first problem statement is just a first impression of the problem and is still full of assumptions. Later on in this research, the problem will be looked at again and will be underpinned, to show it is a strong and widely recognized problem.

## Purpose

My motivation and goal primarily comes from scientific curiosity. This is one of the 3 categories (Deming and Swaffield, 2011) made to classify the motivation for a research. They “focus upon purpose and strategy: what motivates someone to seize a research opportunity, and what intellectual path they decide to take pursuing it” (Deming and Swaffield, 2011). Opportunistic motivations mean wanting to find new understandings and interventions in a changing world. In this case, livestock farming is under pressure,

there is little attention for landscape and the mutual influences that used to exist between farm and landscape seem to be disappearing.

The purpose of this research, considering the previously stated problems:

*Making a (new,) better connection between landscape and animal husbandry.*

By taking the following steps:

First, a step back is necessary. The problem is not completely clear and supported yet, which is already mentioned in the first problem statement. The problem has to be researched more in-depth in order to form it into an avowed problem. Assuming the already stated problem appears to be the real problem, the purpose is restoring the system that seems to be off balance: Adapting farming system to the landscape system and the other way around. This in order to reconnect to landscape characteristics and thus improving diversity and coherence.

## Context

The subject of this thesis does not stand alone, it overlaps with other different research fields.

Regarding animal welfare, also looking to a connection with landscape, there is research conducted considering grazing routines, housing of animals and the effects of it on welfare, the influence of husbandry on outbreak of diseases, research that looks at strengths of conventional, organic and high-health systems and research focusing on social acceptance (Bruijnis, 2006, Bokma-Bakker et al., 2009, Beekman, 2004). These are just a few examples. Within the WUR, there is a whole chair group that focuses on livestock husbandry systems, also considering environment: Animal Production Systems.

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In addition, there is a lot of research done focusing on environmental aspects, like soil quality, water quality, nutrient surpluses caused by fertilizing, ammonia emissions, biodiversity et cetera (van Laar, 2011, Bruggen et al., 2012). Although it can have large impact on complete ecosystems, what can be seen in the field is mostly modest. Nutrient surpluses for example, cause the growth of more nettle-growth along ditches. Thus, this research has a smaller overlap with landscape aesthetics, but is important to consider

Within the field of landscape architecture itself, there is some research done considering livestock husbandry. There are several researches considering (positive) effects of organic agriculture on experience of the landscape (Neven, 2008, Hendriks and Stobbelaar, 2003), but also reflections on the factory farms in the landscape (Gies et al., 2007). Various design studios are organized engaging agricultural activities and developments in the landscape and different landscape architecture offices did research and designed with similar problems (Lola Landschapsarchitecten, 2010, de Jong et al., 2009).

Despite the fact there has been research done considering livestock farming and landscape and there are actual designs conducted, the approach, in my opinion, is mostly too unilateral. This is where the gap pops up: The interaction between agricultural developments and the landscape in design. The reasoning mostly comes only from design itself, looking at what the landscape needs or only from the agricultural sector, which enhances animal welfare and profit for the farmer. It does not come from two directions, because the languages are different. A landscape architect with knowledge of animal sciences can be the bridge between these two, acting as a translator. Only this way an integral design can be made, considering both landscape and farm and adding social aspects.

## Relevance

This research doesn't stand on its own; it influences several parties and fields. So, why exactly does it matter to conduct this study from academic, social and aesthetical perspective (Deming and Swaffield, 2011)?

- As mentioned in the context, there is some research looking at agriculture and landscape architecture, but never really integrating the animal production system and the landscape system in this way. This can add new knowledge to science, but also raises new questions.
- Creating a coherent and diverse landscape will attract people and enhances their acceptance of farmers.
- Looking at animal production systems with a landscape architectural lens is uncommon. It mostly concerns technical and environmental aspects, where this research also involves the aesthetics.





3.

Research design

*The research design shows the way the research and design will be executed: Which questions will be asked? How can these questions be answered? Which methods will be used? How is validity ensured? All these elements together set out the research design.*

## 1. Research Questions

To state the research question, all the previous mentioned topics should be taken in account: the problem, the context, the gap and my own theoretical lens. Together they define the research question.

The main research question will be:

*How can farm and landscape adapt to each other in a (more) responsive way?*

To answer this question, these sub-questions can be asked:

1. What would be the ideal animal husbandry sector, approached intuitively?
2. What is the exact problem between landscape and farm?
3. What can be seen of this in the landscape?
4. In what way can this problem be solved?
5. What is the effect of the proposed solutions on the landscape?

The first three questions are analysis questions to support exploratory research to sharpen the problems. The two last questions are solution oriented design questions and work towards a design and review it.

## 2. Strategies, methods and research-design link

Within this research, several worldviews are adapted. This worldviews result in certain approaches towards strategies and methods (Creswell, 2009). All four worldviews are used in this

research: the Post-positivist worldview, the Social Constructivist, the Advocacy/participatory and Pragmatic worldview. These are focused on qualitative research and more mixed methods. In this research, mostly qualitative methods will be used.

The strategies referred to can be found in Landscape Architecture Research by Deming and Swaffield (2011). In their book, they try to set a frame for classifying, using and evaluating research strategies within landscape architecture. The strategies used are:

- Classification schemes
- Descriptive strategies
- Interpretive strategies
- Projective Design
- Evaluation/diagnosis

These strategies are mostly inductive. "Inductive research, in broad terms, is the generation of descriptions and explanations of relationships in the world through strategies of inquiry grounded in the world of experience and empirical evidence" (Deming and Swaffield, 2011). The strategies used per research question can be seen in table 1. Within the frame of these strategies, the research methods can be placed.

The methods used can be found in figure 3.1. Also, the connection between research and design is mentioned in table 1. There are roughly five ways to describe the link between research and design, according to Duchhart (2011). Three links are used in this proposal:

- Research based design: The research that is done supports the design. For example: first, the analysis is done. This gets translated to the design in later steps to support it.
- Design research: This type of research looks at designs and tries to investigate them. This is used for instance in the third sub question, looking at reference studies. These reference projects can be designed places and I can learn from the

mistakes they made but also the good things they did in that specific project.

- Research through designing (Lenzholzer et al., 2013): Uses design as a research method. This is used in the last steps of the research, during the trial-and-error sketching. By sketching, new possibilities and new knowledge will be generated.

### 3. Flowchart

The flowchart shows the way the process could go and can be seen in figure 3.2 and 3.3.

### 4. Validity

After following all these steps, a design or design principles should be the outcome of this research. But is it valid? How can it be tested? Within landscape architecture, it is difficult to use a concept like validity or trustworthiness. These terms were developed for positivistic research, not for an art-like profession like landscape architecture (Leavy, 2009). There is not one possibility to check the validity and reliability in qualitative research. It depends on links between the problem and the purpose and the way methods

	Question	Strategy	Method	Link research-design
Analysis	1. What would be the ideal animal husbandry sector, approached intuitively?	Interpretive strategies	Dream Vision Story telling	Research based design
	2. What is the exact problem between farm and landscape?	Classification schemes Descriptive strategies Interpretive strategies	Literature study Design reviews	Research based design Design research
	3. What can be seen of this in the landscape?	Descriptive strategies Interpretive strategies Evaluation and diagnosis	Case study Field visits Photo analysis 4 relations approach by Hendriks & Stobbelaar	Research based design Design research
Design	4. In what way can this problem be solved?	Descriptive strategies Projective design Evaluation and diagnosis	Vision making Literature study Systems approach Field visits	Research based design
			Concept making Systems designing	Research through designing
Review	5. What is the effect of the proposed solutions on the landscape?	Descriptive strategies Interpretive strategies Evaluation and diagnosis	Case study Design review Expert questioning Assessment based on 4 relations approach	Research based design Design research

Figure 3.1: Research questions and accompanying strategies, methods and link between design and research



are used. Though, there are some concrete ways to improve the validity. I would like to use the following methods:

- Create space for dialogue (Leavy, 2009): Taking in account multiple perspectives and meanings, for example during the first impressions. The problem stated should be the problem that the people who deal with animal husbandry systems every day. It makes the whole research more valid.
- Triangulation (Creswell, 2009): Use different sources of data to build coherent justification. In my analysis, I try to use several methods to come to the answer of one sub research question. This way I try to enhance the validity of the research.
- Consistency (Deming and Swaffield, 2011): The problem, goal, methods et cetera should be coherent; it should form one big story. Each part should connect to each other seamless and this will enhance the validity of the research.
- Applicability (Deming and Swaffield, 2011): Findings should be generalizable to enhance the external validity. I think that making principles, which could be tested in other sites could help in this research to increase the validity.

These are a few examples of trying to increase validity. It is a very difficult aspect of a qualitative research, though it can't be ignored.

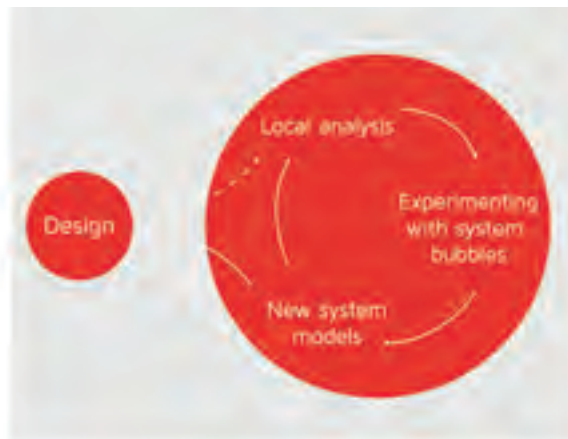


Figure 3.2: Design scheme

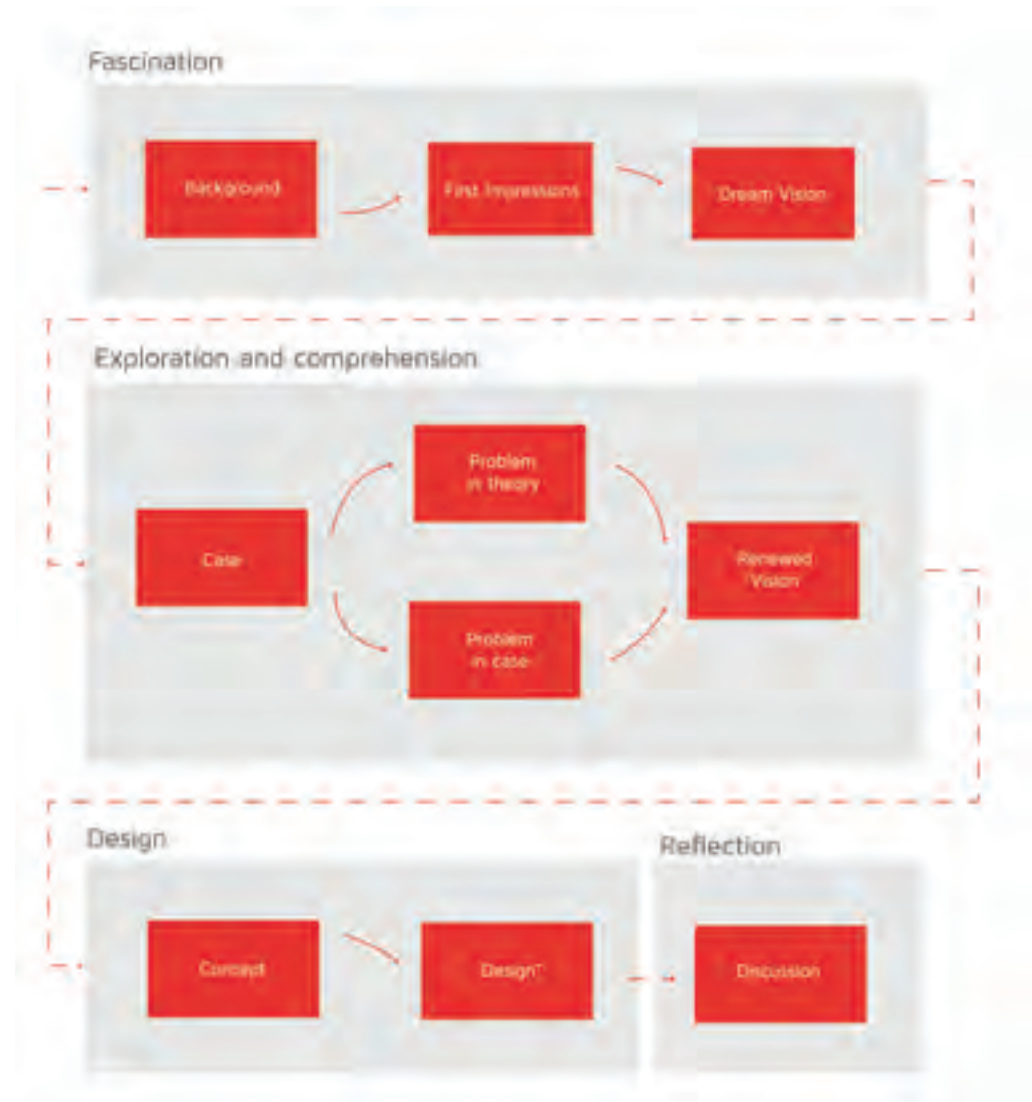


Figure 3.3: Flowchart

4.

Theoretical frame

*This research to the relationship between landscape and animal husbandry will be guided by a theoretical frame. This frame contains the theories that will be used as a basis for research. This context will support and frame the proces. The frame will consist of two parts: the systems approach in both landscape architecture and animal sciences and the appreciation of (agricultural) landscapes.*

## 1. Systems

The systems approach has been used widely since the last century. Ackoff (1981) was one of the researchers that looked to a widely applicable systems approach. He described systems as a set of two or more related elements with the following properties (Ackoff, 1981):

1. Each element has an effect on the functioning of the whole.
2. Each element is affected by at least one other element in the system.
3. All possible subgroups of elements also have the first two properties.

Thinking from systems is a holistic approach; It is a construction made by human to interpret and understand the world surrounding them. It structures thinking and gives meaning to entities and phenomena we are become aware of (Banathy, 1996). Within a system, all parts are depending on each other and have influence on one another. A system is more than the sum of the parts, as already mentioned. When each part is looked at separately, important characteristics of all the parts together in a system are missing. The parts have a synergy, defining the working of the system (Ackoff, 1981). This is the same in the landscape. By taking whole systems as a basis, all influences in and on the landscape can be taken into account and makes it possible to make sustainable designs (McMahon and Hadfield, 2007, Blizzard and Klotz, 2012).

In this case, the focus is on open system, like landscape is. This means it is subject to all kinds of external influences, it is complex,

changes over time and is dynamic (Laszlo and Krippner, 1998). This approach can be called an ecological approach also, but in this case, the name systems approach indicates more directly what is meant. An ecological approach focuses on relations between elements as well, as researched in ecology (Steiner, 2008). The focus on synergy though, is less present. An ecological approach is based on the Darwinist principle 'survival of the fittest', while within the systems considered in this research human intervention is included and thus 'survival of the preferred' counts (Chairgroup Animal Production Systems, 2012). Despite of the differences, there is research to an ecological systems approach in landscape architecture. Ian McHarg described the ecological planning method as: "The method defines the best areas for a potential land use at the convergence of all or most of the factors deemed propitious for the use in the absence of all or most detrimental conditions. Areas meeting this standard are deemed intrinsically suitable for the land use under consideration" (McHarg, 1969). The ecological method is described here as one-way traffic: A land use is taken into consideration and the landscape gets tested to this. In a systems approach, a more cyclical way of looking at the problem is used. Not only: Is this landscape suitable for a certain use? But

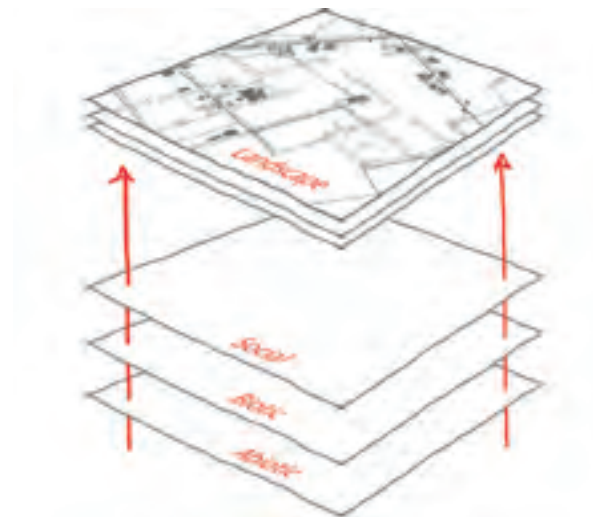


Figure 4.1: Triplex-model



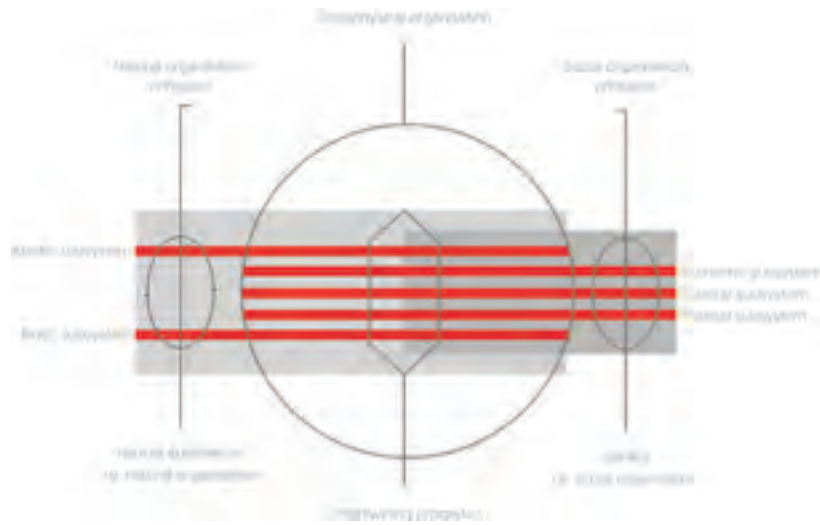


Figure 4.2: Kleefman's Sociophysical-organisation model

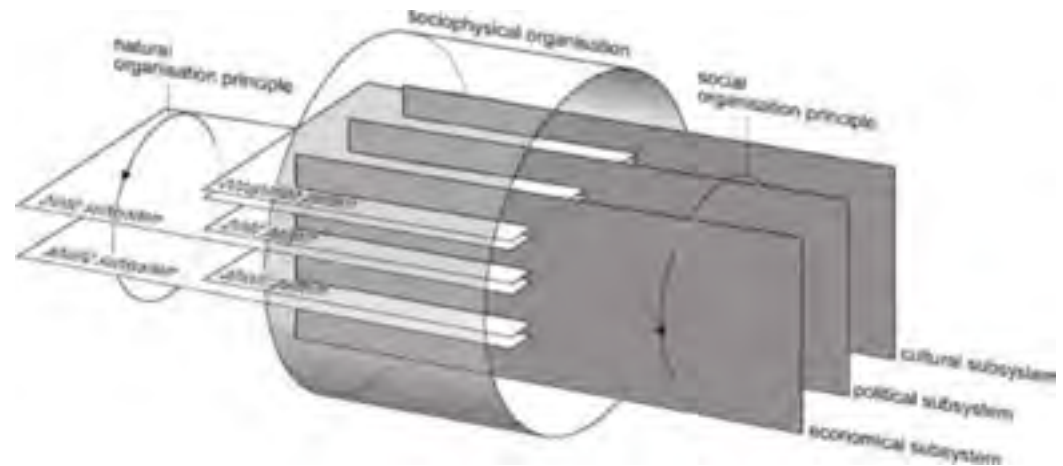


Figure 4.3: Duchhart's combining model

also: Is this land use the right choice for this landscape? By iteration the system will come to a balance. Every part of the system will be in balance to make a sustainable design.

In this case, two kinds of systems are important: the landscape system and animal husbandry systems.

## 2. Landscape systems

Through the years, landscape architecture developed itself from a discipline focusing on the rational and makeable of this world to a discipline empathizing the landscape, researching processes, respond to this and pursuing a sustainable approach. The basis of this shift in approach was formed by Kerkstra and Vrijlandt (1988). They developed the 'triplex model' (figure 4.1). Within this model, landscape is seen as a layer-cake with interaction between the layers: the abiotic pattern, the biotic pattern and the occupation

pattern. Kleefman's Sociophysical-organisation model can be seen as an addition to the triplex model (Kleefmann, 1984). This model makes a division between natural organization principles and social organization principles, with the landscape as result (figure 4.2). This model pays more attention to the social aspects than the triplex model. Eventually, these two models can be merged for a complete picture (Duchhart, 2007). It combines the driving forces of the SPO-model and the attention for defining the landscape in tangible terms. Duchhart's new model can be seen as a system in which several subsystems occur, each depending on each other (figure 4.3). The synergy between these subsystems forms the whole system: the landscape. The landscape can be seen as a mirror, reflecting all the properties of the present layers and visualizing it. If one subsystem changes, it affects the other subsystems and by that, the whole system. The appearance of the landscape is inextricably connected with the interdependent factors, according to this model.

### 3. Animal husbandry systems

Up until now, the systems approach has been explained briefly and the use of this theory in landscape is covered. Though this is a landscape architectural research, the principles of an animal production system (also called an animal husbandry system) will be important to take in account.

An animal production system is a special kind of agricultural system, because it contains the entity 'animal'. They differ through time and depend on the place (Chairgroup Animal Production Systems, 2012). Classification depends on context (Steinfeld and Mäki-Hokkonen, 1995). "Classification of systems is a widely accepted method to cope with the variation that is seen on these time and space scales. Most classifications, however, have implicit value judgments that are, for example, culturally and politically determined" (Chairgroup Animal Production Systems, 2012). Classification could, for example, be based on feeding, breeding regimes, healthcare, housing and ways of dealing with the environment (Innovatie Netwerk, 2010, Vlaams Agrarisch Centrum, 2005) (figure 4.5).

An animal production system can occur on different scale levels, but will have different characteristics. For example: an agricultural region, in which the farmers all use approximately the same way of dealing with their land and animal because of a certain soil type, present everywhere in the area. On a higher scale level, the Netherlands is a production system; the Dutch farmers all have to meet the same regulations. On a lower scale level, one farm can be seen as an animal production system, producing meat and milk in a certain way because of personal preferences of the farmer: "The landscape of any farm is the farmer's portrait of himself" (Leopold and Calkins, 1939). There is a hierarchy (figure 4.6). The highest level has its impacts on the lowest level, but because of the scale difference, these subsystems each have its own characteristics. Where the type of milking parlor is very important in only one farm, this does not affect the Dutch national husbandry

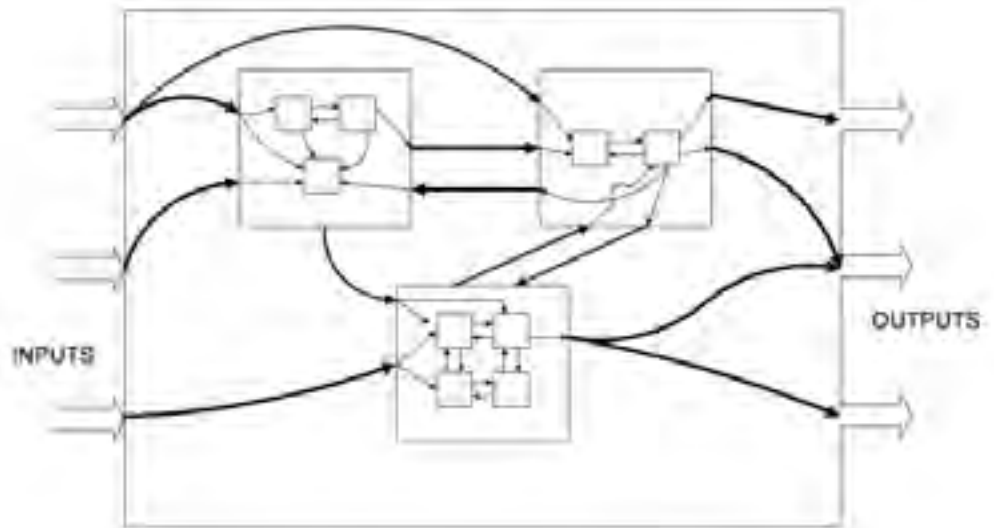


Figure 4.4: System in- and outputs

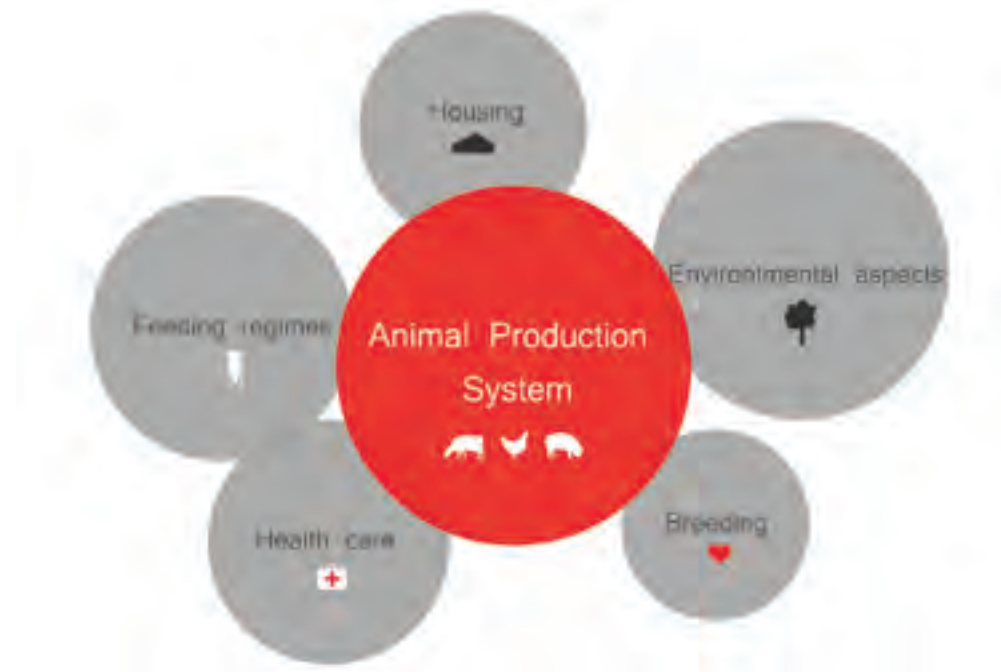


Figure 4.5: Animal production system

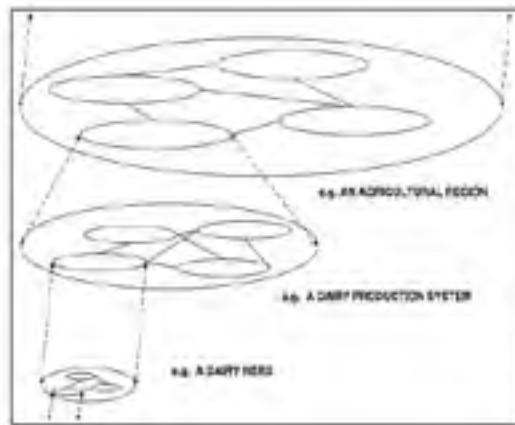


Figure 4.6: Hierarchy within systems

system.

Within Animal Sciences, the animal production system is seen as a system with a clear boundary and clear in- and outputs (figure 4.4). The focus is, on a low scale level, on one species. It is a controlled entity. Therefore, the system seems less complex. Though, there are a lot of external influences that raise the complexity of such a husbandry system. The animals, the crops and the landscape, but also anthropogenic factors, like economical perspectives and views of people influence the system. This makes clear that an animal production system does not stand alone.

#### 4. Merging of the systems

Both landscape and animal husbandry can be seen as complex systems with lots of external influences. Both have clear in- and outputs, but differ in so many ways. The in- and outputs of the systems are tangible on the one side (milk and straw in the animal production system, subsoil and trees in the landscape), but also

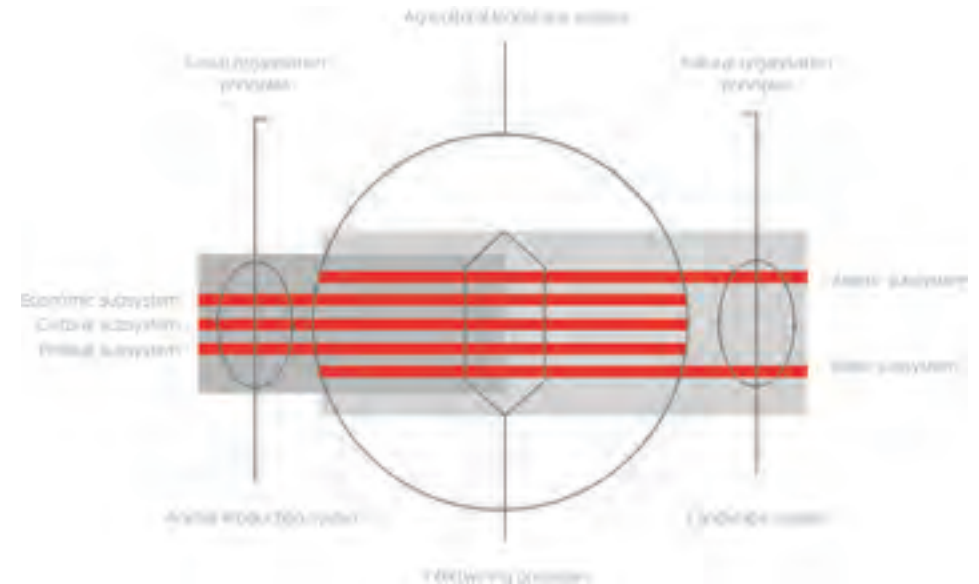


Figure 4.7: Adapted Kleefman-model: Merging the systems

are very abstract, like political influences, opinions of locals and economic factors.

The animal husbandry system and the landscape system can be seen as a part of the agricultural landscape. To compare them, it is important to get them on the same level, with the same kind of in- and outputs. To do this, the Sociophysical-organisation model is used as reference (figure 4.7). The physical parts are the abiotic and biotic properties of the landscape. The economical, political and social influences form conditions for an animal production system. Together these production systems and the landscape interact and form the agricultural landscape. Inputs and outputs of both systems are translated to properties. The properties can change in influence and together all these properties shape the system: the bubble model (figure 4.8 – 4.10). Of course, the two systems are interrelated. Choices made for the production system are based on properties of the landscape. The other way around, a production system can influence the composition of the landscape system.



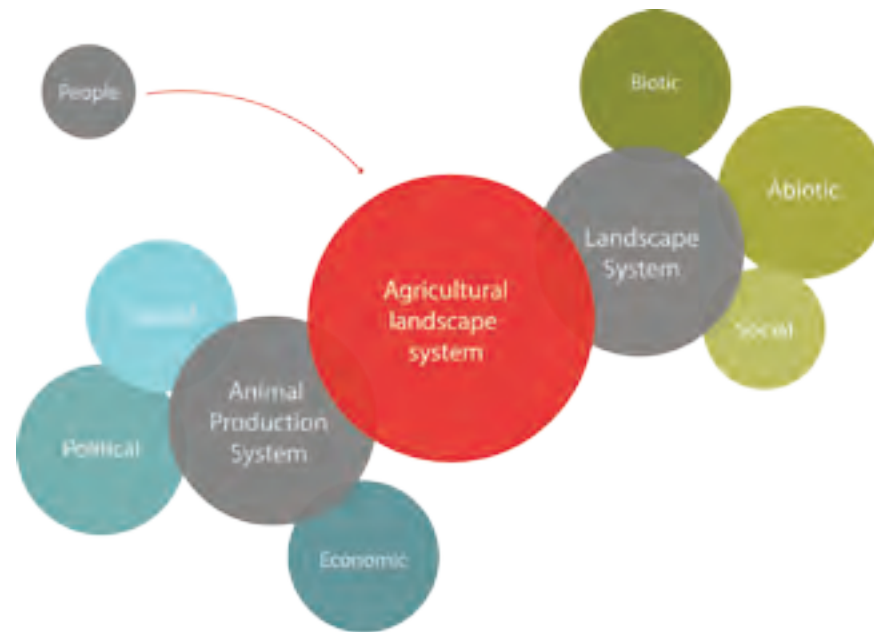


Figure 4.8: The bubble model: Agricultural landscape system



Figure 4.9: Bubbles of the animal production system



Figure 4.10: Bubbles of the landscape system

## 5. Appreciation of (agricultural) landscape

People nowadays live more and more in urbanized areas. There are less possibilities to access green environments and this could cause stress, for example (Headey and Wearing, 1989). Recreation in both cultural and natural landscapes becomes increasingly important for the people living in these urbanized areas (Jacobs and Buijs, 2011). The Dutch agricultural landscape thus is not only seen as a 'production landscape' anymore; it shifted to a 'consumption landscape' (Heins, 2002, Driessen et al., 1995). Because of this shift in use of the agricultural landscape, new standards have to be met. The people from the city, but also the locals want a nice landscape to recreate in. The question is: What do they exactly appreciate in the agricultural landscape?

Appreciation of the landscape is a difficult subject. It is hard to measure and changes over time. The measurability has raised many discussions. Some parties see landscape quality as something rationally measurable. Classifying and collecting the properties of a certain landscapes can evaluate other landscapes. This then should be an objective research. Others think it is 'in the eye of the beholder' and thus not applicable to everyone, but depending on who sees a landscape (Lothian, 1999).

Over time, the appreciation of landscape also changes. Paradigms change and something else is considered as a beautiful landscape of landscape with 'quality'. Again, this also differs per person. In ancient times, Vitruvius' distinguished three terms in order to define quality of a structure: *Utilitas* (usability), *firmitas* (solidity) and *venustas* (beauty). Over time, this changed a lot. In the 1960, a high productive landscape was seen as a high quality landscape and by now sustainability, diversity and coherence are appreciated. In the 16th century, a straight, coordinated and over-designed park was seen as beautiful and the wilderness was considered a mess and unstructured. Nowadays, the remaining wilderness is highly appreciated. These few examples show that appreciation

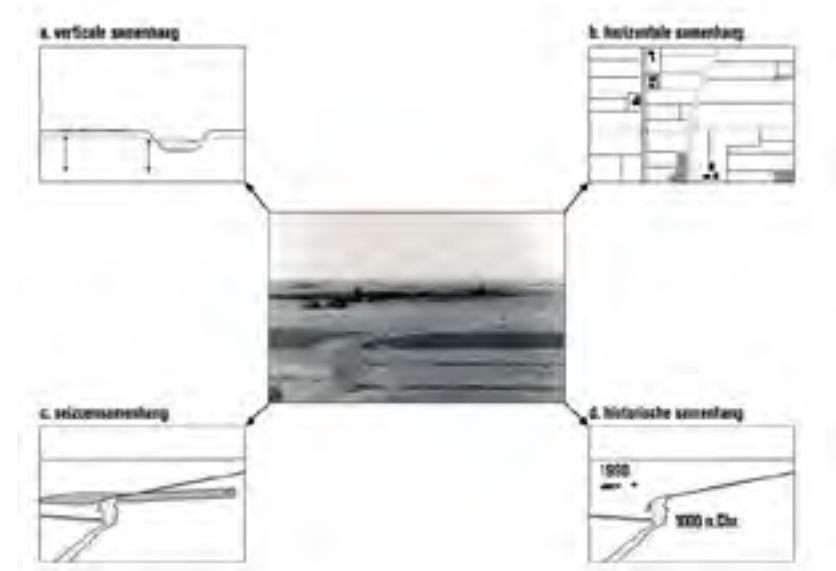


Figure 4.11: Four relations approach by Hendriks and Stobbelaar

of landscape never was and will be the same, but still can be understood in its socio-cultural context.

To look at the appreciation of agricultural landscape in this research, the approach of Hendriks and Stobbelaar (2003) is used: the focus on legibility. Legibility is 'the extent to which a landscape shows coherence, making orientation in time and space possible. This possibility arises when the coherence between landscape system and landscape appearance is visible' (Hendriks and Stobbelaar, 2003). Legibility as a concept was introduced by Kevin Lynch in his book 'Image of the city' (Lynch, 1960). He stated that paths, nodes, districts, edges and landmarks were important to orient in a certain place, and thus enhance the legibility of the landscape. If a landscape is readable (legible), people comprehend and understand it and this increases the appreciation of a landscape (Kaplan and Kaplan, 1989). Hendriks and Stobbelaar formed a frame, based on legibility,

coherence, orientation and identity, to look at the landscape and determine the landscape quality (and thus, the appreciation). The frame is based on four relations and three time timescales (figure 4.11). The four relations are vertical relations, horizontal relations, seasonal relations and historical relations. The timescales are split up in momentary, cyclic and continuous. They assed the quality by looking at how strong the coherence between each relation (vertical, horizontal etc) and the legibility is; the stronger the coherence, the higher the quality is valued.

Both Lynch and Hendriks and Stobbelaar form a framework to look at the quality and thus appreciation of the landscape. They both focus on a set of elements, which helps ‘measuring’ quality. Lynch’s elements focus on visual characteristics, which stands out because of its simplicity. Hendriks and Stobbelaar use the visual, horizontal characteristics too, but add a deeper layer by looking to vertical relationships and adding historical and seasonal aspects. Combining the legibility evaluation of both Lynch and Hendriks and Stobbelaar can form a strong frame to look at the appreciation of the agricultural landscape.

In the rest of the research, the approach of Hendriks and Stobbelaar will be called the four-relations approach:

- Vertical relations: focus on expression of soil, geomorphological properties, water and relief. What can be seen of these aspects in the landscape? The more the landscape reflects the subsurface, the higher the legibility
- Horizontal relations: The composition of landscape elements and patterns in relation to each other. The more the basis of these structures and patterns lays in the landscape, the higher the legibility.
- Seasonal relations: The differences between seasons in the visible landscape and the ability of the landscape to express these seasonal differences. More difference visible is a higher legibility.
- Historical relations: focus on the expression of history in the current visible landscape. If more history is visible, the

	Horizontal	Vertical	Historical	Seasonal
Momentary	Soil type Hydrologic patterns Geomorphological patterns Relief	Building patterns Parceling Infrastructure Watercourses Planting structures	Colors of natural elements Shape of natural elements Land use Activities	Historical land use Historical buildings Historical watercourses Old parceling Old planting structures

Table 4.1: The elements of the four relations

landscape is more legible.

More concrete, table 4.1 (based on Hendriks & Stobbelaar, 2003, p.44) shows the elements that will be looked at when ‘measuring’ the legibility. A five-step scale is used to rate the legibility, containing ++ (most positive), +, o (neutral), - and – (most negative). If a property, for example geomorphological patterns, is reflected clearly in the visible landscape, it will be rated with ++. A mean of each relation can be taken to look if the landscape is legible.

The focus on timescales will not be taken in account in this research. Hendriks and Stobbelaar also split their results on different farm elements: fields, farm yard and edges. In this research, the approach will be used to look the whole of these three elements, and their connection to the surrounding landscape. The approach will be applied on landscape type scale, to look what the interdependence is within a landscape type and in what way they relate to other landscape types.

These criteria’s will be used to look if the landscape currently is legible. It also will help to assess models and making the right choices in the design phase.





animal friendly, consumer-focused concepts

## Dream Vision



"A healthy, sustainable Dutch animal husbandry sector."

This means good animal health and welfare are ensured. Healthy livestock means a good production for the farmer. A fair price should be paid for his products. The farm should be viable. Locals and citizens from nearby villages feel connected to the rural area, and the livestock. They see production is necessary as well as innovation, but because of enough transparency, they know everything happens in a fair, animal friendly way. The farm and the way it is managed, adds something to the landscape and the other way around. The landscape supports the management. A regional approach is necessary. This way, a coherent landscape can be created. Agricultural areas can distinguish themselves, can have an own character and by that, be authentically and self-explanatory.

good animal health and welfare



5.

Dream vision

Animal husbandry system

---

*The dream vision is one of the first elements made during this thesis. The dream vision combines the knowledge I already have as a farmers' daughter and a landscape architecture student and new knowledge I found during the writing of the proposal and the first phases of the thesis. The dream vision is an ultimate goal, most likely too high to achieve, but can inspire the whole process.*

The dream vision can be described as follows (as seen on the left page):

*"A healthy, sustainable Dutch livestock sector. This means good animal health and welfare are ensured. Healthy livestock means a good production for the farmer. A fair price should be paid for his products. The farm should be viable. Locals and citizens from nearby villages feel connected to the rural area and the livestock. They see production is necessary, as well as innovation, but because of enough transparency, they know everything happens in a fair, animal friendly way. The farm and the way it is managed, adds something to the surrounding landscape and the other way around: the landscape supports the management. A regional approach is essential. This way, a coherent landscape can be created. Agricultural area's can distinguish themselves, can have an own character and by that, be aesthetically valuable and self-explanatory."*

The dream vision will be used as a guiding element, something to look back when I forget why I did this thesis. The images should motivate me to try to reach this goal and remind me what I wanted.

This vision is probably too broad and not everything will be reached during this research and making the design. In this instance, it is mostly constructed from my own intuitive perspective. During the research, a lot of new knowledge will come to me and maybe change the vision. Therefore, the vision will be revised just before designing. It should be more specific and

applicable. The new vision eventually will guide the design, but should not ignore the ideals I set for myself.

If my ideals appear to be wrong or only applicable to me, the dream vision, of course, will be changed. The research will help me getting this clear.





Exploration and comprehension







6.

Case

*For investigation more concretely what the wishes and possibilities are regarding a new animal husbandry landscape, a case has been chosen. This case will also help visualizing the assumed problem.*

The case and the design that will be made should be functioning as an example for the rest of the Netherlands. An approach will be created that will be applicable to more areas than just this area. It is important thus, that this case can fulfill this role model function. An important characteristic of the case then should be variety in subsurface, social aspects et cetera.

An area has been chosen in the south of the Netherlands. It lies on the edge of the south eastern sandy landscape, gradually overflowing in the clay deposits of the Meuse. The northern border is formed by this river (figure 6.1). The Zuid-Willemsvaart in the east forms an edge from 's-Hertogenbosch to Veghel and the highway A50 between Veghel and Oss defines the eastern border (figure 6.2). A varied subsurface can be found in this case and thus can be used as a good basis for a widely applicable method.

The geomorphological properties define a large part of the appearance of this location (figure 6.3). In the north, the soil mostly consists of clay deposits of the Meuse. Closer to the Meuse, coarser material was left behind and formed the higher levees. The southern part of the clay deposits is enclosed by a sand ridge, connecting 's-Hertogenbosch with Oss, via Rosmalen, Nuland and Geffen. The southern part of the area consists of large sand planes, sometimes crossed by smaller sand ridges. Along the Zuid-Willemsvaart, a little stream called the Aa has its stream valley. This results in a brook valley landscape.

Historically, these areas have developed itself separately. The stream valley and the higher sand ridge were occupied a long time ago and agriculture has developed itself over a long time and thus differs from the younger landscapes. The younger landscapes are the clay area and the sand planes. The clay area was used as floodplane for the Meuse. The sand planes were covered with

heath pastures. Both of them got reclaimed only less than a hunder years ago and thus developed differently (figure 6.4).

This case is going to help and guide the rest of the research and eventually will serve as test case, to develop and design a new approach to landscape and agriculture.



Figure 6.1: Geomorphological map of the Netherlands





Figure 6.2: Location of the case area

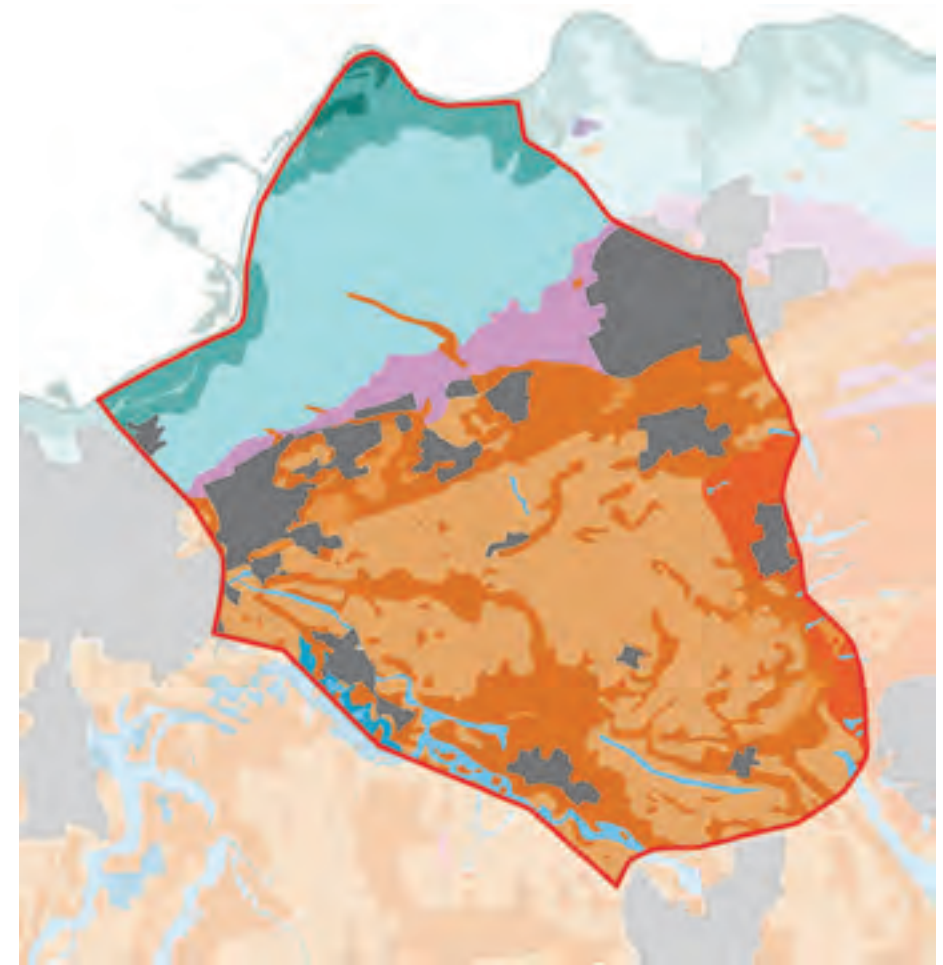


Figure 6.3: Geomorphological map of the case

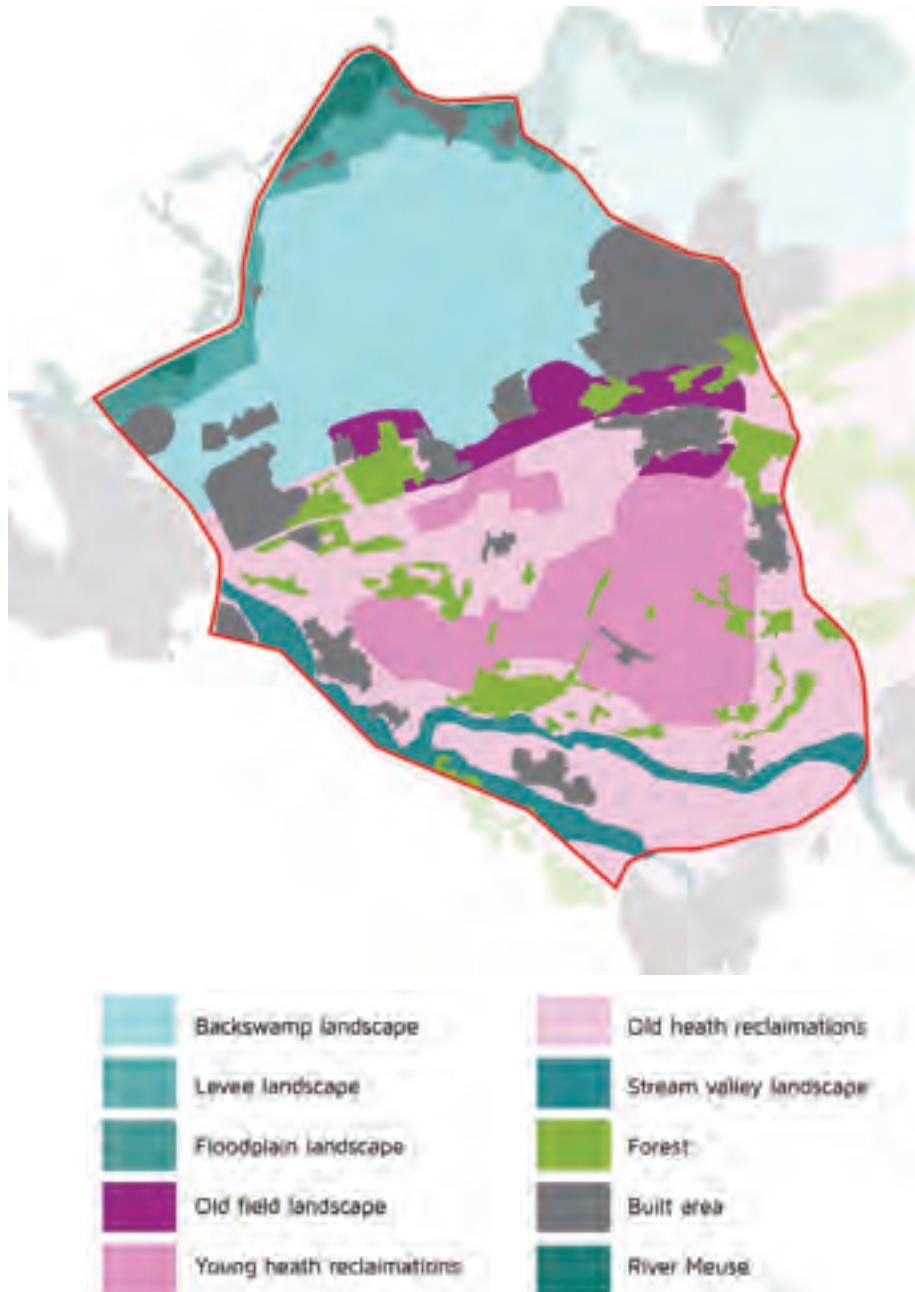


Figure 6.4: Landscape types in the case



Figure 6.5: Waterstreams in the case



7.

Problem in theory



*Agriculture influences landscape and landscape influences agriculture, although the relationship between these two seems to be less mutual than it used to be. All sorts of developments determine this relationship: social constructs, level of technology, interventions by governmental institutes et cetera. Over time, new problems and wishes developed considering animal husbandry. These problems and wishes often have a strong connection with developments within the landscape. The current solutions to bring landscape and agriculture together can be questioned. Also, the perspective of a farmer is way different than the perspective of, for example, citizens. All these subjects can help to make the problem more concrete.*

## 1. Connection farm-landscape

Since men first began to settle on one place, agriculture has been a driving force for the shaping of landscape. Before this phase of settling, hunters and gatherers wandered as nomads. They followed herds of wild livestock to feed themselves and gathered fruits and other sorts of food in the woods. When the first settling began, this turned around. People did not follow the herds anymore, they kept them: the beginning of husbandry. Fruits and cereals were not gathered anymore, they were cultivated. Hunting and gathering did have a small impact on landscape: an occasional temporary settlement, though these were left behind as soon as food ran out. The transition to staying on one place

had a bigger impact (Lambert, 1985). In order to be able to graze livestock and cultivating crops in small extent, land had to be available and should be fertile. Patches of the abundantly present woods were slashed and burnt down. Shifting cultivation was essential for keeping the grounds fertile. After several decades, the plot would be exhausted and was not fertile anymore, so a new patch of forest was taken into use by applying the slash-and-burn method. This had a big impact on the natural woods cover of the Netherlands. During the Bronze Age, the burning and overgrazing of patches of land led to the growth of heath. Locally, intensive use even led to sand drift.

Settlements at that time mostly existed of isolated farmsteads, or in rare occasions, in a cluster of two or three farms. Settlement happened on 'logical' places: high enough, but not too dry.

This developed itself to larger communities and eventually small villages. All that was done depended on the landscape. Settlements were not randomly placed. They depended on the resources available in the surrounding area. A good example that rose in the Middle ages is sod manuring (Plaggenbemesting). This sod-manuring system influenced the landscape, but also was depending on the landscape. Only on specific places it could take place. Heath, grazing pastures for cattle and possible farmland should be present (figure 7.1). Heath mostly occurred on higher, dryer places, grazing pastures were near a brook. Farmland lie in-between, near the farmsteads. Sods of heath were cut and

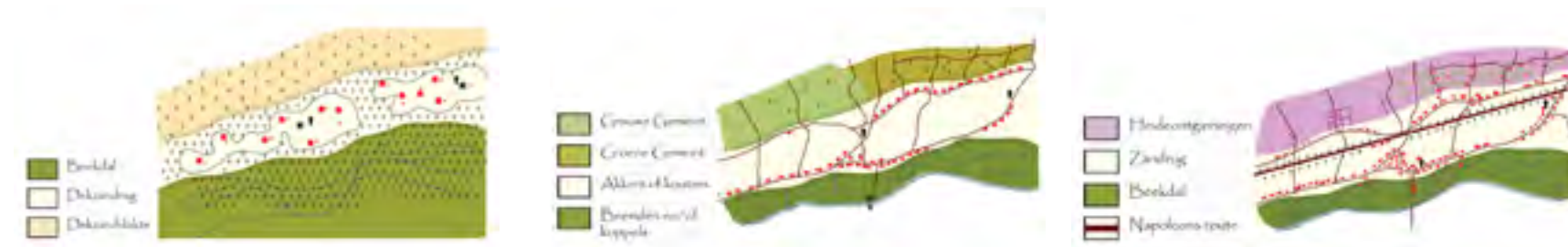


Figure 7.1: Development of the dutch sand landscape over time

spread in a barn where cattle spent the night. Their manure mixed with the heather sods was applied to the fields. This made the soil more fertile, where it otherwise was exhausted after only a few years of intensive use. The extensive use of sod-manuring caused these so-called 'essen' to get higher and higher (figure 7.2). The agricultural system of the sod manuring and the present landscape system together formed a balanced agricultural landscape. The agricultural system represented what was present beneath the soil; it reflected the biotic and abiotic circumstances. Up until then, farming systems were "a result of the specific responses of farming communities to local ecological conditions—that is, they resulted out of a particular form of co-production of nature and society. In an attempt to overcome natural limitations and valorize endogenous qualities, a wide array of regionalized agricultural systems developed" (Renting and van der Ploeg, 2001). There was a diversity of farming techniques. The sod manuring systems is one of these. These systems each produced different

products, depending on the local conditions and the way farmers dealt with it. In the north of the Netherlands, rich clay area's were suitable for arable farming. They produced crops like potatoes and beet. The west of the Netherlands was wet and consisted of peat. The only vegetation suitable there was grass and thus dairy farms with grazing cows were located there. Therefore, the most important product produced here was dairy: milk, cheese and other dairy products. The architecture of the farms made it possible to distinguish rural areas and production systems (Vervloet, 2009) (figure 7.3). The yields of the arable farms in the north were high, so large barns were built to store the crops. The farmers earned enough money, so their houses could be apart from the stables. In the south of the Netherlands, the soil was less fertile and there were lower yields (Lambert, 1985). The urge of building large barns was not present here, not to mention the costs of building such a barn. The barn and the living area therefore were situated under one roof. Building materials were taken from the

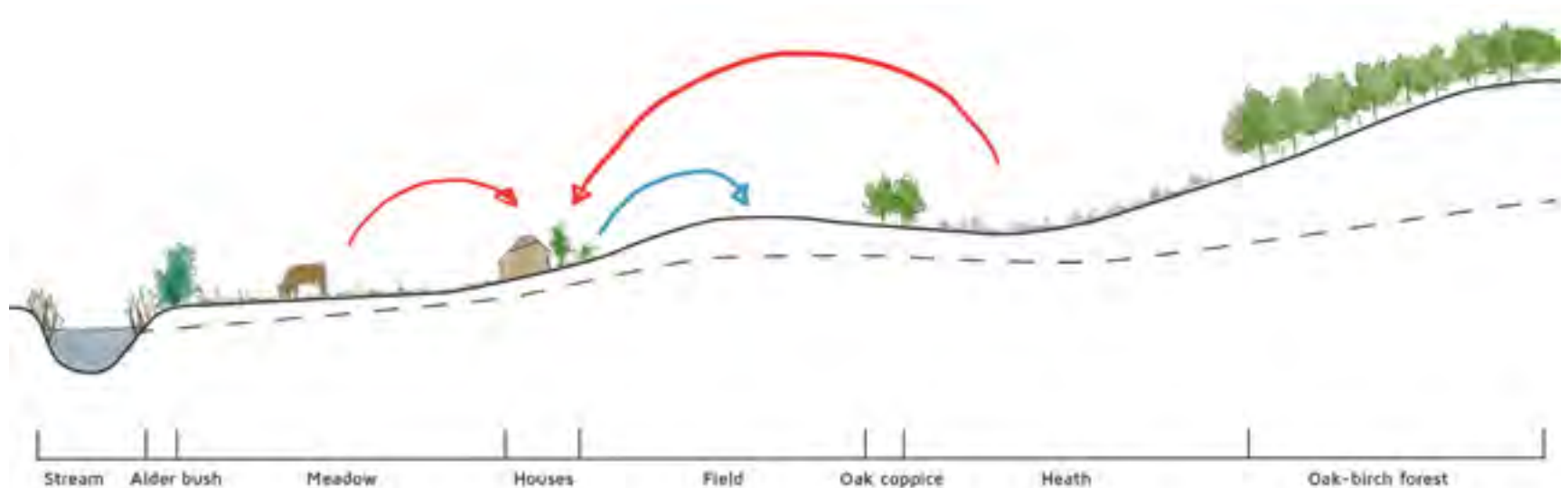


Figure 7.2: Deep litter system: Depending on the landscape and forming the landscape



Figure 7.3: Housing depending on the landscape



Figure 7.4: Duck decoy



Figure 7.5: "Pestbosje"



Figure 7.6: Orchard



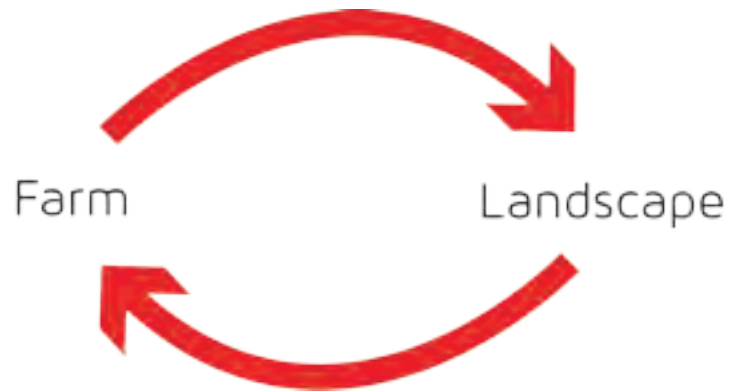


Figure 7.7: Old relation between farm and landscape

direct environment. Where more water and thus reed was present, a thatched roof was normal. Bricks were baked from clay to make stables in the river area (Renes and Baas, 2005). This all influences the appearance of the landscape and shows the dependence of each other (Meeus and van de Ploeg, 1988) (figure 7.7).

In addition to the regional diversity, every farm used to have its own landscape elements. Per region, these elements differ, but they have one thing in common: they all fulfilled a certain function (Renes and Baas, 2005). Green around farms thus had a use and was there for a reason. (figure 7.4 - 7.6) In windy area's, large windbreaks were planted reduce the breeze. Most farms had a small orchard, to provide the farmers with fruits. The underlying 'useless' grass was used to herd some sheep. In wet regions, ditches were used for defining the borders of plots. Hedgerows were used for this purpose in dryer areas. Next to this, the hedgerows provided firewood and branches for brooms and baskets. 'Pestbosjes' were planted on places where sick cattle were buried. The bush indicated the part of the land that was contaminated and should not be used for growing crops. These are just a few examples, but it indicates that every element was there for a reason and was maintained (Burm and Haartsen, 2003).

In the 17th century, the Age of Enlightenment, changed the ways

of thinking. A more scientific approach to the worlds' phenomena was founded, which also influenced agriculture. Scientists started to think about ways to make agriculture more efficient and more profitable (Bieleman, 2008). New equipment was developed, like scythes and ploughs. Seeds were selected on the highest yields, drainage was improved and artificial fertilizer made its entrance. This agricultural revolution developed itself simultaneously with the Industrial Revolution. Without the new ways of processing metal, invention of steam machines and other technical and scientific knowledge, agriculture would not have the possibilities to develop itself in this way. The Industrial Revolution though, could not arise without the agricultural revolution. The higher yields and amount of food that were produced by the farmers made it possible to feed the expanding industrializing cities. So without the first, the second could not exist.

The effect of this regeneration of agriculture (and as part of this: animal husbandry) on the landscape could clearly be seen. Before the agricultural revolution, heath and other rangelands were present all over the Netherlands. The introduction of artificial fertilizer made it possible to take poor soil in use by enriching them with nutrients. Fields that were considered too wet in the 16th century now can be used because of new drainage techniques. While the amount of agricultural land increased with 25 to 30% by these developments, the productions six fold itself between 1800 and 1950 (Hoppenbrouwers, 1986). New breeding techniques, mechanization et cetera made a much intensive use of land and animals possible. The Dutch landscape partly turned from rangelands to agricultural land and existing agricultural land became more intensive. This influences the appearance of the landscape and triggers the assumed problem: Lost mutual influences between the farming system and landscape system (figure 7.8).

Over the years, technology developed itself further and further. There seems to be no limit. The amount of animals kept getting bigger. Their housing gets modernized: the temperature

is controlled, feeding is steered by a computer and milking is automatized. Because of the growing amount of animals, the stables grow. The still intensifying land use and growing machines asks for larger plots. This is made possible by, for example, the 'Ruilverkaveling' (Bieleman, 2008). There is more pressure on the landscape system: a surplus of nutrients disturbs water streams and ecological system. By all sorts of regulations, the application of manure and emission of ammonia is kept within strict limits. Welfare-laws give guidelines about the minimum housing, feeding and health care. A milk quota was introduced to minimize overproduction and after the large outbreak of Classical swine fever in the nineties, the 'Reconstructiewet' was introduced (Bruil and de Laat, 2003). Landscape elements that used fulfill a clear function, are becoming superfluous: Hedgerows are replaced by barbed wire and windbreaks are removed because they could attract pests and thus threaten animal welfare (Renes and Baas, 2005). All these events and regulations are a consequence of the intensifying animal husbandry and left their mark on the landscape. Landscape in contrary, did not have much influence on farming anymore.

The connection between farm and landscape decreases. The influences used to be mutual, but now, the influence of the farm

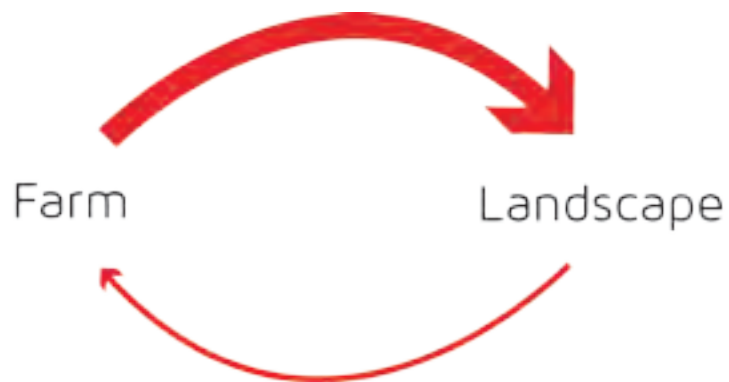


Figure 7.8: New relation between farm and landscape

on the landscape is clearly larger than the other way around (Renting and van der Ploeg, 2001, Hendriks and Stobbelaar, 2003).

All these technical and economical interventions to make higher yields and profits possible develop footloose. The agricultural techniques have developed themselves to such an extend, that a suitable landscape is not necessary anymore. Suitable landscapes can be made, is the idea. Heath fields and manure in the deep litter are useless; the farmer will use artificial fertilizer. The landscape system is under pressure. The old elements, like a stream and accompanying fields and subsoil are too inefficient to use. It gets transferred to an efficient landscape that fits the new animal husbandry systems, focused on, for example, producing milk with low feeding, housing and health costs. Every landscape can be turned into a landscape with large plots and modern farms with big stables. By doing this, the diversity of the landscape disappears. Therefore, the legibility and attractiveness of the landscape decreases. This causes less appreciation by locals and visitors and recreation will decline. The decreasing diversity will be shown in the next chapter.

In the introduction and a few paragraphs back, several different pressures on Dutch agriculture are mentioned. Also, the ways a farmer can deal with these pressures is mentioned:

- Quit
- Expand and intensify
- Facilitate secondary activities
- Switch to organic farming

It can be seen that expanding and intensifying thus is not the only current development. More extensive and organic options are also considered as a counterpart. These developments mostly are more connected to the landscape and can be seen as developments that enhance the legislation and appreciation of the landscape (Hendriks and Stobbelaar, 2003). The facilitation of secondary activities has two sides. Mostly, they are more connected to the landscape and more attention is paid to landscape elements, but



Figure 7.9: Articles about the social perspective on animal production systems

sometimes it can be experienced as disturbing and cluttering the landscape (Vijn et al., 2010, Kempenaar et al., 2009, Veeneklaas et al., 2004).

## 2. Social perspective

From social perspective, the problems that come forth from the disappearing mutual influences between farm and landscape can be seen in many ways. The more and more intensifying animal husbandry causes resistance. Images of pigs in small cages, cows picked up by large grabbers because they died of Mouth- and Foot Disease and the 'kiloknallers' in the supermarkets gives the Dutch agriculture negative associations (figure 7.9). Large barns (megastallen) pollute the visual landscape and sometimes cause smell. The upcoming intensification also leads to more transport, rumbling across small country roads. Therefore, there is large resistance of locals (and city-people) when a plan for a new barn is announced.

People are critical on animal welfare and the current developments. It is important to note the strong improvement in terms of welfare and environmental rules the past few years. Strict governmental laws limit the emission of ammonia and determine a minimum size of surface for livestock and this are just two small examples (Bieleman, 2008). Though, these often expensive developments go hand in hand with more modern expansions of the farm to finance everything. Consumers thus are critical towards animal husbandry, but also want their groceries as cheap as possible (Boogaard, 2009). This results in pressure on the production. On the other hand, there are developments towards organic farming and eye for sustainability visible. In some cases, consumers are prepared to pay extra for milk and meat produced in such systems. These elements together form the general view on livestock husbandry.

When the focus is purely on the landscape, other aspects arise.

In the theoretical frame was mentioned that the agricultural landscape more and more is seen as a recreational area for the city people. A bike ride through a nearby rural area, driving along the dike by car or take a walk over a 'Klompepad': a typical Sunday afternoon. People are drawn by the openness or enclosure, the serenity and space of an agricultural landscape. Though, the diversity between what used to be different agricultural landscapes disappears because of the technological developments. Everywhere the same sheet pile – red bricks – corrugated iron sheets barns pop up. Is there poultry inside or is it a pig barn? No one knows. Where the landscape used to be a guiding principle, the barn now is predominant. By the disappearing coherence and the reducing overall diversity, the landscape is less legible. When the legibility diminishes, the landscape is less attractive (Hendriks and Stobbelaar, 2003). The specific present landscape ensures the distinction between different regions and forms the coherence between the regions itself. They each have their own identity, based on the present production system. By the loss of this coherence and overarching diversity, the landscape gets less legible and thus less appreciated. They will recreate in these areas less. Identity provides binding to a place. When the bonding is lost, the appreciation will also decrease (Hendriks and Stobbelaar, 2003, Roncken, 2011).

### 3. Farmers perspective

Through the years, a lot has changed for the farmer. His farm transformed from a small, mixed farm, completely depending on local recourses and manual labor, to a large, specialized farm, full of machines and electronics, turning into a manager instead of a farmer.

Landscape used to be an essential part of the farm. It even determined the farming system, as mentioned in the first paragraph. Landscape elements were present because they had a certain use. Later on, the elements became useless for

the management for the farm and the aesthetical perspective increased. The townspeople like it: a romantic image of livestock husbandry and accompanying landscape (Woestenburg, 2006, Roncken, 2011). However, not everything stayed the same. The pressure on the price increased and the mechanization continues. Since the 'Ruilverkavelings' years, farmers are placed outside the villages. The villages grew because they more and more became an attractive environment to live. Farms with their incidentals, like smell, did not fit in the villages anymore. Also, the trend of renewing and expanding farms fits better in rural area's (Commissie Centrale Cultuurtechnische, 1973). Farms were moved to 'suitable' places, like the open polder and the young heath reclamations. Previously, these landscapes were unusable as farming landscape, because technology developed itself slowly. In the 60's, the chances were better: A lot of ground was moved and drainage got improved. The plots of a farmer could be spread over a large area and the areal of these plots was just small. The



Figure 7.10: 'Standard' cubicle barn in 1973



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'Ruilverkaveling' made sure the farmer could live close to his land. The plots were merged and increased in size, so cultivation with large machines became possible. The focus shifted from mixed farming to specialized farming. The construction of new stables that accompanied the 'Ruilverkaveling', was namely 'catalog' construction: Each stable the same (figure 7.10). An example of this is the cubicle shed in dairy farming. Around 1972 subsidies were given by the Dutch government for building such a stable (Bieleman, 2008). Since 'Ruilverkaveling' years (in this area around 1960–1970) diversity in stables disappeared. A simple and quick way of building was chosen, which lead to a same character for every stable, no longer depending on the landscape.

From farmers perspective, it is logical he chooses for the highest yields and highest profits. This leads to choosing for the technologic approach. These technical approach can be found in for example information material for farmers. The 'Handboek Melkveehouderij' (Rommelink et al., 2012) gives guidelines for the dairy farmer. The book mostly contains technological solutions and numbers considering soil, sizes for interior of stables, health of the cow et cetera. A landscape approach receives little attention, and when it is mentioned, it is approach in such away it still is technical and economic. An example of this is agricultural nature conservation, which sounds like a landscape approach, but is seen as a way to aquire subsidies and generate a higher profit. The same handbook is available for other sectors, like poultry and pig farming (Vermeij and Wageningen U. R., 2011, Vermeij and Wageningen U. R. Livestock Research, 2010).

There thus is little attention for the aesthetical side of the landscape from farmers perspective, because it is not directly necessary for good farm management (Renes and Baas, 2005). The maintenance of landscape elements takes a lot of effort, needs space and causes shadow on the arable land (light competition) (Demeulemeester et al., 2012). It is seen as a burden, imposed from higher hand. Often farmers are prepared to help improving landscape quality, when there is a benefit in it for them.

## 4. Solutions

The solutions from landscape perspective to enhance the animal husbandry landscape can be categorized in two groups:

1. Current solutions
  - a. Legal solutions
  - b. Extra legal solutions
2. Future solutions
  - a. Scientific solutions

These groups are categorized on timespan: What has happened already and what is going to happen in the future. Legal solutions and extra legal solutions are now seen in the landscape. Legal solutions mostly are imposed by a government and are restricted. Extra legal solutions are based on legal solutions, but take it to higher ground, to give something extra, sometimes involving certification. Scientific solutions are mostly free developed solutions based on scientific knowledge from diverse disciplines. Scientific solutions mostly inspire governmental institutions to make their legal solutions and thus are solutions for the future.

### 4.1 Current solutions

#### a. Legal solutions

The 'Wet Ruimtelijke Ordening' (Law Spatial Organization) determines the way spatial plans in The Netherlands get constructed. On national, provincial and municipality scale different kinds of plans are present. The national and provincial authorities create 'Structuurvisies' and municipalities develop 'bestemmingsplannen'. These plans can contain every aspect of Dutch spatial organisation and of course, there are regulations that involve agriculture within the landscape.

The visions on national scale are already mentioned partly. The Reconstruction is one important example of a current tool to deal with husbandry in the landscape. The way this act functions

has already been set out in the previous chapter. Another policy document is the POP, which is made according to the GLB, the European policy for agriculture. There are guidelines within this document, but mostly focuses on which activity can claim financial support. For agricultural developments that take landscape into account, funding is available. What exactly is classified as good for the landscape is not mentioned.

On provincial scale there are 'structuurvisies'. These mostly contain a section about agricultural development. Still, these are more guidelines than concrete solutions. For example, in the 'structuurvisie' of Noord Brabant the following is mentioned:

*"Developments in the rural area should contribute to the reinforcement and experience of the landscape, for example by investing in the meshed green-blue veining of the rural areas, cultural heritage and in strengthening the recreational infrastructure."* (Provincie Noord-Brabant, 2011)

Meanwhile, they also emphasize the importance of a wide oriented rural economy and agricultural development. This should go along with contributions to the landscape. Concrete applications are not mentioned. This is outsourced to the municipalities.

Most provinces have next to the regular 'structuurvisies' other regulations. In Noord Brabant, the 'Verordening Ruimte' is expanded with a part about careful livestock husbandry, under the guise of "development space has to be earned and is not unlimited" (Provincie Noord-Brabant, 2013). This document focuses mostly on intensive livestock husbandry and gives concrete options for

making husbandry more sustainable, including the landscape. The idea is to create a yardstick to measure if a farm can expand. This is still in process, but can be seen as a step in the right direction.

A more concrete level can be found within the municipalities. The abstract guidelines of the national government and province are translated to more detailed guidelines. Decisions are made when making and adapting zoning plans. Most municipalities have a zoning plan for their rural areas, called 'bestemmingsplan buitengebied'. Concrete data is incorporated herein, like distance to public roads of new agricultural buildings, size of building plots et cetera. It is mostly noted that integration in the landscape of new agricultural developments is important. Integrating in the landscape is "such a form and integration that it is adapted optimally to the existing or to developed spatial, natural and cultural landscape qualities". Some municipalities have a LOP (Landscape development plan) and accompanying 'Beeldkwaliteitsplan' (Visual quality plan) in which concrete rules and examples are given for new stables and farms. Landscape integration than can be based on the 'Beeldkwaliteitsplan'.

Thus, in some cases there can be relied on the visual quality plan when building a new barn. In most cases there are no direct guidelines for 'integration'. This results in difficulties when interpreting and executing integration of new developments in the landscape. A farmer will love his new barn and wants it to be seen (Savelkouds, 2012). A policy maker perhaps thinks it is more important to connect to existing green structures around the barn. A gap thus exists.

The execution also is under pressure. A landscape plan to design the integration in the landscape is in most cases not obligatory when building a new barn. The consequence of this is the sprawl of barns, without paying attention to the landscape. When a landscape plan is compulsory, it is the question who should make these plans and which requirements it should meet. If the farmer himself should make a landscape plan, it is questionable if it is good enough and suits the environment. He will serve



Figure 7.11: Noord Brabant's sustainable score for livestock husbandry

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his own wishes and will make it as easy as possible for his own management. A councilor of the municipality does not have the right education. The only one that really understands the landscape is a landscape architect or –designer, but unfortunately, hiring one is considered to expensive.

Involving a landscape architect has its advantages: The landscape is their (our) main research area, so they know what they are doing. The landscape thus is extensively considered and also the wishes of all involved parties are taken in account to make a suitable design. However, involving a landscape architect does not

mean the plan and the resulting landscape will be perfect. There are multiple reasons for this:

- The farmer is the one hiring the landscape architect and thus has the final word. The landscape architect makes a design for him, so he should agree with it.
- The design is focused on one farm. It is hard to design only one courtyard, trying to connect it to the surrounding landscape, because it such a small entity. It can contribute to the whole landscape, but on its own, it is not able to fix an agricultural region.
- Next to the farmer and the landscape architect, there are other



Figure 7.12: Integration in the landscape of a new barn



actors involved, for example the municipality, water boards and nature organization. These parties each want their own wishes included in the design, but this does not mean these wishes are better for the landscape than the farmers' wishes. Integrating all these voices in the design thus can be negative regarding the landscape.

To illustrate this, a design of Dutch design office specialized in landscape integration is used. This office made an integration plan for a new barn near the Dutch city Baarn (Agroplan, 2012). First, the characteristics of the region are researched. Conclusions are drawn concerning the present soil- and water system, the history of the place and appearance of the landscape. This is translated to a design. In this instance, next to the farmer, the municipality and 'Erven van Utrecht' were present to share their opinion. The farmers wish was a simple landscape plan. He wanted some green with low maintenance and his main reason to set up a landscape plan was speeding up the process of getting his permits. The municipality wanted a landscape plan that connected to the surrounding environment and making the new barn as invisible as possible. The representative of 'Erven van Utrecht' was focused on making a 'special' courtyard, something that would stand out but also added to a new way of looking towards farms. He pleaded for a statement (Agroplan B.V. et al., 2012). The landscape architect tried to bring these wishes together in one design. Three complete different wishes are gathered in the design and eventually, a few simple interventions were the result. On a small scale, all wishes were met, but when zooming out, the connection to the rest of the landscape seems not that big. The farm is situated in an open agricultural peat landscape, characterized by some planting on the front courtyard and an open back. When looking at the design, both sides of the courtyard are closed (figure 7.12).

In more of the designs for new barns, the same thing can be seen. The wishes of all parties are met, but are elaborated too detailed. The connection to the larger picture is not strong enough.

Thus, it can be seen that it is hard to realize the integration of a new agricultural development in the landscape as good as possible. Maybe integration is the wrong solution: it is too detailed. An approach on a larger scale could have a better effect on the landscape. The coherence between farms and a whole agricultural region is taken in account, instead of looking at just one farm.

## b. Extra Legal solutions

Extra legal solutions are based on legal solutions, but go one step further. Extra legal solutions are a choice of the farmer himself and he is free to choose if he wants to meet the requirements of such a solution. In this research one extra legal solution is covered, four others are mentioned shortly (van der Peet et al., 2013, Agentschap NL, 2010).

### MDV

MDV stands for 'Maatlat Duurzame Veehouderij', which can be translated as Yardstick Sustainable Animal husbandry (figure 7.13). The MDV is a certification scheme for the sustainable husbandry of livestock (Stichting Milieukeur, 2012). This scheme is constructed by Stichting Milieukeur. Stichting Milieukeur holds more of these certificates like, Milieukeur (Environmental yardstick), EU Ecolabel and Groen Label Kas (Yardstick greenhouses). A barn certified with the MDV is characterized by a lower environmental impact and considers animal health and –welfare. This should contribute to making livestock husbandry more sustainable.



Figure 7.13: MDV: Yardstick Sustainable Husbandry

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The Dutch government already set up demands for emissions, welfare and integration in the landscape. The MDV takes it a step further. Most actions are extra legal and thus help the husbandry sector getting more sustainable.

The basic requirements can be split up the following categories:

- Emission of ammonia
- Animal welfare
- Animal health
- Energy
- Particulate matter
- Farm and environment

Within each theme, a certain amount of points can be scored.

Also, a minimum amount of points per theme is set. By gathering the minimum amount of points, the barn can be certified as a MDV-barn. The size of the farm plays a role in the scoring. Farms smaller than 350 NGE (Nederlandse Grootte-Eenheid: Dutch Size Unit) are allowed to score less points than farms between 350 and 700 NGE of larger than 700 NGE. So: The bigger the barn, the higher the ambition level.

At the moment, there are certification scheme available for several kinds of livestock: Poultry, rabbits, dairy cows, pigs, dairy goats, veal and beef cattle.

There are tax benefits linked to the MDV. Stichting Milieukeur hopes this way more farmers are prepared to build a barn that meets the requirements of the MDV. There are two benefits: 'Milieu Investerings Aftrek' (MIA) and 'Willekeurige Afschrijving Milieuinvesteringen' (Vamil). For dairy farms, 'Regeling Groenprojecten' can be added to the previous two benefits when meeting even higher standards (Stichting Milieukeur, 2012).

The landscape architect is involved in the theme 'Farm and Environment'. If a farmer chooses to involve a landscape architect, he automatically gets his 50 points. This can be seen as a good

development because the landscape architect should be the one with the most knowledge of the landscape and all processes present. However, there are some downsides. The theme 'Farm and Environment' consists of a clear checklist, considering the following aspects:

- Geographical situation
- Characteristics of planting (structures and species)
- Characteristics of the regional identity
- The meaning and history of the considered farm
- Genesis of the surrounding landscape
- Characteristic spatial patterns and structures in the landscape
- Natural values around the farm
- Spatial structure of the farmyard

If every point is covered in a report and a nice design is made, the plan is good enough. The certification organizations do not pay attention to the content and the quality of the design. They just use the checklist and if everything is present, the barn has scored enough point for 'Farm and Environment' (Docters van Leeuwen, 2012). They completely trust on the expertise of the landscape architect. As mentioned before, more parties have influence on the design. Thus, also in this case, the design probably will not be the best outcome for the landscape.

The MDV is the most important and most influential extra legal body when looking at this research. It involves a separate theme considering landscape. From the beginning, the landscape is taken into account. In the extra legal solutions mentioned next, there is no separate landscape-theme, but these developments do have their outcome on the landscape. In the MDV, the impact on the landscape is consciously. The other extra legal solutions are not as aware of their impact as the MDV.

### IDS (SBIR)

Integraal duurzame stallen (Integral sustainable barns) is a subsidy program of the Dutch government. Farmers who want to build an

innovative stable can request this subsidy. In a project proposal, the farmer can show how he wants to achieve this. The focal point is animal welfare. Next to this, environment, animal health and working conditions are important (van der Peet et al., 2013). These farms automatically fit better in the landscape (Agentschap NL, 2010). If the last statement really is the case in practice can be questioned.

#### Milieukeur

Milieukeur-barns are certified on the basis of environment, animal welfare and forage. A yardstick is made, similar to the MDV. The barn has to score a minimum amount of points in every theme. In addition, the system has to measure up to the existing laws and rules of the standard quality system in the sector. An example is IKB, a certification for dairy-, poultry- and pig farms, checking forage, welfare, use of medicines, food safety, environment, hygiene and traceability (Productstchap Vee en Vlees, 2012).

#### Proefstal

'Proefstallen' are barns that meet high requirements regarding emission of ammonia. These regulations are drawn from the 'Wet Ammoniak en Veehouderij' (Kenniscentrum InfoMil, 2013). A new system should be integrated in the barn to lower the emissions. The farmer can request MIA and Vamil, the same tax benefits a MDV-barn can get.

#### SKAL

'Stichting SKAL' monitors organic farms in the Netherlands. SKAL makes sure the farmers meet the requirements for 'being' an organic farm (figure 7.14). There are strict rules for organic farming; therefore the barns of an organic farm are assumed to meet a higher standard than the law prescribes (Stichting SKAL, 2013, van der Peet et al., 2013).



Figure 7.14: Eco labels

It is assumed barns with an extra legal certification are favorable in the landscape (van der Wielen, 2010). However, the outcome can be discussed. Milieukeur, proefstallen, IDS and SKAL do not give direct guidelines considering landscape and landscape integration should be present automatically when building such a sustainable stable. Only the MDV gives guidelines, but there is no substantive supervision; if the checklist is complete, the design is approved without looking at it. The intention is good, but the outcome may lack in practice.

## 4.2. Future Solutions

### a. Scientific solutions

This whole research is surrounded by literature from other research fields. This was already mentioned in the context. From animal sciences, the behavioral- and health aspect arises. Environmental sciences focus more on the environmental effects of agriculture. The landscape architect tries to bring all involved parties together by analysis and design.

Within landscape architecture, research is done on how to intertwine new agricultural developments in the landscape. This is done from a social perspective, environmental perspective and, as extra addition, aesthetical perspective. This splits in two parts: a theoretical part and a design part.

A part of the research focuses on the theoretical part of



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agricultural landscape. This involves research considering appreciation, effects on the landscape et cetera. The design part takes it to a higher level and processes the conclusions from the theoretical part into a design. Examples are design ateliers organized by scientific organizations like Alterra (de Jong et al., 2009).

The outcome of both the theoretical and design research are taken into account when making new rules and laws. Scientific solutions thus mostly generate knowledge about landscape architecture and the agricultural landscape, which can inspire governmental bodies to translate it to legal and extra legal solutions.



8.

Problem in Case



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*Up until now, the problem was stated very general. Now, the focus will be more on what can be seen and noticed in the field. The case chosen will serve as example. The four categories of the 'problem in theory' will be looked at closer.*

## 1. Connection Landscape – farm

In the previous chapter, it was stated that the relationship between farm and landscape reduced (Renting and van der Ploeg, 2001). All sorts of developments caused a footloose growth and establishing of farms. The connection between subsurface and farm location and –appearance is not there anymore. What is visible of this when looking at the chosen case? To investigate this, old and new maps are used and compared. These maps show the changes in the landscape, from connected farming to footloose farming. The case consists of four different areas: Meadows, Fields, Swamps and Ridge. Three of these regions will be looked at more in detail, compared to old situations and to each other with the help of the four-relations approach of Hendriks and Stobbelaar (2003), already introduced in the theoretical frame.

### The Meadows

The Meadows had an own characteristic: a meandering brook, wet fields along the stream and a strip of farms on a parallel sandy ridge. Farmers established their farms on the higher, dryer parts and used the lower lying parcels as grazing and –hay fields. The lowest part, near the stream, was often too wet to use and suffered from floods. Therefore, a swamp forest could be found there. A lot of small ditches were dug to drain the plots. To be able to reach all the plots, lots of small roads were made.

The example of the 'Potstal'–system can be found here. The grazing plots along the stream, the farms on higher grounds and on the other side of the ridge, the heath fields (the Fields). In this area the farming system was completely adapted to the landscape. The other way around, farming influenced the landscape, including the numerous ditches, the small roads in the valley and the strip of

farms.

Figure 8.2 shows how the old situation relates to the new situation. The most notable elements are the straightened stream, the emptiness in the valley, the larger plots and the big farms. The visual landscape is no longer reflecting the subsurface (figure 8.3). The plots along the stream are the same size as the plots along the road. They are well drained, so no sign of the present stream can be found. The swamp forest in the valley is taken away, so the water can be drained faster. These green elements used to indicate the presence of the Aa and its stream valley, which now is no longer present. The legibility of the landscape thus has decreased.

The old relation between ridge and stream valley still mostly determines the current lines in the landscape. The old road and the linear arrangement of buildings are still present. The plot structures are based on the old structures, but are now much larger scaled (figure 8.1).

The only impact of the seasons is emptiness during winter, the upcoming grass in spring and the maize fields in summer (figure 8.4). There thus is some difference in enclosure, but because of the decreased amount of planting and ditches (and thus ditch vegetation), the variety over the seasons is not what it used to be.

Figure 8.5 and 8.7 show the old and the new map of this area. This map confirms what can be seen in the four relations of Hendriks and Stobbelaar (2003).

### The Swamps

The Swamps are a much younger landscape than the Meadows. The river Meuse deposited a thick layer of clay. The Swamps was a very wet area and therefore hardly habitable. In summer, when the soil was better drained, farmers and other workers were haying the fields and cows were grazing on the plots. Each winter the

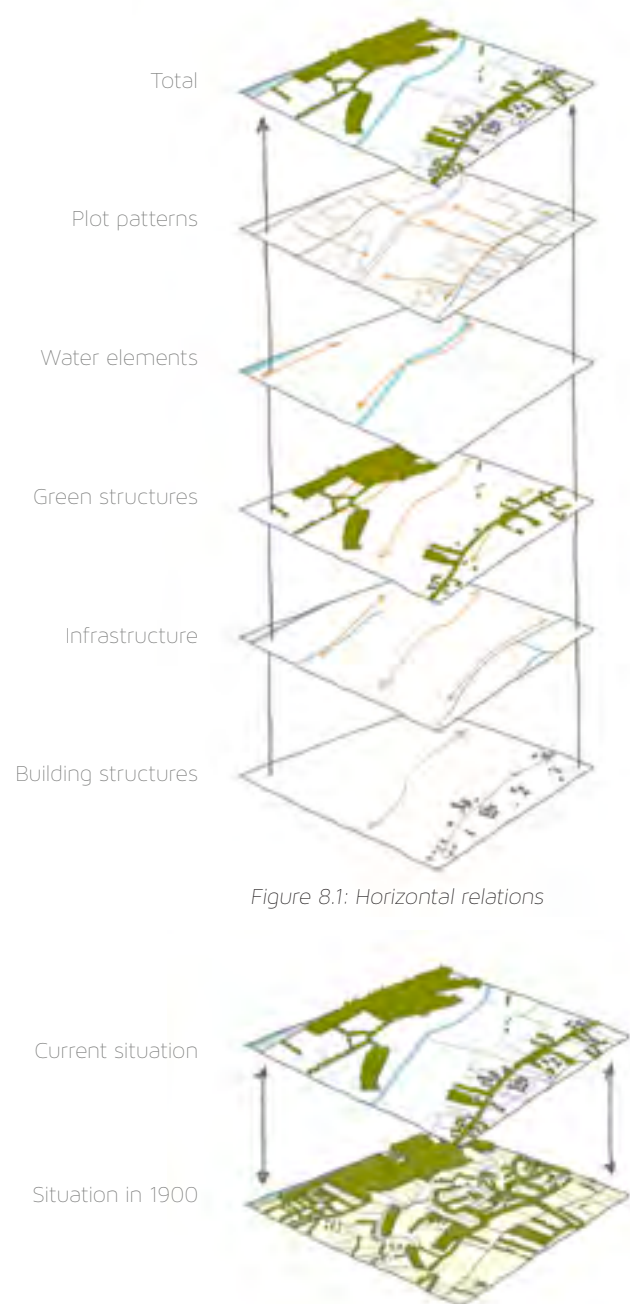


Figure 8.2: Historical relations

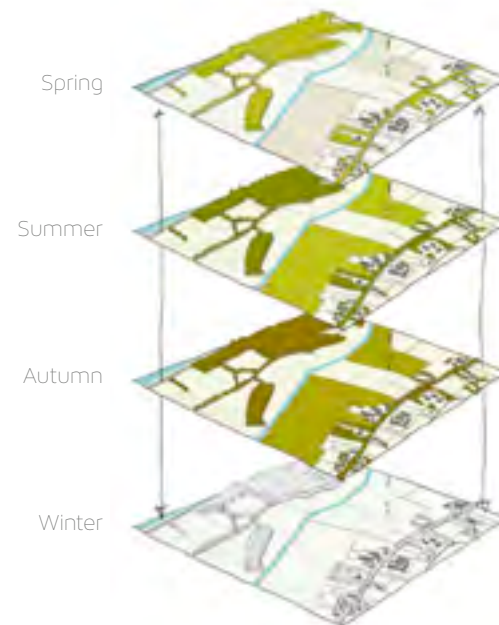
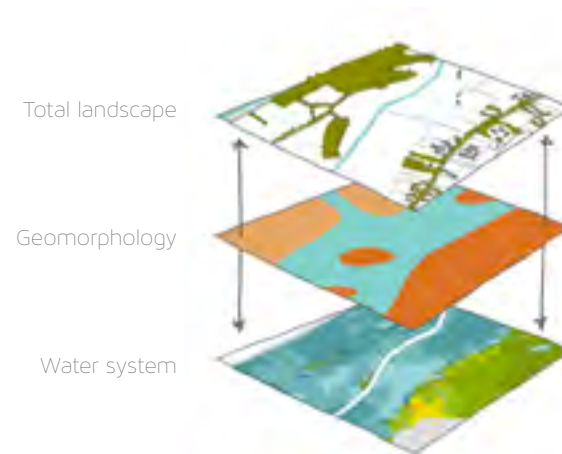


Figure 8.4: Seasonal relations

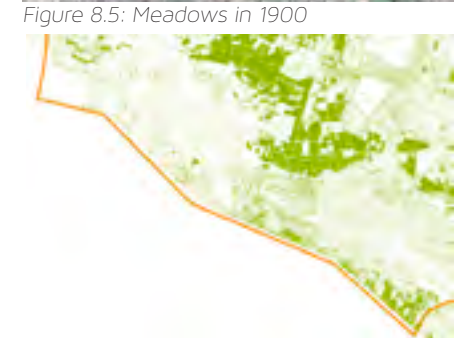
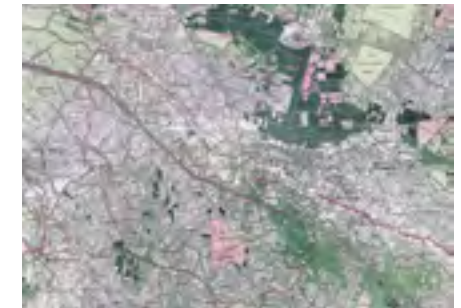


Figure 8.8: Meadows green nowadays

polder flooded, as part of the Beersche Overlaat. The Beersche Overlaat is the flood zone of this part of the Meuse. There were no trees at all in this area, in order to improve the waterflow. After the normalization of the Meuse and the closure of the Beersche Overlaat in 1942, the polder could be used year round. Farms were relocated from small villages to the Swamps, providing them space to develop. This happened in during the Ruilverkaveling (Centrale Cultuurtechnische Commissie, 1973). This was the first occupation of the Swamps. The farms located here are based on the technological approach and the makeability of the landscape and were not depending on the subsurface.

Figure 8.10 shows the relationship between the old and new situation. The vegetation stands out. In contrast to the Meadows, planting is added instead of taken away. First, the decoys were the only planted areas in the Swamps; the rows of trees guiding the road and the clear clusters around the farms are added later (also shown in figure 8.17). The discharge was improved and the machines got bigger, which resulted in merging plots to larger parcels.

Men to large extent influenced the landscape of the Swamps. It used to be impassible and wet. Over time, ditches were dug and the area got pumped. The landscape got filled up more with farms and planting, while it was empty before. The legibility thus decreases. The subsurface remained clay, but was dryer than before. There still is some openness left, but it is not as open as it used to be (figure 8.12).

The current structures are shown in figure 8.9. The longitudinal direction of the parcels is based on the old structures. The only elements that really stand out are the green clusters in the open field.

There is a small difference in seasons, also looking to its history. Back in the days, the openness occurred in all seasons. Only the flooding during the winter was a remarkable thing. Nowadays,

some parts of the Swamps are still too wet for cultivating crops. In summer, some maize and the green of the decoys and road planting form the image of the landscape (figure 8.13).

### The Fields

To both the Swamps and the Fields applies the same thing: they are both young landscapes, where farmers are present since halfway last century. A technological approach thus is adopted. The Fields consisted mostly of 'rough' fields. When artificial fertilizer and drainage was discovered, it became easier to reclaim this heath area. The heath pastures of the Fields provided sods for in the barns in the Meadow-area. The mutual relationship was still important back then. Also here, the occupation started to rise faster during the Ruilverkaveling.

In figure 8.19 the relation between the old and the new situation can be seen. The forest that was there before now is used as agricultural land. The heath is divided in small plots, later guiding the reclamation on larger scale, defining the current edges of the parcels. The new farms are large scale, not depending on the poor subsurface (figure 8.20). This shows the legibility of the landscape has decreased.

The current structures can be seen in figure 8.18. The most important patterns are the reclamation axes, still serving as roads. Along these axes, farms were built. The current green is found along the edges of the plots and roads, forming large chambers in the landscape.

In the Fields, a lot of crops are cultivated, influencing the image during the seasons. Trees and shrubs decreased in amount, so these have less influence on the image than it used to have. During the winter, the Fields are empty, only rows of trees without leaves form the landscape (figure 8.21).

### The whole case



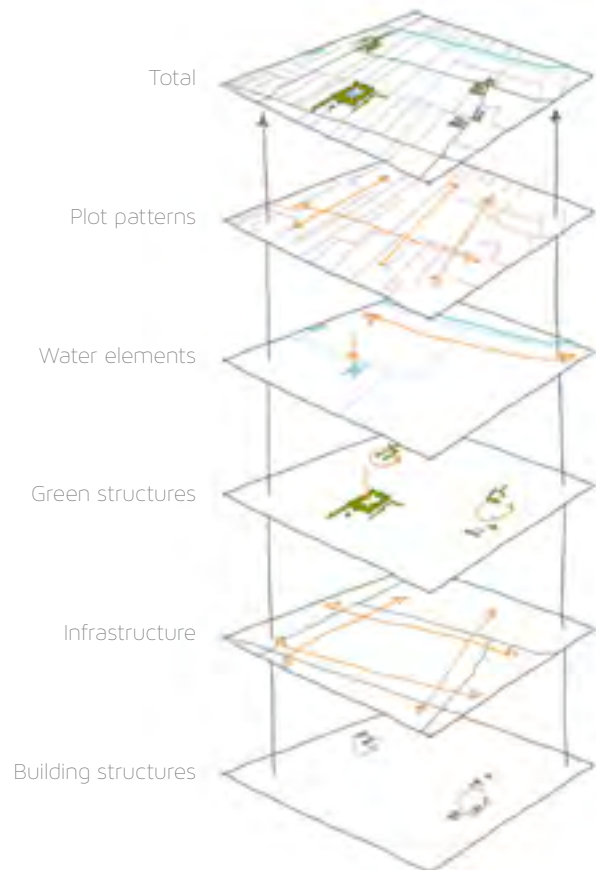


Figure 8.9: Horizontal relations

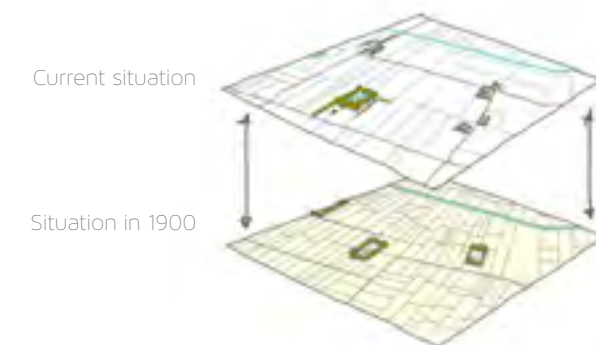


Figure 8.10: Historical relations

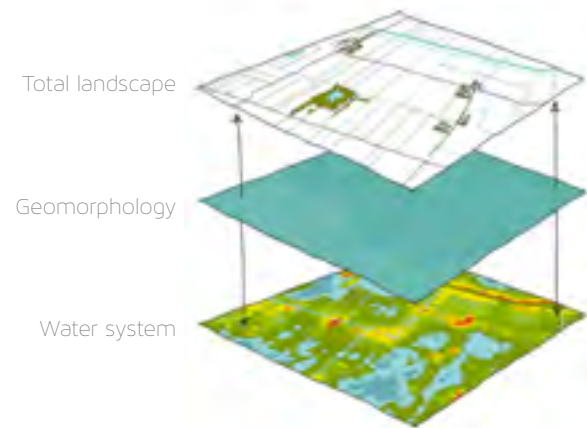


Figure 8.12: Vertical relations

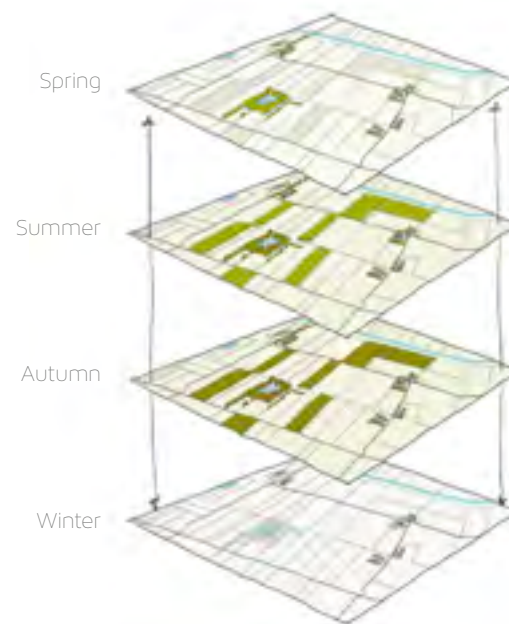


Figure 8.13: Seasonal relations



Figure 8.14: Swamps in 1900



Figure 8.15: Swamps green in 1900

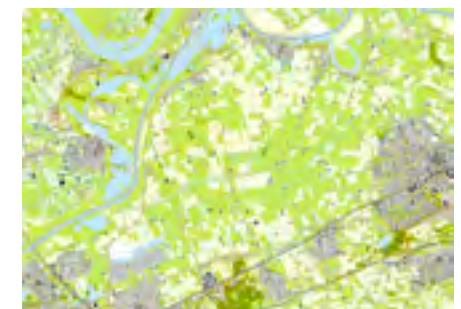


Figure 8.16: Swamps nowadays



Figure 8.17: Swamps green nowadays

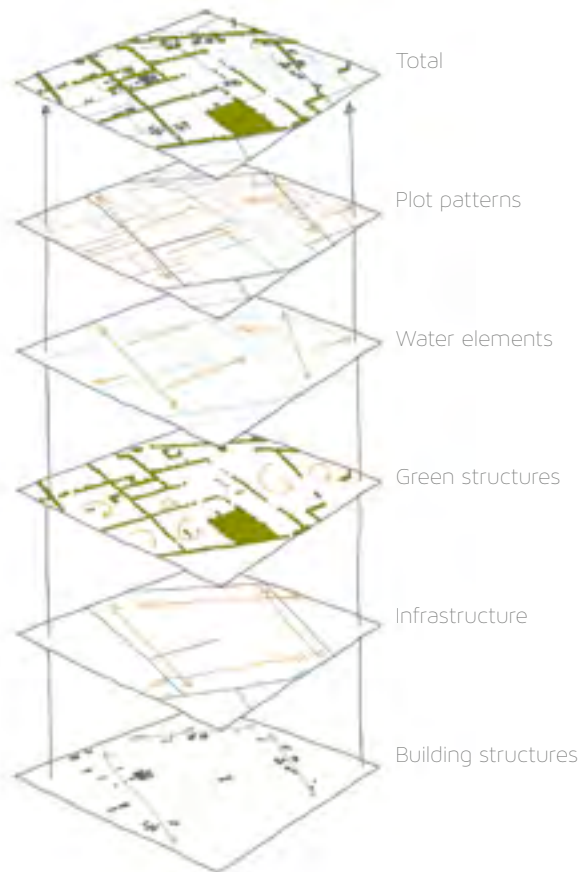


Figure 8.18: Horizontal relations

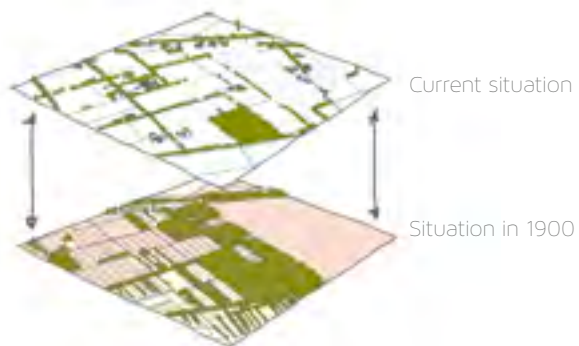


Figure 8.19: Historical relations

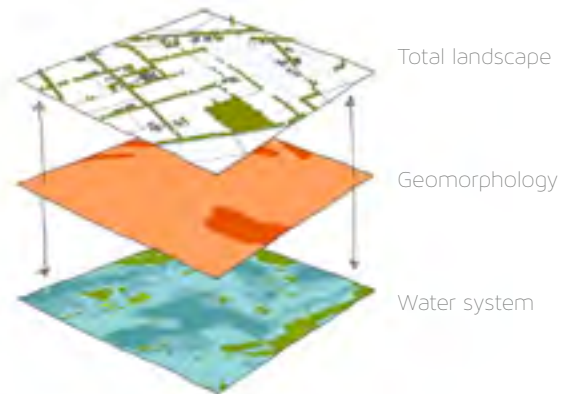


Figure 8.20: Vertical relations

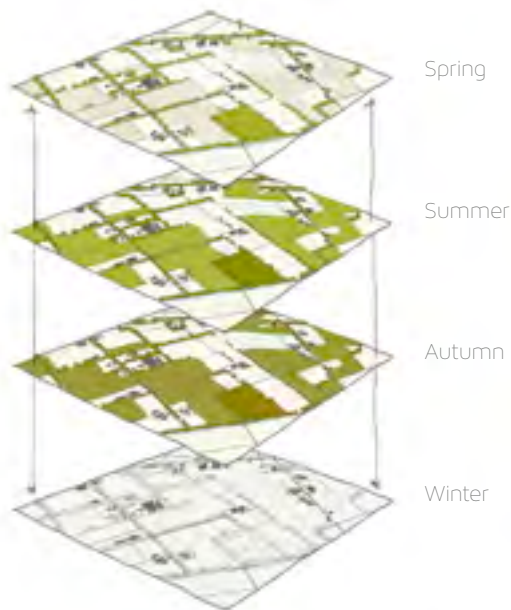


Figure 8.21: Seasonal relations



Figure 8.22: Fields in 1900



Figure 8.23: Fields green in 1900



Figure 8.24: Fields nowadays



Figure 8.25: Fields green nowadays





Figure 8.26: Green 1900



Figure 8.27 Green now



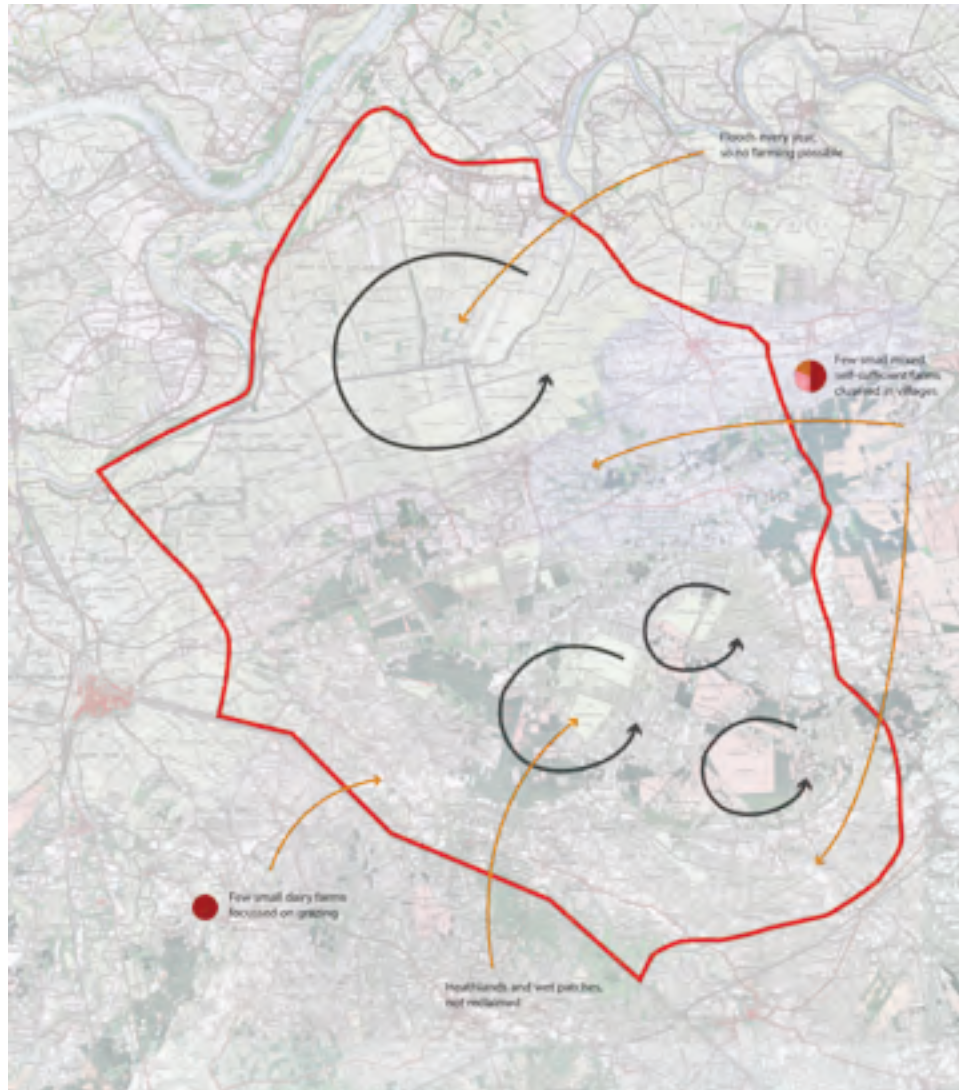


Figure 8.28: Farms 1900

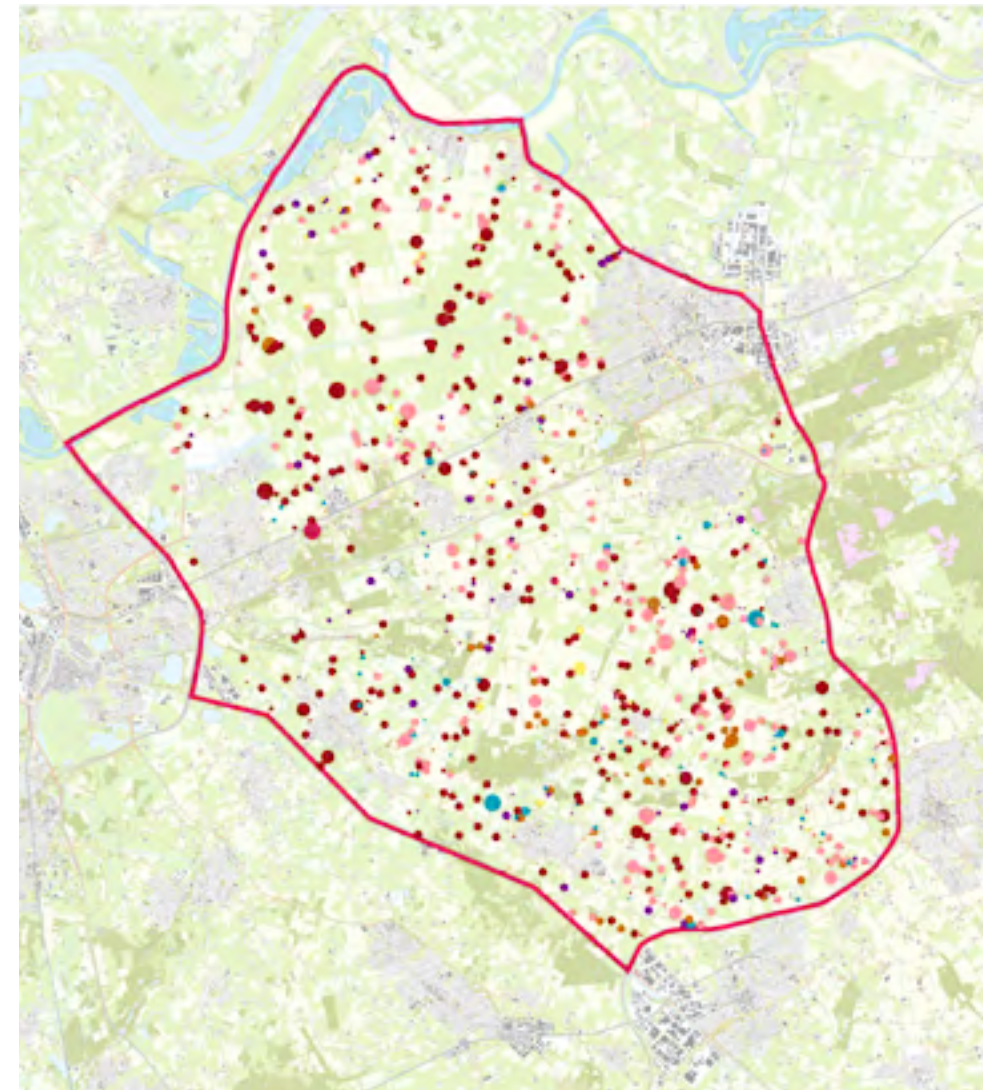


Figure 8.29: Farms now



Figure 8.30: Potential recreants

Now, the three separate regions are looked at. Within these regions, landscape types are less clear, which decreases the legibility. When looking at the larger scale, the whole case, the same can be seen. The contrast between the different landscape types is smaller than in used to be. This decreases the legibility and diversity of the landscape, which makes is less attractive to visit and recreate in. The same can be seen in the farm map. In 1900, farms were much more diverse. The Meadows were characterized by small dairy farms. The ridge consisted of small scale mixed farms. The newer landscapes, the Fields and Swamps

were still empty and did not contain any farms. The current farm map shows that all types of farms are everywhere. The same conclusion can be made: The diversity and legibility of the case area decrease.

### The ridge

From the green maps (figure 8.26 and 8.27) it can be seen that the ridge still has some small scale elements. From the farm maps (figure 8.28 and 8.29) can be seen that only a few farms are left in this area. Therefore, it is decided to not take the ridge in account anymore.

## 2. Social perspective

In the theoretical part of the problem, it was already set out that recreation gains importance. More people live in the cities and thus more people want to get out in the weekend to get their rest. The agricultural landscape is a loved place to go to whenever people recreate. In and around the chosen case, several cities are present that should be taken into account (figure 8.30).

The effects of wishes of the people in this case, both as consumer and citizen, can be seen in the development of the farms within the area. Large industrial stables arise in the Swamps and the Fields. Smaller scale farms, focusing on organic production hardly occur in the whole region (SKAL, 2012). Farms with secondary activities, such as nature conservation and a farm shop, can be found mostly on small to average farms. The larger farms are more focused on just farming (CBS, 2004). At the moment thus, farming adapts itself to the wishes of the consumers in the case.

## 3. Farmers perspective

From farmer's perspective, the focus is concentrated on reducing costs and generating higher profits. This leads to the technical





Figure 8.31: Pig farm in the Swamps



Figure 8.32: Poultry farm in the Fields



Figure 8.33: Dairy farm in the Meadows

approach, already mentioned in the theoretical part. But what can be seen in the field of this theoretical approach?

The answer is quite simple: no or less variation. Almost every barn looks the same: Red-brownish bricks and green sheet piling forming the walls and gray corrugated iron as roof construction. Depending on the kind of animal inside, small details differ. A dairy stable is more open most of the times. More intensive animal farms have closed barn, not giving away what is inside. The type of barn does not differ per landscape anymore; the same 'catalog' stables are implemented in all different landscape types (figure 8.31 – 8.33).

All stables seem the same to a layman. Diversity is not present anymore. The legibility of the landscape thus lowers and the sense of locality disappears. This all leads to a less attractive landscape.

#### 4. Current approach

To take a closer look to the current approach, two streets, almost connected to each other, have been chosen as an example. These streets are called the Grolderseweg and the Venhofstraat and are situated in the Field-area. Along this street, only farms or former farms are situated. The farms are young: almost all of them were built after 1970. Some buildings are older. They were the first reclamation pioneers.

In 1973, the first report for the land consolidation for this area was presented. 't Grolder, which was heathland, was designated as a new location for farms that had to leave the villages (Centrale Cultuurtechnische Commissie, 1973). The new farm plots were integrated in the existing structures, using the present roads and preserving a part of the green structures. Planting that was seen as detrimental at that time was removed. Plots were enlarged and ditches were moved or removed. The landscape plan of the consolidation included new planting, for example windbreaks,



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roadside greenery and planting on farmyards. This would make sure the landscape would be coherent (Centrale Cultuurtechnische Commissie, 1973).

All in all, the land consolidation had huge effects on the appearance of the Fields and still influences the way the Fields look nowadays: a large-scale intensive farming area. In 2005, the Reconstruction law was introduced, in response to the swine fever in 1997. What first would be a law only focusing on pig farming, eventually became a reconstruction of the whole agricultural landscape in 5 provinces, including Noord-Brabant. A new division was made and the landscape was split up in three zones: Agricultural development areas (LOG), Extensification areas and Interweaving areas. The LOG's were the areas where large-scale farming should be concentrated. In the extensification areas, no new farms or expansions are allowed. The interweaving areas do allow some expansion, but under strict conditions (Bruil and de Laat, 2003). 't Grolder is one of those LOG's.

The agricultural landscape in the Fields was assigned for change. More nature in extensive areas, more farms in the LOG's. In practice, the change was that impressive, not only in the Fields, but in all Reconstruction-areas (Bleumink, 2007). In 't Grolder, no new farms are established and all structures dating from the Ruilverkavelings-period are still determining the appearance of the landscape (Lola Landschapsarchitecten, 2010). Some farms did expand quickly, but this also is a result of lower prices and higher demands.

These new expansions can be seen of an example of the current approach towards landscape in livestock husbandry. When taking a look to the pictures, almost all farms have a new stable. All of them meet legal solutions. The municipality in which 't Grolder is located has no visual quality plan, so no clear demands considering landscape are made. Though, most of the new expansions are meeting the requirements of one or more extra legal solutions.



Figure 8.34: Photographed farming street

Each farm along the Grolderseweg and Venhofstraat is photographed, 100 meters from the edge of the farm yard (figure 8.34). This way the farms can be compared in, for example, character and size. It helps giving an image of the current developments and the effect on the landscape.

When taking a look at figure 8.39, a new barn can be seen. This barn was added to the farm in 2010. A proposal for building this sustainable barn was sent to Dienst Regelingen, an organization that processes and judges the applications for subsidies in agriculture. The proposal was considered innovative and sustainable and thus IDS subsidy was assigned to the farmer. He also incorporated a special floor in the stable, making it possible to become a 'Proefstal' (test stable). A 'proefstal' pays extra attention to ammonia losses (Agrabeton, 2008). The floor in the new barn will lower the emission. It was almost logical to also apply for a MDV-certificate. The barn probably will meet all the extra standards for the MDV-certificate, though the real certification has not taken place yet.

When looking at figure 8.39, a new dairy cubicle barn can be seen. It looks modern and is shaped to increase animal health and -welfare and to minimize emission. However, the surrounding

farm yard consists mostly of concrete. The signs of an executed landscape plan are hard to find here. This can be found in more situations, so the use of the landscape plan in the MDV can be questioned. In this instance, the landscape seems hardly seems to be considered.

What are more influences on the landscape of these kinds of barns, meeting all sorts of extra legal demands? The photographs of the barns can help to see what is happening in the field.

Most of the newer barns are bigger than the old ones. This way more animals can be kept. This is a result of intensification of the sector. On the other hand, the increase of size can also be seen as more animal friendly. Often, only a small increase in found in the amount of animals. The livestock thus has more space. Barns get higher to enhance air circulation (Wemmenhove et al., 2009) or to make a large extraction channel for air purification

(Schulz et al., 2013). Material does not seem to differ, when looking at the pictures. The same 'catalog' barns are applied now, maybe even more. Most of the effort is put in animal welfare and lowering emission, which makes the whole barn more expensive. Less money will be available for a good design with sustainable material, so standard material will be used.

Landscape is in this LOG area clearly not the main priority. There is no visual quality plan and no obligated landscape design when building a new stable. The MDV does ask for a landscape plan, but this was only introduced in 2011, right after the barn from the example was built. It will take some time before MDV landscape plans will be visible in the landscape.

When looking at the whole street, some conclusions can be made, regarding landscape. These conclusions are visualized in figure 8.49. These will be the guidelines for the eventual design.



Figure 8.35: Ratio between roof and walls



Figure 8.36: Ratio between roof and walls and silos in front of the barn



Figure 8.37: Long stretched barns



Figure 8.38: The whole stable is hidden and silos are in front of the barn



Figure 8.39: Direction of the barns are not coherent and not related to the direction of the road and there is a lot of concrete around the barn despite its certificates



Figure 8.40: The stable is hidden





Figure 8.41: Stable is hidden



Figure 8.42: Relation between old and new buildings (new buildings are visible only a small part)



Figure 8.43: Relation between old and new buildings and no living area present



Figure 8.44: Living area does not have an entry function for the farm yard



Figure 8.45: Looks like an industrial complex



Figure 8.46: Very light materials are used for the roof and no living area present



Figure 8.47: Silo present in the front living area



Figure 8.48: Whole farm is hidden

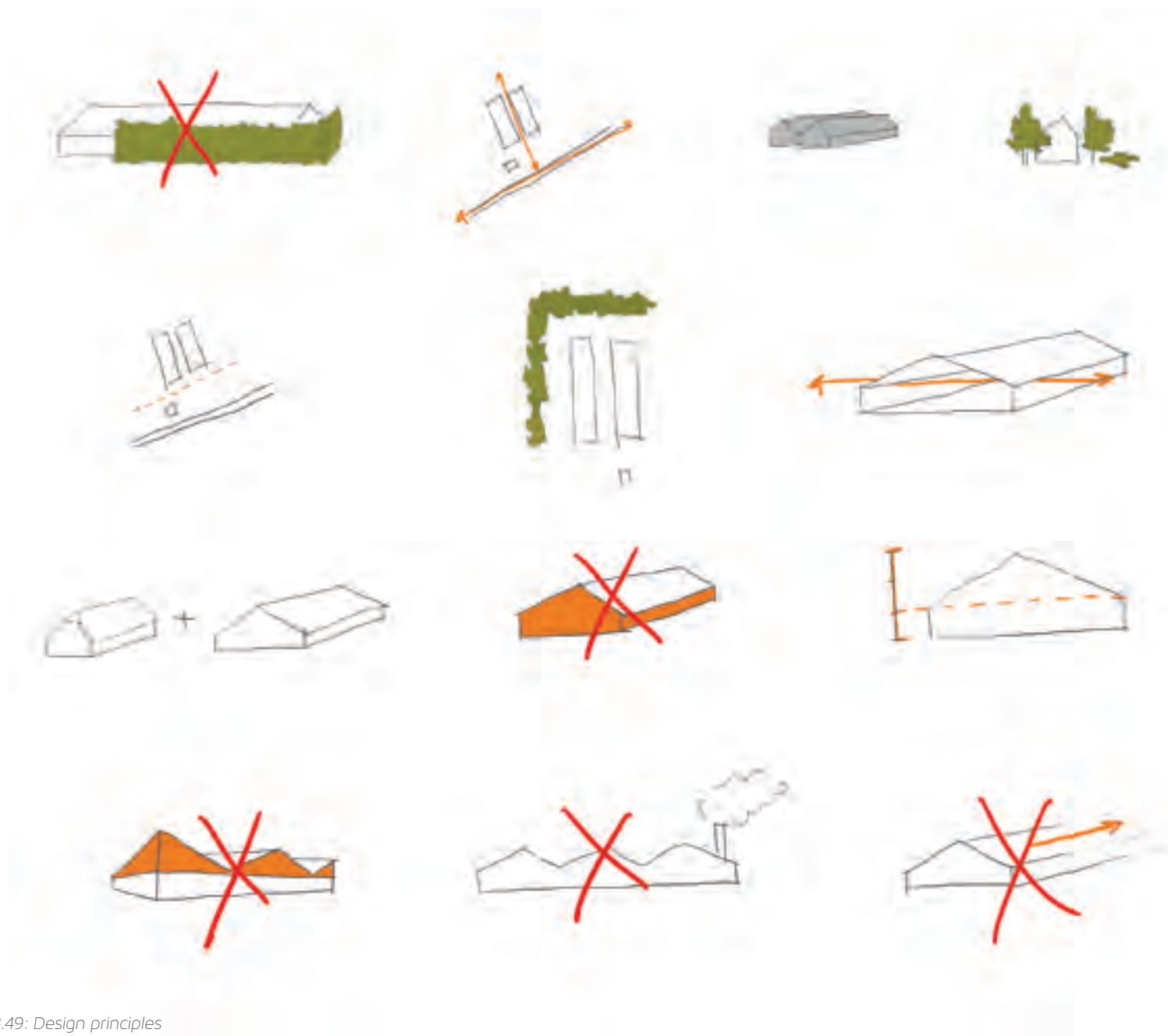


Figure 8.49: Design principles



9.

New vision

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*The New Vision has its basis in the Dream Vision. The Dream Vision was an intuitive way to find out what I thought was important for the sector. The New Vision takes the problem statement and the whole research into account and thus is an underpinned vision to use in the design.*

The New Vision focuses on the influences of farm on landscape and the other way around. As can be concluded from the whole research, the influence of farm on landscape is large at the moment. The landscape in contrary does not have much influence

on the farms. This decreases the legibility of the landscape and orientation within the landscape. To make sure this landscape is legible again, the farms should represent the landscape type they are in. This is the simple statement of the new vision: Reconnection farm and landscape (figure 9.1).

This new vision will be used when making the design. It has its funding in the research and tries to take in account the dreams from the first vision.

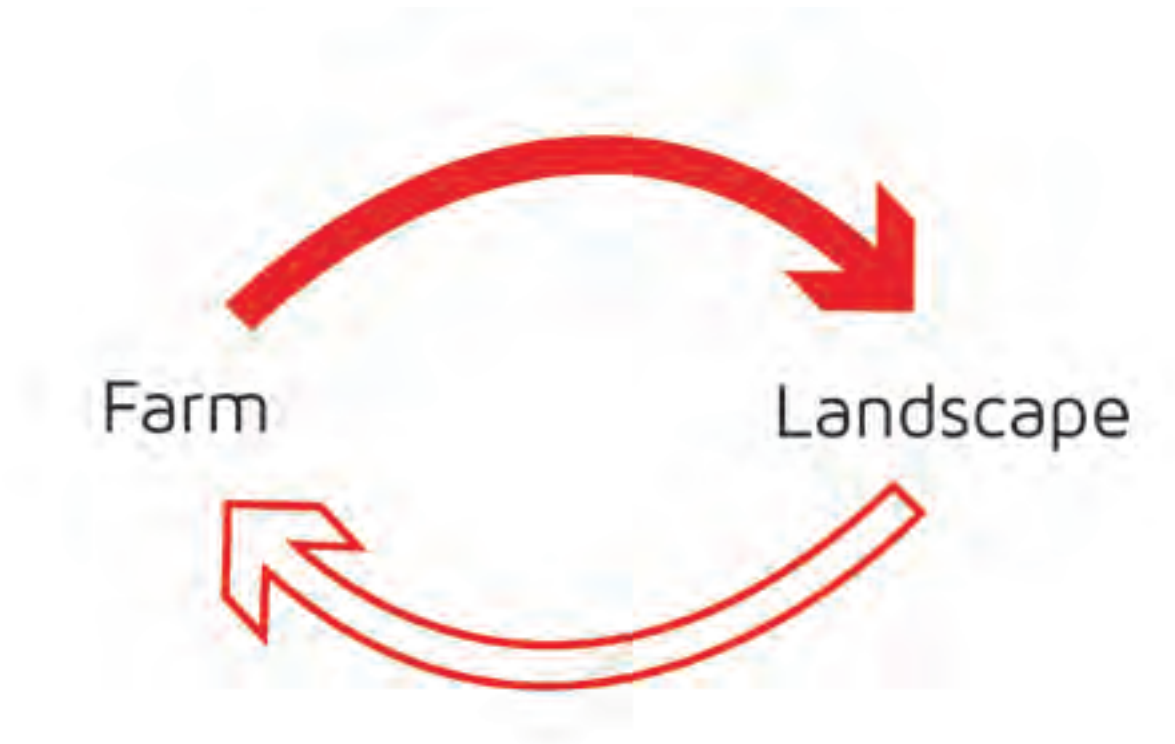


Figure 9.1: The restored connection between farm and landscape



A photograph of a person standing in a cornfield at sunset. The person's arms are raised; the right hand holds a black smartphone, and the left hand is open with fingers spread. The corn plants are in the foreground, and a line of trees is visible in the background under a warm, orange-hued sky. A red banner is overlaid at the bottom.

Design and envisioning







10.

Concept

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*The case consists of, as mentioned earlier on, several parts, distinguishable on the basis of factual properties: the geomorphological characteristics, soil, landscape types and historical development. These parts of the landscape have guided pointing out different area's within the concept and helped forming to the whole concept.*

When looking at the geomorphological map, there are several area's distinguishable: a lower-lying clay area south, near the Meuse, a higher sandy ridge in the middle, a lower sandy area in the south and a brook valley between 's Hertogenbosch and Veghel (figure 10.1).

These areas can also vaguely be seen in the farm-map (figure 10.2). The clay area and brook valley mostly have large dairy farms. The lower sandy area contains more intensive farming. The higher ridge has some farms left, but most of them already suffered from the intensification and were forced to stop. These facts are guiding for making the concept.

In the concept, two types of areas are distinguished: locations for intensive farming and locations for extensive farming (figure 10.3). The smaller extensive areas are buffering the larger intensive areas. The exact use of this locations will be filled in later, depending on local characteristics and wishes of both farmer and landscape. This distinction and buffering will be guiding the design as a framework.

The intensive locations are focussed on large scale production, while also considering animal health and welfare, social wishes and interaction of farming with the landscape. Large scale animal production is required, because of a growing population and food demand. The Dutch high standards and approach within this design ensure that large scale production does not mean animal-unfriendly and landscape polluting production. The production should be transparent and farms should be visitable, but a severe distance from living areas is logical, considering transport and possible odour. The strength of these areas are their efficiency and revenues without losing focus on the context the farm has to

produce within. The landscape gets its chance to have its influence on the farms. The landscape system and the new farming system will be in equilibrium and hopefully form one system.

The extensive areas are a nice contradiction to the intensive locations. They make sure intensive areas do not merge and become one large production landscape. They should contain new farming systems that enhance small scale farming, while still giving the farmers a chance to have a viable farm. The focus on social wishes and animal health and welfare will also be important here. The production though, will be smaller, but more specific and unique. The landscape will have its influence, but the farm has its chance to talk back, so here also an equilibrium will be reached.

The locations chosen for the extensive and intensive areas are based on historical and current characteristics. The 'new' landscapes lend themselves the most for intensive farming. The 'new' landscapes are the lower-lying clay areas and the young heath reclamations on the sand planes and were taken in use especially for farming. They have a large scale character. The brook valley and the sand ridge are older landscapes and thus have a finer grain and a smaller scale character. However this has changed over time to a larger scale, there are some remainings left, indicating this is a different type of landscape. The 'old' landscapes thus lend themselves for more extensive farming.

The diversity in agricultural landscapes has declined, as mentioned before. Diversity enhances appreciation of the landscape. Getting this coherence and diversity back, and thus the connection between subsurface (landscape) and farming, is the main goal. Making a division between these different types of extensive and intensive areas will help creating a new diversity and an appreciated landscape.



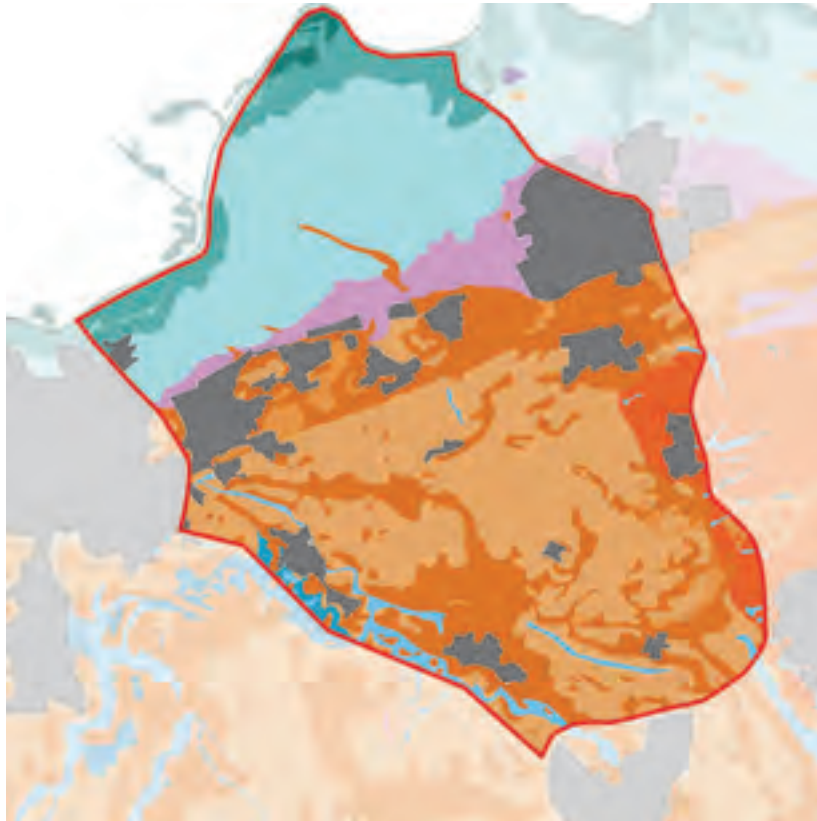


Figure 10.1: Geomorphological map of the case

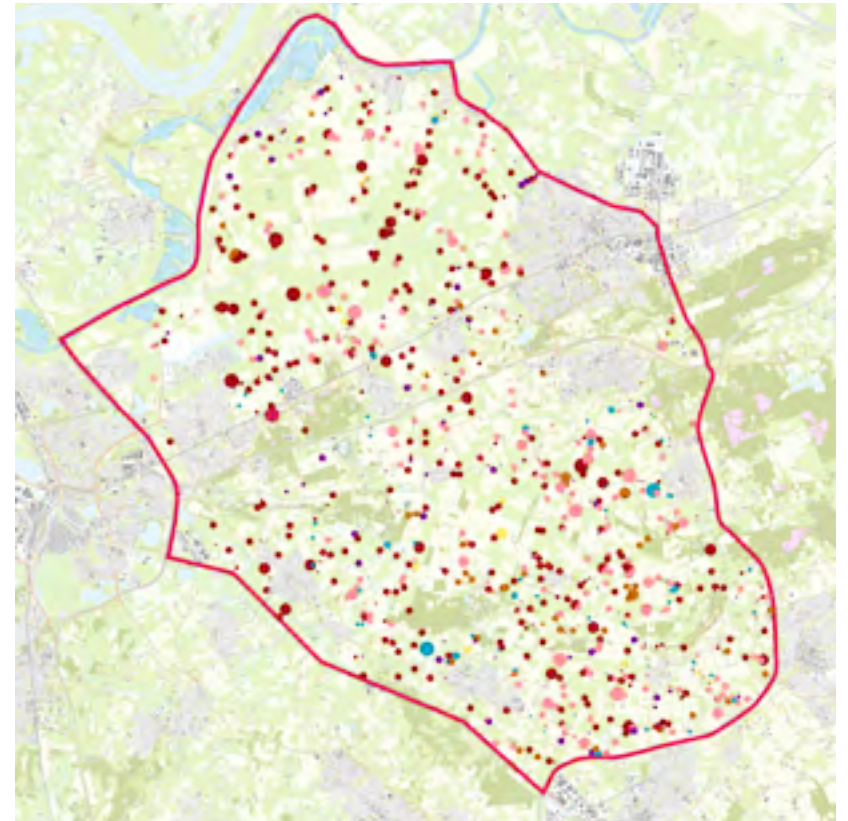


Figure 10.2: Farms now



Figure 10.3: Concept



11.

Design



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*The design will build further on the basics of the concept. Each area is researched closer, looking at specific characteristics, old stories, history and small elements in the landscape. These characteristics will be used in making models. The models will be based on the bubbles of the agricultural landscape system scheme. While experimenting with the bubbles, new ideas come up. These ideas are tested and evaluated. Eventually, the model that tells the story of the landscape the best, is worked out further. Designs are made, details are drawn and the whole will be visualized. In the end, the connection between farm and landscape will be re-established.*

## 1. The design approach

The problem in the whole area is the disappeared mutual influence of farm and landscape. The importance of restoring this relationship also has been set out: When the farm does not represent the landscape anymore, the landscape becomes a big blur. Everything will appear the same, while the landscape originally tells something different. The legibility decreases and this also influences the appreciation of this landscape negatively. The new vision sets out the new goal: reconnecting farm and landscape. A systems approach will be used.

The Swamps, Meadows and Fields are looked at more closely. The history and character of the place will be investigated. The bubbles-system is used to point out what the current agricultural landscape looks like, what the characteristics of the landscape system are and which elements give form to the animal production system. The layer approach of Hendriks and Stobbelaar in chapter 7 already pointed the decreased legibility of each landscape type out.

The ridge has not been researched more in depth. In the 'Problem in case' chapter was seen that not many farmers are left. The area already is quite extensive and the farms already represent the landscape, therefore no design for this area will be presented in

this report.

Models are made to make the reconnection. The bubbles of the agricultural landscape system are used to experiment with possibilities. The possibilities are measured with the Hendriks and Stobbelaars layer approach to look for the best options. Models can be suitable just by themselves or can be merged to make an ideal solution.

Eventually, the best model is projected on the landscape, consisting of different types of elements, together forming the new agricultural system. Both landscape system and animal production system will be taken in account, to make a balance between the two. The projection of the model on the landscape of course is not one-way traffic. New things encountered in the landscape are not denied, but are incorporated in the model again. Designing on different scale levels also helps making a suitable system.

The result is a new composed landscape system, a new animal production system and together they form a new agricultural landscape system. Within this new agricultural landscape system, the farm tells the story of the landscape and the landscape supports the farm. The whole landscape is legible and appreciated.



Figure 11.1: A "Maaskantse Hut"



Figure 11.2: The old polder



Figure 11.3: The "Ooijense Hut"



Figure 11.4: The Hertogswetering



Figure 11.5: Inside a duck decoy



Figure 11.6: The Hertogswetering and openness

## 2. Swamps

The Swamps are a clay area, resulting from fluvial deposits of the Meuse. Every year in winter, this area flooded, and this extra arm of the Meuse was called the Beersche Maas. In the 14th century, a stream was dug in a (then) dry bed of the Beersche Maas. This stream was called the Hertogswetering (Buijks, 2011). This stream was used to drain the Swamps. Centuries long, this area had the same appearance. It was wide and open, the church towers of every small town visible, even from the middle of the area. No planting was allowed; the Beersche Maas should be able to stream without encountering obstacles. In the winter, the area thus was not accessible at all. In summer, only the duck decoys and Maaskantse hutten interrupt the openness of the back swamp landscape (Lucas, 1981, Minkjan, 2006).

Duck decoys are places where ducks were caught for consumption (figure 11.5). A quiet place was required, which made the polder very suitable. The duck decoys were planted, mostly with poplar, being the only, but also distinctive planting in this area. Most of the decoys are not in use anymore, now serving as a small, enclosed quiet place in the middle of the openness of the Swamps. Not all of the decoys in the Swamps are preserved, but the ones remaining are now protected (Minkjan, 2006).

Another important element of the Swamps were the Maaskantse hutten: small huts along the Hertogswetering (figure 11.1 and 11.3). The farmers and workers that were haying the fields in summer could grab a drink here and have a small break. At almost every crossing of the Hertogswetering, a hut was present. The huts were small and made out of wood. They were easily deconstructed, so during wintertime they were taken away because of the floods (Lucas, 1981).

The image of the Swamps thus can be seen as large and open, sometimes interrupted by a decoy or a hut. Long stretched plots divided by ditches formed the landscape. The only thing that grew

was grass (figure 11.2).

In 1942, the Beersche Maas was closed, and for the first time the Swamps could be used in winter too (Buijks, 2011). The drainage could be improved, since it did not flood every winter anymore. The plots were merged under the influence of the land consolidation. The first farms were placed here, forming green clusters of farmyard planting and windbreaks. The roads were planted, to make it a bit less empty, as a part of the land consolidation (Centrale Cultuurtechnische Commissie, 1973). This was also the moment the technologic approach was introduced. Farms did not depend on the surrounding and underlying landscape anymore (figure 11.4 and 11.6).

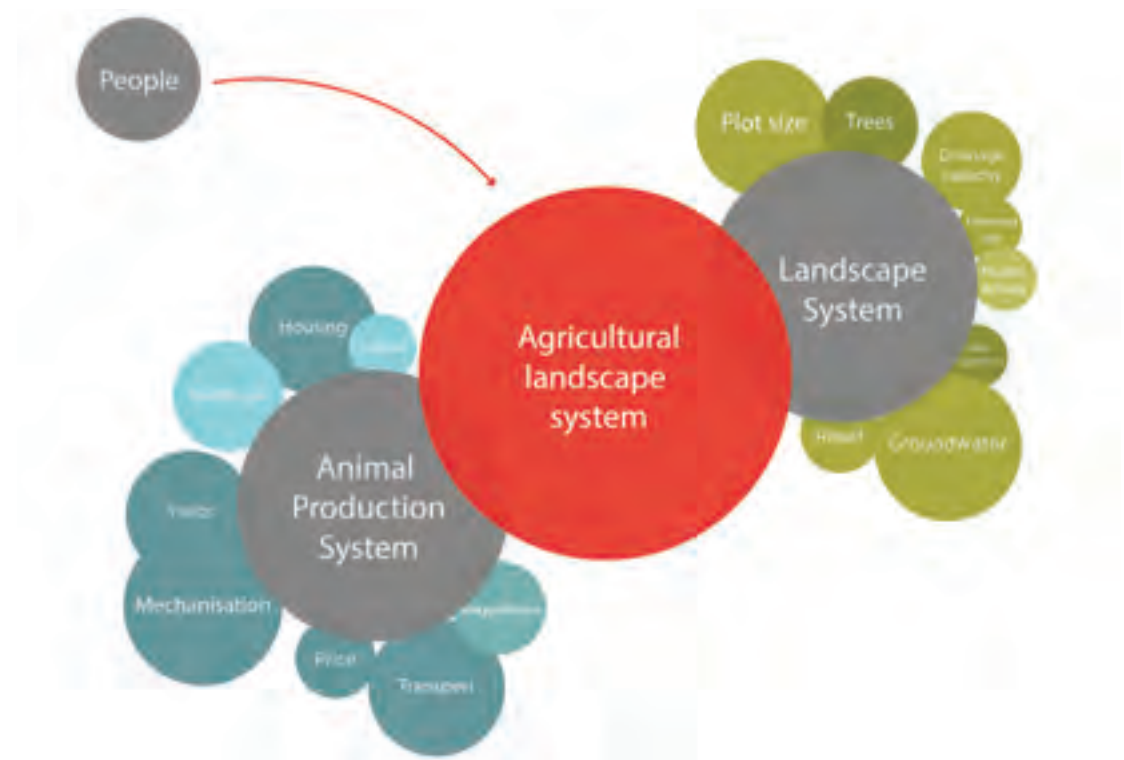


Figure 11.7: The current Agricultural landscape system



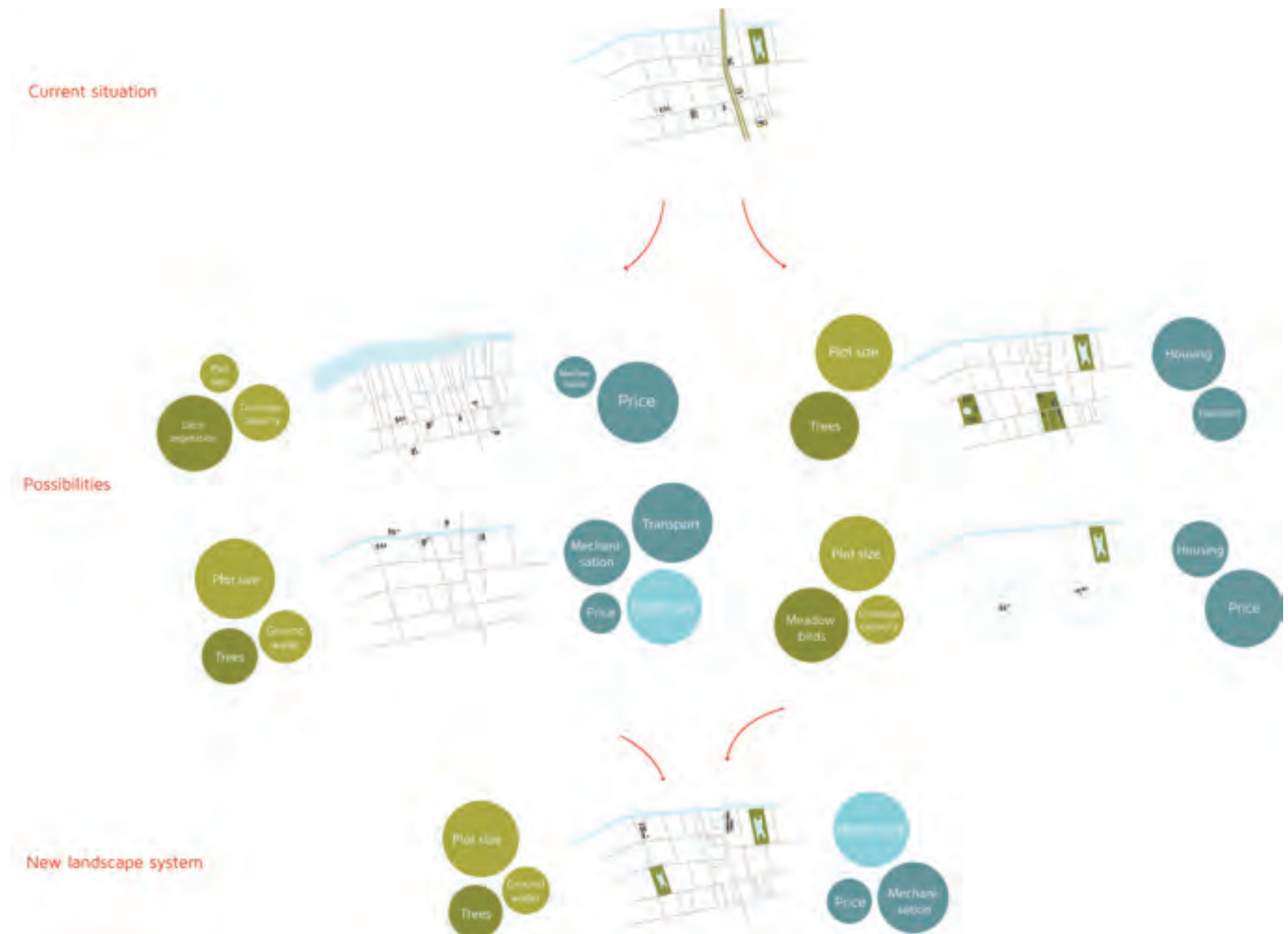


Figure 11.8: Possibilities for the Swamps

The Swamps can be seen as an agricultural landscape system, containing animal production systems and a landscape system. At the moment, the systems can be visualized as seen in figure 11.7. What stands out are the large mechanization-, housing- and yields bubbles, in contrast to the small price bubble: a result of the intensification of the sector. In the landscape system, the large plots and controlled groundwater stand out most. Also trees are quite a large amount and thus have big bubble.

To make the reconnection models are made. These models can be seen in figure 11.8. Different bubbles are used to see what the effects are when they are blown up or made smaller. For example, in the upper left model, the ditch vegetation was enlarged and the plot size bubble made smaller. Also, the price was made higher. A landscape as visualized in the model can be the result: The Hertogswetering widened, with small plots along it. Small scale farming in the higher areas then can be possible. Three other possibilities are tried. Table 11.1 shows the rating of the models according to the layer approach of Hendriks and Stobbelaar. In the end, the best properties are used to merge in a new model.

The new system consists of several important elements (figure 11.9). The Hertogswetering will be the most important element. The intensive farms will find a location along the Hertogswetering, shaped as large estates. These estates will be designed in a formal way, using straight lines, vistas and water elements. The whole estate will be a distinct entity, the stables clearly relating to each other. Openness and transparency of the new barns is important. This way, they will connect to the surrounding landscape of the Swamps. The estates will have a size similar to the remaining duck decoys. The placing along the Hertogswetering will refer to the Maaskantse hutten, most of them located near a crossing of the wetering. A clear distinction is made between the work area and the living area to increase the legibility. The living area will be closest to the public road, having an entry function. The house will fit within the concept of the transparent estates: stately but simple. A private garden can be planted with low plantation to keep the openness. The work area will be behind the living area, which increases the openness. The work area

	Horizontal	Vertical	Historical	Seasonal
1	0	++	-	+
2	+	-	+	0
3	+	-	+	-
4	+	0	0	-

Table 11.1: Rating of the models according to Hendriks & Stobbelaar

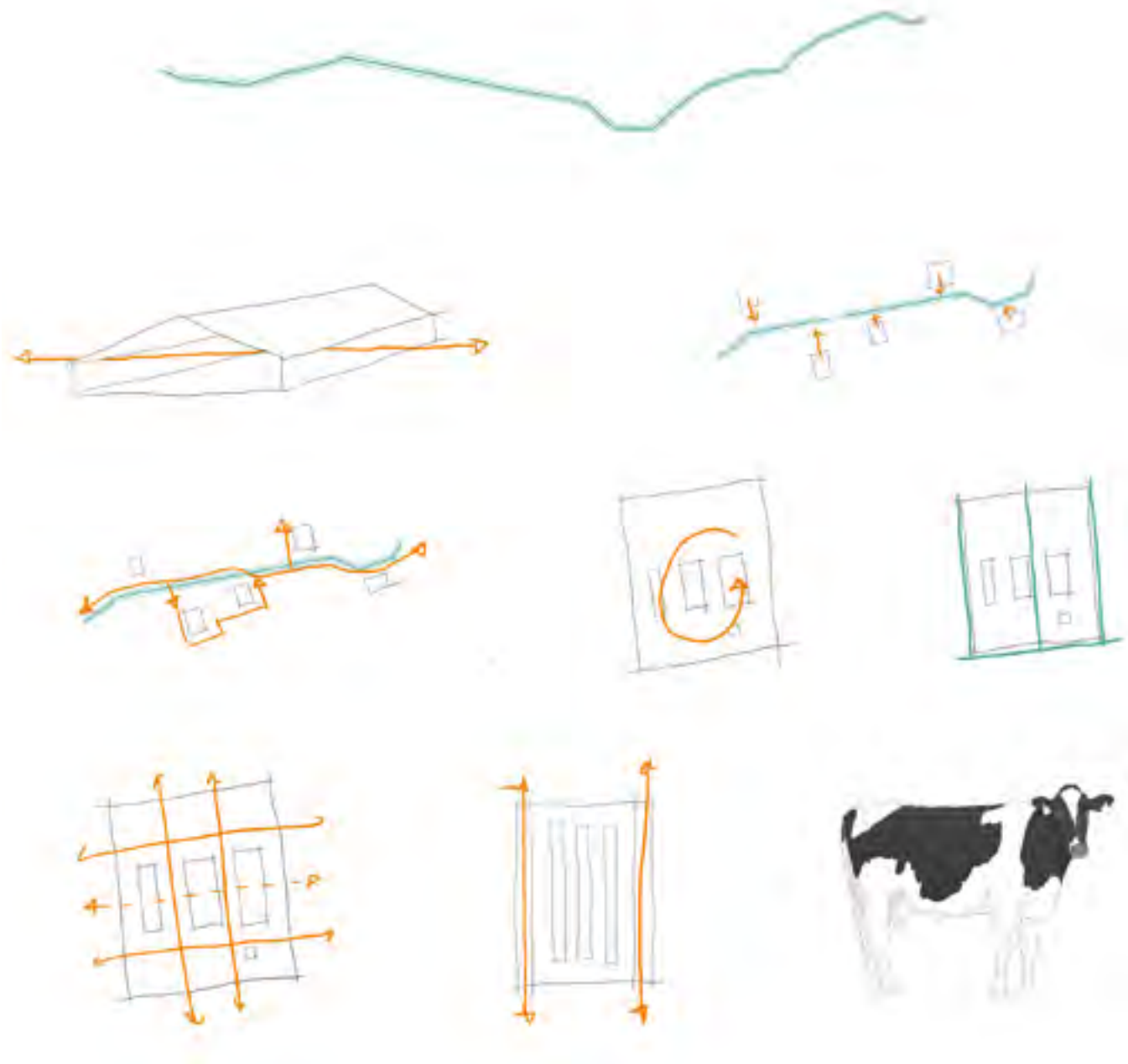


Figure 11.9: Elements of the new system (Left to right, top to bottom):

- The Hertogswetering as guide
- Transperancy of the barns
- Farm estates along the Hertogswetering
- Recreational roads along the Hertogswetering, around the estates
- Coherence on the farm yard
- 'Estate-like' water elements on the farm yard
- Vistas crossing the yard
- An open 0-6-0 barn
- A high productive cow: Holstein Friesian





Figure 11.10: Design for the Swamps

consists of several stables.

The design area thus is concentrated around the Hertogswetering (figure 11.10). The area between the villages will serve as a buffer area, where intensive types of farming are possible, but on a smaller scale reaching up to 300 NGE. The buffer area can contain all sorts of farming: pig farms, poultry farms, dairy farms et cetera. The buffering farms are located along the radial roads in the Swamps. These roads are old roads to connect the villages on the north and south side of the polder. These radial roads will be used to 'announce' the intensive area. The intensive area near the Hertogswetering will only be suitable for dairy farming. Dairy farming gives much more possibilities for openness and thus suits the landscape more. These dairy farms will be 300 NGE or larger.

In other words, a minimum of 250 dairy cows, young stock and calves will be kept here. Friesian-Holstein cows will be used for the milk production. This breed characterizes itself by a high milk production.

The radial roads are used as daily routes for locals and farmers (figure 11.11). The social part is important in this research, so the 'city people' should get their own place here. The recreational route thus goes along the Hertogswetering, not interfering with the daily routes. The recreational route goes along the farms, to give the possibility to visit them (figure 11.12). The route is a connection between 's Hertogenbosch and Oss, two important cities in this area.



Figure 11.11: Daily routes in the Swamps



Figure 11.12: New recreational routes in the Swamps



Figure 11.13: Detail of the farm estates



Figure 11.14: On the farmyard



Figure 11.15: View from the Hertogswetering





Each estate will be owned by one farmer (figure 11.13 and 11.15). He has to meet the requirements mentioned before. Other than that, he is mostly free to set up his own management. Some farmers will choose for a very open type of farming, letting his cattle outside and providing space for visitors. Others will find the openness of the stable itself enough, not allowing visitors in their barn and not allowing cows outside the barn (figure 11.16 and 11.17).

To give an example, one farmyard and its barns are designed in detail (figure 11.18 and 11.19). The cubicle barn is built up in the 0-6-0 form, which means the feed alley is on the two long sides of the barn and 6 rows of cubicles are in the middle. This way, no

walls have to be used and the stable can be open (figure 11.14). This benefits the air circulation, but also contributes to the open landscape. When weather circumstances are less favorable, the walls can be closed with ventilation fabric. Milking will be done by an automatic milking system. A normal milking parlor requires walls to enclose the space; an automatic milking system does not need walls reaching up to the roof. This also enhances the openness. The stable for young stock and calves follows the same principle: feeding alleys along the sides, pens in the middle to make sure no walls are needed. The surrounding land is used as grazing pasture for the cows or provides forage. Most of the forage will be cultivated around



Figure 11.16: Daily routes of the farmer



Figure 11.17: Daily routes of the cattle



Figure 11.18: Cross section of the farm yard



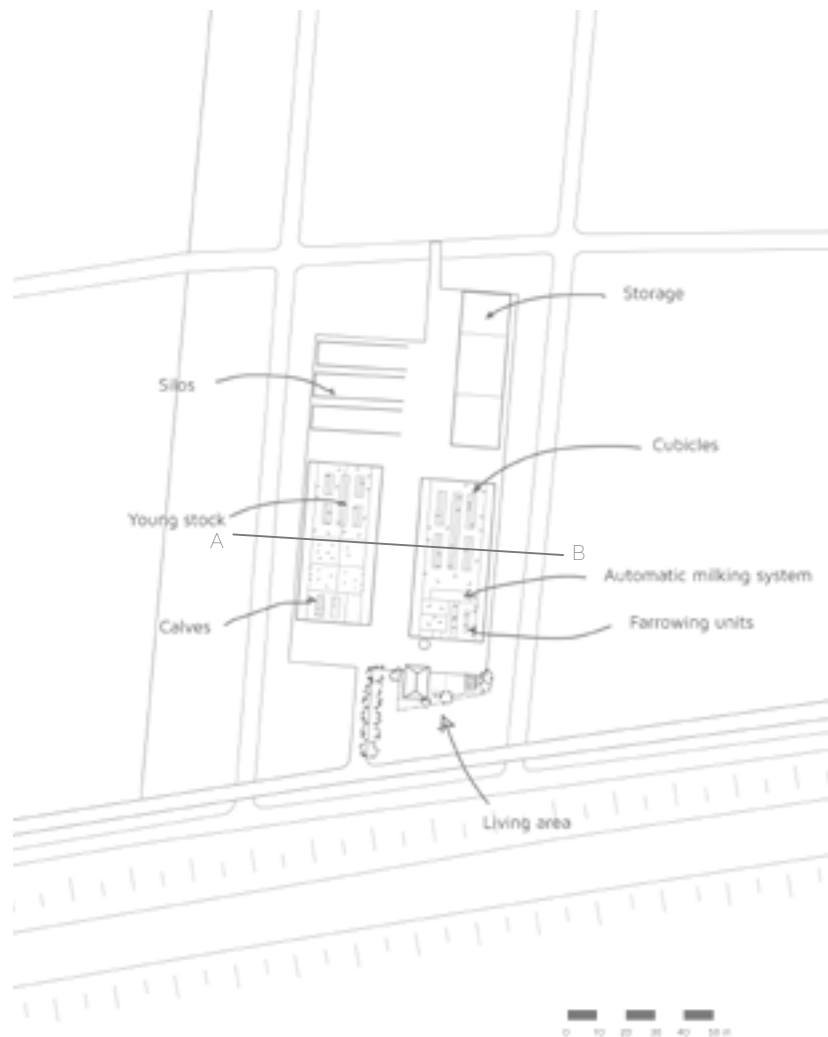


Figure 11.19: Cross section of the farm yard

the farm. Next to this, maize will be imported from other areas, because the Swamps are sometimes too wet. Concentrates are also imported, because the high productive cows used need a lot of energy to produce milk.

This new system is summarized in figure 11.20. Only the amount of trees decreased and the housing is different, so not much change can be seen. This is most likely because this already is a young landscape with young farms. The only reason to change here is restoring influence of landscape on the farm. A real urgent reason unfortunately is not present. Even though, this design makes it possible for the farm to tell the story of this open landscape, interacting with each other and having mutual influences.

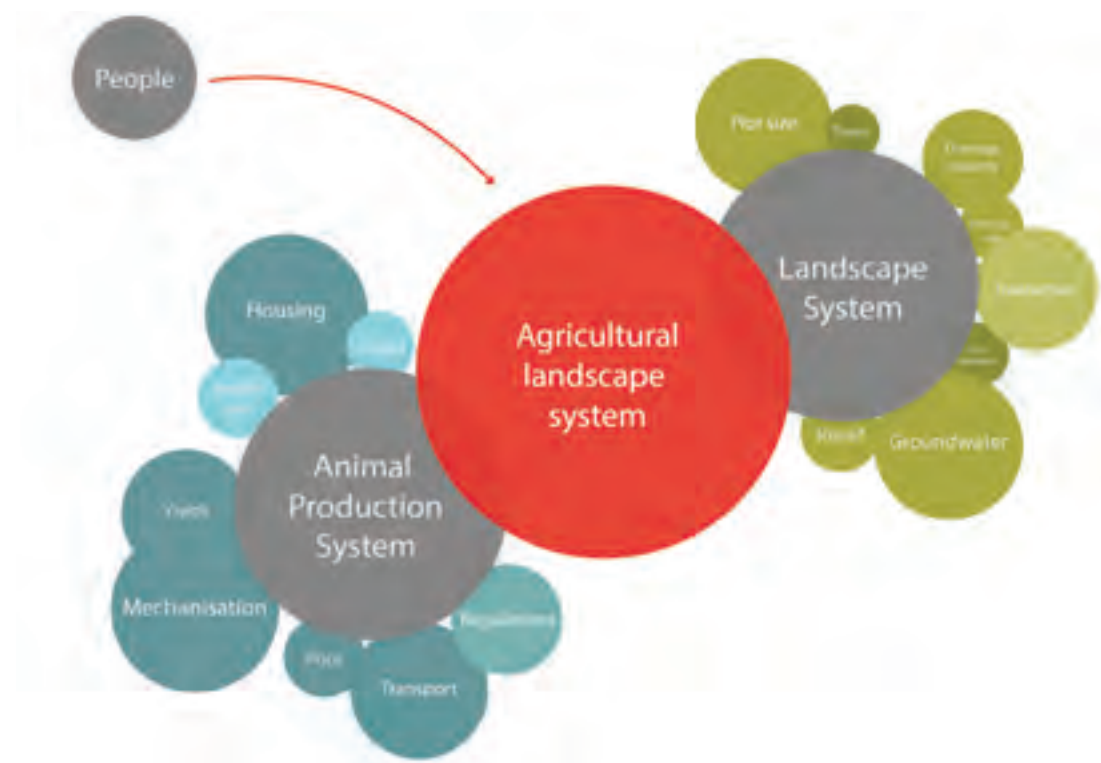


Figure 11.20: The new Agricultural landscape system



Figure 11.21: Heather fields



Figure 11.22: Reclamation of the heath



Figure 11.23: Small sandy road through the fields



Figure 11.24: Large chambers in the Fields



Figure 11.25: Intensive farming



Figure 11.26 : Intensive farm in the Fields

### 3. Fields

The Fields are a young landscape, just like the Swamps. In contrast to the Swamps, the Fields are a sandy area: the sand plains. The Fields consisted of poor soils and were not suitable to use as arable land. Nutrients from sheep manure were present in small amounts, but were mostly used on places where it was needed more. No manure was available to spread in the Fields-area. Therefore, extensive heathlands and pine forest formed the landscape of the Fields (figure 11.21).

In the Fields, both old and young heath reclamations can be found. The old reclamations are located near the villages and have a small-scale character. Up until the 19th century, the Fields the lands in between the villages remained uncultivated land (figure 11.23). The emergence of artificial fertilizer changed this. The poor fields were reclaimed, piece by piece. The dry parts first, later when drainage methods improved the wet parts. Long, straight roads cut through the former heath pastures, serving as reclamation axes (figure 11.22). The large plots formed characterize the young heath reclamations. The green along the roads and the planting along the edges of the plots formed a chamber-like landscape. This young landscape was made for agriculture (figure 11.24).

While it already was larger scale than at that time was normal, the land consolidation reconsidered the whole landscape again. The important structures were kept, but the plots were made larger again. New farms were introduced, which were taken away from the villages (Centrale Cultuurtechnische Commissie, 1973). Green elements disappeared and the scale of the chamber-like landscape increased. Wider and opener spaces were created. The landscape was completely optimized for agriculture (figure 11.25 and 11.26).

The Fields are an agricultural landscape system, containing animal production systems and a landscape system. At the moment, the systems can be visualized as seen in figure 11.27. What stands out are the large mechanization-, housing- and yields bubbles, in

contrast to the small price bubble: a result of the intensification of the sector. In the landscape system, the large plots and controlled groundwater stand out most. A low amount of ditch vegetation and a decreasing number of trees form the biotic part.

Models are made to experiment with different possibilities for a reconnection (figure 11.28). The bubbles are blown up or made smaller to look what the effect is on the landscape. For example, in the bottom right model, history is taken in account: back to the meadows and small farms. The plot size is increased for large heather fields and the price goes up. All models are rated according to Hendriks and Stobbeaer (table 11.2). The best properties are used to merge in a new model.

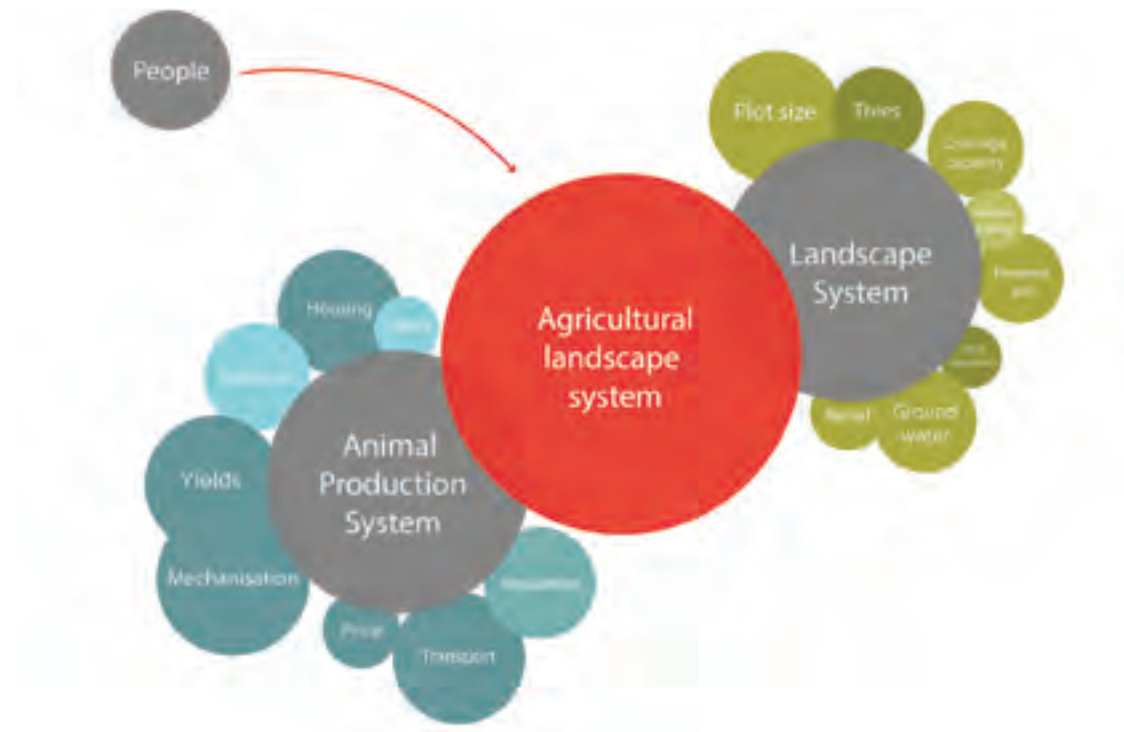


Figure 11.27: Current Agricultural landscape system





Figure 11.28: Possibilities for the Fields

The new system consists of several elements, forming the new landscape (figure 11.29). The most important aspect is the intensive farming that will take place here. Mostly pig- and poultry farming will find its place in the Fields. These types of farming are susceptible for diseases and ask for a good regulation of temperature, humidity and feeding in order to deliver a quality product. Therefore, the barns will be closed buildings. These closed buildings are not possible to interact with the landscape as much as the barns in the Swamp-area. Another option is to let them interact, literally, with each other, and together have an interaction with the landscape.

On the scale of the whole Fields, also here a distinction is made between an intensive and a less intensive area (figure 11.30). The intensive area locates itself in the middle of the Fields, consisting mostly of young heath reclamations. The older heath reclamations are located around the villages and are smaller scaled. The old reclamations are somewhat smaller scaled and next to farmers, a lot of citizens found their place there. In the young area, only

farmers are located. The most intensive area is used to implement the new system.  
To make a clear separation between the intensive and less intensive part, the edge is planted with trees and other plantation. This edge will have an entrance function, to indicate the transition to the intensive area. It connects the most important woodlands of the Fields. This had both an ecological and a recreational function. The edge is almost 30 kilometers long, so it is suitable for a (mountain-) bike ride (figure 11.34).

In the intensive part, the farms will be placed in clusters so they can benefit from each other. The largest advantage of clustering is the closed cycle of animal they make together. For example: a specialized farm where pigs are fattened depends on the inflow of piglets. A farm where piglets are reared depends on a farm where breeding material is selected and produced and a farm where the piglets can go to get fattened or for breeding. When clustering these farms, they can exchange pigs without bridging long

	Horizontal	Vertical	Historical	Seasonal
I	-	+	0	+
II	0	0	0	+
III	+	+	+	0
IV	-	++	++	0

Table 11.2: Rating of the models according to Hendriks & Stobbelaar

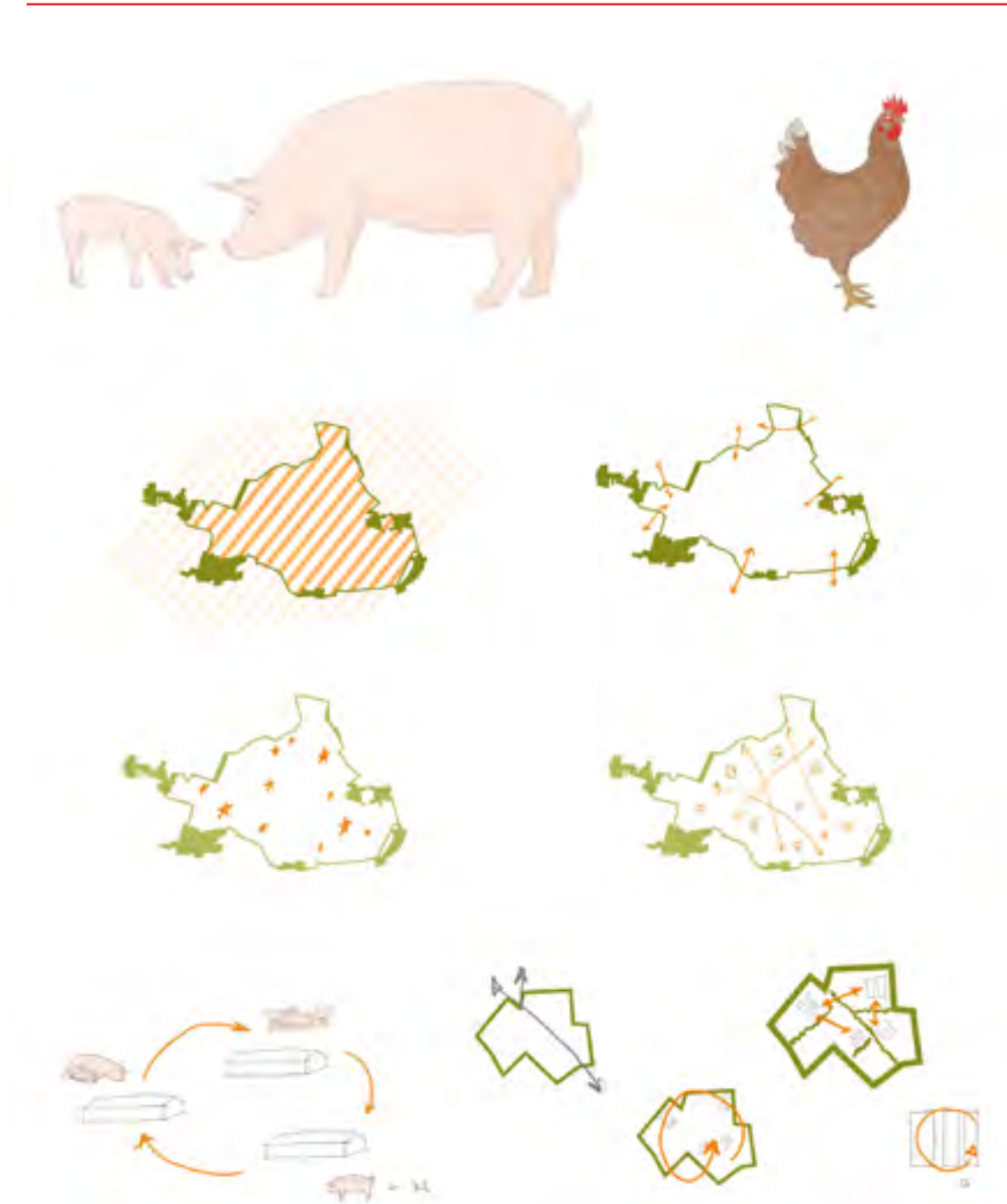


Figure 11.29: Elements of the new system (Left to right, top to bottom):

- Pigs and piglets
- Poultry
- An intensive area with a less intensive buffer
- A border around the intensive area with clear entries
- Clusters within the intensive area
- Open areas between the clusters
- Closed cycles of farming within the clusters
- A road crossing the cluster
- Cluster as one farmyard
- Interdependence and relations between the farms, also from landscape perspective
- Coherent barns in use and appearance





Figure 11.30: Design for the Fields



Figure 11.31: Current transport routes



Figure 11.32: New transport routes

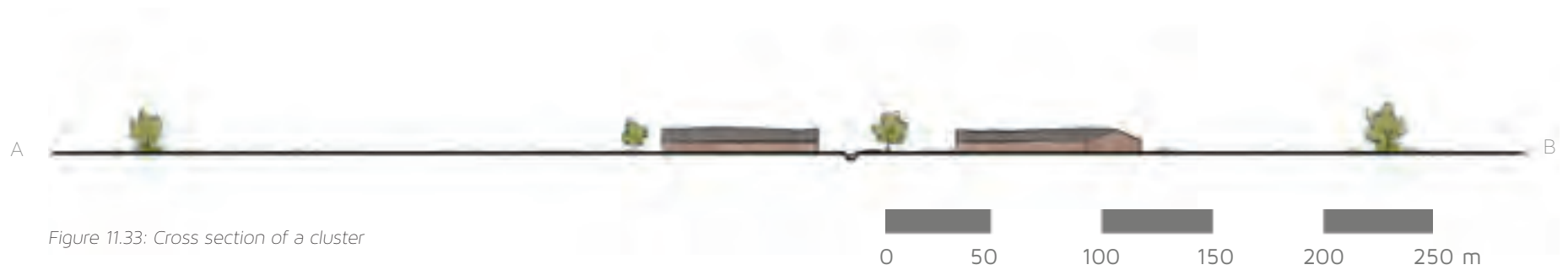


Figure 11.33: Cross section of a cluster



Figure 11.34: Summer recreation along the edge of the intensive area of the Fields







Figure 11.35: Detail of a intensive cluster

distances. One farm serves as farrowing house, another farm rears the piglet and a last farm is focused on fattening the pigs. The input of such a cluster is forage; the output is meat and manure. Clustering the farms will decrease transport: The truck with forage or for manure can go to one place instead of four (figure 11.31 and 11.32).

In the landscape, these farms as a cluster form one farmyard together (figure 11.35). The whole cluster will be surrounded with planting, adding some extra to the chamber-like landscape. The new green will connect to old structures (figure 11.37). The trees will not be placed directly around one farm so it will not serve as a way to hide the farms; it will make them green islands in the fields. They probably will not be recognized as farmyards in first hand, but just as plantation belonging in this landscape. The row of trees defines the space of one farmyard and serves as an entry to a new farmyard. Within the new cluster, the own atmosphere should be noticed and it should be clear that it is a distinct entity. The organization of the farms in the cluster is based on existing structures and the fact they are depending on each other.

The closed character of intensive farming does not lend itself for open and transparent barns, as mentioned earlier. Designing the inside of the stables thus does not add much to the design. However, it is important to take animal health and –welfare and environmental aspects into account. To realize this, the barns will take in more space than conventional stables. This affects the organization within the farming clusters (figure 11.38).

The surrounding arable lands will be used for producing forage. Because of the intensive nature, extra, specialized forage will be imported to increase growth and health. The remaining yield of the arable lands can be sold to other farmers in for example the Swamps, where the soil is less suitable for cultivating for example maize.

The new system is visualized in figure 11.36. Also here, not much

has changed in the system bubbles. Even though, the proposed solutions do have a positive effect on the relationship between farm and landscape. Farms are not hidden, but form a new kind of chamber-like landscape. New green structures are added, referring what there used to be here. Farms are clustered, which has huge advantages for the farms themselves and the surrounding area.

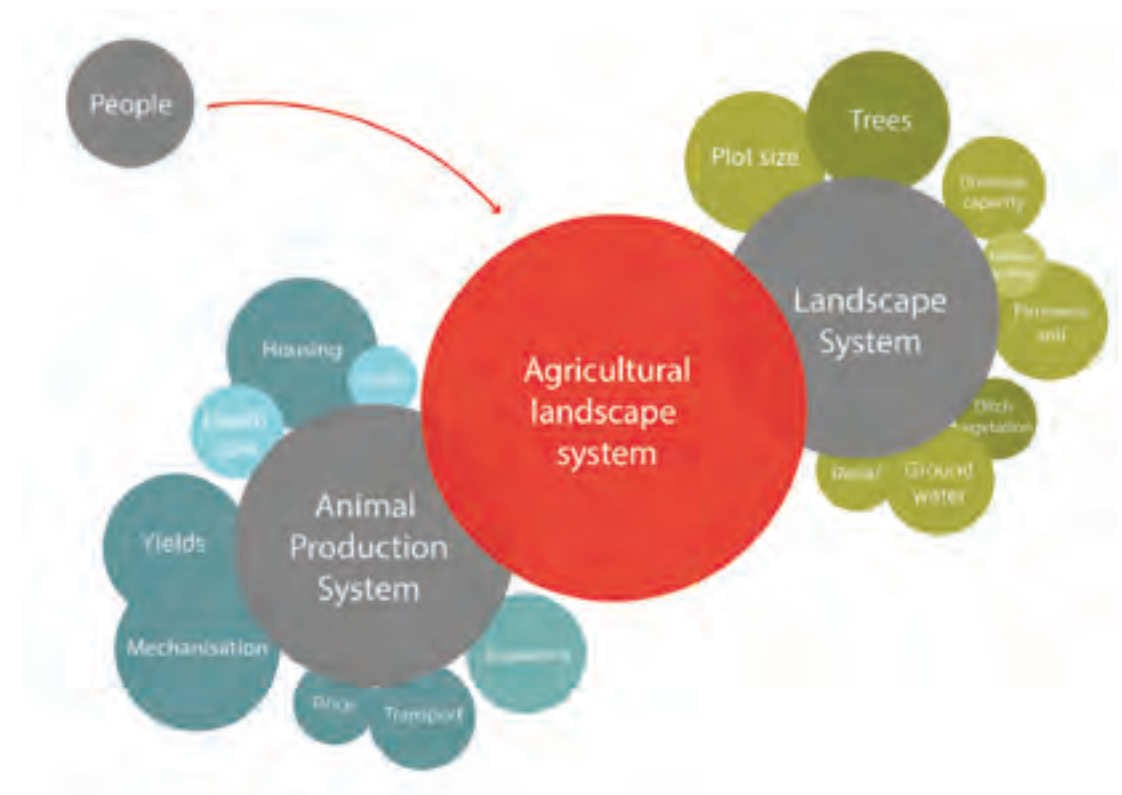


Figure 11.36: New Agricultural landscape system



Figure 11.37: A view between the clusters during the spring





Figure 11.38: Intensive farming within the clusters





Figure 11.39: The meandering Aa



Figure 11.40: Change of the Aa over time



Figure 11.41: The current landscape



Figure 11.42: A dairy farm along the Aa



Figure 11.43: New plans: Low water situation



Figure 11.44: New plans: High water situation



#### 4. Meadows

The Meadows are located around the Aa, a small stream on the west-edge of the case area (11.39). The Aa streams from Nederweert to Veghel and 's-Hertogenbosch, where the Aa merged with the Dommel, together flowing into the Meuse. The Aa used to be a meandering stream (Bruggeman, 2011). Along this stream, villages arose, linear and long stretched on the higher grounds. The stream was dynamic, so the grounds nearby the Aa were wet and flooded often. Therefore, these grounds were mostly swamp forest. A bit closer to the villages, the fields did not flood every year, so they were used as grazing- and haying fields to feed cattle. The parcels were small and lots of small roads made it possible to access the fields. The edges of the plots and the roads were planted: a small-scale landscape was the result. The stream valley of the Aa characterizes itself by the small dairy farms (Noord-Brabant, 2013).

In the 1930's, the Aa was normalized to increase the discharge (Bruggeman, 2011) (figure 11.40). This made the surrounding ground dryer and more suitable for agricultural uses. This development, together with the land consolidation, changed the whole landscape (Landinrichtingsdienst, 1963). The swamp forest took a lot of space, which could have more profitable uses. The plots were merged to larger plots. This was possible because of the new drainage possibilities. A lot of the planting therefore disappeared. This landscape was optimized for agriculture (figure 11.41 and 11.42).

No new farms were introduced here. Smaller farms disappeared or moved. Only a few existing farms got the chance to develop itself further here. Thus, less farms taking up the same space.

In the Fields and Swamps, the urgency was mostly focused on mutual influences of farm and landscape. The farms were not telling the story of the landscape anymore. In the Meadows, this is the same case, but there is more urgent reason to interfere. The water board Aa and Maas and province of Noord Brabant decided

more space for water should be available in the stream valley of the Aa (Maas, 2006). Water should be buffered and should have a more natural course. Letting the Aa remeander could do this. At the moment, the plans are in an advanced stage and the first adaptations in the field are already made. Within this plan, less space is available for farmers. A lot of them therefore are forced to leave the stream valley (figure 11.43 and 11.44).

The Meadows are an agricultural landscape system, containing animal production systems and a landscape system. At the moment, the systems can be visualized as seen in figure 11.45. The Meadows resemble the Swamps and Fields: more and more intensive. What stands out are the large mechanization-, housing- and yields bubbles, in contrast to the small price bubble: a result of the intensification of the sector. In the landscape system, large

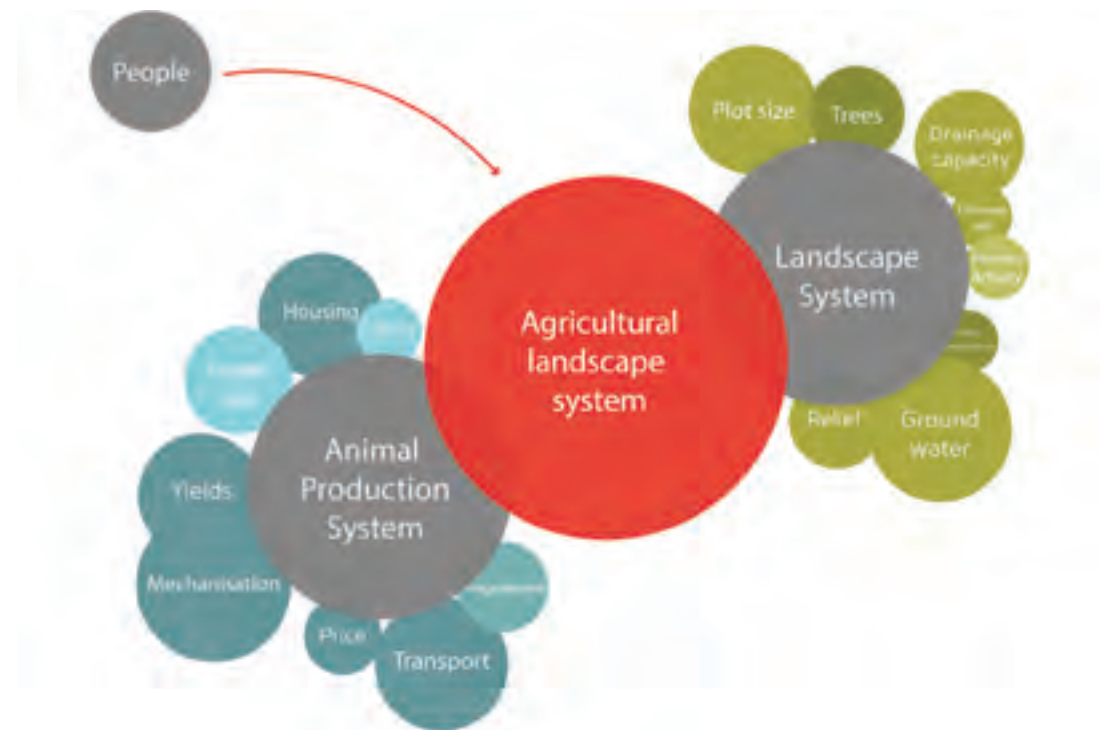


Figure 11.45: Current Agricultural landscape system



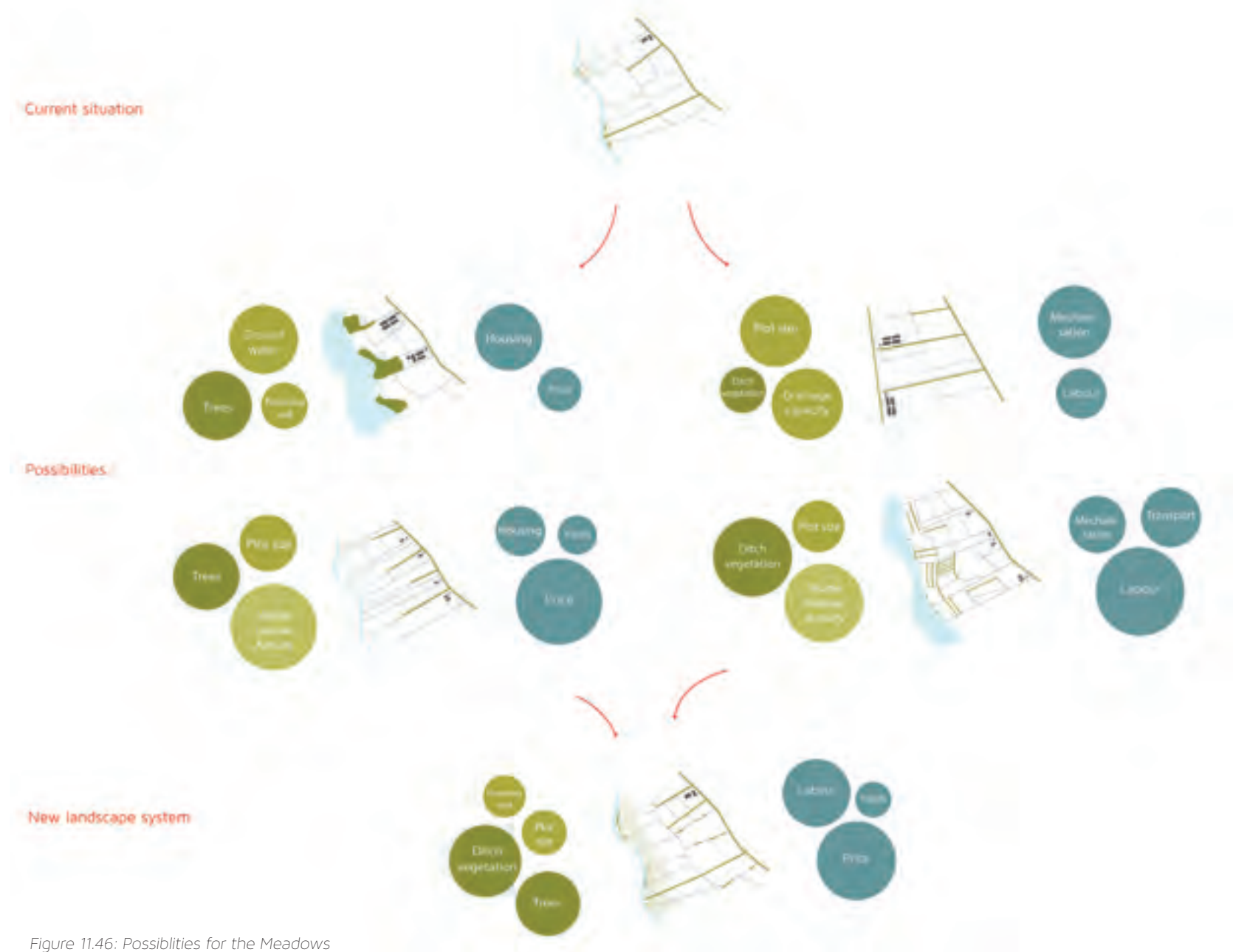


Figure 11.46: Possibilities for the Meadows

plots and controlled discharge is important. The system here has more place for green than the other systems, most likely because of its small-scale history.

Again, models are made to look at different possibilities for mutual influences (figure 11.46). In the bottom left model, the visual human activity is increased and plot size is made smaller, but this also means a higher price. The models are rated according to Hendriks and Stobbelaar (table 11.3). The best properties are used to merge in a new model.

The most important idea in the new system is not to take the farmers from the stream valley, but let them stay. They are part of the history of the Aa and should have their own place. This could be a good chance for a new system and new ideas about farming. The farmers will have to adapt to the new situation, but get their chance to keep their farms. The meandering Aa will be a guiding principle in this system (figure 11.47).

A new farming system is introduced: a pure grazing system. This means the dairy cows will be outside 24/7, the whole year round (figure 11.48). The farmer will have three types of fields: summer grazing fields near the farm, winter grazing fields near the Aa and some arable land on higher grounds (figure 11.49). The natural cycle of the cow will be used as guideline. She will give birth to a calf in spring and thus will give milk during spring and summer. In this period, she needs energetic forage to have a good milk production. By using a mixture of grass, clover and herbs on the summer grazing fields, she will get enough energy. This mixture also has a positive influence on her health. In winter, she will not give milk anymore, so the low-energy grasses in the stream valley are sufficient.

The summer grazing fields are small plots around the stable (figure 11.50). The cows circulate over these plots two times a day (figure 11.51). After one circle, they go into the stable to get milked. In winter, the cows can go to the winter grazing fields, where they

	Horizontal	Vertical	Historical	Seasonal
I	+	0	—	+
II	++	—	—	—
III	+	+	0	++
IV	—	++	++	++

Table 11.3: Rating of the models according to Hendriks & Stobbelaar



Figure 11.47: Elements of the new system (Left to right, top to bottom):

- The meandering Aa as guide
- Smaller plots for circulating of cattle
- A double purpose cow: the Blaarkop
- Green depending on the landscape
- Clear division in uses of land (winter grazing fields, summer grazing fields and arable land)
- In summer: circulation on the summer grazing fields near the barn
- A simple deep litter barn
- Keep the cattle outside 24/7, year round
- Use the natural cycle of the cow: calves and thus milk in summer, no calves and no milk in winter
- The cow will get the grass herself the whole year so no or less forage is needed





Figure 11.48: Design for the Meadows



Figure 11.49: Use of the new plots



Figure 11.50: Detail of a farm in the Meadows



stay all day (figure 11.52). The farmer can also decide to keep them inside when the winter grazing fields are flooded or the weather is not good enough.

For this grazing system, the Blaakop is used. This breed has large hooves, so she can stand on the wet plots of the winter grazing fields. A Blaarkop is a dual-purpose cow. She gives milk, but also can be used for meat. In winter, they do not give milk, so the farmer can decide to sell some of his cows for meat to still have some income.

The farmer himself has more work in this new system (figure 11.53). He has to take the cows from plot to plot in summer, which takes up a lot of time. There are however some huge advantages in this

system that compromise the extra work. A conventional farmer has to get the grass from the field himself to feed the cows. The cattle in this system will get it themselves, the whole year round. Because they feed themselves the whole year, no or less external forage, like maize, is needed. He can feed them with the crops he cultivates on his own arable land. A luxury barn is not needed; the cows are outside as much as possible. The stable can be a simple deep litter barn (figure 11.56 and 11.60). These advantages together save the farmer a lot of money.

Extra income will be generated because his product will be special and thus can be sold for a higher price.

The system has an influence on the landscape. Along the meandering Aa, the winter grazing fields will be located (figure



Figure 11.51: Summer route of a cow

Figure 11.52: Winter route of a cow

Figure 11.53: Daily routes of the farmer



Figure 11.54: Cross section from Aa to the farm yard during summer



Figure 11.55: Cross section from Aa to the farm yard during winter

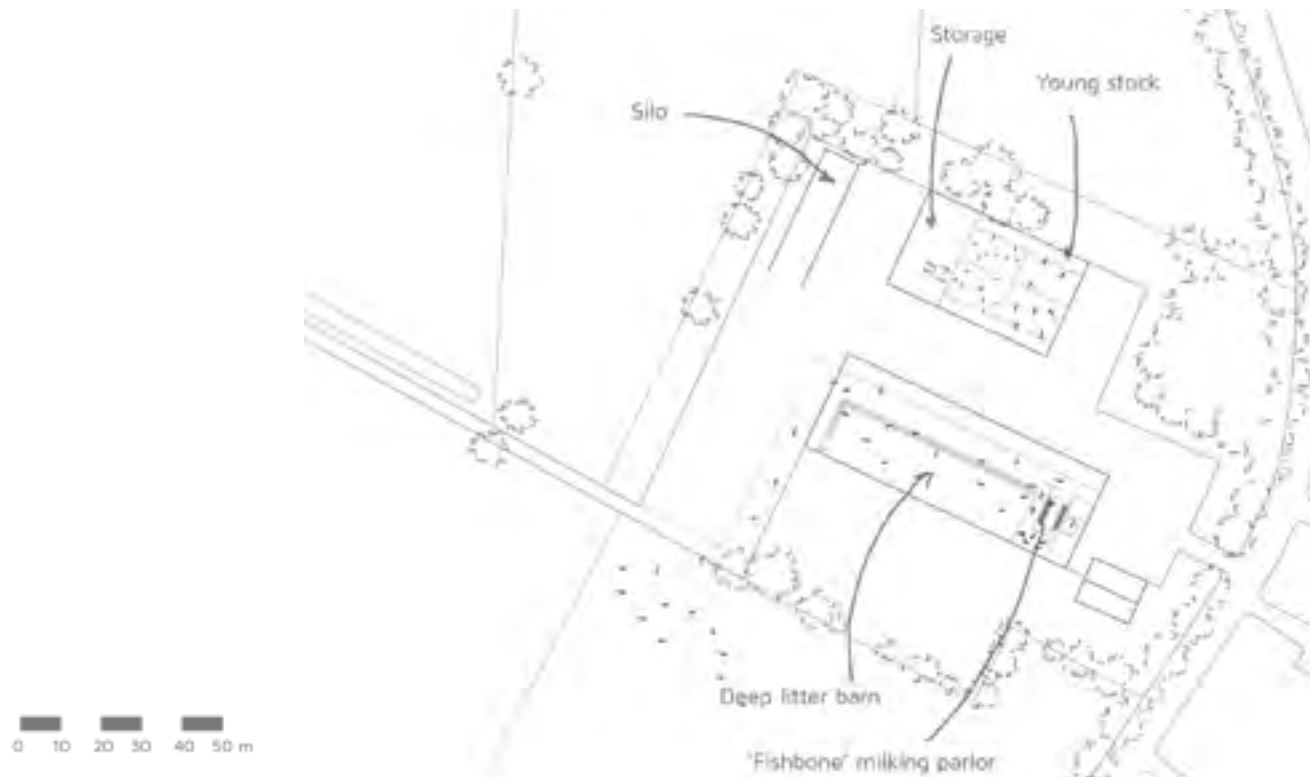


Figure 11.56: Detail of the deep litter barn

Figure 11.57: Blaarkoppen on a autumn day in the winter grazing fields





11.57). These fields will now flood sometimes, which increases the dynamics. The fields along the Aa will be maintained only by the cows and thus have a natural character. Special grass- and herb species will grow here. The swamp forest that used to be here can get a new chance. The plots are split again, so the cows can circulate. This circulation is important. Cows tend to lie down when they are on one place and trample the grass. This decreases the quality of the grass. By circulating, this pressure can be spread over more fields and the fields get a chance to restore themselves. The splitting of plots leads to a more small-scale character in the Meadows (figure 11.59).

People are allowed to enter this area of grazing fields, so they can understand the system and enjoy the atmosphere. The old Aa-dike will be used as a path and from this dike people can walk into the area.

The farms themselves will connect to their green and natural surrounding. The deep litter barns can have open walls, so visitors can look in it. Adding green can restore the original character of the stream valleys. The deep litter barn will be simple. A small milking parlor is located in the front of the stable. This fishbone milking parlor is simple and cheap, but sufficient for the small herd of Blaarkoppen. The farmer most likely will keep 50 to 70 dairy cows to keep his farm running. The male calves will be raised and sold for meat, the female calves will be added to the dairy herd.

To conclude, this system adapts both landscape and farm to bring them closer together (figure 11.58). The farms are adapted on the subsurface and landscape; the landscape meets the requirements of the farm. This new system gives farmers and policy makers new ideas of farming in a region where they actually should leave. The system bubbles are changed a lot. The yields decreased and the labor increased, but this is evened out by a higher price. The landscape changed into a smaller scale landscape with more planting and ditch vegetation. Also, the visibility of human activity increased.

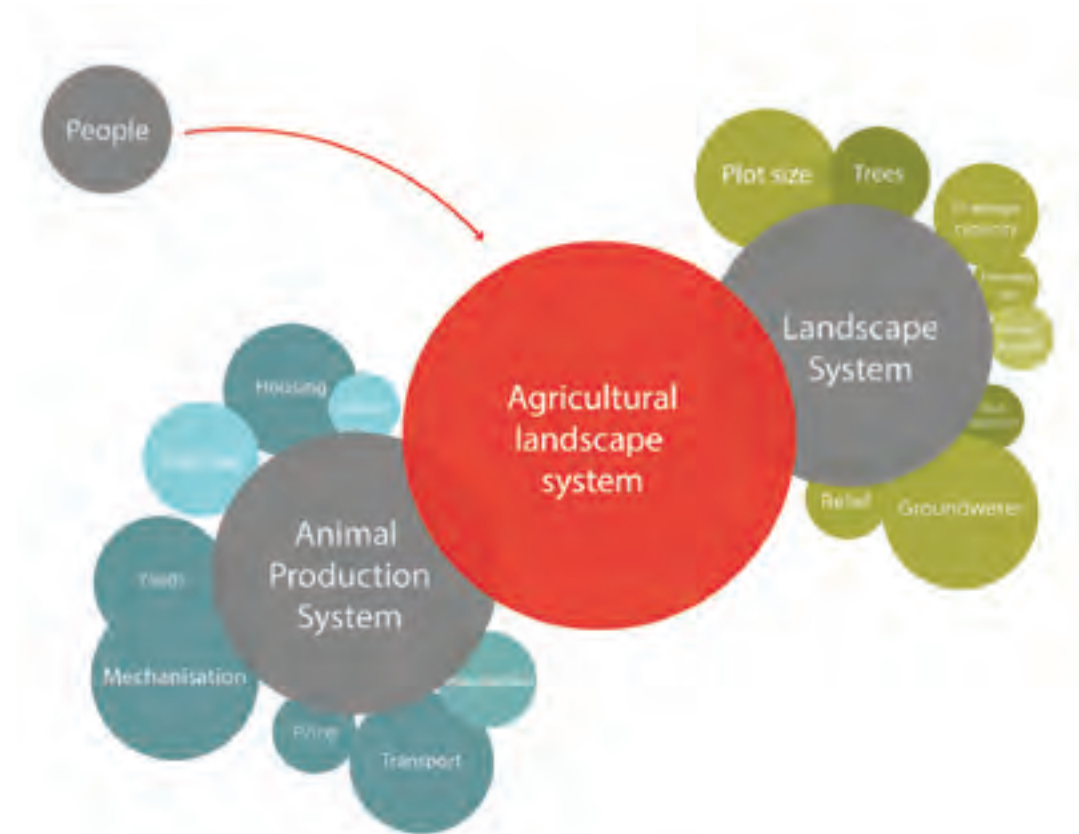


Figure 11.58: New Agricultural landscape system

Figure 11.59: Blaarkoppen on the summer grazing fields





Figure 11.60: The Blaarkoppen in the barn on a rainy day





12.

Conclusion

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*The conclusion summarizes the whole research and its outcomes. The research questions will be answered, the benefits of the design are mentioned and the significance of the research is explained.*

## 1. Research Questions

To look back and come to the conclusion of this research, the research questions stated in the very beginning of this research are brought up again. The answers to these questions are interwoven in the whole research, but to make clear what this research has brought, they are answered here again.

*1. What would be the ideal animal husbandry sector, approached intuitively?*

The ideal animal husbandry sector was sketched by making a dream vision. This dream vision was broad and unbounded, to inspire the whole research. This dream vision was influenced by my background as farmers daughter and my background as landscape architect. The ideal husbandry sector, approached with this background, is:

*"A healthy, sustainable Dutch livestock sector. This means good animal health and welfare are ensured. A fair price should be paid for his products. The farm should be viable. Locals and citizens from nearby villages feel connected to the rural area and the livestock. They see production is necessary, as well as innovation, but because of enough transparency, they know everything happens in a fair, animal friendly way. The farm and the way it is managed, adds something to the surrounding landscape and the other way around: the landscape supports the management. A regional approach is essential. This way, a coherent landscape can be created. Agricultural area's can distinguish themselves, can have an own character and by that, be aesthetically valuable and self-explanatory."*

This first impression and wish was based on the knowledge I already had and the knowledge I gathered during the first stages of my research.

*2. What is the exact problem?*

To make the whole research more specific, a step back was taken. I had a feeling about the problem and on this, I focussed the dream vision. The vision is quite broad, so to narrow it down, a case was chosen and the exact problem in theory was researched. In the case, four distinct landscape types can be found. The problem in theory consisted of literature studies. It was split up in four categories: The connection Farm-Landscape, Social perspective, Farmers perspective and current approaches. These four together showed that agriculture used to be depending on the landscape, but also influenced it. When the focus shifted to higher yields and more mechanisation, a more technological approach was taken. The landscape could be moulded in every shape possible, but this led to less diversity. Less diversity leads lower orientation, a disappeared Genius Loci and thus a less attractive landscape. The farmers use this approach because it is cheap. The citizens do not like this and current approaches to give some character back to the landscape are insufficient.

*3. What can be seen of this in the landscape?*

To look at the problem closer and make sure it is really the problem, the problem in practice is researched. The case, an area in the south of the Netherlands, serves as example and research area. The same four categories are used. The connection between farm and landscape is researched by using the four-relations approach of Hendriks and Stobbelaar (2003). This approach shows the legibility of the landscape. The farmers perspective shows the technological approach: farms are the same everywhere. The current approach is visualised by photographing one street with farms, all appearing the same. The farms are not depending on



Figure 12.1: The new farming map



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the landscape anymore. The four landscape types in the case are not visible in the field anymore. All farms look the same; all four regions look the same. The whole landscape becomes a blur, it is hard to orient yourself, the spirit of the place disappeared and thus the legibility. This all leads to a lower appreciation.

#### 4. In what way can this problem be solved?

By reconnection farm and landscape, the problem can be solved; Let the farms tell the story of the landscape again. The case is used as test-area, experimenting with designing and developing a method that can apply to other areas. The four landscape types in the case are be guiding. In the concept, two older landscape types are assigned as extensive areas; the younger landscapes will be intensive and buffered by the extensive areas. Each area is looked at by using a systems approach, listing the current properties of the animal production system and the landscape system (together forming the agricultural landscape system). Models are made to experiment with possibilities. These models are assessed by using the four-relations approach by Hendriks and Stobelaar (2003). The highest assessed elements are merged into a new model. From this new model, the new system is extracted. This system defines the new design. This design helps the farm tell the story of the landscape, making it a distinct area again.

#### 5. What is the effect of the proposed solutions on the landscape?

Designing a new system, while taking in account both landscape and animal production systems, makes sure a new balance can be created in the landscape. Each landscape type results in a distinct animal production system. This way, the landscape types can distinguish themselves from each other. People will be able to orient themselves again, seeing a farm, knowing what type of landscape they are in. The spirit of the place is clearer and the landscape is legible. This makes it more attractive. Also, the diversity between the landscape types makes the whole case area more interesting (figure 12.1).

Together, these five questions can help to answer the main research question:

**How can farm and landscape adapt to each other in a (more) responsive way?**

First, the ideal relation between farm and landscape is described in the dream vision, answering the first research question. Then, a step back is taken to look what the relationship between farming and landscape right now. The mutual influences they used to have on each other have seemed to disappear.

To reconnect the two and make them more adaptive to each other, a systems approach is used. The landscape and animal husbandry are seen as systems, functioning in an agricultural landscape system. These systems influence each other and in this way, it can be seen which part of the landscape influences animal husbandry and the other way around. The bubble model helps with this. The designs are assessed by the 4 four-relations method by Hendriks and Stobbelaar, to make sure the legibility and thus appreciation of the landscape is ensured. When farm and landscape are more in balance, this assessment will be positive. So to answer the question: Using a systems approach makes it possible to let farm and landscape adapt to each other more responsive. To asses this, the method of Hendriks and Stobbelaar is used. Eventually, a new system will be the result, in which farm influences the landscape, but more important, landscape influences the farm again.

## 2. Benefits

The benefits of the new approach and design for the involved parties in this case can be described as follows:

Social benefits:

From social perspective, this new landscape design can fulfil the needs of the citizens of the surrounding cities. A recreational area

is created: legible and attractive. People can see what happens inside the farms, experience farming itself and learn from it. They can get their milk and meat here, produced animal- and environmental friendly (figure 12.2).



Figure 12.2: Agricultural benefits



Figure 12.3: Landscape benefits

Farmers in the intensive areas get the chance to expand their farms and therefore, generate a higher income. The farmers in the Fields can profit from each other also. The farmers in the Meadows get the chance to stay in their own area, giving them new ideas about farming (figure 12.3).



Figure 12.4: Social benefits

In the Swamps, the openness is enhanced, a reference is made to the history of the area and transparency has increased. The Fields have new clusters, referring to the old chamber-like landscape. A clear entrance is added to the area, to keep intensive and less intensive areas apart. Letting the Aa meander again enhances the Meadows. The connection between farm and Aa is made, which hints back to this areas' history (figure 12.4).

The significance of this research can be described according to the three categories of Deming and Swaffield (2011).

The world food problem is an important issue in the academic world. This research focuses on the producers of food: the farmers. How can they develop in a sustainable and accepted way? Sustainable design is seen as an important research subject by the CELA (Deming and Swaffield, 2011). Using a systems approach, as done in this research, provides sustainable design (McMahon and Hadfield, 2007).

The combination of animal production systems and landscape architecture is not very common. The 'integration of new agricultural developments' has been subject of some research, but more in-depth research with concrete results is not available within landscape architecture. This research offers this new perspective.

The goal of this research is to reconnect farm and landscape to make it more legible and attractive. New agricultural developments now can be realized, encountering fewer objections of citizens. The new design explicitly involves the social aspect and gives room to recreation and appreciation.



A photograph of a dirt path lined with trees in autumn. The path is covered in fallen brown leaves and leads into the distance. The trees on the left have thick trunks and some green foliage, while the trees on the right have more vibrant orange and yellow leaves. A red banner is overlaid at the bottom left of the image.

Reflection







13.

Discussion



*In this final part of the research, the whole research and design will be discussed. The gaps in the research and design will be mentioned to acknowledge its weak points. Being aware of these limitations makes the research stronger (Deming and Swaffield, 2011). Also, some recommendations for later research will be done.*

## 1. Discussion

Several limitations of the design are mentioned. These gaps can be overall or specific on one part of the design, for example a research method.

### Own perspective

This report starts with my own background. It continues with an introduction, research design and theoretical frame, which are supposed to be objective. Although, the focus in the introduction, the choices made in the research design and picking of scientific frames in the research frames depend on my own background. The Dream Vision that follows also is based the wishes I see from my own perspective. This makes this thesis personal, which has its downsides. Too much emotion makes choices irrational. Most choices are made using the theoretical frame and also researching the problem really in depth, makes the research more objective. Even though, the focus will come from my own background and own perspective. Combining this with a scientific lens and other objective methods compromise the emotions.

The positive side of this personal touch is the motivation that keeps this research going. I am personally involved in the sector, which makes me feel responsible. An insufficient design thus is not an option. This helps making the design as perfect as possible, within this limited time. It also narrows the research down, making it a manageable subject. The choices made for the boundaries are personal, but underpinned with the needed research.

### One scenario

In this research, a design is made for an area in which both extensive and intensive farming get their place. This is only one scenario for the future. Depending on various factors, the future could be different and would only give place to just extensive farming or just intensive farming. These developments should be looked at in another research. This research gives handholds for this.

### Methods

#### *4 relations approach by Hendriks & Stobbelaar*

This whole research is built around the four connections within landscape of Hendriks and Stobbelaar (2003). This method is used to look at the current situation of the agricultural landscape in the case and the elaborated model for each area was chosen based on criteria extracted from this approach. The focus on this one method however, can be a weakness of this research. The approach of Hendriks and Stobbelaar is constructed in their book 'Landbouw in een leesbaar landschap', which is 'just' a PhD thesis. Most theories focusing on appreciation stay quite abstract. The motivation for choosing exactly this method is because its helping to assess coherence in the landscape and eventually determining if a landscape is appreciated and attractive. It gives clear handholds to do this.

Next to this, in their research is focused on quality of agricultural landscapes. This gives motive to use it here, because the subject lies within the same field.

#### *Systems approach*

The original systems approach involves a system with clear in- and outputs. An animal production system reflects this kind of system. The landscape system as Kerkstra and Vrijlandt (1988) and Kleefmann (1984) constructed it, does not have a clear in- and

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output. Merging the systems by adapting the model of Kleefmann (1984) rules out these in- and outputs. Transforming it into the bubble model makes it dynamic, working like a system, but does not distinguish clearly what goes in and what goes out. Though, these fluxes interwoven in the bubbles. For example: The transport bubble involves the transport of manure and milk, which are outputs of the system.

### Feasibility of the plan

#### *Urgency*

As already mentioned, the urgency to do something is not very high in most areas, except for the Meadows. However, this design can help a lot. From landscape and social perspective, this change is needed. A farmer will say this change is not very urgent, while the approach in this research could help him a lot. When a new plan of a farmer is totally in line with the landscape, citizens will have fewer objections and the whole plan making process can be faster.

#### *Implementation*

Interventions in this plan occur on several different levels: On regional scale, per area and on farm level. Most important is to make guidelines on the regional scale. A municipality should take this design as a basis and set out the framing elements (like the 'edge' in the Fields, the clusters' green, the path along the Hertogswetering, relocating farms, letting the Aa meander and make the path along this stream). For each area, a guide should be made for the farmers: What do they have to do, what can they do and what comes in return?

A regional approach is essential, but seems impossible after the Reconstruction (a failed regional plan). The difference here lies in its focus. The Reconstruction used a negative perspective: Pig farms are dangerous for human health, so should be clustered. This research and design uses a more positive perspective: Making

the reconnection between farm and landscape, so both can profit from each other.

Even if it is difficult to arrange such regional plan, it structures the area, enhances its characteristics and shows the contrast between landscape types. The legibility of the landscape will increase and thus will be more attractive.

#### *Finance*

A governmental institution should finance the regional plan and the execution of the key elements in each region. The finance of adaptations on farm level will be the farmer's responsibility. The advantages of this plan can rule out the extra costs (figure 12.2) and if necessary, subsidies should be given.

## 2. Recommendations

In this research, I tried to touch as much elements related to the subject as possible. Even though, I had a frame I had to stay within, otherwise I could fill decades with research. This are the elements that could be interesting for further research:

- Try this method on another case to see what the outcomes are and look if the method also works on other cases.
- Look at other scenarios (only extensive farming/only intensive farming), see what their outcomes are for the landscape.
- Give new meaning to the buffers also, instead of just being an introduction to the intensive part.
- Integrate other current issues more: food scarcity, use of fuels, eutrophication, soil pollution, use of pesticides, animal welfare et cetera. There is an endless list of issues in this sector: too much to handle in one research. It is interesting to look what these issues do to the relationship between farm and landscape.
- Take the timescales of Hendriks & Stobbelaar (2003) in account when using the four-relations approach





## References

- 
- Ackoff, R. L. (1981) *Creating the corporate future*. New York: Wiley.
- Agentschap NL (2010) *SBIR Integraal duurzame stal- en houderijsystemen* Available at: <http://www.agentschapnl.nl/subsidies-regelingen/sbir-integraal-duurzame-stal-en-houderijsystemen> (Accessed: 23 december 2013).
- Agrabeton (2008) 'Flinke fiscale voordelen met proefstal', Agrabeton : nieuwsbrief voor duurzaam bouwen in de agrarische sector, (5).
- Agroplan B.V., Hilhorst, A., Gemeente Baarn and Stalbouw.nl 2012. *RE: Consultation considering Hilhorst's new barn*.
- Banathy, B. H. (1996) *Designing social systems in a changing world*. New York: Plenum.
- Beekman, V. (2004) *Als een vis in het water. Maatschappelijke acceptatie van ontwerpen voor nieuwe diervriendelijke veehouderijsystemen*, onbekend: LEI.
- Bieleman, J. (2008) *Boeren in Nederland: Geschiedenis van de landbouw 1500-2000*. Amsterdam: Boom.
- Bleumink, H. (2007) *De geschiedenis van de reconstructie : achtergrondrapport van de evaluatie reconstructie zandgebieden*, Wageningen: Alterra.
- Blizzard, J. L. and Klotz, L. E. (2012) 'A framework for sustainable whole systems design', *Design Studies*, 33(5), pp. 456-479.
- Bokma-Bakker, M. H., Bergevoet, R. H. M., Napel, J. t. and Swanenburg, M. (2009) *De invloed van houderiaspecten op het risico van ziekte-uitbraak op varkensbedrijven en de sterke en zwakke punten in gangbare en high health systemen*, Lelystad: Animal Sciences Group.
- Boogaard, B. K. (2009) *The socio-cultural sustainability of animal farming : an inquiry into social perceptions of dairy farming in the Netherlands and Norway*. PhD Wageningen, [s.n.], [S.l.].
- Bruggeman, M. (2011) De Aa. 's Hertogenbosch: BHIC. Available at: <http://bhic.nl/index.php?id=11650> (Accessed: 22 january 2014).
- Bruggen, C. v., Groenestein, C. M., Haan, B. J. d., Hoogeveen, M. W., Huijsmans, J. F. M., Sluis, S. M. and Velthof, G. L. (2012) *Ammoniakemissie uit dierlijke mest en kunstmest in 2010 : berekeningen met het Nationaal emissiemodel voor Ammoniak (NEMA)*, Wageningen: Wettelijke Onderzoekstaken Natuur & Milieu.
- Bruijnis, M. R. N. (2006) *Weidegang en opstallen van melkvee*. [s.n.], [S.l.].
- Bruil, D. W. and de Laat, F. G. M. (2003) *De Reconstructiewet: reconstructie en ruimtelijke ordening in de praktijk*. Den Haag: Ministerie van VROM.
- Buijks, H. (2011) *De Hertogswetering*. 's Hertogenbosch: BHIC. Available at: <http://www.bhic.nl/index.php?id=13038> (Accessed: 14 january 2014).
- Burm, P. and Haartsen, A. (2003) *Boerenland als natuur: Verhalen over historisch beheer van kleine landschapselementen*. Utrecht: Matrijs.
- CBS (2004) *Steeds meer neveninkomsten voor boeren*: CBS. Available at: <http://www.cbs.nl/nl-NL/menu/themas/landbouw/publicaties/artikelen/archief/2004/2004-1480-wm.htm> (Accessed: 3 January 2014).
-

- 
- Centrale Cultuurtechnische Commissie (1973) *Rapport betreffende de ruilverkaveling van gronden in de gemeenten Berghem, Geffen, Heesch, 's-Hertogenbosch, Lith, Nistelrode, Nuland, Oss, Ravenstein, Rosmalen, Schaijk, Uden en Zeeland, genaamd 'Midden-Maasland' (ca. 14.400 ha.)*. Utrecht: Centrale Cultuurtechnische Commissie.
- Chairgroup Animal Production Systems (2012) *Systems Approach in Animal Sciences*. Wageningen: APS.
- Creswell, J. W. (2009) *Research design : qualitative, quantitative, and mixed methods approaches*. Los Angeles, CA [etc.]: Sage.
- de Jong, D., Meulenkamp, W., Olde Loohuis, R., Rienks, W., van Rooij, B., Swart, W., Vogelzang, T. (2009) *Grootschalig boeren in een kleinschalig landschap: Resultaten van ontwerpessies in Noordoost-Twente*, Wageningen.
- Demeulemeester, K., Janssen, K., Hubrecht, L., Ryckaert, I., Anthonissen, A., Braekman, P. and Rombouts, G. (2012) *'Praktijkgids landsbouw en natuur: Module rundvee, grasland en andere voedergewassen'*, Available: Departement Landbouw en Visserij: afdeling duurzame landbouwontwikkeling.
- Deming, M. E. and Swaffield, S. (2011) *Landscape architecture research : inquiry, strategy, design*. Hoboken, NJ [etc.]: Wiley.
- Docters van Leeuwen, H. 2012. *RE: Interview Maatlat Duurzame Veehouderij*.
- Driessen, P. P. J., Glasbergen, P., van Huigen, P. P. P. and Hijmans van den Bergh, F. (1995) *Vernieuwing van het landelijk gebied. Een verkenning van strategieën voor een gebiedsgerichte aanpak*. Den Haag: VUGA.
- Duchhart, I. (2007) *Designing sustainable landscapes: from experience to theory : a process of reflective learning from case-study projects in Kenya*. Wageningen University, Wageningen.
- Duchhart, I. (2011) *An annotated bibliography on 'research-by-design': (ontwerpend onderzoek)*. Wageningen: Wageningen University.
- Gies, E., Os, J. v., Hermans, T. and Olde Loohuis, R. J. W. (2007) *Megastallen in beeld*, Wageningen: Alterra.
- Headey, B. W. and Wearing, A. J. (1989) *'Personality, life events and subjective well-being: towards a dynamic equilibrium model'*, Journal of Personality and Social Psychology, 57.
- Heins, S. (2002) *Rurale woonmilieus in stad en land. Plattelandsbeelden, vraag naar en aanbod van rurale woonmilieus*. Delft: Eburon.
- Hendriks, K. and Stobbelaar, D. J. (2003) *Landbouw in een leesbaar landschap : hoe gangbare en biologische landbouwbedrijven bijdragen aan landschapskwaliteit*. [s.n.], [S.l.].
- Hoppenbrouwers, P. C. M., Lesger, Cl., Joor, J., van Zanden, J.L., Peys, R. (1986) *Agrarische geschiedenis van Nederland*. Den Haag: Staatsuitgeverij.
- Innovatie Netwerk (2010) *Werkprogramma 2010*. Utrecht: Ministerie van LNV.
- Jacobs, M. H. and Buijs, A. E. (2011) *'Understanding stakeholders' attitudes toward water management interventions: rol of place meanings'*, Water Resources Research, 47(1).
- Kaplan, R. and Kaplan, S. (1989) *The experience of nature :*
-



---

*a psychological perspective*. Cambridge: Cambridge University Press.

Kempenaar, A., Kruit, J., van der Jagt, P., Westerink, J. and Heutinck, L. (2009) *Multifunctionele landbouw en landschap: onderzoek naar de invloed van multifunctionele landbouw op het landschap, nu en in de toekomst*. Wageningen: Alterra.

Kenniscentrum InfoMil (2013) *Regelingen ammoniak en veehouderij (incl. stalbeschrijving)*. Den Haag: Kenniscentrum Infomil. Available at: <http://www.infomil.nl/onderwerpen/landbouw-tuinbouw/ammoniak-en/regeling-ammoniak/> (Accessed: 23 december 2013).

Kerkstra, K. and Vrijlandt, P. (1988) *Het landschap van de zandgebieden : probleemverkenning en oplossingsrichting*. Studiereeks bouwen aan een levend landschap / Directie Bos- en Landschapsbouw;8 Utrecht: Directie Bos- en Landschapsbouw.

Kleefmann, F. (1984) *Planning als zoekinstrument : ruimtelijke planning als instrument bij het richtingzoeken*. Planologische verkenningen;dl. 5 's-Gravenhage: VUGA.

Lambert, A. M. (1985) *The making of the Dutch Landscape: An Historical Geography of the Netherlands*. London: Seminar Press.

Landinrichtingsdienst (1963) *Rapport betreffende ruilverkaveling van gronden in de gemeenten Berlicum, Dinther, Den Dungen, Heesch, Heeswijk, Nistelrode, Nuland, Rosmalen, Schijndel, Uden en Veghel, genaamd ruilverkaveling De Leygraaf (5929 ha)*. Utrecht: Landinrichtingdienst.

Laszlo, A. and Krippner, S. (1998) 'Systems Theories: Their Origins, Foundations, and Development', *Systems theories and a*

*priori aspects of perception*. Amsterdam: Elsevier, pp. 47-74.

Leavy, P. (2009) *Method meets art: Arts-Based Research Practice*. New York: The Guilford Press.

Lenzholzer, S., Duchhart, I. and Koh, J. (2013) 'Research through designing' in *landscape architecture*, *Landscape and Urban Planning*, 113, pp. 120-127.

Leopold, A. and Calkins, H. G. (1939) *The farmer as conservationist*. United States. Soil Conservation Service. Region 8.

LVN (2001) *Toekomst voor de veehouderij: Agenda voor een herontwerp van de sector*. Den Haag: Ministerie van Landbouw, Natuur en Voedselkwaliteit.

Lola Landschapsarchitecten, DLG (2010) *LOGboek: Landbouwontwikkelingsgebieden in beeld*. Velzen-Noord: Pantheon drukkers.

Lothian, A. (1999) 'Landscape and the philosophy of aesthetics: is landscape quality inherent in the landscape or in the eye of the beholder?', *Landscape and Urban Planning*, 44(4), pp. 171-198.

Lucas, P. M. G. (1981) 'De Kesselse Hut', *Maaskroniek*.

Lynch, K. (1960) *The image of the city*. Cambridge (Mass.): MIT Press.

McHarg, I. (1969) *Design with nature*. New York: Natural History Press.

McMahon, M. and Hadfield, M. (2007) 'The Butterfly Effect: Creative sustainable design solutions through systems thinking', The 16th International Conference on Flexible Automation

- 
- and Intelligent Manufacturing: FAIM 2006. Ireland: University of Limerick, pp. 247-254.
- Meeus, J. and van de Ploeg, J. D., et al. (1988) *Changing agricultural landscapes in Europe: Continuity, deterioration or rupture?*, Rotterdam: IFLA conference.
- Minkjan, P. (2006) 'Eendenkooi', Handboek cultuurhistorisch beheer: Landschapsbeheer Nederland.
- Neven, K. (2008) *Hoe kan multifunctionele landbouw bijdragen aan landschapskwaliteit?: een literatuurstudie en een case-study in Het Groene Woud*. [s.n.], [S.l.].
- Noord-Brabant, P. (2013) Veehouderijkaart. 's Hertogenbosch: Provincie Noord-Brabant. Available at: <http://atlas.brabant.nl/webbvb/> (Accessed: 22 January 2014).
- Productstchap Vee en Vlees (2012) *IKB Integrale Keten Beheersing*. Zoetermeer: Productschap Vee en Vlees – Productschap Pluimvee en Eieren. Available at: <http://www.pve.nl/pve?waxtrapp=teGsHsuOnbPTE> (Accessed: 23 december 2013).
- Provincie Noord-Brabant (2011) *Stuctuurvisie Ruimtelijke Ordening*. 's-Hertogenbosch: Provincie Noord-Brabant.
- Provincie Noord-Brabant (2013) 'Op weg naar een zorgvuldige veehouderij in 2020: Ruimte voor initiatieven? Die moet je verdienen!', Available: Provincie Noord-Brabant. Available at: <https://http://www.brabant.nl/dossiers/dossiers-op-thema/platteland/-/media/23A1D6BBD2C64011B2467CF6638F71ED.pdf>.
- Remmelink, G., Blanken, K., van Middelkoop, J., Ouweltjes, W., Wemmenhove, H. and Wageningen U. R. Livestock Research (2012) *Handboek melkveehouderij*. Lelystad: Wageningen UR Livestock Research.
- Renes, H. and Baas, H. (2005) 'Boerenerven in het landschap: een dynamisch erfgoed', Boerderijen in beeld Cultuur Historisch Jaarboek voor Flevoland. Lelystad: De twaalfde provincie, pp. 29-46.
- Renting, H. and van der Ploeg, J. D. (2001) 'Reconnecting nature, farming and society: environmental cooperatives in the Netherlands as institutional arrangements for creating coherence.', *Journal of Environmental Policy and Planning*, 3, pp. 85-101.
- Roncken, P. A. (2011) 'Agrarian Rituals and the Future Sublime', *Images of Farming*. Heijningen: Jap Sam Books, pp. 102-113.
- Savelkoul, G. 2012. *RE: Interview on Maatlat Duurzame Veehouderij*.
- Schulz, J., Bao, E. D., Clauss, M. and Hartung, J. (2013) 'The potential of a new air cleaner to reduce airborne microorganisms in pig house air: preliminary results', *Berliner Und Munchener Tierarztliche Wochenschrift*, 126(3-4), pp. 143-148.
- SKAL (2012) *Bio-bedrijf zoeken*: SKAL. Available at: [https://portal.sk.nl/ACM/faces/form/portal/login/home\\_portallogin.jsp](https://portal.sk.nl/ACM/faces/form/portal/login/home_portallogin.jsp) (Accessed: 3 January 2014).
- Steiner, F. R. (2008) *The living landscape: An ecological approach to landscape planning*. Washington: Island Press.
- Steinfeld, H. and Mäki-Hokkonen, J. (1995) *A classification of livestock production systems*. Rome: FAO. Available at: <http://www.fao.org/docrep/v8180t/v8180TOy.htm> – TopOfPage (Accessed: 21 January 2014).
- Stichting Milieukeur (2012) *Maatlat Duurzame Veehouderij 7, 2013* –
-

---

Melkstallen (rundvee) niveaus voor certificaat A en B. Den Haag: SMK.

Stichting SKAL (2013) *SKAL Bio controle*. Zwolle: Stichting SKAL.

van der Peet, G. F. V., van der Veen, H. B. and Docters van Leeuwen, H. (2013) *Monitoring integraal duurzame stallen : peildatum 1 januari 2013*, Lelystad: Wageningen UR Livestock Research.

van der Wielen, P. (2010) *Monitoring Integraal duurzame stallen. Achtergronddocument bij 'Kwalitatieve monitor Systeeminnovaties verduurzaming landbouw'*, Wageningen: Wettelijke Onderzoekstaken Natuur & Milieu.

van Laar, T. (2011) *Improved modeling of ammonia emissions from dairy cow houses*. [s.n.], [S.l.]

Veeneklaas, F. R., de Regt, W. J., Agricola, H. J., Stoker, J. and Donders, J. L. M. (2004) *Verrommelt het platteland onder stedelijke druk? : storende elementen en landschapsdynamiek in de studiegebieden Abcoude en Epe-Vaassen*. Wageningen: Natuurplanbureau.

Vermeij, I. and Wageningen U. R. (2011) *Handboek pluimveehouderij*. Lelystad: Wageningen UR Livestock Research.

Vermeij, I. and Wageningen U. R. Livestock Research (2010) *Handboek varkenshouderij*. Wageningen: Agrimedia.

Vervloet, J. 2009. *LUP10806: Historische geografie in het Metropolitane landschap: algemeen deel*. Wageningen: Wageningen UR.

Vijn, M., Veen, E., Migchels, G. and Visser, A. (2010) *Stoppen of extensiveren van de agrarische tak op een multifunctioneel bedrijf: verkennend onderzoek naar de*

*gevolgen voor de omgeving*. Lelystad: Praktijkonderzoek Plant & Omgeving, Sector Akkerbouw, Groene Ruimte en Vollegrondsgroenten.

Vlaams Agrarisch Centrum (2005) *Naar een duurzame melkveehouderij*. Merelbeke: VAC.

Waterschap Aa en Maas (2006) *Inrichting Dynamisch Beekdal. 's-Hertogenbosch*: Waterschap Aa en Maas.

Wemmenhove, H., Biewenga, G., Ouweltjes, W. and Verstappen-Boerekamp, J. A. M. (2009) *Moderne huisvesting melkvee*, Lelystad: Animal Sciences Group.

Woestenburg, M. (2006) *'Het romantische boerenland wordt te duur'*, *Resource*, 15, pp. 10-11.



List of figures

---

*Figures not mentioned in this list are made by or property of the author.*

Figure 2.1

Ministerie van Economische Zaken (2013) Cijfers Landbouw en Visserij in Nederland. Available at: <http://www.rijksoverheid.nl/documenten-en-publicaties/brochures/2012/11/05/cijfers-landbouw-natuur-en-visserij.html>.

Figure 4.1

Adapted from: Kerkstra, K. and Vrijlandt, P. (1988) Het landschap van de zandgebieden : probleemverkenning en oplossingsrichting. Studiereeks bouwen aan een levend landschap / Directie Bos- en Landschapsbouw;8 Utrecht: Directie Bos- en Landschapsbouw.

Figure 4.2

Adapted from: Kleefmann, F. (1984) Planning als zoekinstrument : ruimtelijke planning als instrument bij het richtingzoeken. Planologische verkenningen;dl. 5 's-Gravenhage: VUGA.

Figure 4.3

Duchhart, I. (2007) Designing sustainable landscapes: from experience to theory : a process of reflective learning from case-study projects in Kenya. Wageningen University, Wageningen.

Figure 4.4

Chairgroup Animal Production Systems (2012) Systems Approach in Animal Sciences. Wageningen: APS.

Figure 4.6

Chairgroup Animal Production Systems (2012) Systems Approach in Animal Sciences. Wageningen: APS.

Figure 4.7

Adapted from: Kleefmann, F. (1984) Planning als zoekinstrument :

ruimtelijke planning als instrument bij het richtingzoeken. Planologische verkenningen;dl. 5 's-Gravenhage: VUGA.

Figure 4.11

Hendriks, K. and Stobbelaar, D. J. (2003) Landbouw in een leesbaar landschap : hoe gangbare en biologische landbouwbedrijven bijdragen aan landschapskwaliteit. Met lit. opg. - Met samenvatting in het Nederlands en Engels, s.n.], [S.l. [Online] Available at: <http://edepot.wur.nl/121408>

Figure 5

Composed of:

Bosma Melktechniek (2013) AutoRotor Magnum 90 (Buitenmelker). Available at: [http://www.bosmamelktechniek.nl/BosmaMelktechniekAutorotor\\_bestanden/image006.jpg](http://www.bosmamelktechniek.nl/BosmaMelktechniekAutorotor_bestanden/image006.jpg) (Accessed: 16 May 2013).

Campina (2013) Boerderijdagen 2013. Available at: <http://www.campina.nl/onze-boeren/boerderijdagen.aspx> (Accessed: 15 May 2013).

Geschiere, S. (2007) De Wroezeelaar. Available at: [http://4.bp.blogspot.com/\\_TcbpmLn1r0/RnmaT2m19BI/AAAAAAAAABk/zVyiCHLinFs/s1600-h/eb070620+raalte+varkensspeelgoed38k.jpg](http://4.bp.blogspot.com/_TcbpmLn1r0/RnmaT2m19BI/AAAAAAAAABk/zVyiCHLinFs/s1600-h/eb070620+raalte+varkensspeelgoed38k.jpg) (Accessed: 15 May 2013).

Havermans, F. (2012) Innovative Cowshed 2.0. Available at: <https://frankhavermans.files.wordpress.com/2012/05/71.jpg?w=640&h=356> (Accessed: 14 May 2013).

Mandersloot, R. (2011) Een tweeling met verschillende vaders. Available at: <http://pictures.boeren.nu/groot/2010/22/2874-een-tweeling-met-ver.jpg> (Accessed: 15 May 2013).

Pure Graze (2013) Pure Graze logo. Available at: <http://www.pure-graze.com/consument.html> (Accessed: 14 May 2013).

Stichting Milieukeur (2007) Logo Maatlat Duurzame Veehouderij. Available at: <http://www.maatlatduurzameveehouderij.nl/Content/Images/logo-veehouderij.png> (Accessed: 12 May 2013).

Vista (2013) Kwatrijnstal. Available at: <http://www.vista.nl/projecten/inrichtingsplan/kwatrijnstal.html> (Accessed: 15 May 2013).

---

West 8 (2006) Cow – Horizon project. Available at: [http://www.west8.nl/projects/installations/cow\\_horizon\\_project/](http://www.west8.nl/projects/installations/cow_horizon_project/) (Accessed: 14 May 2013).

Figure 6.1

Adapted from: WTKG (2012) Geomorfologische kaart Nederland. Available at: [http://www.wtkg.org/images/geo\\_kaart\\_morf\\_1985.jpg](http://www.wtkg.org/images/geo_kaart_morf_1985.jpg) (Accessed: 9 October 2013).

Figure 7.1

Vervloet, J. (2008a) Historische geografie in het Metropolitane landschap: Zandlandschap. Wageningen: Wageningen U.R

Figure 7.3

Vervloet, J. (2008b) Historische Geografie van het Metropolitane landschap: Algemeen. Wageningen: Wageningen U.R.

Figure 7.4

Morijn, R. (2013) Dutch duck decoy. Available at: <http://www.flickr.com/photos/10989519@N06/8945719871/> (Accessed: 8 December 2013).

Figure 7.5

De Jong, W. (2008) Pestbosjes. Available at: <http://www.flickr.com/photos/28272629@N05/3027539080/in/photo-list-5BwVTE-cnbrX3> (Accessed: 8 December 2013).

Figure 7.6

Noordenbos, F. (2010) A flowering cherry orchard. Available at: <http://www.flickr.com/photos/38465066@N04/4546773666> (Accessed: 8 December 2013).

Figure 7.9

ANP (2013) Circa 1000 mensen bij demonstratie megastallen. Available at: <http://www.nu.nl/binnenland/3477768/circa-1000-mensen-bij-demonstratie-megastallen.html> (Accessed: 8 December 2013).

Brandsma, J. (2013) Meer mogelijkheden om megastal te weren: Trouw. Available at: <http://www.trouw.nl/tr/nl/4492/Nederland/article/detail/3459474/2013/06/15/Meer-mogelijkheden-om-megastal-te-weren.dhtml> (Accessed: 9 December 2013).

EVMI (2012) Klant wil bio- fair trade en bovenal lokaal product. Available at: <http://www.evmi.nl/marketing-sales/klant-wil-bio-fair-trade-en-bovenal-lokaal-product/> (Accessed: 9 December 2013).

Kils, H. (2012) Regels gebruik van antibiotica in veehouderij worden strenger: NRC. Available at: <http://www.nrc.nl/nieuws/2012/06/01/regels-gebruik-van-antibiotica-in-veehouderij-worden-strenger/> (Accessed: 9 December 2013).

Figure 7.11

Provincie Noord-Brabant (2013) Logo Brabantse Zorgvuldigheidsscore Veehouderij. Available at: <http://www.brabant.nl/-/media/D833BD60D8B64493BE99CF001D0034E1.jpg> (Accessed: 24 December 2013).

Figure 7.12

Agroplan B.V. (2012) Schetsontwerp MDV stal. De Bilt: Agroplan.

Figure 7.13

Stichting Milieukeur (2007) Logo Maatlat Duurzame Veehouderij. Available at: <http://www.maatlatduurzameveehouderij.nl/Content/Images/logo-veehouderij.png> (Accessed: 12 May 2013).

Figure 7.14

Duurzaameten (2012) Eko label. Available at: [http://www.duurzaameten.nl/media/441614/keurmerk\\_eko-europees.bmp](http://www.duurzaameten.nl/media/441614/keurmerk_eko-europees.bmp) (Accessed: 30 December 2013).

Figure 8.5

Kadaster (1899) Topografische militaire kaart (bonneblad – kleur). Available at: <http://www.watwaswaar.nl> (Accessed: 6 Jan-



---

uary 2014).

Figure 8.7

Kadaster (2014) Topografische kaart. Available at: <http://www.watwaswaar.nl> (Accessed: 6 January 2014).

Figure 8.14

Kadaster (1899) Topografische militaire kaart (bonneblad – kleur). Available at: <http://www.watwaswaar.nl> (Accessed: 6 January 2014).

Figure 8.16

Kadaster (2014) Topografische kaart. Available at: <http://www.watwaswaar.nl> (Accessed: 6 January 2014).

Figure 8.22

Kadaster (1899) Topografische militaire kaart (bonneblad – kleur). Available at: <http://www.watwaswaar.nl> (Accessed: 6 January 2014).

Figure 8.24

Kadaster (2014) Topografische kaart. Available at: <http://www.watwaswaar.nl> (Accessed: 6 January 2014).

Figure 8.27

Google (2009) Streetview. Available at: <https://maps.google.nl> (Accessed: 7 January 2014).

Figure 8.28

Google (2009) Streetview. Available at: <https://maps.google.nl> (Accessed: 7 January 2014).

Figure 8.30

Bing (2013) Aerial photograph of Grolderseweg–Venhofstraat. Available at: <http://www.bing.com/maps/?v=2&cp=51.701957~5.521000&lvl=14&dir=0&sty=h&form=LMLTCC> (Accessed: 16 December 2013).

Figure 11.1

Kesselse Hut. Available at: [http://www.bhic.nl/data/upload/alem-maren-kessel/alemmk\\_kesselsehutl.jpg](http://www.bhic.nl/data/upload/alem-maren-kessel/alemmk_kesselsehutl.jpg) (Accessed: 23 September 2013).

Figure 11.2

Beerse Overlaat (2011) Hertogswetering. Available at: <http://www.flickr.com/photos/57585715@N07/5641397272/in/photolist-9AvCSd-5tmGL2-5tr6u3-fFxMMb-6D2Ycf-9vrsEP-9vutNh-9vVigC-9vViTf-9vSgDv-9vSg98-9vSgug-8ZSf6q-8ZSeXm-8ZSfEQ-8ZSeyJ-4XGtNj-a9MnA5> (Accessed: 13 June 2013).

Figure 11.3

Streekarchief BNO Oss Oijense Hut. Available at: [http://beeldbank.bhic.nl/index2.php?option=com\\_memo-rix&Itemid=2&task=result&resultplugin=topview&rp-p=1&topviewIndex=0&PhotoID=BCO011542&cp=1](http://beeldbank.bhic.nl/index2.php?option=com_memo-rix&Itemid=2&task=result&resultplugin=topview&rp-p=1&topviewIndex=0&PhotoID=BCO011542&cp=1) (Accessed: 24 January 2014).

Figure 11.4

van de Lavoir, P. (2008) Hertogswetering avondlucht. Available at: <http://www.flickr.com/photos/petervandela-voir/2684092658/> (Accessed: 13 June 2013)

Figure 11.5

Eendenkooi Macharen (2008). Available at: <http://static.panoramio.com/photos/original/12016793.jpg> (Accessed: 13 June 2013).

Figure 11.6

Smits, R. (2009) Hertogswetering. Available at: <http://www.flickr.com/photos/68462234@N06/6234034251/in/photolist-auT4ca-9AvBBb-9AvwpS-9AvCSd-5tmGL2-5tr6u3-fFxMMb-6D2Ycf-9vrsEP-9vutNh-9vVigC-9vViTf-9vSgDv-9vSg98-9vSgug-8ZSf6q-8ZSeXm-8ZSfEQ-8ZSeyJ-4XGtNj-a9MnA5> (Accessed: 13 June 2013).

Figure 11.21

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Heideveld (1913). Available at: <http://resolver.kb.nl/resolve?urn=urn:gyn:SFA03:SFA022829348&role=image&size=variable> (Accessed: 17 October 2013).

's-Hertogenbosch: Waterschap Aa en Maas.

Figure 11.22

Kuit, F. (1963) Opening van de Ruilverkaveling. Available at: [http://beeldbank.bhic.nl/index2.php?option=com\\_memorix-&Itemid=2&task=result&result=&resultplugin=topview&rp=1&topviewIndex=0&PhotoID=BCB1797&cp=2](http://beeldbank.bhic.nl/index2.php?option=com_memorix-&Itemid=2&task=result&result=&resultplugin=topview&rp=1&topviewIndex=0&PhotoID=BCB1797&cp=2) (Accessed: 17 October 2013).

Figure 11.23

Busselsesteeg - Achterdonksestraat. Available at: [http://beeldbank.bhic.nl/index2.php?option=com\\_memorix-&Itemid=2&task=result&lang=dutch&cp=3&resultplugin=topview&rp=1&topviewIndex=0&PhotoID=BH-C001027445&cp=39](http://beeldbank.bhic.nl/index2.php?option=com_memorix-&Itemid=2&task=result&lang=dutch&cp=3&resultplugin=topview&rp=1&topviewIndex=0&PhotoID=BH-C001027445&cp=39) (Accessed: 17 October 2013)

Figure 11.39

Aa bij het Hersend. Available at: <http://www.deplaets.nl/attachments/Image/hersend.jpg> (Accessed: 14 October 2013).

Figure 11.40

Normalisatie van de Aa.

Figure 11.41

van Griensven, B. (2012) Riviertje de Aa nabij de Kilsdonkse molen Heeswijk-Dinther. Available at: <http://www.flickr.com/photos/96689974@N04/8887429057/in/photolist-exmp2t> (Accessed: 14 October 2013).

Figure 11.43

Waterschap Aa en Maas (2006) Inrichting Dynamisch Beekdal. 's-Hertogenbosch: Waterschap Aa en Maas.

Figure 11.44

Waterschap Aa en Maas (2006) Inrichting Dynamisch Beekdal.









